INTERNATIONAL CENTRE FOR COMPLEX PROJECT MANAGEMENT

ICCPM

Complex Project Management
Global Perspectives and the Strategic Agenda to 2025

THE TASK FORCE REPORT




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FOREWORD

Stephen Hayes MBE
CEO ICCPM

We live in a world of increasing complexity. Management practices developed over the last century on the assumption of static influences are insufficient to deal with increasing ambiguity and emergence, where flexibility is key.

We rightly applaud the attempts by complexity and systems thinking theorists to develop and implement new approaches to better manage such complexity. But to put these into practice we also need an international rally point for government and industry to be able to share what has already been developed and to lead the development of future capability – and we need it **now**.

During the closing session of ICCPM's 2009 Global Roundtable series *'The Conspiracy of Optimism – Why Mega Projects Fail'*, the CEO of a large US-based multinational voiced the thoughts of all participants - *'is this just another talk-fest or are we going to do something about it?'* As the International Peak Body for Complex Project Management, ICCPM accepted the challenge and subsequently instigated and facilitated an international task force in collaboration with Global Access Partners.

This report is the outcome, and marks the point of departure for a new approach to the management of complex programmes.

It has three elements; an executive summary, the main report, and a compendium of working papers. It seeks to share a range of perspectives and for the most part avoids taking particular positions – however, similar themes have emerged reinforcing the notion of systemic correlation between seemingly unconnected endeavours.

The report provides 9 higher level policy recommendations plus shorter-term actions; these are supported by 60 recommendations targeting detailed, specific areas for improvement and 31 suggestions for further research. It represents many voices and raises issues of complexity management in many different forms and contexts, across different industry sectors, government and academia. By offering a range of perspectives from differing levels of organisational maturity and focussing the creative tension of academic viewpoints, it is intended to spark much-needed debate and discussion.

It does not pretend to provide all the answers – in managing complexity there is no magical Philosophers Stone that turns base metal into gold overnight – although it does provide insight into areas where government and industry can make short to medium-term investment to gain real improvements in complex project management performance.

But more importantly, the report is the catalyst for establishing concerted support for strategic investment in complex project management research. The solutions to managing complexity will only emerge from global collaboration of all those who are addressing issues in complexity management from multiple perspectives - theorists, academics and practitioners working together. Such management approaches are in themselves complex, and must develop incrementally to reflect the nature of the continually changing, complex environment they seek to control.

The international task force leading the development of this report recommended

the establishment of a specialist research centre as part of ICCPM to lead global strategic investment in complex project management research. To maintain investment impetus and direction, the arrangements have been developed to support the launch of the Specialist Research Centre (SRC) – International Complex Project Management Centre for Knowledge Development and Dissemination (KD2) at the same time as the release of this report.

We actively seek your feedback and contributions to the compendium of working papers as they continue to develop into a comprehensive complex project management knowledge resource; and we are particularly interested in extending the case study material to include stories and examples from as many different organisations and countries as possible. complex projects are very often executed across such boundaries, and it is necessary to understand that what works in Australia, the UK and the USA may need to be modified for applicability to different cultures. We also value your input as partners and contributors to the complex project management research agenda under the aegis of the International Complex Project Management Research Council and the ICCPM Board.

Finally, this Report would not have been possible without the commitment and energy of the dedicated individuals acknowledged below. Your efforts have been greatly appreciated and you have each made a significant contribution to the development of CPM. I would especially like to acknowledge Mr Dan Kopunic, former ICCPM Principal Research Director, for his professional expertise in managing the Task Force, compiling, producing and editing the compendium and CPM report, including generation of the recommendations whilst on secondment from the Australian Defence Materiel Organisation, Department of Defence.

On behalf of ICCPM and its partners, we look forward to continuing this exciting journey to deliver outcomes to meet the real-world needs and increasingly complex issues faced by both government and industry.

Stephen Hayes MBE
Chairman CPM Task Force

Photo by EADS

Photo by EADS

INTRODUCTION

"... things are getting better and better and worse and worse, faster and faster, simultaneously." - **Tom Atlee**[i]

Be they troubled defence programs, bungled information technology (IT) projects or unwieldy infrastructure developments, a host of both public and private sector complex projects have struggled to remain within agreed budgets, deliver when promised and provide specified outcomes. Traditional project management approaches, tools and techniques are inadequate for managing the increasing complexity and ambiguity of our rapidly changing business environment.

Accelerating change is driving the need for industry, government and academia to acknowledge the vital role played by Complex Project Management (CPM) and commit resources to research and improving performance.

The application of CPM has the ability to assist organisations and individuals to deliver successful projects. The ever spiralling costs of complex projects can only be addressed through enhanced investment in CPM backed by a robust and well-resourced research agenda.

Traditional project management processes coupled with systems engineering and procurement and supply chain logistics remain the cornerstone of project delivery; however, CPM introduces higher-order concepts required to enable successful performance in more dynamic and emergent environments. CPM offers a systems thinking approach in considering the nature of complex projects against a background of strategy, stakeholder needs and expectations, and organisational and project delivery frameworks.

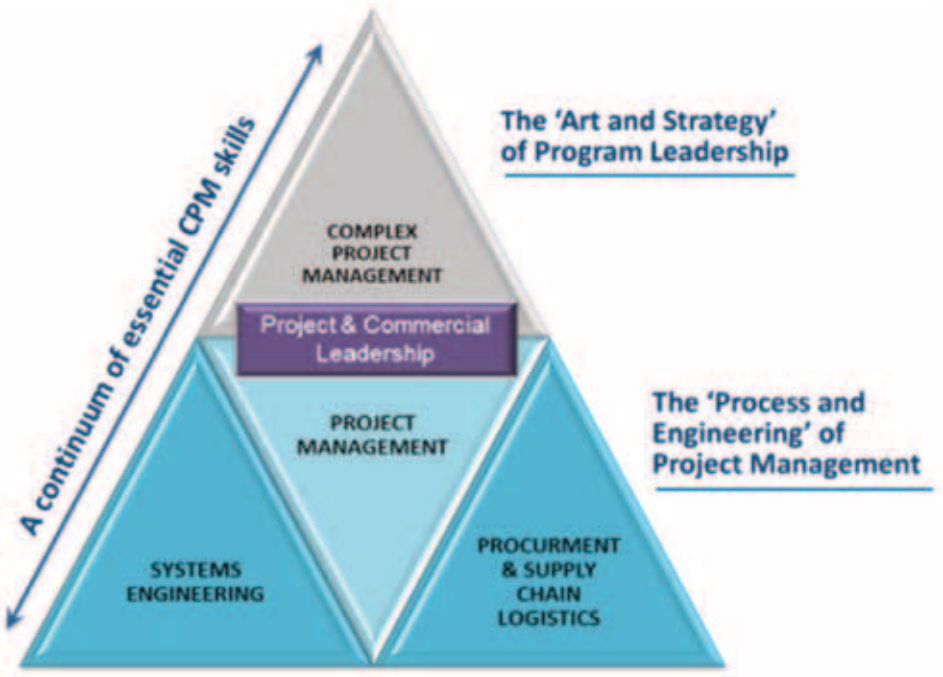

Diagram 1: *Complex Project Management (CPM) Framework*

International Complex Project Management Task Force

Driven by the need for more effective solutions in an age of pressing global problems and financial austerity, the International Centre for Complex Project Management (ICCPM) and Global Access Partners (GAP) established an International Complex Project Management Task Force. The Task Force of international thought leaders and globally experienced practitioners included key national and international stakeholders from the private sector, governments and academic institutions. Each member of the Task Force is directly involved in the design, development or delivery of complex projects and attended in a personal and professional, rather than representational, capacity to encourage candour, robust debate and innovative thinking.

Terms of Reference

The Task Force aimed to inform global stakeholders in government and industry, leverage knowledge within the CPM community to drive resilient solutions and provide a roadmap for future research based on sound academic and experiential analysis. It emphasised the importance of investment in research and championed better implementation of policy to improve global complex project delivery.

ICCPM and GAP began planning the project in late 2009 and held the inaugural Task Force meeting on May 10, 2010, establishing the CPM Report framework. Given the global constitution of membership they either attended in person or via electronic media, with further meetings held up to March 2011 to guide the CPM Report development. The Task Force discussed relevant systemic project management issues, intervention opportunities and developed a vision for ongoing research, culminating in a strategic agenda to 2025.

The Task Force oversaw the creation of a tiered set of documents titled *"Complex Project Management Report – Global Perspectives and the Strategic Agenda to 2025"*, comprising the Executive Summary, this Report, and the Compendium of Working Papers that contains detailed articles written on a range of related topics by the broad global network of practitioners and academic contributors. These documents are not intended to provide linear solutions to complex problems or, given the group's broad membership, provide a definitive view on all issues. The Compendium exists to stimulate interest and debate whilst paving the way for future research to guide government and industry investment aimed at improving the management of complex projects. The report emphasises the need to improve our understanding of CPM and its ongoing value to the procurement and project delivery community. Further, the report highlights that CPM is a fundamental part in the training of future Delivery Leaders and that there is a pressing need for further research to support the development and maturation of their necessary skills and behavioural attributes.

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THE PROBLEM

Complex Project Management is about the management of risk and uncertainty in delivering project outcomes; especially the risk of abrupt and irreversible emergent effects that escalate rapidly. We need leadership that is prepared to honestly acknowledge the size of the challenge, set out the options, and build support for and drive implementation of solutions.

> *"Most large capital investments come in late and over budget, never living up to expectations. More than 70% of new manufacturing plants in North America, for example, close within their first decade of operation. Approximately three-quarters of mergers and acquisitions never pay-off… And efforts to enter new markets fare no better." - Lovallo and Kahneman*[ii]

> *"Project success appears to equate to achieving an acceptable level of failure or minimising lost benefits." - KPMG*[iii]

Complex projects often span multiple countries with widely differing cultures and world views. Project teams are increasingly multidisciplinary and virtual, drawing expertise from government, industry and international partners. The use of virtual teams, whose members are distributed around the world in multiple time zones, has been made possible by the development of powerful IT tools and communication systems. However, this also means that many more people than ever before can influence the decision-making and implementation processes. The intrinsic complexity of projects, in part, is driven by political, social, technological and environmental issues, as well as including end user expectations which may change dramatically over the project life-cycle. Indeed, even minor projects can be complicated by hierarchical, siloed, and unnecessarily competitive organisational arrangements, wherein communication and trust can break down.

"Making Change Work", an IBM survey[iv] of 1,500 change managers in October 2008, found that only 40% of projects were successfully completed on time and budget, with the best organisations outperforming the worst by a factor of 10. 'Human factors' such as difficulties in changing mindsets and attitudes (58%), dysfunctional corporate culture (49%) and lack of support from senior management (32%) were identified as the main barriers to success, while 35% of projects had severely underestimated their degree of complexity.

At the same time, a survey by Logica Management Consulting of 380 senior European executives[v] found that over a third of the companies surveyed had abandoned a major project in the previous three years, while 37% of 'process change' projects had failed to deliver benefits. A Global IT Project Management Survey of 600 firms around the world by KPMG[vi] found that almost half had suffered a project failure in the previous year, just one firm in 50 had a 100% project success rate and 86% of firms found that project results fell short by 25%.

Although the definition of success can lie in the eye of a particular stakeholder and change over time, the performance of complex initiatives can make or break an organisation. Britain's Millennium Dome was a successful and innovative construction perceived by some as a white elephant due to a lack of vision for the exhibition that it was designed to house. However, it has now become an iconic landmark as the O2 events centre. The turnaround of Britain's failing Gateway supermarkets into the successful Somerfield operation[vii], during the late 1990's and early 2000's, consisted of 820 projects that were implemented in 100 days and involved 45,000 employees. It brought together 'top down' organisation and 'bottom up' content that ensured success. By contrast, the collapse of FoxMeyer Drug Co's US $65M mission critical computer system[viii] saw the company filing for bankruptcy protection in 1996 after enjoying US$5.1 billion sales the previous year. Overwhelmed by the failure and the hardware, software and consultant costs involved, the firm was sold to chief rival McKesson Corp for just US$80 million.

A review of federally funded technology projects by the United States Government Accountability Office[ix] showed that 49% of IT projects were poorly planned and/or performing badly, while in the U.K the British Government expended over £4 billion on a succession of failed IT schemes between 2000 and 2008[x]. Indeed, one senior manager noted that *"Only 30% of our projects and programs are successful"*[xi].

How then does one go about deciding what changes to make that will successfully, or even adequately, address the levels of complexity that can lead to failure? In the United States, Congress and the Department of Defense have certainly tried. In the past 15 years, Congress has added more than 500 sections of acquisition provisions to Title VIII of the National Defense Authorization Act. Similarly, the US Federal Acquisition Regulation and Defense Federal Acquisition Regulation Supplement now contain nearly 3,000 pages of acquisition regulations to try to control the system processes. In spite of these changes, US Defence acquisition has not been substantially improved.

A 2008 report by the US Government Accountability Office[xii] revealed that the Pentagon's 95 largest weapon systems were nearly US$300 billion over budget and a 2009 review by Deloitte Consulting[xiii] predicted that, at the current rate of increase, the average cost overrun would exceed 46% in 2020, up from 26% today. Notable failures include the Arsenal Ship[xiv] advocated by the Chief of Naval Operations without support from stakeholders or the technical community, and the Zumwalt DDG-1000[xv], whose technical excellence was not sufficient to save it from its lack of an apparent purpose. The main causes have been identified as; increasing technological sophistication creating problems with system interfaces; integration and interoperability; a 'hollowing out' of core systems engineering talent in both defence contractors and government departments; and a flawed funding process based on unrealistic cost estimates. *"Most programs are funded and launched while there is still significant uncertainty about everything from systems and technologies to integration, interoperability, and supply chain requirements…This lack of certainty and knowledge makes it difficult or impossible to make informed funding decisions, which often leads to cost overruns and schedule delays"*[xvi].

Australia has not been immune to the detrimental effects of complexity on major programs. The problems faced by the Australian Department of Defence's Kaman Super Seasprite program, which was cancelled after investing AU $1.3 billion[xvii], typifies an example of systemic failure.

The aforementioned examples highlighting complex project management failures are not limited to specific sectors. Throughout the world, there are examples of failures on similar scales within infrastructure, public policy implementation, medical R&D,

energy/nuclear and financial systems. Often, interventions into Complex Projects through the application of traditional PM methods or tools results in worse outcomes for the project or organisation where other unforeseen issues have then emerged. By addressing failures through the lens of complex project management and the multidisciplinary approach it offers, potential solutions can be found to address complexity and uncertainty and reduce the incidence of failure.

A series of roundtable discussions undertaken by the ICCPM in 2009 identified the 'conspiracy of optimism' as a major cause of complex project failure. These discussions highlighted that project sponsors and purchasers appear eager to accept unrealistically low tenders from suppliers who then rely on 'scope creep' to drive the price up to realistic but unbudgeted levels. Participants also acknowledged that current tools and decision making processes are inadequate when challenged with understanding uncertainty. Many project management organisations still remain dependant on standard linear probability versus impact risk assessments, that lack the nuanced contingency cost provisions associated with complex risk events occurring.

Furthermore, institutionalised procurement practices mean that the officials or politicians making expenditure decisions are seldom experts in the actual capability being acquired, and so their choices tend to be risk averse and determined by legal frameworks of liability rather than actual needs and social benefits. This dysfunction is exacerbated by a lack of proper engagement between government and industry.

Competition has a fundamental role to play in the demonstrable achievement of value for money for buyer organisations like governments. However, the nature, timing and objectives of the application of competition to high end complex projects needs to be carefully considered from the outset to achieve the best results for all parties. The Report also identifies issues with the use of competition 'as a weapon', in cases where genuine value for money outcomes are marginal. Large one-off procurements, for example, may offer few major contracting opportunities in relation to certain technologies or complex capabilities in each generation. And if a firm fails to win a particular tender, it must pass on accumulated losses (cost of tendering) to the next successful tender bid or fail to survive. This encourages unrealistic and unsustainable behaviours such as optimism bias, underbidding, unrealistic delivery schedules and other inefficient and undesirable actions focused on achieving the short term goal of winning the job. Both buyers and suppliers in those situations eventually pay the price for the focus on short term outcomes driven by inappropriately applied competitive processes which may mask the true long term risks and opportunities inherent in the project. Conversely focus on competition only at the "entry" stage of major complex programs may leave buyer organisations without leverage to incentivise suppliers to continue to provide all the benefits of the original agreement when any reasonable alternative has left the market.

Successful projects are predicated on meeting rational estimates of costs and capability, but 'scope creep' is inevitable with acquisitions that extend over a decade or more. In the realm of defence procurement, for example, today's complex international security environment drives rapidly changing and sometimes unconstrained requirements. When this fact is coupled with unrealistically low cost/schedule estimates that were prematurely set long before even the requirements analysis had been completed, it can lead to an unaffordable and unachievable capability portfolio.

Strategic partnerships and contracting methodologies require agility to ensure success in complex endeavours. The ability of project teams to manage emerging issues in the face of uncertainty is vital. Traditional procurement agreements, bound by rigid governance structures and the unsophisticated apportionment of liability, tend to obscure the opportunity to realise the benefits of effective collaboration. Purchasers may know what they want, but they must also be aware that critical drivers may change in unpredictable ways, due to the frenetic increase in global interconnectivity. Alternatively, purchasers may know the output they want from the project but have little idea how to generate the desired outcomes. These issues

have common themes and demand new relationship and business models, including strategic partnerships and adaptable contracting methodologies to adequately manage them.

Few contemporary project managers are adequately equipped as complex project delivery leaders within today's world of increasing complexity and long delivery timelines. This is compounded by a boom and bust pattern of procurement in some sectors, that can mean there are no experienced managers from the previous cycle in critical positions when the next cycle starts. It has been recognised, by the development of the Complex Project Manager's Competency Standards that the leadership skills required to manage in these ambiguous and uncontrolled environments are beyond the remit of traditional project manager development.

Unaccommodated, misaligned or even unknown concepts of what success looks like to different stakeholders can lead to attempts to influence programs in reaction to political or public pressure. This challenge is exacerbated by the tension that exists between stakeholder perspectives as to what constitutes product versus project success.

The dramatic effects of interdependencies with other programs are often underestimated or neglected completely. Seldom does any complex endeavor transition into service in complete isolation. Insufficient attention to this interconnectedness at the early stages of projects is an enormous opportunity lost and often an invitation to failure. In much the same way requirements analysis, with methods such as behavior trees should be conducted prior to design. So too should an analysis of project interdependencies be carried out.

Due to the temporal challenges of complex projects this analysis must be ongoing and iterative. Leaders must be acutely aware of their dynamic environment and how their deliverables will incorporate and interface into the broader landscape.

Projects must be properly shaped and validated before large budgets are committed. Organisations undertaking major expenditures show increasing maturity by gradually phasing projects, assessing and reassessing their costs and benefits as more relevant information becomes available. Based on this approach thresholds and indicators can be Incorporated in governance regimes that would allow forensic analysis of performance, assessing potential benefits and initiate cancellation where appropriate.

The need to create better funding mechanisms tailored to the unique nature of complex projects is pressing. The reactive response to emerging complexity facing projects has seen budgetary flexibility constrained. It some situations a more creative response could prove beneficial, not least in terms of incentives for contractors and other stakeholders to encourage success. There has been realisation that traditional budget cycles are no longer appropriate for highly complex projects in dynamic economic environments. This has provoked the adoption of innovative accounting methods by some forward-thinking companies, with their experience paying dividends in project delivery.

Unfortunately, the delivery of complex projects across a wide range of sectors and nations spans from disastrous to mediocre. Beyond the failings of any particular management group, industry, government or nation, there is a fundamental lack of systems thinking in the management of complex projects which has an opportunity cost for humanity of billions of dollars, wasting untold human effort and depriving other urgent social systems of much needed investment, all within a world of finite resources and increasing demands. The failure of international agreements to tackle climate change, the collapse of health reforms, and the problems associated with IT innovations, increasing defence budgets and the failed mergers, acquisitions and restructuring of individual businesses, all mean that a paradigm shift in the way complex projects are approached and managed is urgently required.

THE ISSUES

What is Complexity?

Complex Projects have been characterised by many sources as *"embodying uncertainty, ambiguity, dynamic interfaces and significant political or external influences"*[xviii]. Such projects also tend to run longer than the life-cycle of the technologies involved. Complex projects are undertakings for which traditional methods, practices and frameworks are inadequate in terms of; scale, rate of change, heterogeneity, multiple pathways and ambiguous objectives. CPM must assess and comprehend project context, criticality, collaboration, convergence and confluence at various points of intervention along the project's life-cycle to maintain flexibility through organisational agility and project resilience, thus maximising its chances of success. In short, projects which are merely complicated may only require traditional linear approaches to management; however, in contrast, complex projects demand the addition of adaptable, visionary leadership coupled with new processes and approaches.

Advances in knowledge and capability have raced ahead of social and political change. Only the most agile organisations have fully absorbed the impact of this new reality, while the more permanent structures and systems in society, such as the judiciary, education and governance, have lagged behind. A world in which governments are unable to keep pace with accelerating complexity leads to expensive project failures in health spending, IT projects, infrastructure projects, defence programs and elsewhere.

Given common issues of globalisation, the burgeoning knowledge economy, an ageing workforce and cultural dichotomies between nations, CPM needs to be addressed at a trans-national global level as well as a domestic cross-organisational level. The focus should encompass the whole spectrum of project dynamics, rather than discrete functional processes, and place it in context as part of a much larger whole. Programs involving difficult political issues and multiple influential stakeholders, ranging from capital acquisition to climate change mitigation and disaster relief, should be assessed and planned as complex projects. Improved CPM techniques would not only ensure effective program delivery with increased benefits, but also reduce costs and improve productivity across government and industry.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) *Complex Systems Program*[xix] differentiates complex systems from those that are fiendishly complicated by two attributes: Emergence and Self Organisation. Self-organisation involves interactions between the constituent parts of the system spontaneously producing behaviours that are potentially exponential in outcomes, which do not require the conscious and continuous intervention of any management system to evolve or change paradigms.

While a complicated project comprises a plethora of distinct and mostly linear elements essential to the project as a whole, complexity implies multiple mutual interdependencies, in which the constituent parts themselves are capable of change (exceeding system boundary tipping points). Thus when one variable changes, other variables may or may not change as a result, creating new realities and paradigms, depending on the dynamic drivers. The perceived complexity of a situation or system is relative to the capacity of the responsible individual or group to comprehend it. The current lack of effective CPM has been driven by a shortage of suitable managers, changing patterns of demand, a confusing multiplicity of relationship models, generic management certification and lack of focused well-rounded and complementary research.

The emergent properties of complex projects greatly increase the unpredictability and variability of the risk profile over time as the cascading effects of multiple interdependencies are felt. Risk may be defined as the probability of an event

multiplied by its consequences, and given the unpredictable nature of complex emergent systems, the vast resource costs involved and the catastrophic consequences of failure, the ability to manage complex projects effectively – and so effectively manage their risk – is of paramount importance to project success.

The Working Papers

Articles written by contributors to the Task Force are presented in full in the Compendium of Working Papers, and are summarised in this Report within six themes, which collectively inform a suggested future research programme.

Figure 1: *CPM Report Themes*

Delivery Leadership

The challenge of leadership today lies in dealing with the greater uncertainty and ambiguity that has arisen as a consequence of accelerating change. This is driven not only by social, technological and cultural diversity, but also by the transformational shift from an 'information age' of interrelated systems to a 'knowledge age' where the focus is on interconnected capabilities, rather than individual solutions.

In order to deal with these new complexities, successful organisations are shifting from centralised power and decision making structures to a distributed, shared leadership model, which involves a shift from 'power over' to 'power with'. While traditional project management focuses on the 'iron' triangle of cost, schedule and performance, complex project management must encompass aspects in the non-technical, intangible domain (called soft systems), including economics, human resources, stakeholders, leadership, systems thinking and politics in its widest sense. There is a growing need for all people working on projects to possess multidisciplinary awareness and skills, to be open to the meanings, language, mental models of professionals from many disciplines and cultures. Leaders must acknowledge a multiplicity of internal and external stakeholder interests across a wide range of perspectives. The leaders of complex projects must be able to forge an understanding of how high-order thinking may resolve conflicting assumptions and interests amid rapid social, economic and technological change.

The responsibilities and accountabilities of complex project management often overlap with other leadership positions in business and politics. The relationships between these different entities – politicians, government agencies, officials and company executives - with managers of complex projects can, therefore, be problematic. There needs to be holistic oversight, clarification and agreement upon roles and responsibilities to encourage collaboration within and across projects. Anything less can lead to factional infighting, resulting in unhealthy tension.

Commitment to longer-term benefits through collaboration and trust will ensure that sustainability is driven from all levels of an organisation or project. Within this new paradigm of emergent complexity, executive decision makers must provide types of leadership which embrace and enable an environment for innovation,

commitment, increased risk appetites and accountability. In order for executives to provide this leadership and encourage positive behaviors of their workforce, they must first look internally and understand their own behavioral drivers and personal characteristics. Ultimately, executive leadership behaviors set organisational cultural patterns which determine the environment for ongoing success - or failure.

As the social, environmental and economic complexity of projects escalates, there is an increasing demand for people with the sophisticated interpersonal skills, emotional intelligence and personal attributes required to manage them. Complex projects demand visionary leaders, rather than traditional managers. On the path to visionary leadership, the first step is to understand one's own leadership behaviours and one's own style of 'action logic'[xx] when interpreting the surroundings and reactions to a challenge to power and safety. Knowing one's own action logic can be the first step to developing a more effective leadership style. Senior executives must encourage adaptive leadership and foster positive behaviours in their workforce by first understanding their own behaviours and how they unconsciously influence and affect project and organisational outcomes.

Complex project leaders must simultaneously juggle a mix of macro environmental, technical, business and human challenges, taking a holistic view of the interconnections of perceived isolated interests. They must strike the correct balance between short-term gain and long-term organisational and social goals, assessing the trade-offs when defining and altering project scope, deciding on a contract, making resource choices, managing risks and evaluating business outcomes. Leaders must apply intuition, emotional intelligence and empathy in building relationships and maintaining trust while dealing with ambiguity, uncertainty, risk and emergent, ambiguous 'unknown unknowns' over protracted time-scales.

Leaders are required both to embody and model the requisite behaviours for leadership success and be stewards and co-inventors of an emerging culture of leadership at all levels. This allows members to thrive while achieving satisfactory business results in the midst of increasing complexity[xxi]. The best leaders are facilitators, connectors, orchestrators and, above all, inspirational. Not only must they command the requisite technical knowledge; they must operate comfortably as the hubs of networks of meaning, learning and knowledge.

A recent report released by IBM as part of their biennial "Global CEO Study"[xxii] series identified complexity as the most pressing leadership challenge facing Chief Executive Officers in 2010. The unprecedented level of interconnection and interdependency faced by complex project leaders requires enlightened leadership styles and new and flexible business structures acknowledging the non-linear and less controllable nature of the environments in which modern managers operate. The study of *"Complex Adaptive Systems"*[xxiii] informs the understanding of dynamic emergent systems while *"Complexity Leadership Theory"*[xxiv] acknowledges the entrenched demands of bureaucracy and enables adaptability to generate novel and tailored solutions.

Improved selection of complex project managers is vital. Stratified systems theory[xxv] shows that capabilities proven at lower management levels may be inadequate in more complex situations. Career-path appreciation tools can fast-track individuals able to handle complexity, concept formulation, ambiguity and uncertainty on the basis of future potential, rather than past performance, (where individuals may operate at high levels of performance in their current role, but on promotion fail, as they have already reached their full potential). The use of *"Occupational Personality Questionnaires"*[xxvi] is one tool that can identify those with the capacity for the cognitive flexibility required to succeed, regardless of extroversion or introversion, emotional intelligence and consciousness of systems thinking.

The concept of 'distributive leadership' and the need for wisdom, rather than simply knowledge, in CPM are discussed at length in the Working Papers. Eight key organisational principles are identified, balanced in four tensioned pairs: an implicit organisational purpose uniting the project with clear individual objectives; the freedom to act within explicit boundaries; trust of people's skill and will within a few simple rules; and tolerance of ambiguity and uncertainty tempered with informative feedback loops.

Leaders may adopt four key strategies in terms of behavioural choices: telling, selling, involving or devolving. While traditional management practice lay in knowing what to do and telling others when to do it, its modern incarnation includes the emotional intelligence to sense the behaviour best suited for the context and person involved. The hardest task for today's complex project leaders may be in knowing when to follow (servant leadership), rather than when to lead, so enabling the collective 'wisdom of the crowds' to set direction ensuring alignment with organisational goals. Leaders must understand that traditional business oligarchy (leadership by the few of the many) is giving way in complex situations to polyarchy (leadership by the many)[xxvii].

The concept of 'reflective leadership' acknowledges the observation of David Snowden, former head of Knowledge Management at IBM, that all projects can be considered complex if people are involved[xxviii]. Building on this, Dr Svetlana Cicmil, senior lecturer in project management at Bristol Business School, notes that; *"project managers deal with project complexity by utilizing standard project management tools and techniques in combination with a set of alternative skills and competencies that are not codified or captured in the conventional [linear] recommendations of good practice"*[xxix]. These alternative soft skills involve relationships between people or groups and handling the *"irrational [and complex] behaviour that seems to be endemic to the human condition"*. There are four key aspects to leadership in complex situations - managing relationships and recognising the divergence of interests; understanding human behaviour; appreciating the importance of context and identifying the impact of systemicity. Complex project managers who have succeeded in one project often fail in their next assignment. Whether this stems from exhaustion or the reuse of previously relevant tactics in a new situation calling for different methods, the phenomenon requires examination beyond the notion of people with the right 'instincts' merely being in the right situation at the right time. This is a fertile area for potential research.

Regardless of personality 'type', managers who have been 'burnt' by failure on previous projects are more likely to succeed on future ones after learning from their mistakes, and ways must be found for experience to be gained in less traumatic and expensive ways in future. Some large companies, including Boeing, run courses in simulated project management and there is a growing place for such techniques in future. Simulations, in isolation, are not the panacea to managing complexity, but they can be of considerable value if used, like simulators in flight schools, to test and improve skills developed by more traditional means. Designing such simulations would itself be a valuable exercise for government, industry and academic stakeholders, forcing them to examine pressing issues in complex project management without fear or favour; and applicable to broader applications for humanity.

The *"Advanced Simulation Approach"* developed and implemented by NASA[xxx], ensures that accumulated research, knowledge and wisdom is acted upon in practice. Professionals in complex, high pressure occupations from surgeons to pilots and soldiers practise their craft in immersive realistic simulations to improve performance and reduce the risk of failure in action. The tacit skills required by complex project leaders can be usefully improved through sophisticated project simulations modelling the key human, technical, process and financial variables and replicating the key decision-making challenges leaders will face in the field.

Approaches such as NASA's 'participatory modelling' can be successfully applied to reconcile a host of conflicting demands that has been usefully employed to balance fishing, farming, leisure and conservation requirements on Australia's North West Shelf[xxxi]. Interested parties were invited to contribute to developing the model which not only promotes personal commitment and ownership but also adds to the validity of its database, negating the influence of participants concerned only with their own vested interest. The modelling of stakeholder interests over time is as challenging, but because it deals with human beings, remains much more volatile, dynamic and hence problematic. The identification or creation of software to explore the concepts of complex systems is very promising and worthy of potential investment as an area of research and development.

There is a need for leaders to adopt 'system-of-systems-level thinking' in order to conceptualise volatile, uncertain and complex situations, in conjunction with improving the effectiveness of interconnected organisational functions and encouraging adaptive leadership at all levels. Innovation and resilience are key to maximising resultant opportunities and minimising risk from the emergent properties of complex projects. The challenge for executives today is to become comfortable with distributed and flexible leadership approaches in the face of ambiguity and emergent dynamics, rather than rely on increasingly outmoded notions of formal, linear planning and control. *'Complexity Leadership Theory'* acknowledges the dynamic tension between administrative and adaptive functions and argues that CPM leaders must act as an interface to enable solutions to emerge.

Policy Recommendation 1

Maintain delivery leadership capability appropriate to the degree of project complexity.

Complex projects demand strong leadership as well as traditional management expertise in planning, budgeting, organising, staffing, monitoring and mentoring team members. Complex projects also require expert leadership that exhibits collaboration, teamwork and shared team leadership as appropriate. This assumes that the project leader is supported by a multi-disciplined, highly skilled and dedicated team. It is also important to promote CPM as a specialised discipline and thus reduce the knowledge boundaries between functional silos and enable cross-pollination of specialist knowledge.

Action recommendations

- Define, agree and initiate CPM delivery leader development as a project in itself with appropriately senior leadership.
- Implement continuous review of capability against project complexity.
- Implement continuous experiential learning.

Policy Recommendation 2

Operate to global CPM standards of good practice, methods and tools.

Building on the observations set out in the Report, the existing Complex Project Management Competency Standards should be developed into a set of broader international standards. These standards would need to address a diverse range of subjects such as: competency standards (for traditional project management, but also cognitive capability and emotional intelligence), leadership skills, tactical tools, participation and relationship models, governance frameworks, education and learning methods, culture and behaviours, change management, risk and opportunity management (including balancing short-term and long-term aspects), resilience and sustainability, simulation, narrative construction, knowledge sharing, collaboration, talent management, and innovative approaches to financial control and accounting methodologies.

Action recommendations

- Assess current CPM processes and capability against global CPM standards.
- Institutionalise a tailored set of global CPM standards supported by a system of contemporary periodic reviews and updates.

Collaboration and Competition

Image: *Four Dreamliners are shown in the final assembly facility in Everett, Wash., in the United States.* ***Photo by Boeing****.*

As a result of several decades of experience in 'outsourcing' of non-core organisational functions, coupled with globalisation, businesses today are enmeshed in complex organisational communities comprised of alliances with strategic suppliers, networks of customers, and partnerships with key political groups, regulatory entities, and even competitors. Through these networked dynamics, organisations are addressing the pressures of unprecedented change, global competition, time-to-market compression and rapidly changing technologies to capture and deliver outcomes that meet all stakeholder interests. Governments now rely more heavily on the private sector to fund or co-fund the delivery of major projects, and contractors are held to high standards of accountability in a climate of zero tolerance for failure, defects or negative outcomes with political pressure to micro-manage every aspect.

Furthermore, there is a growing acknowledgement that burgeoning connectivity is driving accelerated change and complexity across the world. The EU funded 'Global Systems Dynamics and Policy' project[xxxii] is researching complex projects, while a series of multidisciplinary foresighting exercises are being carried out around the world. In Australia, the Prime Minister's Science and Engineering Council is reporting on the links between energy, water and carbon, as well as with food security. None of these issues can be dealt with in isolation. The use of smart grids allowing people to monitor their energy and water use is an example of interconnectivity allowing complex solutions to be delivered in new ways. Measures to tackle such issues should not compete against each other for funds and attention, but leverage their synchronicities to increase their impact on problems with common roots and solutions, creating outcomes of greater value and benefit than the sum of their individual parts.

Methods of collaboration between government and industry require new relationship paradigms, emphasising the need to move towards a win/win mentality. Traditionally, industry players compete with each other, with government selecting 'the best' provider despite the fact that

any single provider will inevitably display inadequacies compared to the total amount of expertise and capability in the industry as a whole. In future complex projects, government could seek to create 'multiple company industry teams' or 'integrated product/project teams', with a broader range of capabilities to form bodies analogous to the US Missile Defence Agency's (MDA) 'National Team'[xxxiii]; a group of industry figures that defined the way forward in terms of capability, with projects spinning off from these discussions to form individual sustainable missile defence system elements.

An important pathway to sustainability is the ability to capture and deliver outcomes that meet all stakeholder interests with ongoing social benefits. The economic framework of free market enterprise dictates that where there is competition there is a balancing of unit price and relative quantity by the 'invisible hand' of supply and demand. However, unnecessary competition leads to wasted resources and in order to maximise longer-term sustainable benefits, it will be necessary to collaborate on large scale, 'high capital, high risk' projects and so provide the diversity required to better manage complexity. Some very large projects are now being undertaken by varying clusters of contractors who simultaneously collaborate on some aspects and compete on others. Collaboration is based on a win/win relationship to the benefit of all stakeholders.

There must be a radical re-construction of the role of contractual vehicles in commercial negotiations. Theorist Ian Macneil saw business contracts as *"instruments for social cooperation"* which *"arise because the parties recognize that there is more to be gained by some level of cooperation than by separation."*[xxxiv]. The International Association for Contract & Commercial Management (IACCM) *10th Annual Report on the Most Frequently Negotiated Terms* is a powerful indictment of the failure of current contracting approaches concerning upfront risk allocation (liability), risk mitigation and avoidance, and the contracting method dominating interactions during the negotiation of formal agreements. Many contracts can *"be governed efficiently only if the parties adopt a consciously cooperative attitude"*, but the typical corporate response to a crisis, based on combative legal frameworks, all too often drives trading partners to conflict, rather than uniting them in seeking mutually beneficial solutions. Contracts and the legal fraternity charged with their creation are frequently seen as obstacles to value creation and are viewed by many project management practitioners as an unfortunate pre-requisite to doing business, rather than as a fundamental enabling asset to successful relationships. Legal tertiary education and contracting frameworks need to be reviewed and improved. Public and private sectors alike can overcome the associated challenges through the development of a portfolio of relationship models, structures and commercial practices that recognise the diversity and dynamic challenges of today's business drivers. Creative approaches to positive risk management recognise the need to develop a shared interest in successful outcomes through identification of resultant mutual opportunity, rather than perceived protection against risk of future failure and loss.

IACCM research reveal the tendency by most organisations to focus negotiation on terms which relate to the *consequence* of things going wrong. This strongly 'positional' approach to negotiation (i.e. hinging around 'non-negotiable' policy principles that are protective in nature) leads to loss of focus on the clarity of purpose and the process for governance. When they do not pay adequate attention to these key terms and the transitions between them, organisations increase the *probability* of project failure.

There are several key phases where misalignments often occur – the translations between goals and scope, to selection criteria, to performance measures, to on-going amendment and change. IACCM explored the most frequent sources of contract claims and disputes. The results are a powerful illustration of the weakness of today's requirement management and relationship management procedures. The number one issue is acceptance and delivery – surely a massive indictment of project management quality if contracts can reach this final stage before fundamental problems are identified.

IACCM research shows that large organisations – public and private sector – rarely monitor and analyse their experiences from bidding, negotiation, or

contract management. Therefore few are learning from repetitive conversations or outcomes – for example, what common factors may lead to frequent areas of claim or dispute? This reflects what is perhaps a fundamental weakness common to both contract management and project management – each situation is viewed as unique and handled as a 'one off' or 'one of a kind' activity. Yet in truth, there is often significant cross-learning to be gained from the portfolio of activities under management. This is an area where 'complexity' is glorified, when it might be simplified.

The Compendium of Working Papers presents several project managers' perspectives on stakeholder analysis, critically evaluating a sample of the many techniques and tools available. These include the OGC's Interest Grid; Michell, Agle and Wood's concept of *"Power, Legitimacy and Urgency"*; Moorhouse's *"Second Order Stakeholder Mapping"*; and Bourne's *"Stakeholder Circle"*. The *"Arnold Stakeholder Analysis Technique Evaluation Schema"* assesses each approach in terms of simplicity, level of effort, structure, maintenance, adaptability and stakeholder insight. The Stakeholder Management chapter also includes critiques of the work of Frooman, Kaler, Freeman, Weber, Roloff, Rowley, Fassin, Karlsen and Gable, and Shireman.

Policy Recommendation 3

Operate the entire supply chain as a single entity delivering against mutually agreed outcomes with equitable risk and reward sharing.

This demands a commitment to long-term project sponsorship; improved talent management strategies, business processes and financial control; shared learning and best practice; flexibility; and leveraging the diverse skills of all involved in the complex project. It also means that contracting models should identify and maintain alignment of contracting parties and their capabilities to deliver the expected outcomes, including incentivising innovation and exceptional performance. Contractual processes must become enablers, not inhibitors, to successful complex project delivery.

Action recommendations

- Define, agree and institutionalise collaboration strategies across and between all stakeholder and supply chain groupings, recognising the degree of uncertainty inherent in complex projects and adjusting contractual vehicles accordingly.
- Review the appropriateness of procurement, supply chain management and contracting processes according to the degree of project complexity.

A New Approach to Benefits Realisation

Benefits realisation is a specific term used to explain longer term future value of a capability, product or infrastructure. The immediate costs of a large project can inhibit the adoption of measures required to meet long-term infrastructure, Defence and health needs, despite the recognition that their longer-term benefits will out-weigh the short-term sacrifice (for example, the derived benefits of the Sydney Opera House). Management and executive decisions need to be conceived with an understanding of the language of benefits realisation.

If complex projects are to be truly sustainable and provide win/win outcomes, then a longer-term view of benefits realisation needs to be conceptualised and communicated to create shared understanding and meaning, to improve procurement decisions and to better inform service design and delivery over the entire life-cycle.

It has been argued that this new approach will improve perceptions around risk mitigation and subsequent opportunity management, executive leadership decisions and trust through knowledge dissemination. Such 'contracting for benefits' clearly has potential advantages; however, due to the rigidity of contemporary commercial practices and reduced risk appetites to try something innovative, there is a lack of robust empirical evidence about what works and in what situations relationship contracting becomes appropriate. Research into the development of relationship contracting is urgently required to develop new commercial relationship approaches, frameworks and models. Robust post-implementation reviews should, therefore, provide quantitative data on the performance of contracting methodologies in terms of benefits realisation, which can then be used to guide and reward ever more effective approaches, particularly in terms of driving stakeholder interest and commitment through ongoing incentives.

An appreciation of benefits realisation can also tap into the power of narrative, visionary leadership and 'story telling' to engage stakeholders in continuous exploration and understanding of benefits beyond that of short to medium-term implementation. Such approaches must be structured and communicated to filter out humanity's natural tendency towards confirmation bias: a mental model which seeks evidence to confirm a pre-conceived hypothesis, based on intrinsic assumptions that reject

everything which does not reinforce it. Believing this false reality is worse than having no conceived vision at all. Benefits realisation can help bridge the gap between 'not knowing' and 'doing' by providing evidence-based decisions for successful actions, which can, in turn, improve forecasting and enduring sponsor support.

Organisations should not wait until a project has closed to consider the lessons they have learned. Planning for success calls for 'pre-mortems'[xxxv] – reviews conducted after the planning process is complete can inject an additional level of realism into the plans. The immediate and continuing measurement of planning performance sends a clear message that the firm is adaptable, flexible and can be defined as a learning organisation acting on robust evidence about what works and what does not, nourishing understanding and facilitating acceptance of the benefits realisation concept.

The UK Office of Government Commerce (OGC) defines the aims of benefits management as ensuring *"desired business change or policy outcomes have been clearly defined, are measurable, and provide a compelling case for investment – and ultimately to ensure that the change or policy outcomes are actually achieved."*[xxxvi] The traditional approach to benefits management encompasses the articulation, quantification and valuation of the benefits of a chosen project or solution, justified in a business case; the use of cost-benefit appraisal through net present value (NPV); the identification of benefits in causal maps, profiles and realisation plans; the tracking and reporting of benefits realised against those forecast; and a post-implementation review to capture lessons learned.

Challenges exist with organisational adoption of the benefits realisation concept, which is partly due to non-compliance with established organisational practice, but the roots of the problem lie elsewhere, not least in the often cited 'conspiracy of optimism'. As UK Treasury reports, "There is a demonstrated, systemic tendency for project appraisers to be overly optimistic. This is a worldwide phenomenon that affects both the private and public sectors… appraisers tend to overstate benefits, and underestimate timings and costs."[xxxvii] Nobel Prize winning economist Daniel Kahneman also refers to *"Delusional optimism:xxxviii we over-emphasize projects' potential benefits and underestimate likely costs, spinning success scenarios while ignoring the possibility of mistakes."* The authors of the largest ever study of public sector infrastructure projects[xxxix] concluded that estimates were *"highly, systematically, and significantly misleading (inflated). The result is large benefit shortfalls."* And the cause is, *"the planned, systematic, deliberate misstatement of costs and benefits to get projects approved."* In short, those involved were *"lying"*, not just being overly optimistic.

Whether this temptation is born of delusion or deception, the result is the production of unrealistic forecasts which force benefits management activity to focus defensively on justifying the indefensible. Recent research has, therefore, found that even when recommended approaches are adopted, little improved benefits realisation results. Naidoo and Palk, in a study of e-Government in South Africa and the UK in 2010[xl], found that organisations with stringent processes do not perform significantly better than those with less formal processes or no process at all. The problem is not the absence of frameworks but the 'Knowing-Doing Gap'[xli].

Traditional approaches may be necessary, but they are clearly not sufficient, so to improve performance three challenges must be addressed.

Firstly, 'benefits fraud', optimism bias and strategic misrepresentation should be tackled by ensuring the benefits claimed are robust and realisable by utilising *"benefits eligibility frameworks"*[xlii] to maintain a clear line of sight from strategic intent through to realisation. Claimed benefits should be validated with their intended recipients, and independent reviews and rigorous metrics should challenge *"assumptions which masquerade as facts"*. Secondly, attention should be paid to benefits which might be realised beyond those forecasted and, finally, capability should be fully exploited by continuously engaging the user in an active search for value by realigning reward and recognition strategies. Benefits must be managed from a portfolio, rather than project perspective and the emphasis shifted from optimism in planning and pessimism after implementation, to realism in planning and enthusiasm in operation.

A case study examining the British government's "Tell Us Once"[xliii] programme, which aimed to help people notify all government departments of changes in their circumstances in a single step, produced a series of key principles. These included the need for valuation to inform service design; the understanding of benefits realisation as an ongoing attitude rather than a one-off exercise; the adoption of a flexible, holistic approach embracing staff, citizens and business and government actors; and participative engagement with key stakeholders. In essence, benefits realisation is everyone's job.

A more effective and new approach to benefits realisation includes the adoption of modular or agile approaches to project design and development where lessons learned and emergent understandings are captured and applied on a regular, continuing basis. At a minimum, opportunities should be assessed at each stage or phase gate review. Organisations can apply a 'scout and beacon' approach[xliv] in which 'Scouts' scan the environment for potential opportunities; and 'Beacons' are lit clearly communicating that ideas are welcomed.

Policy Recommendation 4

Ensure that investment and risk management processes balance short-term expenditure and risk, in the context of through-life benefit.

This includes looking beyond traditional rates of return that focus on weighted average costs of capital and the risk premium that reflects the project's specific risk characteristics, and identifying and planning for other forms of potential value to improve effectiveness and efficiency, such as social, political, organisational and environmental factors. It also addresses 'benefits fraud', optimism bias and strategic misrepresentation by ensuring that benefits claimed are realisable. Tracking the project's benefits ensures that performance matches promise and that the metrics used are a positive influence on behaviour through improved recognition and reward strategies.

Action recommendations

- Identify and institutionalise through-life product/ project benefit measures that are suitable for informing risk and investment management strategies appropriate to the degree of project complexity and deliverable operational life (including disposal).

Management of Risk, Opportunity and Resilience

The management of risk is central to an organisation's decision-making framework. Risk can be viewed through the lenses of cost, time, quality, human resources, capability and environmental impacts, but whatever the terms in which it is assessed, the management of risk is intrinsic to behaviours and the implementation of real outcomes. As risk is subjective in nature, what is risky in one circumstance may not be risky in another due to factors such as experience, appetite, knowledge, education, established processes and culture - its management cannot be avoided simply by statements of risk apportionment and responsibility in a contract.

However, as projects become more complex, societies more demanding and politicians less tolerant to risk taking, it can prove difficult to find parties prepared to accept emergent risk burdens without payment of risk premiums. Furthermore, the public and private sectors have very different ways of managing information and making decisions about risk, which can lead to misunderstanding, conflicts and other problems emerging over the course of long-term projects, during which several generations of administrators, managers and politicians may come and go.

Risk is best managed by the party best situated to reduce, avoid or mitigate it. The avoidance of risk in one area can have a cumulative effect through interdependencies with complex projects/programs. The mature management of risk concerning enterprise ventures must be understood by both Government and industry in a homogenous way, ensuring a common intent and meeting of minds around initial risk assumptions. Therefore, where government is responsible for the mitigation of risk, they must be prepared to accept responsibility for it and not outsource the legal responsibility through payment of risk premiums; an approach which all too often leads to dispute, conflict, delay, financial waste, and ultimately, failure to achieve all of the desired outcomes.

Currently, the bulk of attention is still focussed on mitigating technical risk, and few resources are devoted to integrating risk profiles derived from emerging environmental, social and political risk, which are just as important as technical factors and can also turn impending project success into failure. Enlightened, holistic risk management seeks to mitigate, rather than eliminate risk and offset it by the identification of opportunities, absorbing

the impact of risk, or creating value from resultant opportunities rather than avoiding the risk altogether.

The drivers of complexity – which in turn determine the perceived and actual degree of inherent risk – can be seen as 'capability drivers' inherent in the organisation and individuals which comprise the project team, and 'complexity drivers' specific to the project itself. Capability drivers include the project's leadership style and team experience, their structure and track record, their platform/ technology experience and learning culture and flexibility. Project-specific drivers span business criticality, novelty, intricacy, scope, cost, direction, stakeholder characteristics and component interactions and relationships. *"Project Complexity Measures"*[xlv] should be undertaken at the beginning of the project and throughout its life-cycle, particularly when it faces major change, to monitor and address factors which may increase the risk of project failure.

The term *'Enterism'* may be adopted to describe the practice of setting an unrealistically low budget to win a tender, then increasing the price once the purchaser is committed[xlvi], or establishing the cost and schedule at a politically acceptable, rather than economically realistic, level. From the outset, *'enterism'* will inevitably lead to cost over-runs, erosion of project schedule, budget and quality. Unfortunately, the recent financial crisis and concomitant difficulties of funding new complex projects is placing further pressure on project proposals (business cases) to ignore or minimise project risks in order to gain approval.

Parametric estimating approaches provide statistical forecasts for potential project options and can manage and mitigate risk, involving the gathering and normalising of data, the determining of *"Cost Estimating Relationships"*[xlvii] (CERs) using statistical analysis, hypothesis testing and, finally, the execution of the model. *"Historical Trend Analysis"*[xlviii], an application of parametric estimating in the context of business case approval, involving economic analysis, investment appraisals and estimations of value for money, has a proven record of success in linear environments. However, while such parametric models can help ensure that budgets are adequate and integrated master schedules are realistic for complex projects, application of statistical modelling must be balanced with the project manager's intuition and understanding of the broader dynamics in the environment, thus managing the risks for all stakeholders concerned. Therefore, parametric estimations are fundamental in early development of project proposals; however, they must be complemented with alternative approaches, both quantitative and qualitative, to provide an expanded 'world view'. When synthesising performance metrics, especially in terms of risk and opportunity, their interpretation should address the problem of balancing short-term demands with long-term outcomes.

The ever present potential for 'scope creep' should be acknowledged as a risk early in the development of projects and scope consciously controlled with relation to initial requirements, regularly reviewed, and any 'creep' controlled or barred entirely, depending on a mature balancing of risks against opportunities. Governments create the risk factor of 'scope creep' through many ways and must display much greater discipline themselves as purchasers. While 'requirement creep' can often be managed by ensuring clarity of understanding of end user needs, a less publicised problem lies in the immaturity of requirements identification and designs, when only vague requirements have been articulated by the purchaser. Much time can therefore be wasted in attempts to accurately forecast a budget for the wrong design. Such deviation between initial requirements and final design in complex projects inevitably leads to serious consequences such as delay, lower product quality and excessive financial investment and thus cost, culminating in reduced organisational capability for both consumer and supplier. One useful methodology to address improved identification and stakeholder understanding of requirements is Behaviour Engineering, developed by Griffith University in Australia.

The capability of the current range of audit and investigation tools utilised by project managers must be reviewed and questioned when applied within complex environments and the development of more non-linear triangulated (3 points of reference) methodologies that take both soft and hard systems into account should be urged. Governments obviously do not embark on high capital projects in order for them to fail

and project leaders require better methods to allow them to examine whether or not a complex project is performing as planned. This is particularly important as decision makers responsible for complex projects may have little understanding of complex project management itself. The Executive Resource Group in the UK[xlix] is currently involved in launching a 'joined up assurance project' along these lines.

Risk, and for that matter opportunity management, is an activity spanning the duration of any project, sometimes extending beyond the contract deliverables, realising latent risks and opportunities. Combining duration with risk subjectivity and changing stakeholders' perspectives, interests and aims, can lead to different interpretations of perceived risk profiles that are not necessarily aligned across enterprise, portfolio, program and project risks. Risk management must be multi-dimensional and recognise the macro-level/ enterprise impact of inevitable political changes that occur over long project durations. Australia's Air Warfare destroyers and Collins Class submarines will see spans of 18 – 25 years between their initial planning and the last platform being completed while perhaps 70 years may elapse from the initial concept designs of the Joint Strike Fighter being drawn until the last aircraft leaves service. This creates a situation where projects may have so many 'sunk costs', that politicians or executives who inherit the project feel an overwhelming need to complete them despite changes in need, technology and circumstances. This creates problems such as those which befell the Seasprite Helicopter project in Australia for many years until the government of the day cancelled it. The concept of 'sunk costs' may not be economically rational, but it is politically important, and may be justifiable, but only through the understanding and communication of benefits realisation.

Risk management can be defined as *"the process of analysing an organisation's exposure to risk and determining how to best handle such exposure"*[l]. There are fundamental differences between how risk is perceived and managed in the public and private sectors and within decision-making frameworks - organisational attributes and opportunities and threats to effective risk management are explored in the Working Papers. CPM encompasses non-traditional and intangible areas of risk management, including social impacts and the emergent (2nd and 3rd order) effects of the new system on extant systems. One of the greatest risks lies in how a new project will be integrated with other legacy systems and the extant dynamics of the environment as a whole.

Risk management concerns exposure to variability in outcomes or consequences compared with those forecast. As such, it encompasses both downside and upside risk, i.e. outcomes that are both worse and better than those anticipated. However, risk management in practice is often more concerned with the mitigation of downside risk than leveraging opportunities to create value and improve benefits realisation. Opportunity management aims to maximise such benefits over and above those forecast, resulting from the dynamics of complexity. However, given the relationship between risk and opportunity management, traditional approaches to the latter have focused on applying the fundamentals of the former, including estimating risk and opportunity as the product of impact and probability, allocating responsibility for the management of identified risks and opportunities and monitoring progress via risk and opportunity registers as well as regular reporting.

This approach may well be necessary, but, given the track record of complex project delivery and benefits realisation discussed earlier, it is clearly insufficient when faced with emergent opportunities in a complex project environment. Organisations must plan to leverage opportunities by establishing a culture, supported by process and tools to capture value, in which opportunities are expected and anticipated. Such opportunities include: identifying where risks have prohibited a development path, but provided transparency on multiple alternate paths to which new users and markets for current project components may become apparent, or new uses and applications for current project functionality may emerge; new ways in which project phasing can be changed to meet or exceed current user and market needs may be identified; and ways in which project outcomes can be changed to meet unanticipated user and market needs may be found. Mature organisations can approach realised risk innovatively

and pursue a resultant opportunity, thus producing greater value for the project, program or even the organisation.

A detailed analysis of NASA's Exploration Systems Mission Directorate's (ESMD) *"Integrated Risk and Knowledge Management Program"* (IRKM-P)[li] shows the benefits of an enlightened approach. The IRKM-P was initiated by NASA in 2006 and employs continuous risk management to evaluate events which could prevent the achievement of objectives coupled with proactive implementation of measures to control or mitigate those risks. These risk records are enhanced to capture lessons learned, including conclusions and recommendations, and infused into future activities through the dissemination of knowledge. The program encompasses knowledge based risks, the ESMD's 'Riskapedia' wiki, the use of risk management case studies and Process 2.0 – a review system based on US Army after action reviews. The key to the success in managing risk within NASA through the IRKM approach is the integration of risk management systems, approaches and tools with the human element of knowledge, understanding and experience around those variables that are intangible, including resource support through case studies and lessons learnt; providing triple loop learning opportunities for improvement. Continuous participative engagement with users can therefore capture feedback and provide insight via a rich suite of metrics and enhanced narrative. A real and ongoing dialogue with users can help identify opportunities to create additional value.

Taking a portfolio approach can be highly effective. This involves asking whether opportunities are being identified and exploited across the organisation's portfolio and what lessons can be learned and applied to increase value and quality or reduce time and costs.

Just as portfolio-level risks can extend beyond the risks of the individual projects and programs (and vice versa) to encompass both generic risks (technical, contracting and implementation, for example) and aggregated risks (such as over-reliance on a single supplier for several discrete projects' outcomes, placing pressure on resources), organisations can improve risk and opportunity management by taking a Portfolio-level view of opportunity management. To borrow from a phrase popularised by Donald Rumsfeld[lii], *"There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know."* The key to opportunity management, as with risk management, is consequently not only to manage what we know, but to also be aware of the limits to our knowledge. Projects are highly vulnerable to 'unknown unknowns' as, by definition, they cannot be specifically planned for or insured against. Projects must be resilient enough to weather such 'black swan'[liii] events by recovering from shocks and disturbances, adapting through learning, and undergoing transformation when necessary.

The Institute for Strategy and Complexity Management (ISCM) located in the Netherlands, has created a methodology called 'Strategic Scenario Planning', facilitated by Dr Zsolt M Nyiri and Dr Joop Remmé, that addresses much of what Donald Rumsfeld speaks of; the known unknowns and unknown unknowns, based in perceptions of reality. This methodology surfaces the reality of strategic planning at portfolio, program and even project levels, providing transparency on what is actually occurring as opposed to what people 'say' is occurring; thereby addressing the risk of 'conspiracy of optimism', identifying intangible risks (among other variables) and then stress testing the planning against this reality. This View Point Model (VPM) is fundamental in synthesising the impact of business drivers and stakeholder behaviour on strategy implementation, through the identification of risk, priority and value.

A sustainable organisation must by definition be a resilient one, containing resource diversity and sufficient agility to respond and prosper to changing circumstances within dynamic environments. Resilience is the reward for maintaining diversity within a system and stands in contrast with much of today's management techniques, such as Just In Time (JIT), Lean, outsourcing and excessive process and standardisation. While these techniques are important for reasons of efficiency, resilience must be balanced with that organisational efficiency and not become subordinate to

short-term gains, based around accounting and budget reporting cycles of 12 months duration. Management practice is moving from the concept of stress resistance towards resilience itself, where the aim is not to ignore the emergent impacts, but to recover quickly from them to restore the system's original integrity, or even growing capacity (i.e. leveraging resilience to take advantage of opportunities). All action plans must also allow for the team and individual members to change their behaviour or actions in the light of experience to meet changed circumstances. CPM should support the development of systemic variety and so increase the system's resilience when adversely affected by events. However, this form of resilience must be part of the culture and integral to an organisation's ability to plan and deliver complex projects, and not be attempted as a short-term reaction to a specific risk occurrence.

Research into developing resilient practice to meet the challenge of social complexity in project management has taken a variety of forms. Kathleen Sutcliffe and Karl Weick advocate the fostering of awareness in organisations to combat future uncertainties they may face. In *"Managing the Unexpected; Assuring High Performance in an Age of Complexity"*[liv] they urge managers to *"notice the unexpected in the making [emergence] and halt its development."* Seemingly minor and unrelated incidents may speak of a larger pattern or archetype of failure which, if left untreated, may trigger major systems failure. Overworked, time-pressed managers will inevitably tend to ignore 'insignificant' developments or information about 'near misses' and be unwilling to inquire into 'grey areas' which defy clear resolution or reflect on the failure of methods employed. High reliability organisations, such as hospital emergency rooms or fire brigades, are explicitly designed to perform well under extreme stress, utilising tools such as sense-making, stress reduction and decision migration and labelling.

Complex Project Managers, leaders and organisational executives must be willing to engage in a constant learning experience (i.e. IRKM-P) and reflect upon and amend their practices in the light of experience. The encouragement of skills beyond those emphasised in traditional management will increase the ability of organisations to identify and manage emerging obstacles to success; thus providing agility and resilience.

Examples to illustrate the impact of resilience abound in recent Australian history. Major economic reforms, particularly the removal of tariffs during the 1980s, provoked a restructuring of the economy as manufacturing capacity moved overseas and the service sector expanded. Inevitably there were winners and losers in the short term, but it is generally agreed that the changes underpinned steady growth in national per capita wealth. In agriculture, the steady reduction in wool's share of the fibre market over the last five decades led to incremental change in sheep grazing across Australia, while removal of the wool floor price in the early 1990s was a transformative shock. Many regional centres have not fully recovered from these two events. At a more localised scale, towns built around a single industry have suffered different fates after those industries have moved on or changed their methods of operation (such as the 'fly-in, fly-out' workforce). The loss of BHP Steel jobs from Wollongong, for example, was countered by a planned growth in higher education and Wollongong University is now the major employer in a town which still thrives. These are all examples of changes in the environment having the effect, analogous to tipping points, of creating new paradigms, where if the system does not address diversity and effect systemic change it will not be resilient or sufficiently agile enough to take advantage of external changes.

These economic events, and the social changes resulting from them, as evidenced by the recent Global Financial Crisis (GFC), highlight the role of resilience in complex systems. The Australian economy replaced manufacturing by developing new service industries, helped in part by parallel changes in technology such as IT and the internet. Farming methods optimised for sheep grazing, however, have struggled to find viable alternatives. Wollongong made a conscious choice to invest in education as an alternative to steel, in contrast to other 'rust belt' towns which have not yet recovered from the loss of their major employer. In the successful transformations, the systems were made resilient by having accidental or planned diversity. Before the change occurred, the diversity, if viewed through an accountant's lens, could have

been seen as costly redundancies which stood in the way of economic efficiency but were, in fact, essential attributes insuring against unexpected shocks.

The emergent properties of complexity theory guarantee that complex projects will face unforeseen events while merely complicated projects, in contrast, may simply insure against and plan for predictable risk. Complex projects must be structured and organisationally supported to incorporate not just risk management, but also opportunity management, taking advantage of intrinsic organisational diversity, resilience and agility.

Policy Recommendation 5

Implement risk and opportunity management processes which are appropriate to the degree of project complexity and adaptable to changes in the external environment.

The approach must incorporate commitment, communication and training, organisational framework, measurement and review, all underpinned by a mature risk management process and risk management information system, while also developing resilience – that is, the ability to recover quickly from setbacks of any kind.

Action recommendations

- Implement a complexity assessment process at the earliest possible lifecycle phase of a project and review at subsequent phase boundaries.
- Implement continuous monitoring of both the development and future operational environments.
- Define, agree and institutionalise risk and opportunity management process that is tailorable to the degree of project complexity, accepting as axiomatic that the success of a risk averse approach will be inversely proportional to the degree of project complexity.
- Locate risk and opportunity management responsibility according to supply chain domain knowledge, experience and specialisations.
- Ensure consistency of risk adversity levels across the supply chain.

Culture, Communication and Relationships

"Consider what happens in an organisation when a rumour of reorganisation surfaces: the complex human system starts to mutate and change in unknowable ways; new patterns form in anticipation of the event. On the other hand, if you walk up to an aircraft with a box of tools in your hand, nothing changes."[lv] – **David Snowdon**, former Head of Knowledge Management at IBM

The 'human factor' or dynamics of interconnected systems is a central driver of complexity, while culture underpins the psychology and behaviours that evolve it, especially across international boundaries. All human behaviours, interactions and reactions are driven by core human characteristics (morals, values and beliefs), mental models and experiential learning that can be constructive or destructive, depending on circumstance and personal interests. Therefore, as humans are central to the creation of complexity, the people involved, the ways they communicate and the relationships they develop constitute the behaviour and combined culture of the organisation or project in question. A divergence in values, be they professional, economic, demographical and/or geographical, between stakeholders, is a major influence on cultural complexity, but culture is an under-appreciated factor, even in domestic terms.

The Sydney North Shore Water Tunnel project[lvi], for example, succeeded through the creation and adoption of a vision of the future which assisted in uniting stakeholder assumptions and expectations in overcoming internal and external relationship barriers. However, while the Sydney Cross City Tunnel's failure[lvii] to secure the public's engagement and interests led to financial failure and bankruptcy as project plans were developed and delivered with a dangerous disregard for end user patterns that encompass social needs and wants.

The role of civil society in giving an active voice to public opinion (i.e. providing emancipation) and those affected by complex projects is an ever more pressing consideration, and can be addressed through an understanding of systems thinking (specifically, Critical Systems Heuristics, CSH, by Ulrich, 2003). While the increasingly important role of the internet in accelerating and exacerbating public reaction to complex projects has been a focus of current research, the wider issues of how best to engage with stakeholders,

the appropriate time to do so and the right messages to send in such communications remain fundamental. The acknowledgement of the combination of technology, culture, communication and relationships has poignancy for government policy design and implementation. Stakeholder engagement in political and social reform is an ongoing issue and there is clearly a difference between engaging stakeholders in planning a project and keeping them 'onside' when such reforms are implemented in practice. Furthermore, the advent of social networking will add to future complexity in terms of public action and reaction.

Social, technological and environmental impacts have increasing interconnectedness, attracting heightened political importance, while issues are becoming scientifically, socially and inter-culturally complex. As the social agenda diverges, and more interests need to be accommodated, community expectations are trending towards a demand for 'instant gratification' as people in society, as consumers and workers, expect more choice and more direct influence on decision making. The era of 'big government' is morphing into a 'big society' in which individuals and community groups play a greater role in choosing and formulating the services they require and use. Such shifts from centralised bureaucracies to distributed democratic accountability can dilute the criteria for success, with the situation compounded by the inability or unwillingness of some groups and individuals to accept personal or communal responsibility. Stakeholder groups, including professional entities employed by project organisations or government agencies, can become deeply entrenched in particular points of view or world views *(Weltanschauung)* and present obstacles in designing suitably flexible projects or limit the speed with which crises can be resolved. To prevent the interests of certain stakeholders being served at the expense of others, new approaches to conflict resolution, via a deeper understanding of culture, communications (including technological mediums) and relationships, are required.

The management of stakeholder expectations is, therefore, critical, both when communicating privately among interested and influential stakeholders and with citizens who may only have a minor interest. The focus is usually on the former, rather than the latter, despite public opinion being a major driver of what constitutes success and benefit. The need for dialogue at all levels of government is clear, as experienced in Australia where local, state and federal differences often emerge. All three levels of government were involved in disaster recovery in Queensland[lviii], for example, as well as corporate bodies and private organisations, adding complexity to an already chaotic situation. However, the need for better expectation management is not confined to national issues, due to the influence of globalisation and increasing real-time communication. There is an opportunity to create an international forum of national governments that can improve delivery of social benefits while containing costs.

The need to engage influential and interested stakeholders through multiple forms of communications sooner in the development process must be emphasised in CPM education, with CPM leaders canvassing initial assumptions and reaching a collaborative agreement on potential options/solutions before they are implemented, rather than expecting stakeholder support after the event. The need to use communication methodologies to handle new levels of stakeholder complexity should be emphasised in the management of complex projects, as all too often a project is forced into combative and confrontational social, legal and political relational environments, creating impossible situations for project managers responsible for dealing with fundamentally intractable situations. From this perspective the leader of a complex project is a key stakeholder, who becomes disenfranchised through an inability to influence culture and external relationships that negatively impact the project.

The growth of Information Communication Technologies (ICT) has enabled a rapid expansion of personal, group and community connectivity, revolutionising the ways in which people coordinate and organise their activity. The resolution of information regarding the progress of programs from diverse sources to form a correct picture of the project's overall status is a challenge for distributed teams, and new approaches must allow information flows

between cross-cultural, cross-disciplinary teams to be dynamically updated, analysed, shared, understood and accepted. This is particularly challenging where separate multiple platforms or systems are combined into a single system where each part must offer a seamless fit.

A nuanced and informed understanding of culture, communication and relationships is, therefore, fundamental to complex project leadership. The transition to a 'knowledge age' economy is particularly crucial, with older and more traditional managers often ill at ease with a younger, more flexible and fluid workforce skilled in social networking and distributed communication. Project leaders should be able to leverage the new capabilities of entry level 'millennials', particularly their affinity with networking, team work, computer literacy and multi-tasking, as comfortably as they deal with the CEOs of major foreign corporations or senior government ministers.

As previously discussed, both the increasing pace of technological progress and the social and cultural effects of globalisation have driven complexity in project management. The so called TPC Matrix[lix], for example, provides an observation grid which may be used to highlight cultural and political issues as a source and driver of complexity.

Global manufacturing, for example, might see the local government in an Australian city contract a German engineering department, and a Chinese manufacturer to produce a Light Rail system. Close collaboration through relationships and communication will reduce costs and increase the likelihood of success, but the very different professional, educational, social and political cultures involved may militate against the deeper understanding of the communication; although shared communities of practice may encourage it. Project managers must have at their disposal better tools to cope with today's ever greater degree of social complexity and information. Some companies are now shifting away from centralised power and decision-making structures due to the difficulty of maintaining accurate meaning and context within the variety of communication mediums.

The *"Knowledge Sharing Initiative"* run by NASA's Academy of Program and Project Leadership[lx] was designed at the start of the last decade to exploit NASA's formidable but often untapped wealth of personal knowledge and intellectual capital; it gathers and shares lessons and insights across the agency through informal first person story telling by NASA project managers.

Fulfilling Dan Goldin's requirement to be *'faster, better and cheaper'*[lxi], NASA's focus has shifted from a small number of large projects to a large number of smaller ones over the past decade, mostly as a result of funding appropriations from the US government. This rendered its long-term 'apprenticeship' system of management training obsolete and, faced with an ageing workforce, an expanding number of projects and tight budgets, NASA now relies on its knowledge management systems to identify and capture hard won expertise which would otherwise be lost when experienced professionals retire. The programs bring together technologists, librarians and scientists and encompass human resourcing through to engineering. Thought leaders, project managers and systems engineers engage in an ongoing series of forums, conferences and publications to enable the sharing of narratives and the capturing of lessons learned, enabling understanding and meaning that forms the basis of knowledge.

The system's architecture helps people find, organise and share captured information by efficiently managing knowledge resources and develops techniques and tools to enable teams to collaborate across temporal and spatial divides. Its three fundamental principles are, respect for practitioners, an emphasis on reflection, and the valuing of narrative.

The threat of importing dysfunctional cultures en masse should also be recognised when building complex project teams and cross-discipline relationships. Given a limited pool of human resources, which tends to migrate from one project to the next in various areas and at various times, the culture of a previous project is often imported into that of the new one for better or worse. Many people employed in creating the Australian National Broadband Network were previously employed by Telstra and so Telstra's 'culture' has been imported into the project. This phenomenon also occurred when British Airways was created through the merger of

two nationalised airlines and two regional airlines in 1971[lxii]. Little attention was given to the maintenance of separate cultures by individuals who still identified themselves by their old organisational cultures. Even five years after the merger, employees within the maintenance function still wore the pre-merger logo on their work uniforms, placing cultural value on old symbolism. Managers must be aware of this, both in terms of its positive and negative impacts, and address it by framing a consolidated cultural identity, through such things as organisational norms, symbolism, customs and meaning.

Policy Recommendation 6

Address human behavioural aspects across all major stakeholders who are required to adapt to changes in both project and future operational environments, and to share their experience, knowledge and wisdom globally.

Knowledge and wisdom sharing allows success to be replicated but it needs to be set within a compelling narrative rather than a theoretical abstraction, with human need and behavioural preference taken into account. When coupled with techniques such as scenario planning, simulation and the use of 'story', it helps alter perspectives, build alignment, and provide appropriate tool sets for dealing with complex situations.

Action recommendations

- Accept and admit that cultures and behaviours in a global project environment will differ across regional and sector boundaries, and provide for this aspect in change and leadership programmes.
- Inculcate a culture in which people feel secure in the face of continuous change and high risk, allowing transparency, a willingness to share knowledge, and adaptability in dealing with ambiguity and uncertainty. Open, timely and truthful communication is key to this.
- Identify individual behavioural preference and align those preferences to the degree of project complexity.

Sustainability and Education

In anticipation of a world of a growing population and increasingly limited resources, complex projects/programs must be sustainable in concept, design, development, delivery, operations and disposal. Unsustainable outcomes squander resources which could be better employed in other areas (opportunity costs), from education and health to IT and infrastructure. Sustainability will become an increasingly critical success factor in the project's performance and realised benefits. Sustainability is conceptualised through an understanding of the interconnectedness of system boundaries that act to produce emergent and sometimes ambiguous environments in an attempt to reach equilibrium.

Sustainability relies on the ability to effectively collaborate in competitive economic, natural, political and social environments. As Renee Moorefield[lxiii] observes, business, culture, ecosystems and the planet itself are in a state of constant change and a persistent determination to maintain the status quo can only imperil, rather than ensure, our long-term survival. No company can keep pace with the evolving demands of technology, customers and world markets by clinging to obsolete methods, no matter how well they have served in the past. In order to thrive tomorrow we must continually examine our circumstances today and respond to the shifting world around us with innovation and verve.

Although a July 2008 survey of 3,199 executives from industries and regions around the world by *The McKinsey Quarterly*[lxv] showed that 60% of company change programs produced no positive results, it did identify the factors which allowed the successful 40% to flourish. Enlightened companies set ambitious, but comprehendible objectives and engaged the whole workforce in achieving them. High-profile leadership was vital, but so were a variety of communication and accountability systems to keep everyone committed and interested. Notably, the project leaders presented the need for change in a positive and affirming manner, rather than as negative, reactive responses to particular problems. To ensure the sustainability of organisations, therefore, the reform agenda must move towards a positively reinforcing and continual re-invention aimed at encouraging vitality, commitment and diversity at all levels.

A 'systems anatomy' approach can help produce an organisational strategy, project plan and supporting design for any major

restructuring of a long-standing business activity (ISCM's VPM has applicability here). This adopts elements from Peter Checkland's Soft Systems Methodology, Stafford Beer's Viable Systems Model (VSM) and Integration Definition (IDEF) modelling[lxv] retaining the advantages of each, while offering a 'light' method to help companies sustain their operations in the face of change. Systems Anatomy modelling develops deeper understanding of an organisation by treating it as a system with a clearly defined and explicit vision and purpose. Every system will have multiple stakeholders, each with their own individual view of both the system's role and the means by which successful achievement of these aims will be successfully achieved and measured. The combination of these defines the project's overall purpose, which will demand a number of activities, each requiring material and capabilities at a quantified resource level. The wider environment will give rise to both risk and constraints upon the activities performed while the business groups / projects / activities within the system are regarded as interacting subsystems, all of which must demonstrate a clear contribution to the stated goal.

A commonly acknowledged key to ensuring sustainable capability of organisations lies in the investment in education of their most valuable assets – their people. US$200 billion dollars is spent on training and development each year in the US alone. The development of the *Standards for Complex Project Management*[lxvi] by a group of senior government and industry leaders from across the globe, provides a model for the formation of knowledge and behaviours required of such leaders. It gives special attention to the soft skills critical to successful adaptive leadership, and emphasising the catalytic role of project leadership in the delivery of sustainable business outcomes for the organisation. Such project leadership has a vital role to play in aligning portfolio, program and projects with an organisation's strategic vision and ensuring it remains competitive and effective over the long term. The role universities can play in developing new methods of partnering should not be underestimated, although traditional models, such as Joint Venturing Alliances, may prove to be inadequate in the new environment. A more cooperative relationship between academia, industry and government is required, based on triple loop learning, to facilitate accelerated cross-pollinated knowledge. Similar to the way benchmarking is used to transfer standards and structures from one industry to another, Henry Ford's production techniques have been innovatively imported to medical emergency queuing theory to resolve bottlenecks.

Acknowledging the constant innovations required in the implementation and production of outcomes in complex projects and recognising organisational functional silos, this limits aggregation of knowledge. Fresh approaches to education promoting sustainability and cross-discipline awareness (i.e. lenses) are required to develop the next generation of complex project leaders. These will entail innovative teaching and learning design and delivery that depend upon the willingness and capacity of academic and industry practitioners to collaborate across boundaries to develop leaders who are simultaneously cognitively flexible, emotionally intelligent and reflective of experience.

Future approaches to sustainable organisational capability and growth should encompass the elements described in the complex project management standards, including such factors as strategy, business planning, life-cycle management, reporting and performance measurement, change and journey, innovation, creativity, intelligent working techniques, organisational architecture, systems thinking and integration, leadership, culture, and probity and governance.

Both formal university education programs and customised organisational and individual development activities have the potential to deliver improved sustainable results for project-based organisations. For example, NASA's Academy of Program/ Project and Engineering Leadership (APPEL) lead by its founding Director, Dr Ed Hoffman, serves NASA by enabling individual and team excellence in program and project management and engineering through the application of learning strategies, methods, models and tools. APPEL promotes communication and transfer of wisdom through knowledge sharing events and publications. It creates opportunities for

project management collaboration through research and exchange with universities, government agencies, professional associations, and industry partners. APPEL serves as a clearinghouse of world-class expertise for project teams through performance enhancement services tools, and also develops project leadership maturity through career development processes and programs.

NASA achieved accelerated change in virtually every facet of the organisation, and reflected worldwide changes in the business environment. In a short span of time the responsibility of project managers shifted from a focus on mission success (technical, business, safety, and customer satisfaction) to responsibility for business management, commercialisation, new technology identification and development, customer satisfaction, strategy, and much more.

Using the complex project management standards as a guiding framework, both formal university education and customised organisational and individual development activities have been developed respectively. In collaboration with ICCPM's global Associate Partner Network they include the Queensland University of Technology's Executive Masters in Complex Project Management, and ICCPM's short courses beginning with the Executive Education Foundations Unit on Systems Thinking and CPM. This tiered 'system of influences' comprises trainee characteristics, including innate ability, personality and motivation to learn; the training design, including a strong transfer design and appropriate content; and the work environment, including support, rewards and the opportunity to use new learning. Organisations must proactively manage their educational investments and align this opportunity with organisational demands to influence change in the workplace, effectively adding sustainable value.

Much research remains to be done in response to the need to deliver complex projects more efficiently, effectively, economically and ethically[lxvii], given their high levels of emergence, ambiguity, temporal changes and technical demands. Three areas for future development by ICCPM through focussed government and industry support are; the development and refining of CPM standards; the establishment of measures for successful education and training; and the creation of models for collaborative partnerships between industry and the education sector.

Ultimately, the most complex project that humanity faces is ensuring the sustainability of the planet. Human (social), organisational, economic and natural systems must have the capacity to self-regulate to ensure the enduring viability of the environment on which they depend, be it a single variable actor or the entire system of systems. The employment of evolving self-organising systems relies on diversity and natural evolution and so many individual elements within the system are inevitably going to cause undesirable changes. This perceived undesirability is traditionally trumpeted by the media as argument for the failure of the system, when it is actually part of the process of success. A child is not born with the capacity to walk until it masters its complex body and the environment it interacts with.

Policy Recommendation 7

Establish systems to manage the interconnectedness and interdependencies that affect project success and build in long-term sustainability.

This is achieved through instituting collaborative decision making and governance frameworks, and building organisational resilience including re-designing, where necessary, structures and systems to ensure that excessive control is not hampering adaptive dynamics. Project managers and senior executives must become familiar with Complexity Leadership Theory (CLT) and be able to implement potential solutions as dictated by their emergent environment.

Action recommendations

- Implement collaborative decision making and governance frameworks across the entire supply chain supported by common, accessible, communication mechanisms.
- Review structures and systems to ensure appropriate subsidiarity.

Policy Recommendation 8

Offer specialist CPM education programmes according to the degree of project complexity and required capability and ensure that knowledge, skill and wisdom, once captured, is preserved.

This necessitates the use of tools such as behaviour engineering, strategic scenario testing, simulation, Viable Systems Model (VSM), and framework for managing complexity interconnections (F4MCI). The use of communities of practice, stakeholder participation models and CPM Response Teams support improved systems thinking.

Action recommendations

- Implement a systems-based approach to CPM, providing the necessary education and training in CPM methods and tools appropriate to multiple levels of seniority.
- Implement experiential learning as a core activity.

ONGOING RESEARCH AGENDA

The ongoing research agenda is derived from this CPM Report, feedback from international facilitated workshops in the US, UK and Australia, and the ICCPM/ GAP Global Task Force. The compiled list of recommended research areas will be presented to the soon to be established Research Council, within ICCPM, for refinement and grant appropriation.

A fundamental recommendation of the Task Force was the establishment of a permanent global Complex Project Management Specialist Research Centre (SRC) that builds on the work done by the ICCPM and is funded by a range of international governments and organisations. Such a centre would developed practical solutions to the problems of managing complexity, foster global co-operation, close the gulf in understanding between professionals and non-specialists and act as a critical advisor to organisations, both public and private, involved in complex projects. The SRC would allow the cross-pollination of experiential learning and provide a reputable and independent source of practical advice on the management of complex projects.

It is envisaged that the outcomes of the research from the SRC would form the basis of practical intervention methodologies and tools for addressing projects of concern, as well as providing the foundational knowledge on which to build new project and organisational structures that are better able to address the effects of complexity. The SRC would carry forward the interactions of the Task Force, providing a forum within which practical solutions can be developed from the ICCPM network as well as providing a platform for advocacy for change among stakeholders. It would enable the sharing of best practice in a “safe”, non-attributable environment, offer education to managers and drive systematic reform. In conjunction with the ICCPM, the SRC would provide a venue for “truth telling” among peers experiencing common issues associated with managing complexity. The SRC would act as an enabler, bringing together peers and subject matter experts, to assist organisation in simulating the effect of decisions and reforms on projects and programs.

As the work of the Task Force indicates, a good deal of knowledge regarding CPM already exists, the difficulty identified is associated with encouraging governments and organisations to recognise the utility of that knowledge, put it into practice, share

experiences and learn from it. The proposed centre will assist in driving this process.

The research agenda will include exploration of the forms that industry/government co-operation can take and the possible models which can be adopted in pursuing such collaborations. The connection between CPM and traditional project management and the pragmatic incremental steps between those disciplines must also be further explored. Ministers, departmental executives and business leaders are looking for support and advice in making complex decisions. They need 'stories' to tell to encourage change and collaboration as natural elements of needed reform. Research and information sharing are important, but the priority must be the offer of immediate solutions, which the SRC could generate. The SRC will structure nascent industry and government networks to create multi-government discussion forums to share better costing models and techniques across national boundaries. It might also facilitate the creation of a CPM 'Response' team, advising such networks on failing projects, instituting CPM best practice in project and organisational development, and support project management understanding of existing complex projects.

The aim of developing knowledge in complex management in general, and the research agenda championed by the proposed Global Specialist Research Centre in particular, will be to provide understanding of complexity to a level that human beings can work with successfully, while recognising the challenges of dealing with complexity at a holistic, system of systems level.

An inaugural set of possible research questions is provided in Annex B of this document; we actively seek and encourage comments, suggestions and additions to this list.

Policy Recommendation 9

Establish and support a permanent, co-ordinated global specialist research centre for CPM.

This should be funded internationally through a range of governments and organisations and be located within ICCPM. Such a research centre would continue the discussion of this report's observations, maintain the CPM standards, keep the network alive, provide a platform for advocacy, and acquire ongoing legitimacy among stakeholders. In developing and sharing best practice and fostering global cooperation, the centre would improve overall awareness and understanding of CPM and advise governments involved in managing complex projects.

Action recommendations

- Implement collaborative decision making and governance frameworks across the entire supply chain supported by common, accessible, communication mechanisms.
- Review structures and systems to ensure appropriate subsidiarity.

ANNEX A:

Working Papers' Core Recommendations

A challenging economic environment and changing public expectations pose problems for governments and businesses alike in the successful delivery of complex projects, to the traditional project management success criteria of, 'on time and on budget'. In response, the Task Force generated a series of recommendations for industry, government and, crucially, for collaboration between the two, to improve complex project delivery and explore future concepts of success.

Both Government and Industry often attempt more complex programs than the private sector alone; but given current financial structures, governments and industry can ill afford to waste money on failing technological or industrial programs or social schemes. Greater attention to the unique characteristics of CPM would improve the collaborative outcomes of projects, helping project managers to successfully achieve their aims and reduce the incidence of expensive political embarrassments. Risk and uncertainty are inevitable and there are no 'one size fits all' solutions, but strong leadership can drive effective complex project delivery if supported by cultural and behavioural change.

The Report surfaced a number of Core Recommendations within the Theme Areas that formed chapters of the accompanying compendium of Working Papers. These have been grouped based on the topic they address, derived from the chapters in that Compendium.

Core Recommendations by Chapter

Recommendations grouped by Working Papers Chapter

Chapter 1

- **Continue to support the development of a framework for Complex Project Manager certification and education.**
  Certification by IPMA and PMI will continue to be the mainstay of the Project Manager's baseline credentials but the explicit acknowledgement of Complex Project Management implies the requirement of a higher order experience set. The value of proven experience, education and demonstrated competency in complex project management will take on even more organisational relevance beyond having the certification itself.

- **Support the implementation of formal education and training in systems thinking concepts and approaches as the foundation of the Complex Project Manager's development.**
  In order for Complex PMs to fully appreciate broader organisational influences and the dynamics that result, a Complex PM should have a foundation of formal education built on Systems Thinking concepts and approaches.

- **Establish a coherent and consolidated delivery leader development program as part of an overall talent management framework.**
  In order to build organisational capability, agility and sustainability, strategic HR tools should be used to identify those potential complex project delivery leaders allowing suitable individuals to be fast tracked on the basis of future potential rather than past performance.

- **Maintain investment in ongoing development of competency standards that include emphasis on cognitive capability and the mastery of Emotional Intelligence (EI).**

As complex project management gains greater acceptance as a discipline, the hiring, assignment, promotion and professional development of PMs will be based on comprehensive competency models, founded on existing traditional PM, but emphasising mastery of soft interpersonal understanding, awareness and skills. In order for these models to be effective, organisations must tailor the standards to their specific policies. Accordingly, the senior HR executives, business unit heads and the enterprise project management office need to institutionalise organisation-specific competencies, thereby building a strategic framework for talent management success.

- **Invest in the development of adaptive leadership skills for Complex Project Managers.**

Leadership skills such as critical thinking, complexity leadership, stakeholder engagement and the ability to implement portfolio-wide sustainable change, will be core strategic strengths of future CPM competencies. A delivery leader of complex projects must display the ability to create, develop and maintain healthy relationships in the face of diverse and often competing stakeholder interests and priorities.

- **Engage with industry and Governments to develop aligned and integrated complex project leadership frameworks for use in collaborative environments.**

Increasingly there is a need for both government and industry to collaborate and to develop aligned and integrated leadership frameworks. Considered leadership selection against the complex PM Standards within specific organisational contexts and cultures is required.

- **Develop and establish policies which clearly define "leadership" within specific organisational contexts.**

Organisations must adopt policies and guidance to clearly articulate what project/program 'leadership' means within their organisational context and culture. This policy must be aligned and integrated with the overarching CPM competency and development framework policies.

- **Establish talent management policies in organisations to identify, develop, and retain talents resident within the organisation.**

There is increasing competition for talent within complex project management; hence there is growing need for both industry and government to develop policies espousing talent management and retention strategies to avoid detrimental industry cannibalisation undermining resilience and sustainable capability. Talent comes in all shapes, sizes and ages. Investment in development of policies focusing on "growing your own" will recoup returns to the organisation through more efficient use of existing resources.

- **Develop and implement shared leadership models throughout and across organisations.**

The focus of CPM must move from simply project management to shared team leadership. With shared team leadership a small core leadership team is established to share responsibility for guiding the project, each member taking the lead when their expertise is most needed. The team must be multi-disciplined, highly skilled, dedicated to the project full time and co-located.

Chapter 2

- **Implement techniques to enable self organisation and distributed leadership.**

While the boundary separating the "edge of chaos" from a point too "far from equilibrium" is not simply defined, leadership techniques should be employed that allow leaders freedom and flexibility short of chaos promoting self-organisation and distributed leadership.

- **Adopt specialised decision making aids tailored specifically for CPM.**

Employ decision making tools such as Behaviour Engineering, View Point Modelling (VPM), Viable Systems Model (VSM) (Systems Thinking) and F4MCI - Framework for Managing Complexity of Interconnections to gather information for decision makers. These tools provide decision makers with greater insight into all aspects of managing complexity.

- **Develop organisational processes and frameworks that synthesise the output of innovative tools and methodologies to better support leaders in timely executive decision making.**
Leaders can be swamped with the output of multiple tools and reporting systems. What is required is a methodology for synthesising the data derived from such tools into a coherent, accessible summary.

- **Institute the concept of sunk costs to align with accountability and political influence.**
Project Leaders must be aware of what constitutes Sunk Costs and at what stage in a complex projects lifecycle a threshold is approached or breached, activating project review. Independent evaluation coupled with closed loop knowledge methodologies will account for non-linear processes and should also be adopted.

- **Invest in the redesign of organisational structures to address complexity.**
Executives must rethink the way they design their organisational structures and systems to make sure that administrative and controlling functions are not barriers to adaptive dynamics and processes. Administrative structures pressure the system for results and to stay within pre-defined rules and procedures i.e., exploitation, while adaptive structures operates in the face of emergence to generate new ideas and new ways of doing things i.e., exploration.

- **Invest in the establishment of a permanent global specialist research centre for CPM.**
There is a need for the establishment of a permanent global specialist research centre for CPM. The objective of the Centre would be to:

    a. Draw on global resources to foster and develop research that addresses contemporary and long-term issues faced by CPM organisations globally.

    b. Facilitate the sharing of best practice and emerging developments in CPM.

    c. Provide a “safe environment” for simulated application of new approaches in CPM and for modelling CPM interventions in specific projects.

    d. Foster ongoing global cooperation in CPM

- **Establish cross enterprise/Government Communities of Practice (COP)**
Informal learning approaches such as Communities of Practice (COP) should be established drawing members from across nations, industry sectors, enterprises and governments to facilitate the development and assimilation of knowledge in best practice CPM, and promote broader understanding of systemic issues. COP should adopt new and emerging social learning technologies and communication forums to facilitate the widest possible connectivity among members.

- **Establish collaborative governance frameworks.**
New forms of collaborative governance frameworks should be established to improve communication and to clarify relationships between organisations representing different industry sectors and between principals/governments. Such frameworks require support by aligned financial and human resource structures to enable executive decision making within a distributed leadership culture.

- **Develop and implement novel frameworks to support integrated centralised and decentralised decision making and accountability.**
In order to cope with emergent complexity, organisations require a combination of centralised and decentralised decision making models and the relevant governance frameworks to support that diversity (policy, process and procedures). In support of this executives must appropriately empower their CPM’s to make decisions when the imperative exists and clearly communicate to stakeholders their authority limitations.

- **Sponsors/Governments to make explicit their commitment to long-term project sponsorships**
Sponsors/Government must underline their commitment to high-capital, long-

duration projects and programs to provide certainty and risk mitigation for suppliers and investors. Industry is less likely to fully engage in collaborative and beneficial relationships with government or major project sponsors if it doubts their long term commitment. This is especially relevant to future collaborations in major long term and complex infrastructure, defence, IT and renewable energy programs. A sharing of risk between stakeholders, based on better risk management and opportunity management, supported by the certainties of long term commitments, would reduce the cost of such partnership programs and better ensure success.

- **Adopt new approaches to accounting methodologies.**

As all complex projects are likely to exceed the duration of annual accounting cycles, a new approach (linked to longer term economic benefits and benefits realisation) is required to fund complex projects, especially within collaborative environments. New accounting methodologies should support the development and maintenance of trust and recognition of shared interests/risks amongst collaborating parties. These new accounting approaches need to be flexible and transparent so as to address considerations in regard to maintaining shareholder value, meeting the requirements of Sponsor/Government appropriation processes and allowing sufficient transparency of value/benefits realisation.

- **Develop and adopt improved financial control policies**

New policies and accounting regulations should be developed to recognise the specific challenges facing management of complex programs. Such policies and regulations should explicitly support transparency among partners and collaborative risk management frameworks in complex long term programs.

- **Executives and CPMs should team with "change partners" and adopt structured and systemic methods to facilitate the adoption of changes generated by projects**

Change is most effectively initiated through projects where CPMs are change agents with influence and appropriately equipped/empowered to facilitate the type of change required to adopt the product or service the project aims to deliver. Organisations should increase the utilisation of "change partners" (also known as change management experts) throughout their organisation, and by projects, to assist in adoption of changes delivered by projects so as to fully realise the expected benefits. Moreover, change management methods should be incorporated into complex project management methodologies to be applied during the normal course of business by project management teams.

Chapter 3

- **Establish a Whole-of-Government/Organisation Major Project Authority (MPA) to improve holistic portfolio management and take advantage of the efficient and effective utilisation of resources.**

A Whole-of-Government/Organisation Major Project Authority will have oversight across the portfolio of projects, enabling the holistic appreciation of competing tensions of complex projects. This authority should have access to ministerial/executive decision makers and oversight of all project investments, including the ability to stop or re-scope failing projects. The Whole-of-Government/Organisation Project Authority would set policy for CPM and oversight the development and implementation of CPM principles and methodologies into programs. Such an agency also ensures the most effective and efficient utilisation of relevant resources, allowing for effective benchmarking across different investment sectors, and providing for consistency across programs.

- **Support the establishment of collaborative CPM Response Team(s).**

The creation of a collaborative Response team has been identified as a practical and effective mechanism to address/overcome industry-industry, government-industry and government-government challenges. Response teams may to be deployed in to collaborative complex projects where risk is shared and would be armed with skills,

knowledge and the authority to instruct critical change and to boost management capability as required. Independent Response teams, drawn from members of the ICCPM partner networks, and coordinated by the ICCPM, can be constituted and deployed on a flexible basis to support governments and industry in addressing independent expert reviews of failing projects and address emergent CPM related issues. A Whole of Government Major Project Authority would utilise the concept of collaborative Response teams as a foundational element of its approach to managing complex programs.

- **Adopt detailed and systemic benefits management processes and practices that support the development and validation of robust and realisable benefits.**
Business cases should treat benefits consistently by using a portfolio-wide Benefits Eligibility Framework and applying reference class forecasting. All identified benefits should be validated where possible with the recipients and be subject to ongoing independent review. Stage/Phase 'Gates with teeth' should be applied that include formal re-commitment to the benefits case.

- **Adopt broader perspectives on project value to increase upside opportunities.**
It is recommended that organisations look beyond the traditional measures of value, such as rate of return, to identify other potential returns and opportunities from complex projects. These may include improved efficiencies and effectiveness in social, political, organisational and environmental areas.

- **Incorporate benefits realisation monitoring into project and organisational performance measurement.**
Project performance measurement and organisational governance regimes should track benefits realisation to ensure the 'performance matches the promise'. Such systems should utilise metrics that influence behaviour, realign reward and recognition strategies, ensure continuous participative engagement, look beyond the economic man paradigm to bed down behavioural change, manage the portfolio benefits, conduct real time reviews that aim to learn not to blame.

- **Undertake a strategic assessment of organisational capabilities to identify core functions and their contribution to value.**
Organisations should identify where their business process and functions add value to their end product, in contrast with what functions and capabilities that could or should be 'in-sourced' or "out-sourced" either outright or through strategic relationships with complementary organisations.

- **Develop strategic in-sourcing policy.**
Both industry and government must review internal policy regarding the phenomenon of outsourcing/in-sourcing to better enable an economic equilibrium and transition of resources. Within complex projects there is an increasing number of interfaces, agents, stakeholders, business units etc., hence to reduce waste and provide additional value to customers from services and products, the strategic identification of transient organisational/government activities must be reviewed and aligned policy developed.

- **Revise existing risk management to incorporate innovative approaches.**
Traditional risk management systems should be revised to incorporate non-traditional approaches to the identification and management of risk. Non-traditional risk management includes macro risk issues such as social system effects and macro level events on related systems as well as utilising experiential data to look beyond simply technical risks. Further opportunity management can play a role in the holistic definition of what is a risk, and what opportunities can be gained by a change in risk profiles

Chapter 4

- **Expand and continue to support CPM Communities of Practice (COP).**
COP's, such as the existing ICCPM Focus Groups ensure consistency of terminology, methods and techniques, across teams, divisions, organisations and sectors – not only by facilitating communication, collaboration and trust, but also by enabling benchmarking, wider performance measurement and continuous improvement.

- **Develop and adopt frameworks that promote contracting solidarity with strategic partners.**

Organisations can improve contractual performance and CPM outcomes by the adoption of frameworks that promote contracting solidarity or trust with contracting partners. These frameworks assume and encourage cooperation and continuing dialogue and the recognition that the overriding purpose of contracting should be to determine and then maintain the alignment of the parties and their respective capabilities to deliver the expected benefits to all parties.

- **Establish systems for capturing and disseminating data derived from the operation of contracts to inform the development of policy and practice.**

Organisations should regularly capture data on the frequency, source and consequence of change along with similar data related to claims and disputes.

- **Institute an approach to contract creation/formation with a view to achieving the long term outcomes sought from the agreement rather than "game playing" to achieve short term goals.**

At contract creation/ formation parties with short term interests and goals become influential on both sides and can drive contract formation to achieve short term goals that may not be aligned with the long term outcomes sought. The situation demands a better planned and more integrated commercial approach (i.e. relational contracting), which can best be driven by the parties who are responsible for delivering the end benefits sought under the agreement. In contract formation the role of external stakeholders and advisors should be subordinate to the long term goals of the project.

- **Develop and institute relational contracting and risk management methodologies that recognise the iterative and collaborative nature of risk management.**

Building on past experiences organisations need to adopt a new approach to conceptualising commercial relationships and give effect to them through appropriate contracting constructs. This necessitates the training of relevant specialist advisors such as legal practitioners to transform their mind set from an adversarial to collaborative approach. This is especially important in the identification and management of risk over extended periods of time, without impacting cost, schedule and quality. All involved in CPM need to recognise that risk identification and management is an iterative activity that needs to be conducted in a collaborative manner continually over the life of the agreement.

- **Institute arrangements that support the earlier engagement of suppliers in procurement project planning.**

It has been recognised that procurement organisations in both public and private sectors benefit from the early involvement of supplier organisations in their requirements definition and project scoping activities. Procurement organisations should sponsor the creation of safe environments for information transfer with potential suppliers without the legalities of loss, or the driver of competition, affecting the veracity of the information and the scope of the engagement.

- **Institute the concept of benefits realisation into organisational management practices.**

Organisations, including governments, should create a language and value framework of benefits realisation and define it within their specific organisational context. The concept of benefits realisation should be used as the driver for understanding short and long term benefits when evaluating business cases. The concept must be developed in parallel with the concept of 'sunk costs', i.e. to balance the attainment of benefits with the reality of investment decisions.

Chapter 5

- **Adopt and implement stakeholder participation models, tools and methodologies within a coordinated stakeholder engagement and management framework to ensure better organisational and stakeholder outcomes.**

Adoption of quality stakeholder participation models and tools within a consolidated stakeholder management framework allows for greater clarity in stakeholder interests and benefit requirements while addressing the influence of political complexity in long term projects. Such a reform will also contribute to a reduction in transaction costs, boost efficiency and raise customer's satisfaction.

- **Invest in and support the establishment of multiple organisation teaming and collaboration.**

Collaboration is essential to take advantage of the issues and opportunities presented by rapidly changing technologies and to address short term or emergent requirements. Such inter-organisational relationships would provide a staging point for a broader range of diverse capabilities whilst maintaining organisational independence and probity.

- **Conduct considerate and iterative stakeholder engagement.**

In both the definition and realisation phases of any complex project it is vital for project teams to continuously develop their understanding of the stakeholders' objectives, interests, constraints and expectations, whether these are reasonable or not. Stakeholder management is not a discrete activity; it should not be regarded as a separate aspect from day to day project management. It must be integrated into the project business as usual philosophy and it should not be outsourced or handed over to the PR department. It is important to continually identify changes to stakeholder dynamics especially their levels of interest and influence throughout the project lifecycle.

- **Develop new strategic relationship systems.**

A dynamic collaboration system is needed to help government, business and society deal with ever increasing complexity. This will require the development of new strategic relationship systems, underpinned by stakeholder characteristic awareness. All too often a project is forced into relational environments which are not suited for it, creating impossible situations for project managers tasked with dealing with fundamentally unsound situations.

- **Invest in transformation of organisational culture to encourage flexibility and agility.**

Disjointed cultural relationships predominantly based on functional structures within and between organisations have been identified as direct causes for many major project failures, due to a lack of organisational flexibility, agility and awareness of interfacing activities. As an example, many project teams are set up in a matrix construct in an attempt to be agile and flexible, however in reality they operate in a functional way, as dictated by the overarching constraints of organisational culture.

- **Recognise the political dimension.**

Complex projects, due to their extended durations, tend to have crucial and dynamic political dimensions that affect success. This is compounded by an ever greater number of changing stakeholders, governments and regulations that influence today's globalised decision making environment, where complex management demands leadership and courage (speaking truth to power) in political negotiations.

- **Generate debate among decision makers.**

Just as system engineering and conventional project management are necessary, but not sufficient for success in complex projects, so considerations of complex project management itself are not the end of the debate. More fundamental questions regarding sustainability, economic competition and human relationships must be acknowledged and aired through such forums as the ICCPM global roundtable events and supporting education through short courses and research.

- **Recognise and promote 'story telling' as means of knowledge transfer.**
Within project based organisations, storytelling is a powerful way to communicate knowledge. Experience from leading project based organisations has identified that storytelling facilitates the emergence of leadership from the 'bottom-up', particularly when senior leaders' support this method of knowledge transfer.

- **Develop simulated practitioner environments for Complex Project Management.**
Managers of complex projects need to learn through transparent experience, and the most efficient way to do so is with sophisticated simulations of complex projects. The tacit skills needed for dealing with situations in complex projects, where there aren't necessarily any right answers, are best developed through transparent experience. Such simulated environments allow participants take decisions, see the outcomes of these decisions and discover the causal links between the two. Participants thus complement the knowledge acquired using traditional methods, by putting theory into practice, and making mistakes in the safety of a simulated environment. By giving participants compressed and transparent project management experiences and the chance to 'live' and visualise the sorts of decisions, issues and outcomes they are about to encounter in the real world, these simulations can provide efficient and effective performance improvement opportunities.

- **Promote the cross-discipline and cross sector knowledge transfer.**
Such knowledge transfer allows relevant learning from solutions and practices developed from outside complex project management paradigms and in different organisational and industry contexts.

- **Establish knowledge sharing and dissemination frameworks to identify, translate and promote the replication of success stories.**
There is a significant amount of facilitative knowledge and practice in the world, often in sectors which would not usually communicate or benchmark each other. Methodologies are required to allow translation of lessons learnt and knowledge developed from successes in different projects, industries or sectors.

- **Continue to promote and invest in Complex Project Management as a specialised discipline**
The bedrock of CPM as a specialist discipline is founded in the mastery of traditional functions of PM. The transition from a PM to a CPM cannot be taught through texts alone as knowledge, familiarity and awareness of the combined interactions of organisational functions, create a higher order specialisation in its own right. The organisational promotion of CPM as a specialised discipline reduces the knowledge boundaries between functional silos and enables cross pollination of disciplinary knowledge.

- **Establish systemic, targeted and coordinated talent management systems to manage talent as an asset to be developed.**
The increasing competition for talent, driven by technological advances, a more transient global workforce, growing economies in developing countries and retirement of 'baby boomers', has emphasised the value of talent management. Within CPM this means, both industry and government must improve talent management and recruitment and retention strategies to avoid detrimental cannibalisation and poaching undermining existing capability and long term sustainability. Better understanding of the workforce motivators, a more flexible approach to working conditions, remuneration, personal and career development, mentoring and morale, would improve retention rates and productivity. These talent issues must be aligned with organisational culture and goals.

- **Understand the organisation's knowledge drivers before selecting software applications for mandated use.**
Project management organisations will need to disabuse their stakeholders and

executives of the expectations set by IT consultants, the media and the vendor community that software applications provide the next “silver bullet”.

- **Adopt experiential learning as the norm in CPM.**
The professional development of CPMs will increasingly focus on reality-based learning and on-the-job training, an approach certain organisations have taken for many years. Learning providers will be required to send CPMs back to the job from such sessions with the ability to immediately apply what they learned to their current projects.

- **Recognise and enhance the role of informal learning in the development of CPMs and support development of such opportunities.**
Organisations will continue to develop and exploit informal learning approaches such as communities of practice (CoP), various forms of social media, as well as coaching and mentoring. Combined with “millennials” joining the workforce and baby boomers retiring in greater numbers, we will witness more effective use of social learning technologies and approaches, such as wikis, blogs, videos, podcasts and other methods of communication within complex projects.

- **Develop and implement policy that is aligned with and supports institutional change agendas.**
To culturally imbed changed, specifically institutional change, both internal and external environments must influence and support the change. Lessons should be drawn from positive examples of organisational cultural change, such as that undertaken at NASA, to identify those drivers and sources of change that can be harnessed or promoted by organisations. Policy should then be developed that institutionalises these forces and promotes their development.

- **Develop knowledge frameworks that capture lessons learn by the practitioner for the practitioner.**
Professionals feel validated when their lessons and stories are valued and become more willing to make time in busy schedules to share and, just as importantly, take the input of others on board. Such forums must be led by the practitioners themselves and be controlled by them, without fear that senior management will use any criticism aired to their detriment. It should not become a meaningless ‘quality circle’ exercise driven by officialdom and forced on practitioners regardless of their own wishes and priorities.

- **Establish a collaborative, participatory forum for simulated scenario modelling and testing of complex project environments.**
All parties in complex industries where ongoing collaborative engagement is required for success will benefit from the establishment of a physical scenario and modelling house, where collaborating organisations can simulate complex interactions, be they legal, technical, social, political etc. This scenario modelling house may be used to validate lessons learnt, develop CPM practitioner skills and also to validate areas of ICCPM research.

- **Establish multi-organisational or multi-government forums to share lessons learnt and explore developments in CPM related fields.**
All parties will benefit from the establishment of multi-party forums in which cross governmental/ organisational procurement/ acquisition/ delivery portfolios are discussed to share lessons learned, challenges and explore effective solutions with a view to collaborating where possible.

- **Sponsor cross pollination (through action research) of experiential learning between government and industry.**
Complexity in projects does not follow uniform dynamics; therefore increased experiential learning is required, encompassing alternate world views. This includes the cross-sector fertilisation of industry benchmarks. Such policy solutions from outside complex project management paradigms could prove valuable in this space. This also assists in personnel development and talent retention.

Chapter 7

- **Invest in ongoing and increased education and awareness of CPM.**

Continued sponsorship of structured CPM education assists in institutionalising the benefits of CPM within an organisations workforce. With the aim of placing 'Old heads on young shoulders", young professionals could be rapidly developed in CPM and universities encouraged to initiate development of these skills in their students through combined workplace and educational forums.

- **Support promotion of Complex Project Management as a specialised discipline.**

CPM is qualitatively different from the attributes required to deliver simpler programmes. The agility and resilience of its inevitably broad spread of skills should not be limited to the narrower boundaries of established professional disciplines. There is a need to distinguish between project management as a process and as a function or discipline.

- **Sponsor and invest in the incorporation of the principles of Complex Project Management in undergraduate education.**

Undergraduate studies must develop abilities in CPM. Given the nature of CPM, undergraduates require a sound understanding of the interfaces of business functions at a holistic level. Instead of Universities 'protecting' disciplinary stove pipes, they should encourage cross pollination of skills/knowledge/awareness in their students.

- **Sponsor greater collaboration in education.**

The current workforce of project managers, business analysts, engineers and architects have limited capacity to meet the challenges posed by new and emerging business processes that are more interconnected, interdependent, and interrelated than ever before. To reap the rewards of significant, large-scale business/technology initiatives, professionals must be supported by appropriate skills, knowledge and expertise in operating within and dealing with new developments. Collaboration of organisations via aligned competency models and the use of common language will improve understanding of CPM between stakeholders and drive long-term benefits through combined efficiencies.

- **Establish forums that enable cross pollination of learning and practice.**

The sharing of experiences across traditional boundaries and in usually adversarial environments would prove beneficial to public and private stakeholders alike. Project complexity does not follow uniform dynamics and so the sharing of experiential learning is vital if the repetition of costly mistakes is to be avoided and the adoption of better practice enabled. There are major opportunities for the adoption and cross-fertilisation of industry benchmarks and policy solutions from outside CPM paradigms. The establishment of cross enterprise and government communities of practice would facilitate informal learning approaches and policy creation should take into account the exponential growth on social learning technologies and communication forums.

ANNEX B:

Inaugural Research Agenda Recommendations

In parallel with the CPM Report - Global Perspectives and the Strategic Agenda to 2025; a Specialist Research Centre, named the International Complex Project Management Centre for Knowledge Development and Dissemination (KD2) will be launched. The existing Task Force will be invited to become the International Complex Project Management Research Council (ICPMRC), exercising oversight of the research programme.

In operation KD2 will draw on the ICCPM Associate Partner Network, academic researchers, subject matter experts and experienced practitioners to provide research aimed at reforms to the manner complex projects are managed and target research aimed at specific projects/ organisations or systemic issues in CPM. KD2 will have a number of complimentary objectives and aims:

- General research into issues of importance to the development of CPM as a recognised discipline in its own right.
- Targeted research into specific fundamental issues associated with the management of complexity.
- Commisioned research into issues facing specific projects or organisations in their management of complexity. This may include developing interventions into failing projects or organisations.
- Facilitating dialogue between peers and subject matter experts, to simulate the effects of proposed decisions and reforms on projects and organisations. This may include independent assessment of project viability and likelihood of benefits realisation.
- Providing credible, independent, unbiased, assessments of issues of complexity facing the management of specific projects or organisations, drawing on the global resources of the ICCPM partner network.

KD2 will also provide a venue for ‘truth telling’ and ‘truth testing’ among peers experiencing common problematic issues associated with managing complexity, enabling the sharing of best practice developments in a ‘safe’ and unattributable environment.

The inaugural Research Recommendations below provide suggestions for future CPM research and investment. The ICPMRC, along with input from the ICCPM Focus Groups, will ensure appropriate consultation and consideration and investment allocations is given to specific and prominent research topics.

Again, chapter numbers relate to the Working Papers compendium.

CHAPTER 1

Research Recommendation V.	Establish the characteristics that define the boundary between complicated and complex.
Research Recommendation VI.	How does the contextual nature of 'complexity' apply to complex project management?
Research Recommendation VII.	Define the measures of success and success drivers in complex projects over and above those of the traditional project management triangle (Cost, Schedule, and Quality), including through-life deliverable performance.
Research Recommendation VIII.	What is the relationship between the application of rigid process compliance and complex project success?
Research Recommendation IX.	What behavioural characteristics, personal qualities and capabilities can be observed in successful complex project managers that are absent in unsuccessful complex projects?
Research Recommendation X.	What is the relationship between professional accreditation and project success as defined in research question III?
Research Recommendation XI.	Assess the value of the talent management functional role in building organisational sustainability, performance and leadership.

CHAPTER 2

Research Recommendation XII.	To what extent does organisational standardisation reduce agility, resilience and diversity within complex projects? What is the optimal degree of standardisation at varying complexity levels?
Research Recommendation XIII.	What methods and tools are available to improve monitoring and control of a complex project over its lifecycle? How may these best be combined?
Research Recommendation XIV.	What organisational and governance frameworks have been proven to support successful change management in complex environments? To what extent do these need enhancement?
Research Recommendation XV.	Does the traditional role of the Finance function need enhancement to cater for issues arising in complex projects?
Research Recommendation XVI.	How do social systems and human behaviours influence complex project leadership?
Research Recommendation XVII.	How may Project Critical Success Factors (CSFs) be aligned to Enterprise level (CSFs) across the supply chain?
Research Recommendation XVIII.	What modifications (if any) to funding and appropriation models are needed in complex projects?
Research Recommendation XIX.	How may Enterprise level decision making be better aligned to portfolios, programs and projects?
Research Recommendation XX.	To what extent do (investment and performance) scenario/simulations improve the delivery of complex projects?

CHAPTER 3

Research Recommendation XXI. What project structures and supply chain cooperation models can encourage and support resilience?

Research Recommendation XXII. What assessment methods can determine the degree of complication/ degree of complexity at the earliest possible lifecycle stage?

CHAPTER 4

Research Recommendation XXIII. Create a library of successful and unsuccessful complex project implementation studies across the lifecycle spectrum, categorising success/ failure drivers within both technical and non-technical areas.

Research Recommendation XXIV. What is the comparative statistical divergence between organisational honesty (reality) and contractual relationships (intent) in tendering using risk management framework? How may VPM contribute to this?

Research Recommendation XXV. What contracting models can best support risk and liability management in a collaborative emergent environment?

CHAPTER 5

Research Recommendation XXVI. How do changing environmental stakeholder expectations affect the definition and delivery of project success?

Research Recommendation XXVII. How can supply chain relationships best be managed in order to create additional value/benefits within complex projects?

CHAPTER 6

Research Recommendation XXVIII. How may socio-cultural knowledge be transferred to models, methods and instruments to create new skill sets for complex project managers?

Research Recommendation XXIX. What structures and frameworks would enable integrated learning between PM practitioners, researchers and academia?

Research Recommendation XXX. What vehicles would contribute to and improve transfer of cross-sector good practice?

Research Recommendation XXXI. At what point, if any, do formalised processes cease to be effective in CPM and identify the reasons for this?

CHAPTER 7

Research Recommendation XXXII. How does organisational culture improve/ undermine experiential learning?

Research Recommendation XXXIII. How does organisational culture support/ inhibit the successful delivery of complex projects?

Research Recommendation XXXIV. How may delivery leaders contribute to political negotiations and project outcomes across Government, Industry and Collaborative teams?

Research Recommendation XXXV. What ‘soft’ behavioural attributes such as Cognitive flexibility, Emotional intelligence, and Systems thinking contribute to successful delivery leadership?

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