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New Project Management Models for the Changing World

This issue of Project Perspectives is stretching towards the new content of project management necessitated by the changing world. Recently the national economies have almost worldwide experienced the severity of sudden and unexpected economic crisis. This is resulting in new rules, reshaped structures and changes in markets. From managerial viewpoint the new emerged aspects cover more sustainable operations, their resilience and agility with respect of suddenly changing business environment.

Besides of this economic crisis the main business drivers in our horizon are clearly different than the ones forming the strategic basis of mainstream businesses. Energy efficiency, environmentally friendly solutions, security based design, water resources and congested cities are examples of business drivers that are profoundly changing our world and businesses. At the same time value creation is getting more complicated and requires attention. It is often influenced by dynamic expectations, market changes, increasingly global media and multifarious groups of different stakeholders.

Project management models are reflections of our understanding of the project management content, its elements and their priorities. This Project Perspectives issue is presenting several managerial viewpoints and solutions that can clearly be value adding into the current project management models. These viewpoints, their appearance and content arise from the lessons that have been learned from recent volatility and changes. One should put attention on aspects such as i) Forming and weight of front-end operations, ii) Lean management and sustainability of projects, iii) Role of leadership, iv) Sensemaking as a skill area, v) PMO as an organizational innovation, vi) Service driven projects and their management, vii) Lessons from natural and man-made disasters, and viii) Integrated risk management concepts.

There are also several other viewpoints and aspects that can be found from the papers of this issue. I would like to express my gratitude to all authors for co-creating this fruitful result. It is in a concise way covering many significant and novel aspects capable to enrich our current understanding on project management.

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Erratum
Managing the Front-End: Back to the beginning

From its earliest days project management was holistic, covering the overall project life-cycle, from the initial development phases into hand-over and operation. In the 70s and 80s however this changed and the discipline came to be seen predominantly as an execution function, focussing on delivering the project ‘on time, in budget, to scope’. This emphasis, crucially, misses two important things: most of the causes of projects failing are to be found in issues arising in the front-end definitional stage of the project; and setting the project targets is a vital part of managing the project. If we want to be really effective in improving project management performance we should therefore be focussing on the front-end. Yet we hardly understand what the management competencies there look like and we have very few training or education programs focussed on it.

Historically, project management always involved managing the front-end

The term ‘project management’ first seems to have appeared formally in the early 1950s in the US defense-aerospace sector (Johnson 1997, 2002). The emerging threat to mainland USA from Russian ICBMs (InterContinental Ballistic Missiles) prompted the US Air Force (and Navy and Army) to look very seriously at how the development of counter ICBMs could be accelerated. Brigadier Bernard Schriever, heavily influenced by the new ‘systems analysis’ thinking being developed by the RAND Corporation, had already (in 1951) sought greater organizational integration between the USAF’s (the Air Force’s) R&D and its production arms by having the Air Research and Development and Air Material Commands work together in ‘special project offices’ under a ‘project manager’ who had full responsibility for the project.

In 1954 Schriever was appointed to head the USAF Atlas ICBM development where, continuing the push for integration and urgency, he proposed that contractors should act as system integrators responsible for creating the system’s specifications and then overseeing its development (Hughes, 1998; Johnson, 2002). Essentially Schriever used project and program management as the fundamental means of organizing the system’s development, and systems engineering as the mechanism to coordinate it technically.

Meanwhile the US Navy began work on Polaris. Such was the urgency and technical difficulty that an Admiral, William F. Raborn, was appointed as head of the Polaris Special Projects Office in 1955. Polaris’s project management was more hands-on than the Air Force’s, one result of which was the development in 1957 of PERT as a planning and monitoring tool. Like Critical Path Method (CPM), which was invented by DuPont in 1957-59, PERT became iconic as a symbol of the new discipline of project management. Raborn, cleverly and presciently, used PERT as a tool in stakeholder management (though the term was not used), publicising it to Congress and the Press as the first management tool of the nuclear and computer age (Sapolsky, 1972). Schriever too didn’t just focus on planning, controlling and coordinating technical and organisational matters. Like Raborn, he also concentrated on building excellent teamwork.

This new project management ‘systems’ approach, if we can call it that, was then given added weight, and thrust, first by the arrival of Robert McNamara as US Secretary of Defense in 1960 and second by NASA (specifically Apollo) in the 60s;
from there they spread throughout the US, and then into NATO and the wider aerospace and electronics industries. McNamara introduced several Operations Research-based practices to run alongside PERT – tools such as Life Cycle Costing, Integrated Logistics Support, Quality Assurance, Value Engineering, Configuration Management, and the Work Breakdown Structure. Meanwhile, following President Kennedy’s 1961 historic call for ‘landing a man on the moon and returning him safely to earth’ by the end of the decade, the Apollo program brought systems (project) management squarely into the public gaze. Configuration management was a core control discipline with rigorous design reviews and work package management – ‘the devil is in the interface’ (Johnson, 2002). Matrix structures were deployed to harness specialist resources while task forces addressed specific problems in a huge, incredibly involved organizational undertaking (Brooks et al., 1979). Quality, reliability and ‘all-up’ testing became immensely important as phased testing became too time-consuming and costly.

The point of this somewhat unusual historical introduction to a paper on project management is to show that in its origins project management involved managing the front-end of projects. It was intimately intertwined with engineering, but was also concerned with people issues from the very early days of project design and development. Yet our model of project management has, at least since the late 1970s, tended to ignore this front-end phase. Why? How has this come to pass? As we’ll see, to a large extent the reason probably lies in the relative simplicity, efficacy and hence attractiveness project management when positioned as an execution-oriented discipline, as reflected for example in the Project Management Institute’s highly influential ‘Body of Knowledge’ – the PMBOK Guide® (PMI, 2008). But this model of project management crucially misses the all-important front-end.

Project management as a middle management, execution-oriented discipline

DOD’s project management systems and bureaucratic procedures spread rapidly throughout the 60s such that the defense-aerospace sector rapidly became mired in p.m. procedures: control seemed to slow-up development rather than govern it. At the same time, the matrix form of organization began to be adopted in many of the high-tech project-based firms. Both moves brought in difficulties: administrative burdens (Morris 1994) and problems of authority and power (Davies and Lawrence, 1984). As a consequence, many executives suddenly found themselves pitched into managing projects for the first time – and the experience wasn’t always a good one!

Conferences and seminars on how to perform in this brave new world now began to proliferate. This led to a feeling for a more formal articulation and method of communication and as a result project management associations began springing up, initially as an ad hoc network, increasingly as semi-professional associations (Hodgson and Munio, 2010; the US Project Management Institute (PMI) in 1969; the International Management Systems Association (now the International Project Management Association – IPMA) in 1972 with various European project management associations being formed contemporaneously. Crucially, however, their perspective was essentially the middle management, project execution one of accomplishing the project goals that had been given and on the tools and techniques for doing this; it was rarely the successful accomplishment of the project per se, which is where the discipline had started and is after all what really matters.

One of the attributes of professionals is evidence of the mastery of a distinct body of knowledge leading to a ‘license to practice’ in the area - certification. This obviously implies some definition of the knowledge area. This was a path first mooted within PMI eight or nine years later in the mid-70s (Cook, 1977). To this end PMI published a Guide to the Project Management Body of Knowledge® (PMBOK) in 1983. This identified six knowledge areas “unique to the project management field” (1.5.1): scope, time, cost, quality, human resources, and communications management; the 1987 edition added risk and contract/procurement and the 1996 edition added integration. (The structure and much of the content has remain unchanged since its creation.)

Certification has proven incredibly popular and with it the PMBOK Guide® has become enormously influential. As of March 2010, there were reported to be over 3 million copies of the PMBOK Guide in circulation (PMI, 2010) with 375,959 people certified by PMI as PMPs (Project Management Professionals). All over the world people (though by no means everyone) recognise PMBOK as the model of project management. Yet there are several problems with it, not least its omissions such as: strategy, value, and benefits; people issues (roles, such as the sponsor; and behaviours; technology management; estimating; and various matters relating to procurement (for example, partnering). And although the user is encouraged to tailor the choice of topics and their application to fit the project’s needs, the tone of the Body of Knowledge is decidedly normative. It is difficult to know how or on what basis to modify its rules, or if indeed they should be modified at all. But above all, the model of project management represented by PMBOK is one of execution, where the requirements have been defined, where the cost, schedule, scope and other targets have been set. It completely misses the front-end development.

Expanding the conception - the ontology - of project management

Ironically, just as project management was getting launched as a ‘mass-management’ discipline in the 70s, the performance of projects, already often bad, was now seen to be deteriorating sharply. In some cases, projects failed precisely because they lacked effective project management – Concorde, the Anglo-French supersonic airliner, for example. But in others, although DoD ‘best practice’ was being applied, the model didn’t work. Concorde’s American rival was managed using DoD systems but with no effective stakeholder management (Horwitch, 1982). Nuclear power projects suffered similar stakeholder opposition coupled with concurrence and ‘regulatory ratcheting.’ The oil and gas industry faced exceptional costs as it moved into difficult new environments such as Alaska and the North Sea. In fact, high cost inflation world-wide seriously compromised project budgets. Even the US weapons programs, despite being the home of project management, experienced problems, particularly of technology selection and proving, project definition, supplier selection, and above all concurrency (Morris, 1994). The apparent high rate of failure, as measured at least by cost or schedule overrun, gave rise to a number of studies (e.g. Peck and Scherer (1962), Summers (1965), Perry et al. (1969) on defence; Hirschman (1967) and Baum and Tobert (1985) on development projects; and specialist reviews of energy and power plants, systems projects, R&D projects, autos and airports (Morris, 1994)). Collectively they were to offer a new paradigm for projects (Jugdev and Müller, 2005), one focused on the effectiveness of the project itself rather than the efficiency with which it was delivered (Miller and Lessard, 2000), in effect challenging the prevailing execution ontology and suggest a broader
The Pentagon had emphasized the importance of the Front-End as early as 1970.

Managing the front-end

A strong feature in all these studies, almost without exception, is that the data shows that most of the factors which seriously affect the project outcome, for good or ill, will have been built-in to the front-end definitional decisions. Thus Meier: “most unsuccessful programs fail at the beginning. The principal causes of growth ... can be traced to several causes related to over-zealous advocacy, immature technology, lack of corporate technology roadmaps, requirements instability, ineffective acquisition strategy, unrealistic program baselines, inadequate systems engineering, and workforce issues” (Meier, 2008: 59).

NASA had reached not dissimilar conclusions in its 1992 Lee review of its program and project management performance: inadequate Phase B (Formulation) requirements definition; unrealistic dependency on unproven technology; annual funding instability; complex organizational structures; misapplied cost estimates; scope additions due to ‘requirements creep’; acquisition strategy not promoting cost containment (http://www.nasa.gov/offices/oce/appel/).

In fact the Pentagon had emphasized the importance of the Front-End as early as 1970 with the creation of a Milestone 0 – one before the then existing first Milestone – to confirm approval of the Mission Element Need Statement (the threat, capabilities to conduct the mission, and need, constraints, resources and schedule for doing so) (Morris, 1994:132).

The UK defence world had been emphasizing the front-end even before this – since the mid 1960s – but from a different perspective. The 1966 Downey Report had argued for more time (around 15%) and resource to be spent on front-end work (Ministry of Technology, 1966), a view re-iterated by Jordan, Lee and Cawsey (1988) in their well-regard ‘Learning from Experience’ report, and embodied in the Ministry of Defence’s SMART procurement protocols in 1997. (Miller and Lessard reckoned up to 35% of the project cost could be spent in front-end work on large [energy and mining] engineering projects (ibid: 31).)

Merely spending time at the front-end is not a guarantee of success of course: UK and US defense projects have continued to be late and over budget long after Downey (and SMART) and DoD’s Milestone 0 processes were put in place, criticism being levelled at the MoD for the same things that Meier summarised for DoD and Lee did for NASA, but also due to bureaucratic procurement processes, ineffective decision-making, and poor scrutiny of projects – in effect, failures of governance (Kincaid, 1997: 14). Thirteen years after SMART Acquisition was introduced MoD projects are still coming in late and over budget, largely, a recent analysis contends, because of insufficient de-risking in the front-end leading to a disconnect between risks and estimates (Kirkpatrick, 2009).

Setting project targets is a critical part of the front-end (governance) responsibility. Should the targets be hard to achieve (‘stretch’) or relatively easy? The answer will largely colour project management’s reputation. Does project management have a say in setting the estimates? (Sometimes the Estimating function is not part of Project Management.) What about other measures such as Health & Safety, cash flow, sustainability, whole-life costing? Business ‘effectiveness’ targets will be set by ‘the business functions’ but at a minimum a reality check is needed; more ambitiously, a value-oriented approach to development can mean project management significantly contributing to the sponsor’s business goals (Morris, 2009). (And to others!) All this is still a substantially under-researched area, despite the contributions of such as Shenhar and Dvir (2007); Williams, Samset and Sunnevåg, 2009; Miller and Lessard (2000).

So, if it’s so important why haven’t we learnt how to do it better?

The problem is, we don’t know generically what managing the front-end really entails, nor how to teach it.

Part of the trouble is that in the early stages of a project things are typically complex, intangible and uncertain: by a kind of Ashby’s law of requisite variety, management here is a lot less easy to explicate than in the more ‘mechanistic’ world (in the Burns and Stalker (1961) sense) of ‘build’ and ‘down-stream’ implementation. Front-end management entails work on a truly wide range of subjects: needs and requirements, technology and design, policy and strategy, finance and commercial arrangements, all of which need to be planned (scheduled and budgeted), risk-assessed and organized appropriately. The work is intellectual; the risks and opportunities can be huge. None of these fields are easy to work in, and the personalities in play will often be powerful. The style of management is often therefore altogether different – ranging from the encouraging, as for example in letting designers have the freedom to conjure up innovative and aesthetically pleasing designs; to the hard-nosed, as in negotiating fi-
nancial terms and conditions. Williams and Samset (2010) rightly point to the psychological and social pressures and uncertainties which work of this nature often brings. Many project managers who are used exclusively to managing downstream execution will be, and will feel, out of their depth here. Certainly there will be an elevated role for leadership by senior project management personnel in articulating goals and helping to shape strategies, whether through bold transformational assertion or inveigling through low cunning.

Not everyone might agree ab initio that managing the front-end is any different from managing any other stage of a project. PMBOK with its emphasis on process is most on the issue. (But silence is hardly acceptance, especially in a 'body of knowledge.') Proponents of Agile are similarly agnostic – though one could readily argue that Agile itself is more task management than project management. In any case, a context-independent perspective hardly fits with current thinking, either organisationally (Shenhar and Dvir, 2007) or epistemologically (Griseri, 2002).

While 'Project Leadership' courses have, of late, become increasingly popular these hardly cover the panoply of issues that populate front-end work. They tend to concentrate on the behavioural competencies required for effective leadership. The real trouble is, we lack an understanding of the competencies required to manage the front-end. What we have is partial and imperfect. We have few illustrative case-studies. We should, surely, develop some urgently to begin understanding the skills, knowledge and behaviours required. (While recognising that the mix will vary by project type too: a proposal to fund an oil and gas field development is very different from a large ICT project; a private-finance schools project is quite different from a drug development project.) Until we have a better understanding of the roles and competencies at work in the front-end we are to a large extent shooting in the dark.

On top of this, we don’t yet know what the value, and hence the market, would be for such training and education, nor indeed to what extent there is a need for technical and commercial, and other, substantive topics to be covered. If managing the front-end is substantially different for different types of project, how much would be gained by comparing and learning about putting together such different things? How generic and transferable are these competencies?

These are questions for trainers and educationalists. Project-based institutions – firms, government departments, etc. – face the problem from different perspectives. Certainly training and education is important but what happens after everyone’s done the training; or there isn’t the budget for it? NASA has moved from p.m. training to a program focussed on competencies, knowledge management and coaching. Knowledge Management is notoriously difficult however (Morris, 2006); is a program like this efficacious only after an initial concentrated training attack?

Conclusions
It is evident from an extensive amount of research that management of the front-end definitional stages of projects is of overwhelming importance to their ultimate outcome yet we have little empirical data to suggest how best management competencies here should be improved. A start would be to begin mapping these competencies prior to assessing what the perceived value would be of generic education and training programs or whether more project type-specific or even merely more behavioural oriented programs would be more appropriate, or indeed whether to forego such instruction and concentrate, as NASA has, on facilitation, knowledge sharing and counselling.

References
Davis, S. M. and Lawrence, P. R. (1977) Matrix organizations, Addison Wesley.


Summers, R. (1965) Cost estimates as predictors of actual weapons costs Rand Corporation, RM - 3061-PR Santa Monica, CA


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He has also worked on the linkage between corporate and project strategy (Translating Corporate Strategy into Project Strategy (PMI, 2004) and on project-based learning. He is currently co-editing The Oxford Handboook on Project Management (OUP, 2010). In addition to his five books, he is the author of over 110 papers.

He is an (Honorary) Fellow of the Association for Project Management (and past Chairman - he was also Deputy Chairman of IPMA), a Fellow of the Institution of Civil Engineers, and a Fellow of the Chartered Institute of Building. He was the recipient of PMI’s 2005 Research Achievement Award, IPMA’s 2009 Research Award, and APM’s 2008 Sir Monty Finniston Life Time Achievement Award.
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The Changing Landscape of Project Management

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Professor, SKEMA Business School, Lille, France
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This paper discusses the historical development of project management models based on my analysis. This paper was originally published under the title “The Changing Landscape of Project Management” for the World Project and Program Management Workshop of ESC Lille (now SKEMA Business School) in August 2004 (Lille, 2004); updating of, and additions to the original paper following the project management development since then have been conducted in this paper.

Project management models can be drawn from such attributes as project management structure and methods, socio-economic drivers that prompt the build-up of the model in question, typical project management techniques offered by the model, primary application areas and mechanism for popularizing the model, and can be classified into seven models over the four generations.

One should be aware that the evolution of project management models does not necessarily represent the incremental sophistication of project management methods, and, that the value of project management models should be relative to the practicing industry branch, organization or individual rather than absolute; hence, incoming new models do not necessarily replace existing ones.

The Project Management Model
First I analyze the mechanism of a specific project management model being formed with distinctive features and offer a historical view on such models.

Formation of a Project Management Model
Figure 1 represents my analysis of the factors and their interaction to form a specific project management model.

A Historical View of Project Management Models
Figure 2 depicts my historical view of project management models over the four generations. A three-generation approach to project management was made by Prof. Shigenobu Ohara in “P2M - A Guidebook of Project & Program Management for Enterprise Innovation” (Shigenobu Ohara et al, 2001) and many comparative discussions of the traditional project management versus modern

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>The basic project management model (1) is the classical project management model with triple constraints of quality, namely, technical performance, time and costs.</td>
</tr>
<tr>
<td>2</td>
<td>Socio-economic drivers demand modifications to the basic model (2); while a modified project management model (3a) is being prototyped through the publication of adapted formats by practitioners and academia, specific requirements from application areas are presented, and if of value, incorporated into the model (3b).</td>
</tr>
<tr>
<td>3</td>
<td>Then, a new PM model with a specific structure and methods is formed (4), which, in turn, creates new or adapted techniques and tools (5) that support the model.</td>
</tr>
<tr>
<td>4</td>
<td>The new project management model supported by practical techniques and tools is popularized into the application area which has originally proposed specific requirements for the modification as well as new areas of application (6) which consider the model fit.</td>
</tr>
<tr>
<td>5</td>
<td>Further development of models proceeds based on the new model, or the basic model, with new inputs (7a and 7b) and in like manner.</td>
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project management models were made. This analysis expands such discussions with my own analysis.

From the original “Classical” model, put as Model A, project management has developed into the “Modern” model (Model B), which is subdivided into Models B-1, B-2 and B-3 bearing characteristics particular to relevant application areas as well as the “Neo-Classical” model (Model A’) which is a global operation adaptation of Model A, and then into the “Strategic” model (Model C) expected as an innovative project management model in this century.

A hypothesis is, and this is being confirmed year to year that the “Versatile” model (Model D) is forthcoming in the future in which traditional general management will have been replaced by or merged into project management.

A detailed analysis of the respective models is given in the paragraphs to follow. It should be noted that incoming new models have not replaced the existing models but are rather coexisting with them as project management models offer relative value to practitioners (refer to the arrows in the figure).

In trying to identify project management models, one should be aware that the evolution of project management models does not necessarily represent the incremental sophistication of project management methods; it has been the process of liberating project management from its original rigid form to such variations that are more accessible by many practitioners in many fields owing to less complicated yet more balanced processes. It is, however, noted that along the structural shift of the economy to a varying degree as a result of the collapse of Leman Brothers in September 2008 and the subsequent recession, the relative weight of capital formation projects has been increasing and it is confirmed by many public and industrial organizations’ estimates (Tanaka, 2010) there will be hefty opportunities for major-scaled infrastructure projects and project related to sustainability, which has invited reversion to a “heavy weight” project management model, typically Model A’ here.
Anatomy of Project Management Models

Model A: Classical Project Management Model
The original project management model, in the modern context, was born at NASA in the 1950’s and since has been developed in the space, defense, engineering/construction and general construction industry.

The features, drivers that pushed for this model, typical techniques, application areas and popularization mechanism are described in the following table (Figure 3).

In short, this model represents planning and management methods for capital investment and national or social infrastructure projects; is highly robust; and heavily focused on the triple objectives, as well as constraints, of quality or technical performance, time and costs. Meanwhile due to its rigid structure, the model required highly experienced professional project managers for utilization and was not easily accessible to those in other than the mentioned application areas.

All in all, the FBC or faster - better - cheaper doctrine started manifesting itself. To meet these challenges, more flexible project management models were sought after by an increasing number of industry branches and public services; and dialogues were held between traditional project management users and entrant users or users-to-be with project management associations serving as catalysts. As a result, the modern project management model was created largely by way of “A Guide to the Project Management Body of Knowledge” or generally known as the PMBOK® Guide (1996 Edition) issued by the Project Management Institute (PMI) based in the United States of America (PMI, 1996) and the APM Project Management Body of Knowledge, or APM PM BoK, published by the Association for Project Management based in the United Kingdom (APM, 1992).

Salient features of this model are balanced project management processes integrating both “hard” processes such as those of quality, resources/costs, time, procurement and “soft” processes, including, those of scope, risk, communications, people/human resources, organization and integration; project management processes in project management bodies of knowledge (PM BoKs) distinctly separated from product processes; and wide applicability due to its soft structure and easy project management process description. This model is described further in Figure 4.

Model B: Modern Project Management Model
While the classical model was gradually applied to expanded areas with patch type modifications, the industry met the following situation in the latter half of the 1980’s:
- The industry started moving at an accelerated pace.
- The global economy was growing.
- Deregulation became a major force, calling for free market competition.
- The market driven economy was shaping itself; how to meet market needs (market-in) rather than how to sell products based on core technology (product-out) became the question.
- Too many failed projects were seen in the IT services industry.
- The market began to address value reframing (deconstruction/reconstruction).

This model is highly robust

Faster-better-cheaper doctrine started manifesting itself
are pharmaceutical companies in the U.S.A. in the middle of the 1980’s that formed the Pharmaceutical SIG of PMI about the same time. The aircraft industry and car manufacturing industry followed them.

Model B-2
Model B-2 is characterized by being a dominant, common business management language for fast moving global business operations as in the information services and management industry, telecommunication industry and the financial industry.

Without constraints imposed by legacy project management practices and forming an emerging, absolute majority of the project management population in the world, the mentioned branches of industry are instrumental in popularizing the Modern Project Management model which takes balanced PM processes integrating both the hard and soft elements of project management as main features. Their contribution in having made project management accessible to such business persons having limited relevant experience is noteworthy.

Model B-3
This model is project management as a change agent for agencies, corporations and other organizations. This model serves project management’s original mission to plan and manage an implementation framework for changes in order to lead an organization to specific set of transition strategy.

This model is used for BPR or more positively corporate transformation projects as well as new services introduction projects. The background that government agencies are turning to project management can be summarized by referring to decreases in government and public services staff strength, increasing outsourcing at government agencies, demonstrating high performance and earning taxpayer satisfaction, the faster-better-cheaper (FBC) principle importing the doctrine in business and fast growing e-Government services demand articulated services on the part of government agencies; timeline management and communications management skills are vital.

Model A': Neo-Classical Project Management Model
Model A, Classical, is still used in the field of defense and social infrastructure projects. In the meanwhile, another large user of this model, the oil & gas and chemicals industry has shifted to the Neo-classical Model, put as Model A’, which is the adaptation of the original Classical Model to global collaboration for optimum capital and resources deployment while adopting some features of Model B yet under increasing sizes, complexity and global operations span of capital projects, and uneven distribution of finance sources.

Model A’ is characterized with strategic alliances, owner/contractor integration (one team concept), joint venture/consortium prime contractors, structured financing/finance engineering, front-end loading, enhanced work break-down structure (WBS), multi-pillar operations management, global resources procurement management system, and global project IT and communications systems among others.
Model C: Strategic Project Management Model

Over the decades, it has generally been held that strategic business management and project management are two separate business disciplines. In this thinking, project management is focused on the most efficient and effective delivery of a project conceived by strategic business management in the upstream of the project life cycle. However in the face of increasing global competition of business causing faster obsolescence of products and services; a large part of the old economy is losing competitiveness due to decreased demand itself, competition from destructive technology or due to internal lack of coherence between organizational strategy and methods to implement it; the new economy is increasingly taking on actual value to consumers; and there emerge needs to address complex social, economic and business issues as organic programs, strategic project management models have been proposed in this century. The Strategic Project Management model stresses the integration of project management with business (or organizational) elements and offers an all-in-one package of strategic project business management and project management.

The Strategic Project Management model addresses pursuit of innovation and added value out of projects and programs; linking organizational strategy with projects through project portfolio management (PPP), program management and project management; structuring of project portfolio management and program management; value feedback and continuing utilization of program and project products; and organizational project management maturity model, among others (Figure 5).

P2M Guidebook or “P2M - A Guide of Project and Program Management for Enterprise Innovation (PMAJ, 2007), set an eminent model in this category by stating that it is:

- A new framework of program management based on the constructivist philosophy, embracing program conception, modeling, design and structuring for higher added value and/or innovation programs in addition to the conventional management of program execution;
- A methodology for addressing and solving complex problems in the society, business and public services by way of program management; and
- A project business model to cover the whole trajectory (lifecycle) of a program, from interpretation of business strategy, through program conception to formation, delivery of a program through component projects forming the program, to utilization of program product for value exploitation as well as recycling of intellectual value accumulated through program activities for new business.

<table>
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<tr>
<th>Model C</th>
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<tr>
<td><strong>Generation</strong></td>
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<td><strong>Model</strong></td>
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<td><strong>Period Applied</strong></td>
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<tr>
<td><strong>Features</strong></td>
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<td>- Addresses business issues</td>
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<td>- Pursuit of innovation and added value out of projects</td>
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<td>- Linking organizational strategy with projects through project portfolio management (PPP), program management and project management</td>
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<td>- Structuring of project portfolio management and program management</td>
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<td>- Value feedback and continuing utilization of program and project products</td>
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<td>- Organizational project management maturity model</td>
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<td><strong>Drivers</strong></td>
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<td>- Value creation as rationale for ongoing concerns</td>
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<td>- Gap between organizational strategy and projects</td>
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<td>- Revitalization of organizations that have lost or are losing competitiveness</td>
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<td>- Recovery of corporate loss due to inconsistency between organizational strategy and projects</td>
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<td>- Needs to address complex social, economic and business issues as organic program</td>
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<td><strong>Typical Techniques</strong></td>
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<td><strong>Application Areas (Potential)</strong></td>
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<tr>
<td>- All industry branches, government agencies, public organizations, international organizations</td>
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<tr>
<td><strong>Popularization Mechanism</strong></td>
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<tr>
<td>- APM PM BoK 4th Edition initiated its mention to strategic and commercial aspects in project management</td>
</tr>
<tr>
<td>- Japanese P2M introduced new dimensions of program management, covering interpretation of business strategy, visioning-conceptualizing, design and structuring and implementation management of programs</td>
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<tr>
<td>- PMI’s OPM3 was released in December 2003</td>
</tr>
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<td>- Popularization initiatives to be launched</td>
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</table>

Figure 5. Model C: Strategic Project Management Model
Model D: Versatile Project Management Model
This model is hypothetical and envisions versatile, user-friendly management methods for all organizations, either business, public, non-profit, or societal, and ordinary individuals. I label the society where this model is eminent, as the “PM ubiquitous society”.

Conclusion
Project management has evolved to offer a variety of models that fit growing areas of application. Project management that was started with robust classical methods now sees balanced processes and expands into a strategic model leading to the vehicle to implement organizational strategy.

There are two parallel directions that project management is heading for; one is the road to a highly user-friendly and versatile model, or “feather weight” model for every organizations, which trend is developing thanks to the tremendous expansion of PM application areas and the other is reversion to very robust classical project management model, or the “heavy weight” model for infrastructure projects combined with a strategic model for innovation focusing on combined strength of corporations across industry branches as well as government struggling for increasing its national share in the fast-growing new infrastructure projects.

References
Lille (2004)
Proceedings of World Project and Program Management Workshop 2004 on “The Changing Landscape of Project Management”, ESC Lille (now SKEMA Business School), France

Shigenobu Ohara et al (2001)

“An Emerging Wave to Expand the National Industrial Competitiveness Using Open Innovation and Being Supported by Meta Program Management”, presented at Project Management Kiev 2010, Ukrainian Project Management Association, page 7 to 20

PMI (1996)

APM (1992)

PMAJ (2007)
“P2M - A Guidebook of Project and Program Management for Enterprise Innovation “, 2007, Project Management Association of Japan (PMAJ), Japan

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Some Observations and Lessons Learned:
Katrina, Wilma, and Iraq

This paper documents critical technical and managerial concerns encountered by one manager during restoration and reconstruction activities of U.S. Government installations and Iraqi oil industry facilities after natural and man-made disasters. The authors rely on personal observation and interpretation of activities and documentation for which they were responsible or to which they contributed, while serving in various project and program technical and management positions for a major international contractor performing within cost reimbursement contractual schemes. This observational technique may provide interpretations that are less reliable but more valid than those obtained by other research processes. The authors determine that best practices for this kind of work must include careful consideration of communication reliability and frequency, which are critical for adaptation to change; development of trust among stakeholders; prompt and accurate triage of facilities for work prioritization; well-planned logistical activity durations factored into the work schedule; daily cost reports; and realistic human resources replacement policies, especially for efforts of longer duration.

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Introduction

Natural and man-made disasters seem to afflict our world more frequently and with worse effect as time advances. This is the logical outcome of a number of demographic trends and geographic conditions (McDonald, 2003). Learning to more quickly and accurately react to the emergency conditions enables recovery to commence sooner, and this can lead to reduction of time-dependent damages. It is the authors’ impressions that much academic work focuses on design or planning to prevent or mitigate the effects of natural or man-made disasters and enable rapid emergency response. Such attention is appropriate. Obviously, however, even the best of such plans and designs sometimes fail, and substantial recovery efforts are required. In such cases the effort of private sector contractors is essential to major disaster restoration and reconstruction effort. Therefore, insights into sound management practices of contractors can be useful, both for contractors and for those who oversee contracted recovery work.

The words recovery, restoration, and reconstruction can sometimes be confusing in their application. When a major disaster occurs, it is typically government entities—fire fighters, law enforcement professionals, emergency medical technicians, government emergency managers, and perhaps the military—that respond immediately to control people and traffic for security and safety within the affected area; to search for and rescue victims; to stabilize essential structures against further damage; and to provide emergency resource allocation and oversight. The recovery phase commences after that disaster emergency response phase ends, when the immediate threat to life and major property damage passes.

Restoration and reconstruction begin with the disaster recovery phase. Restoration comprises the activities that bring structurally sound, economically repairable facilities back to pre-disaster levels of functionality and aesthetics. Timely response continues to be emphasized, since some facility systems may be restored at reduced cost by quick reaction and attention. Other restoration might be more deliberate and maybe last years into the recovery phase, although the necessary timeliness of some restoration actions imposes their completion to be scheduled immediately after the emergency phase subsides. When restoration is not practicable, facilities that are unsound, uneconomically repairable, and must be demolished might be reconstructed, if their functions are yet needed and affordable. Major reconstruction efforts after disasters can last many years.

It is in this stressful circumstance that adaptability to change, accurate and timely triage of damages, logistical planning, project controls, and human resource management sometimes take on a different and more urgent nature than common construction projects. The observations that follow derive from the lead author’s personal experience in such an environment. Informed readers should be able to judge the probable accuracy of the observations and conclusions induced, even if the reliability of the observations in all such circumstances is less certain.
Adaptability to change

Adapting effectively to change ensures that fluctuating circumstances do not overcome the capacity of people and their organizations to accomplish essential tasks, despite the imposition of unexpected demands on resources. Uncertainty about change is what complicates its management. Some possibilities can be anticipated and addressed by wise planning, but experience shows that other eventualities are surprising even to seasoned managers. Detailed, unexpected changes during the early stages of disaster recovery seemed more frequent than for non-disaster work. For example, after many houses were nearly restored, a U.S. Government contractor was told to immediately cease working on them and move effort elsewhere. That decision was sudden and totally unexpected. Some inefficiency was thereby exacerbated in the already resource-constrained circumstances. The toxic effects on operational efficiency and employee morale might have been moderated with better communication between the parties.

Good communication results in prompt and accurate exchange of information both up and down the supervisory chain in an organization and across stakeholder boundaries among owners, contractors, and consultants. Not surprisingly, electronic mail was especially useful, since all parties with a possible “need to know” could be apprised of likely or certain changes coming their way. Internet, e-mail, telephones, and other media can be provided in devastated regions on an emergency basis by satellite, until the more routine communication nodes are fully operational. Also, the communication effectiveness of traditional, face-to-face operational coordination meetings should be implemented in any event, but especially when electronic means are limited.

Besides communication media availability, the attitudes of those who communicate have much to do with recovery efficiency and effectiveness. Trust must be intrinsic to full and complete communication among recovery project parties. If trust is lacking, then so shall communication be inaccurate and incomplete (Rapp, 2009). Changes will be more abrupt and have greater adverse impact, if people are unwilling to keep each other informed, not only of what they are certain others must be told, but even of what they think others might need to know. One knows that bad news gets no better with age.

Recovery managers may deal with owners who can take the emotional impact of devastating losses and changes in their lives in easy stride. Then again, the owners they encounter in their work may be utterly distraught and barely able to discuss their losses and make the decisions that allow the contractor to proceed with essential recovery work. Restoration contractors commonly state that many homeowners, in particular, struggle to maintain composure. Much of their material wealth, including items irreplaceable despite insurance, is snatched from their lives. Recovery professionals must remain sensitive in their communication with owner-clients, or they and their work become the focus of frustration and irrational expectations. This can enable the victims of drastic, disaster-caused change to take change in stride with less difficulty.

Attitudes of those who communicate have much to do with recovery efficiency and effectiveness

Accurate building and facility triage

Types of damage that buildings and other facilities experience tend to vary with the causes and magnitude of disasters and the types of structure and construction that are tested. In many cases, the total destruction of buildings or other facilities is obvious. They require only assessment for material content for proper debris processing and disposal, before they can be fully demolished. For those buildings or other facilities that appear sound, leveraging the knowledge of owners or other occupants and employees greatly speeds the initial assessments of damages and improves their accuracy. All reasonable efforts should be made to consult owners about their buildings and obtain record drawings of their construction. In the case of mass regional evacuations, the lack of knowledgeable local people may preclude the contractor from conducting necessary technical inspections with desired thoroughness.

Recovery contractors should bring engineering expertise in abundance, planning to release from the project those who are not required after the initial, extensive inspection and prioritization of work sequence. Time is of the essence. The contractor’s experts recommend courses of action for the various buildings and facilities, and the owner-client must rapidly decide to accept or amend the recommendations. When the owner has its own experts, it is not uncommon for a reconciliation process to ensue. In any event, the owner should delegate decision-making authority about building disposition to its lead person “on the ground,” who routinely interacts with the contractor every day. The responsiveness of owner decision-making and the resulting permission for the contractor to act swiftly in some cases were different for Katrina and Wilma, due to somewhat different levels of decision-making trust placed by higher Government authority in their managers who directed the contractor.

Projects in war zones can be dangerous, so it is understandable that some engineers in the contractor’s organization may not wish to risk traveling to the work. To some extent, damage can be analyzed and designs can be conceived at a distance on the basis of detailed photographs and documentation from the project. This may be enough to restore simpler parts of facilities to acceptable functionality. Experience shows, however, that even the most conscientious efforts to restore complicated systems from afar tend to fail on the first attempt. There is much justification for engineers involved with complicated restoration to visit the site of the object of their endeavors. If
Public sector client-owners may have difficulty deciding their work priorities. Seasoned contractors may perhaps help less experienced managers in the client’s organization to determine and weight decision factors, especially those of a technical nature that are pertinent to robust and accurate work prioritization. This happens most effectively when the contractor learns the client’s needs and agenda. The understanding comes from forthright communication between the parties, and this is encouraged by mutual trust.

**Role of logistics**

There is a story of an American military leader insisting, “I don’t know what . . . this ‘logistics’ is . . . but I want some of it,” (Cox, 2009). Indeed, logistics is constrained and critical to restoration and reconstruction in the aftermath of a large disaster. The urgency of need and volume of necessary materials can be even greater than what is demanded during large-scale military operations. Although some definitions are more detailed, one might summarize logistics the same as did an anonymous source in the author’s notes: a system of people, equipment, and procedures that optimizes the delivery of materials to their location of use. Logistics has evolved into a discipline that touches far more than the military. Certainly all disaster recovery managers need to understand and apply sound logistical principles.

Delivering extensive quantities of diverse materials to their location of use in a heavily damaged region can be difficult. While general requirements might be anticipated, especially if good emergency planning has been performed, the devil remains in the details. Just as with triage, determining exactly what will be required to restore and reconstruct damaged structures and facilities requires time. Contractors must integrate the nuances of owners’ and users’ desires for the recovery effort. In many cases the requirements of non-owner entities that fund the recovery work, such as insurance companies or government agencies, must also be satisfied. Doing this promptly and thoroughly can be challenging, since the more stakeholders there are, the more complicated is a robust solution.

Normal channels of material procurement and delivery and their many related aspects, all of which can be viewed to comprise logistics, shall probably be severed by major regional disasters. Not all major retail sources of common building materials have highly dependable logistical systems for the volumes of materials required post-disaster. A project that one of the authors worked placed orders with a well-known retailer only to belatedly discover that assurances of performance rang hollow, and that the store managers could not forecast when deliveries would be made or what was on incoming trucks. Maintaining reliable services for small contractors during periods of normal demand proved much easier for the major home building supply firm than supplying a project of large scope, when demand escalated throughout the region after hurricanes struck. The wise contractor establishes multiple supply and logistical alternatives no matter how reliable a given source appears to be.

Even when construction contractors accurately determine recovery logistical requirements, proper information is not always transmitted reliably. Materials may arrive late, at the wrong location, in insufficient quantities, or with incorrect specifications. Those typical complexities couple with the abnormally frequent delays and miscommunications sometimes created by the restricted lines of communication of a disaster-stricken region. Timely delivery of enough correct materials to the proper work site is less certain, especially early in the recovery phase. Such logistical degradation was readily apparent after the hurricanes along the U.S. Gulf Coast, 2005, and in the oil fields of southern Iraq, 2006-2007. In the latter case, security and international dimensions created even more resistance than the normal operational “friction” that major restoration or reconstruction activities impose.

People often correctly admonish that materials-related tasks must be integrated into construction schedules, or the schedule is hardly worth the paper upon which it is written. Not only should materials delivery be incorporated into schedules, but also the durations of the activities should be realistic. In 2006 the lead author researched the scheduled and actual delivery dates of materials and services obtained by over 1,800 satisfied purchase orders (POs) for which he had program records. Some POs had been placed over a year before. All had been placed to satisfy requirements for restoring portions of the Iraqi oil infrastructure. Actual delivery dates often trailed originally scheduled dates. The author sought a factor that could have been routinely applied to all PO order-ship times to have assured a 50 percent probability of timely delivery of goods and services. Order-ship time is defined to be the duration from the date the PO is placed to the date the goods are delivered or the service is performed.

The necessary factor was calculated to be 1.4. That is, if every order-ship duration of the roughly 1,800 POs had been extended by 40 percent from its initial forecast, then 50 percent of the POs would have met their forecasted delivery dates. Greater delivery dependability would have required that a larger factor be applied. Will this same 40 percent factor apply to the median satisfaction of POs for other programs? Would there have been some factor required to achieve the median delivery forecast, anyway, even if not in the midst of an overseas conflict? Perhaps, but the investigation nevertheless provides some objective evidence that international logistical operations, especially those within regions of armed conflict, will result in delivery dates significantly extended from the norm. Assorted discussions with procurement and controls professionals of the program convinced the author that order-ship times would have been considerably more dependable under normal construction conditions. Expediting amended the delivery dates to reduce unpleasant...
surprises, but operational planning nevertheless suffered somewhat by the substantial delays of original to actual delivery dates.

Managers gave extra attention to materials whose procurement laid on the restoration projects’ critical paths, so their arrival was much timelier than the average. One understands, however, that delays of materials on near-critical paths can increase schedule risk, so attention must be given those POs. In any case, this analysis indicates the magnitude of delays that can occur internationally despite aggressive expediting. Informal review of causes of the delays exposed over-optimistic shipping dates from suppliers and unexpected intermediate transportation delays. All links in the chain of a project’s procurement and logistical system must be examined to reduce the risk of delays.

**Project controls**

Cost reimbursement disaster recovery contracts have been common. Some owners are reluctant to negotiate such contractual types, if a firm-fixed price contract can be agreed. Nevertheless, the nature of equitable risk-sharing between owner and contractor makes cost-reimbursement contracts viable, if the scope of work is uncertain. For firm-fixed price contracts the owner is concerned with quality and schedule, while the contractor manages costs to ensure a profit. On cost-reimbursement contracts, however, the owner must become deeply involved in cost control. Cost-reimbursement contractual provisions offering an incentive fee for control of costs can motivate the contractor to assume more responsibility for cost control. The owner then reviews costs to remain satisfied that all charged are allowable, allocable, and reasonable within the contractual terms.

Savvy owners demand that the contractor provide a cost report, which ensures a current account of costs incurred. A major concern for cost-reimbursement contracts is recurrently forecasting a reliable project cost estimate-at-completion, EAC, for the owner (Rapp, 2009). The owner must be prepared to curtail the amount and type of programmed work as the EAC approaches the limit of the available funds. A monthly or bi-weekly report during disaster recovery will be far too infrequent for the fast-paced nature of such work during the months immediately after recovery commences. Costs might escalate too much, too quickly for necessary changes during two or four-week reporting gaps. Instead a daily cost report is preferred in order that owners can best make timely and correct decisions to remain within budget. The reporting system that feeds such a document must be highly responsive and accurate. Unless the client requires something different, it might be better for a contractor to devise a disaster recovery reporting format than to try to adapt a more cumbersome format applied for typical, deliberate construction projects.

The characteristics of a readily adaptable report can vary, but the following simplified spreadsheet format offers an idea of what has proven useful in a cost-reimbursement environment with subcontractors paid under time and materials (T&M) provisions. A worksheet can be prepared by a contractor for each of its subcontractors, and then summarized with the contractor’s own costs.

Initially, daily columns depict only forecasts of equipment and labor item hours and extended costs. These are synchronized with the scopes of work assigned and performance periods of relevant subcontracts and cost estimates. As each day passes, the forecasted numbers are replaced by actual numbers reported from the field. (The fonts of reported, actual numbers can be changed to preclude confusion with those that remain only forecasts.)

A cost reimbursement environment compels the wise owner and dutiful contractor to require that daily cost-related numbers be reported by separate channels, so that entries can be compared every day. This affords control and assures both parties that the report is probably accurate. The disaster

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Hourly Rate</th>
<th>Daily Hours</th>
<th>Total No.</th>
<th>Daily Cost</th>
<th>Total Cost</th>
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</thead>
<tbody>
<tr>
<td>Equipment A</td>
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<tr>
<td>Equipment B</td>
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<tr>
<td>Equipment C</td>
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<tr>
<td>Daily Eqpt.Sum</td>
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<tr>
<td>Labor</td>
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<td>Trade A</td>
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<td>Trade B</td>
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<tr>
<td>Trade C</td>
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<tr>
<td>Daily Labor Sum</td>
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<tr>
<td>Daily Total Sum</td>
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**Figure 1. Daily cost tally spreadsheet report format**
recovery projects on which the author served determined a viable system by which to assure accurate cost reporting. Subcontractors reported to the contractor early the next morning all labor, equipment, and materials that they applied to the work the previous day. The by-name, detailed figures were sense-checked and tallied in the field, then forwarded to the cost control professional, who was also located at the project site. The contractor's cost controller compared those values with work effort values documented and reported by contractor superintendents through operational channels. If the subcontractor's figures agreed, then they were entered into the cost report that morning. Discrepancies that sometimes resulted were readily reconciled, and the final numbers and costs were reported to the owner-client by midday. Readily adding by spreadsheet the reported costs to-date (actual cost of work performed, ACWP) to the forecasted numbers to-go (estimate-to-complete, ETC) enabled the contractor to accurately update the owner-client every day about the probable total cost of the work, the EAC.

Smart contractors will manage client expectations effectively to ensure that clients expect no more reporting detail or accuracy than can practically be provided for the existing level of staffing. If the contractor permits clients to seek almost any type or volume of information that might be reported, then project control effort moves from a proactive, forward-looking perspective to a backwards-looking, reactive stance. This does the project little good. Even with a cost-reimbursement contract, the contractor should do all it can to get the owner-client to commit to an array of information they absolutely need for their decision-making. Then that and only that should be reported. Clients tend to discipline themselves to restrict increased reporting requirements when accurately apprised of the additional cost of the staff to meet their elevated demands.

**Human resources policy**
The intensity of disaster reconstruction operations places severe demands on the participants. A “12-7” schedule, 12 hours of work per day, seven days per week, is not uncommon. If that grind is sustained for long periods of time, the stress on those involved can be considerable and result in degraded job performance. Periodic rest and relaxation, R&R, periods are practically essential. It is the author's opinion that professionals who work the extended hours, especially if at remote recovery locations precluding what might be a more “typical” life offering regular leisure, should be replaced after two years and maybe more frequently. Such circumstances would most likely be encountered in overseas assignments to restore or reconstruct large facilities.

Employees who have served the reconstruction effort well for extended periods should be “taken care of” upon departure and offered equivalent employment elsewhere, if possible. Even if other employment that they accept is unavailable, managers in this environment should recognize that some people need to be replaced, anyway, due to the long-term effects of a nearly unchanging and stressful work environment. Only the most disciplined professionals can recurrently perform tasks of the same type, with the same requirements, with many of the same people, at the same facility, for extended work hours over a number of years without growing somewhat stale and indifferent. It helps a program to get new ideas and fresh blood into a long-term effort. Also, if staff members create relationships that become excessively “cozy,” then periodic replacement can help to control and discover fraud, deceitful reporting, incompetence, or other harmful behaviors.

Add to these other stressful conditions any psychological impact of working in a region of open conflict, and it requires little imagination to appreciate the added tension, and why an appropriate staff replacement policy is necessary. Presumably, a policy would be published at the beginning of a program to make planned replacement common and accepted. Published policies reduce perceptions of unfair, disparate treatment of employees and the degraded morale that can result. Unfortunately, as with other managerial concerns when their effects will be far ahead, the more immediate start-up needs of a new program or project will tend to trump the attention of managers. Therefore, the human resources office should promptly and proactively facilitate policy development.

**Conclusion**
The above lessons in disaster recovery management are among those that had substantial impact on projects in which the lead author participated three to four years ago. One cannot guarantee that they are reliable in all circumstances, but it is reasonable to expect that they are valid for the circumstances described. One expects that they can offer readers, especially those who have little experience in major disaster recovery efforts, some useful planning and operational insights about disaster recovery contract work.

**References**
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Strategy Making with an Alphabet Soup of Objectives

Most people, it seems, are notoriously bad at formulating objectives. The strange thing is that the readers generally tend to accept even nonsensical expressions, and find some kind of meaning by interpretation. This paper takes a look at this phenomenon and explores some of the reasons behind, giving examples from three major public projects.

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Qualitative information and misunderstandings in decision making
An alphabet soup is a soup made with alphabet shaped noodles. It is commonly used as a metaphor for an abundance of abbreviations or acronyms. In this paper it is used to characterize project objectives that are nonsensical or misleading and therefore of no use. Experience suggests that even though we might have a clear idea of what we want to achieve, we are notoriously sloppy in defining realistic and unambiguous objectives. The strange thing is that this doesn’t seem to matter much, apparently because of our unbounded willingness to understand even nonsensical expressions. What might be even more surprising is that despite of this, the message is often interpreted in the same way by different individuals. However, this is far from certain, and since we are talking about objectives that have been set to guide essential decisions, the uncertainty might often be too high.

Most of the communication between individuals is in terms of qualitative expressions. Qualitative information is not something that we use in a given situation; it is what we all use in our communication. Our qualitative expressions may not in themselves be sufficient to express exactly what we wish to convey, but will still with reasonable probability be understood the way they are intended. More so if it is within one specific context. It will depend upon what the basis for the information is. Some is based on systematic quantitative analysis of fact, and some of assumptions and judgment. At an early stage of inquiry available information is limited, and we will largely have to resort to qualitative expressions based on assumptions and judgmental information. This may not only be to our disadvantage. On the contrary, using textual information instead of numbers might make it easier to visualize and discuss complex matters. The level of precision is necessarily restricted and we might make fundamental mistakes so that our expressions are erroneous in relation to our intention - even completely meaningless. This paper discusses how to improve qualitative information, taking as examples the agreed objectives in three large public projects.

Qualitative versus quantitative information
Our world has become increasingly transparent and fine-grained as the result of the IT-revolution, and a seemingly unstoppable growth in computing power. This has made previously unthinkable degrees of detail and precision possible. For example, your mobile phone can now indicate your position on the planet at any time within a few meters accuracy. The amount of information underlying these capabilities is enormous. Multiplied with the number of mobile phone users and the time factor it is incomprehensively large. This type of technology makes each one of us volume consumers of information and with an increasing demand on precision and verification. Consequently, much of the education that shapes the intellect increasingly is based on quantitative information, not least in the fields of technology and economy. Clearly, quantitative data is better suited to provide information in a concise format, to test correlation between variables and generalize findings to larger populations based on statistical analysis. In fact, statistical analysis require quantitative information, preferably at interval or ratio level, see figure 1.
An increasing demand for exact documentation as basis for decisions leads to occasional failure to see the potential of systematic use of qualitative information. The main problem with textual information is that the precision and our possibility to verify are restricted. Also, qualitative information is often more prone to individual biases and interpretation, and may therefore be less credible than hard facts. The statistical processing of such information is mostly limited for instance to medians, quartiles and distributions (non-parametric statistics). Nevertheless, in a given case it may be possible to classify qualitative information with relatively high resolution, as shown in figure 2. However, doing so often dilutes credibility since subjective assessments are involved, which opens up for questions of interpretation and categorization. Our urge to emphasize the worth of quantitative information leads to a systematic undervaluing of the principle advantages of using qualitative information: Namely that it can be generated quickly, it is the prime basis of human communication, but also that it is necessary in order to provide a comprehensive picture of complex matters.

Moreover, much information simply cannot be quantified. Also, whenever quantitative information is not reliable it may be more appropriate to use qualitative expressions until more reliable information can be acquired. Finally, it is commonly accepted that huge amounts of quantitative data or highly aggregated data often tend to blur rather than clarify a situation.

Of course, in practice it’s not a question of either-or, but having it both ways. Qualitative assessment helps describe the whole, while quantitative information imparts precision to the description. This is why we mainly use qualitative information for communication. The content of communication may easily be regarded as parts of an information hierarchy in which the underlying implicit information often is quantitative. The credibility

![Figure 1. Qualitative and quantitative information characterized according to nature of the scales or measurement used (Olsson and Sörensen, 2003)](image1)

![Figure 2. Different qualitative expressions of judgemental probability, suggesting that information can be classified at nominal level with some resolution. (Teigen, 2006)](image2)
Figure 3. Validity as an expression of the quality of information (Hellevik, 1991)

Figure 4. Validity and reliability - the question of hitting the target, and the precision of the shot

The term validity is used by researchers to characterize the degree to which information reflects the phenomenon being studied. A general model to illustrate this is shown in figure 3. Valid information requires two criteria to be fulfilled. First, construct validity must be ensured, that is the interpretation must correspond exactly to the body temperature. The example applies to quantitative information. In qualitative assessments our possibility to ensure precision will be restricted and the construct validity will be the decisive factor in judging the worth of the analysis. The challenge is to ensure that the information element used provides a valid expression of what we want to describe. If this is the case, we can at least be reasonably sure that the information is relevant.

The validity problem occurs when there is a mismatch. If the goal of a transport project is "to improve traffic safety", the problem arises if "local employment" is chosen as an indication of attaining that goal. Intuitively, we can assert that the two are not closely correlated. More direct indicators of high validity will for example be "the number of crossings" or "the number of people injured or killed".

A reliability problem arises when we use vague statements or expressions with low precision. In the above example, expressions like "improves" and "safety" gives considerable room for interpretation. Precision might be increased by being explicit as to for whom, in this case, the composition of the target group, the degree, here the anticipated change, timing, etc. As mentioned, we have to rely excessively on quantitative information in the earliest phases of a project, in the absence of accurate data, lack of time and resources for acquiring it. Or because realization of the project might be several years into the future so that present data are uncertain in view of future changes that might be difficult to predict.

But also, it might be preferable to wave precision and instead do with expressions such as "good", "to a great degree", "important", or "considerable" to describe extents, amounts or levels. This may allow considerable freedom in assessing different models or concepts, discuss these in larger contexts, for instance in terms of scenarios, and discuss consequences of possible changes. Hence, it may be useful to lower the requirements for precision temporarily, but no means to lower our demands for construct validity. In other words, we can accept some uncertainty in our attempts to hit the target, but a complete miss is unacceptable even though reliability may be high, as illustrated in figure 4.

Judgmental, stochastic assessment of utility

Reliability, or the extent to which information is trustworthy, can in principle be tested. It is ensured whenever indicators are unambiguous or measurements have no systematic errors. The test is that several people independently using the same indicator for the same problem should obtain the same result. Sources and methods of acquiring information are decisive in order to ensure reliable information.

The validity of information cannot be re-examined, but in principle have to be based upon judgment. Hence the choice of indicator is decisive. There are two ways to ensure valid information: (1) By choosing indicators that provide the most direct measure, and (2) by using several indicators that together comprise a good indication of the phenomenon described. For example, "number of graduates" is a direct indicator of the phenomenon "university education". But the number alone gives an incomplete picture of what is attained. So it clearly needs to be supplemented with information on marks or "level of achievement" as well as the relevant "type of education". Likewise, "the quality of education" may be characterized such as by the ranking of a university with respect to others. Other supplementary indicators could be "duration of studies" compared to an average and "drop outs"; the number of students who leave before finishing. In combination these indicators would give a more complete picture of what we want to measure. This example illustrates the hierarchical character of information. Education is the overriding phenomenon to be measured.
It is described using subordinating indicators or information elements that together afford an acceptable, valid description of the phenomenon. Some elements are vital since they have a high validity, while other elements with low validity may be unnecessary or directly flawed.

Consider an example of the evaluation of the project to build an office building some time after its completion. The aim is to find "how well users are satisfied with the building". Eight indicators that might be used to acquire information are listed in table 1. For example people's opinion on "building functionality" is a direct indicator and consequently a good a term for testing. On the other hand "job satisfaction" is influenced by many factors other than perception of the building and hence is less valid. The extent of "evening overtime work" presumably is little influenced by the building itself and hence has low validity. In the example the indicators are ranked according to validity which illustrates that there is good reason to strictly adhere to the requirement of validity, to focus and enhance the worth of assessments and save resources.

**Precision - clarity and unambiguity**

Unambiguity is a precondition for dependable information. This applies to the indicators that designate the information sought, as well as to the acquired information on which assessments are based. In qualitative expressions the language itself is essential, both the words used and the semantics. Words are often interpreted differently. The lexical definition of a word reflects how it is understood in common usage. The lexical definition is often too broad to be used for specific purposes. Hence, a lexical definition can be amended or narrowed down to a precise definition. For example the lexical definition of "resistance" would be "the action of resisting" and "armed or violent opposition". However, the word has different meanings in physics, medicine, finance and politics. A precise definition in physics and electrical engineering would be that resistance is the ratio of voltage to current in a conducting medium (Ohm's law). Ambiguity of understanding may be prevented by amending the terms likely to indicate the essence of the precise definition, as by writing "electrical resistance". Such terms are used to ease communication within specific fields. Even so, definition problems may arise in communication between disciplines and between professionals and the public who rely largely on the example the indicators are ranked according to validity which illustrates that there is good reason to strictly adhere to the requirement of validity, to focus and enhance the worth of assessments and save resources.

That said, using more precise definitions would solve only a part of the problem. Vagueness enters also in our use of adjectives to indicate quality, quantity or size. Words such as "good", "high" and "substantial" are categories in classification at nominal level, as illustrated in figure 2, and consequently may easily be misinterpreted. Moreover, many words may be understood differently depending on one's point of view. For example the word "normal" used to describe a transport project may be understood by one party as (1) within the usual limits, and by another party as (2) within limits of what is acceptable. Or, what exactly is the meaning of "the mercury content of drinking water is normal"? Does "normal" mean in comparison to other lakes, in comparison to lakes in virgin wilderness, or with respect to the legal health hazard exposure limits? (Hansson, 2003)

The choices of words used to express value or worth are significant in obtaining and disseminating information. This is easily seen in communication between different stakeholders in relation to a project that is considered controversial for some reason or another. Not least, terms like "needs" and "benefits" will often be a cause of disagreement between various parties both regarding to the interpretation and the information content of the concepts.

**Rational choice, causality and probability**

Logic in its broadest sense means correspondence with reason or generally accepted principles of rational thought and action. That which does not correspond is illogical. Fallacy is a collective term for arguments that have logical flaws or are invalid. As a branch of knowledge, logic deals with the principles and application of the rational. This is not least the case in linguistics, as in how we use, combine and give meanings to words. We usually rely on rational bases in planning actions or projects. Causality and probability are two essential principles that underlie the analysis and assessments of rationality.

Causality, or cause-effect relationships, helps us decide which actions should be made in order to achieve a desired effect. Conceivably, different alternative actions may have the same effect. By definition, the rational choice is any one of them, as all achieve the effect. But, if alternative strategies differ such as in time taken or resources required, the strategy requiring the least resources will be the rational choice. Likewise, a specific action may result in various effects in addition to the desired effect. This complicates assessment, as others cause-effect relationships must then be taken into consideration. Some side effects may be undesirable and in some cases unacceptable. A rational choice must then weigh up the impact of possible undesired side effects and maybe eliminate strategies that could result in unacceptable side effects.

This type of rational thought is easily applied to physical systems but is far less tractable for social systems. The reason is that physical systems follow

<table>
<thead>
<tr>
<th>Validity</th>
<th>Indicator</th>
</tr>
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<tbody>
<tr>
<td>High</td>
<td>The functionality of the building as perceived by the users</td>
</tr>
<tr>
<td>Medium</td>
<td>Maintenance of the building</td>
</tr>
<tr>
<td>Low</td>
<td>Users perception of job satisfaction</td>
</tr>
</tbody>
</table>

Table 1. A selection of indicators that might be used to assess tenants' user satisfaction in abn office building
natural laws and thus in principle are predictable. Social systems, in contrast, are in principle unpredictable. This is because the units in the system can make their own decisions. Consequently, attempts at large scale rational planning are more or less doomed to fail. The cause-effect relationship also is more problematic than it is for physical systems. Events in society don't necessarily follow a one-dimensional cause-effect chain or a two dimensional activity tree. They are better described by dynamic systems with mutual influences between the different elements. Such systems may be described mathematically and to some extent be simulated, but experience suggests unpromising results since the system to some extent is unpredictable.

A simple alternative which could be used early on in the planning process is to try to identify simple cause-effect relationships, but also bring in probability assessments to consider the uncertainty that may affect the relationship. If so, the strategy will be rational if the probability of success is at least as high the probability of success for some of the alternative equivalent strategies.

The challenge in this case would be to identify the essential cause-effect relationships, and make a realistic assessment of probability. This represents considerable challenges. But, in looking at customary practice in planning projects, the threshold for improvement seemingly is very low and possibilities of marked improvement accordingly high. This was for example the conclusion in a study of major international development projects that analyzed cause-effect chains, expressed as formally agreed objectives that constituted the basis for decision making in these projects (Samset, 2006). The study comprised examples of best-case projects designed and quality assured to the same norms.

The study showed that all projects had substantial flaws. On the whole, the descriptions of the objectives were vague, and objectives at differing levels of ambition were mingled unsystematically. Some projects lacked descriptions of anticipated effects or had strategic goals that were far more ambitious than realistic. For instance, when "better standard of living" was listed as an anticipated effect of a small road project, and "economic growth" as the anticipated result of a plant nursery project, it is intuitively easy to see that the gap between cause and effect is excessive and that the objectives are overly ambitious. The study concluded that the design of these projects was flawed to the extent that none of the steering documents were suited to management and overriding decision making. Surprisingly, most of the flaws were trivial and should have been detected, as all the projects had been designed using the same approval method that aimed to avoid precisely these sorts of flaws.

Identifying objectives: Three cases

The principles described above are illustrated below based on information from the earliest phases of three large public projects: (1) Acquisition of fighter jets, (2) Construction of a shipping tunnel, and (3) A road construction project.

A project with unclear justification

Take a look at the strategic objectives underlying the acquisition of new combat aircrafts for Norway:

"Airstrike capabilities that shall contribute to national security, sovereignty and freedom of action"

This statement contains four separate objectives that seemingly are clustered together haphazardly. The expression "that shall contribute" indicates causality. In other words "airstrike capabilities" is the cause and what follows is the expected effect. However, both "national security, sovereignty and freedom of action" is something that already exists. This means that the expression "contribute to" makes little sense and should be replaced by maintain. The formulation then is airstrike capabilities to maintain security, sovereignty and free-
A project with no obvious justification

A project with an even more compounded statement of objectives is the Stad shipping tunnel. The intention is to construct a huge tunnel for smaller vessels between two fjords in Norway. The objective is formulated this way:

"Enhance the operative conditions for maritime transport along the coast by increasing accessibility and safety for sea transport in the region, as well as support local employment and population."

This statement contains five meaningful elements: (1) Operative conditions for maritime transport, (2) increased sea transport, (3) increased safety at sea, (4) higher employment and (5) increase in local population. The word "by" refers back to the first objective, in contradiction to the example in which "shall" points forward. As it stands, the "operative conditions for maritime transport" is the effect, whilst the other aspects are causes. This is an obvious error. The "operative conditions for maritime transport", whatever that means, should lead to increased sea transport, increased safety at sea, higher employment and a population increase, not the other way around.

In this case the down-to-earth interpretation of the concept "operative conditions" probably means the shipping tunnel itself. Calling a spade a spade is a good advice, and the cause-effect chain would then be as depicted below.

As in the previous example the shipping tunnel should be deleted as it is no more than the project output. Increased safety at sea and increased sea transport along the coast believably are the first order effects of the project. Consequently all that is left of the strategic objective is the support of employment, which is a precondition for increasing the population.

This is the logical structure that leaves the question that needs to be clarified more by politics than by logic. What is the underlying reason for the project? Is it the population issue? If so, is the shipping tunnel an enterprise that with sufficient probability will attract new residents to the area? Or is employment the principal aspect? If so, can the project be justified from a greater socio-economic assessment of the impact of the anticipated increase in the traffic with small ships?
In this case, the statement of the overall objective in the bill put before Parliament gave no concise answer to such questions, and consequently no credible grounds for the project.

**A purposeless project**

The third project is road connection (LOFAST) from a small town at the outer part of an archipelago to another town on the mainland. The bill before Parliament correctly defines the output as "about 30 kilometers of new roads, including four tunnels, two longer and nine shorter bridges". However, the bill contains hardly any mention of the goal or the strategic objective for the project. The closest statements a justification is:

"The project will give a region with a population of 25000 a permanent road link to the mainland and thereby provide a ferryless mainland connection for the Lofoten archipelago."

This statement contains three meaningful elements: (1) road to be built, (2) permanent road link to the mainland, and (3) ferryless connection to the mainland. The linking words "give" and "thereby provide" comprise a cause-effect linkage as shown below.

Clearly, the new road is just an output, not a strategic objective. The two other outputs mentioned are merely different ways of saying the same thing, so causality is meaningless. Further, both will be realized the moment the road is completed. This means that the project has no overriding strategic objective. The 25000 residents that would benefit from the new road, most likely will get it. But the parliamentary bill has no description of the intended effect that can justify realization of the project. This also is not unusual in public decision documents.

**Conclusions**

Qualitative information is not something chosen for a particular situation, but rather something we all use in our daily communication. To a great extent, we rely on qualitative expressions that itself may inadequately describe what we wish to communicate, but nonetheless most likely will be understood as we wish. The credibility of the content of the communication depends on the basis of its information. Much of the information that we use is based on underlying systematic analysis of facts, often comprising qualitative information. Other portions are based on assumptions and judgment. An initial assessment of aspects such as needs and assumed effects of a possible project will to a great deal refer to qualitative information based on assumptions and judgment. As mentioned, this is not just a disadvantage. It may in fact simplify the visualization and discussion of complex matters. Clearly, the level of precision in such cases is low. Consequently, one must be particularly careful in securing validity of definitions to ensure that the information used as the starting point for further analysis and project development is unambiguous and as consistent as possible. Much qualitative information tends to be presented in complex, compound statements. An analysis of such information presupposes that the relevant text is broken down into its separate meaningful elements. Much of the analysis at the earliest stages would then comprise categorization, structuring, or assessing characteristics. In such cases, the assessments of causality and probability are useful aids, as discussed and illustrated in this paper.


Focusing on turning an initial idea into a project with a successful outcome, this book fills a gap in current literature on project management and is thoroughly grounded in the latest research in this field. It emphasizes the practical application of decision making based on qualitative and judgmental information.
Knut Samset is Professor of Project Management at the Faculty of Engineering Science and Technology, Norwegian University of Science and Technology, Norway, www.ntnu.no. He is the Founding Director of the Concept Research Program on Front-end Management of Large Investment Projects, and Founding Director and Senior Partner of Scanteam, an international consultancy based in Oslo.
Complex Project Management (CPM) is the “next new thing” in our quest to achieve stronger project performance. Successful projects not only deliver on time, on budget, and with the full scope of features and functions. In addition, they deliver the expected benefits in terms of contributions to the bottom line of businesses. And projects today are increasingly complex, or even very complex. Our conventional project management tools and techniques alone are not adequate to successfully manage highly complex projects.

In this article we will discuss briefly the project complexity model developed by the author. Then the team complexity is opened as an example of managerial dimension that require attention with complex projects.

**Project Complexity Model**

CPM is such a hot topic that the book published by this author, *Complex Project Management, A New Model*, was selected the receive the 2009 PMI David I. Cleland Project Management Literature Award to honor the best project management literature published in the last calendar year. The book presented a new project complexity model, developed as an outgrowth of significant research on topics such as complexity science, project risk management, project sizing and estimating, and project outcomes. The purpose of the model is to diagnose the complexity profile of projects, determine the complexity dimensions that are present on projects, and then examine management approaches to manage the complexities.

The project complexity model consists of nine complexity dimensions that may (and often do) exist on highly complex projects and programs (Figure 1).

**Team composition dimension of complexity**

This article considers the unique complexities of projects with large, diverse and often virtual teams that pose challenges to project success, and offers both old and new management strategies to handle the complexities. Refer to Table 1: Team Composition Complexity Profile to examine the nature of these project characteristics as team complexity dimensions increase.

Great teams, like all great organizations, are those that make a distinctive impact and deliver superior performance over a long period of time (Collins, 2001). For a project, performance is typically measured in terms of on time, under budget, with full scope of features, meeting quality specifications, and delivering the business benefit that was expected. Project teams do not need to be big to be great...big does not equal great. But all too often contemporary project teams are too large, too dispersed, too diverse, and just plain too complex to manage using typical project management techniques alone. So how can we be successful when a project demands complex teams? Success in the 21st century demands that we acquire new competencies to form, manage, and use large, diverse teams as a competitive advantage.

**The Good: Performance of great teams is from powerful to very powerful**

“A small group of thoughtful people could change the world. Indeed, it’s the only thing that ever has.”

—Margaret Mead, anthropologist

Transformational projects in the 21st century almost always involve multiple forms and types of teams. Applying the effective team management practices to diverse groups at the right time is in itself a complex endeavour. Successful teams are the result of many elements coming together, including adaptive team leadership, optimal team structure, just the right team composition, a disciplined culture, co-location of core team leaders, effective collaboration, communication, and coordination, and patience to steer the groups...
<table>
<thead>
<tr>
<th>Complexity Dimensions</th>
<th>Project Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Independent Project</td>
</tr>
<tr>
<td>1. Size/Time/Cost</td>
<td>Size: 3-4 team members</td>
</tr>
<tr>
<td></td>
<td>Time: &lt; 3 months</td>
</tr>
<tr>
<td></td>
<td>Cost: &lt; $250K</td>
</tr>
<tr>
<td>2. Team Composition and Past Performance</td>
<td>PM: Competent, experienced</td>
</tr>
<tr>
<td></td>
<td>Team: Internal; worked together in past</td>
</tr>
<tr>
<td></td>
<td>Methodology: Defined, proven</td>
</tr>
<tr>
<td></td>
<td>Contracts: Straightforward</td>
</tr>
<tr>
<td></td>
<td>Contractor Past Performance: Good</td>
</tr>
<tr>
<td>3. Urgency and Flexibility of Cost, Time, and Scope</td>
<td>Scope: Minimized</td>
</tr>
<tr>
<td></td>
<td>Milestones: Small</td>
</tr>
<tr>
<td></td>
<td>Schedule/Budget: Flexible</td>
</tr>
<tr>
<td>4. Clarity of Problem, Opportunity, Solution</td>
<td>Objectives: Defined and clear</td>
</tr>
<tr>
<td></td>
<td>Opportunity/Solution: Easily understood</td>
</tr>
<tr>
<td>5. Requirements Volatility and Risk</td>
<td>Customer Support: Strong</td>
</tr>
<tr>
<td></td>
<td>Requirements: Understood, straightforward, stable</td>
</tr>
<tr>
<td></td>
<td>Functionality: Straightforward</td>
</tr>
<tr>
<td>6. Strategic Importance, Political Implications, Stakeholders</td>
<td>Executive Support: Strong</td>
</tr>
<tr>
<td></td>
<td>Political Implications: None</td>
</tr>
<tr>
<td></td>
<td>Communications: Straightforward</td>
</tr>
<tr>
<td></td>
<td>Stakeholder Management: Straightforward</td>
</tr>
<tr>
<td>7. Level of Change</td>
<td>Organizational Change: Impacts a single business unit, one familiar business process, and one IT system</td>
</tr>
<tr>
<td></td>
<td>Commercial Change: No changes to existing commercial practices</td>
</tr>
<tr>
<td>8. Risks, Dependencies, and External Constraints</td>
<td>Risk Level: Low</td>
</tr>
<tr>
<td></td>
<td>External Constraints: No external influences</td>
</tr>
<tr>
<td></td>
<td>Integration: No integration issues</td>
</tr>
<tr>
<td></td>
<td>Potential Damages: No punitive exposure</td>
</tr>
<tr>
<td>9. Level of IT Complexity</td>
<td>Technology: Technology is proven and well-understood</td>
</tr>
<tr>
<td></td>
<td>IT Complexity: Application development and legacy integration easily understood</td>
</tr>
</tbody>
</table>
as each evolves from a collection of people, into a good team, and finally into a great team.

Since projects involving significant change in the way business is conducted are almost certain to involve complex team structures, it is not unusual for project teams to have sponsors, customers, architects, and developers sprinkled around the globe. It is too expensive, and simply too exhausting, to continually travel around the world to meet with team members in person. To reap the rewards of significant changes to optimize business and technology, we must find new ways to manage complex teams, complementing face-to-face sessions with robust virtual exchanges (Hass, 2010).

The demands of the twenty-first century are requiring businesses to reject traditional “command and control” management structures and reach out into the virtual and physical world to create innovative approaches to team composition. To remain competitive, companies are establishing inventive, but also complex, organizational communities. These alliances may be with strategic suppliers, networks of customers, and win-win partnerships with key political groups, regulatory entities, and yes, even with competitors. Through these inventive alliances, which manifest themselves in both physical and virtual models, organizations are addressing the pressures of unprecedented change, global competition, time-to-market compression, rapidly changing technologies, and increasing business and technological complexity.

Geographical diversity and dependency on technology for communication and collaboration dramatically magnify the challenges of leading teams. Applying the appropriate team management techniques to multiple parties at the right time is a complex endeavor. The project leadership role becomes as much about team leadership and group development, as about project and requirements management.

We will first explore the nature of the complexities that come into play when managing complex teams with dissimilar cultural norms, complicated contractual agreements, and multiple methodologies, including:

- Teams as complex adaptive systems
- Interactional uncertainty
- Integration challenges

We then examine the use of sophisticated team management techniques, while at the same time establishing an environment of adaptability, innovation, and creativity. Areas that will be examined include:

- Leveraging team potential
- Becoming a team leader
- Using team collaboration, communication and coordination tools and techniques.

The Bad: Teams are difficult or very difficult to manage

There are many complexities that come into play when managing complex teams with dissimilar cultural norms, complicated contractual agreements, and multiple methodologies. Here, we explore just a few.

Teams as Complex Adaptive Systems

As complexity science teaches us, human behavior is complex because humans are always reacting to their environment, and therefore human activity is impossible to predict. In addition, teams are complex adaptive systems within the larger program; the program is also a complex adaptive system operating within a complex adaptive organization; the organization is trying to succeed (by changing and adapting) within a complex adaptive global economy. As a leader of a new complex project or program, you cannot predict how your team members will react to each other, to the project requirements, and to their place within the program and the larger organization. So, complex team leadership is hard, very hard. Stop thinking of yourself as a project or program manager, and begin to hone your team leadership skills, for you are now managing through teams. When managing a complex project, you are a team leader, not a project manager.

Interactional Uncertainty

At first glance, it appears that team members who have worked together in the past will evolve into a high-performing team quickly. However, they may have baggage and bring biases or resentments toward one another to the new team. Whereas, team members who have not yet worked together are likely to hold back until they learn about each other, the team dynamics, the task at hand, and their expected role and responsibility. This concept, referred to as “interactional uncertainty,” (Jensen et al, 2006) recognizes that if there is uncertainty in a relationship, the participants will tend to withhold information and calculate the effects of sharing information. The project leadership team must guide members through the inevitable early stages of team growth toward “interactional certainty” that leads to trust. Then, team members can focus their energies on positive interactions. When working in a virtual environment, it is very challenging to establish a trusting environment, achieve “interactional certainty” and therefore, foster trusting relationships.

Integration Challenges

Working with many disparate teams almost always leads to integration issues, making it difficult to amalgamate interdependent solution components that have been designed and constructed by different teams. Teams often use dissimilar procedures, practices, and tools which results in work products of varying quality and consistency. Finally, deficiencies in many project management techniques, e.g., risk management and complexity management can lead to unknown consequences requiring rework to resolve.

The Complex: Great teams are from complex to very complex

To lead complex layers of teams, project leaders must leverage the potential of teams, master team leadership, and learn to use sophisticated collaboration, communication, and coordination systems. Teams are a critical asset used to improve performance in all kinds of organizations. Yet today’s business leaders consistently overlook opportunities to exploit their potential, confusing teams with teamwork, empowerment, or participative management. We simply cannot meet 21st century challenges, from business transformation to innovation to global competition, without understanding and leveraging the power and wisdom of teams.

Leverage the power of teams to achieve results unavailable to individuals

“Teams help ordinary people achieve extraordinary results.” —W.H. Murray, Scottish Himalayan Expedition

Successful complex project managers appreciate the power of teams. Success stories abound: Motorola surpassed the Japanese in the battle to dominate the cell phone market by using teams as a competitive advantage; 3M uses teams to reach its goal of generating half of each year’s revenues from the previous five years’ innovations. High-performing teams are all around us: U.S. Navy Seals, tiger teams established to perform a special mission or attack a difficult problem, paramedic teams, fire fighter teams, surgical teams, symphony orchestras, and professional sports teams. These teams demonstrate their accomplishments, insights, and enthusiasm on a daily basis and are a persuasive testament to the power of teams. Clearly, we must learn how to form, develop,
“Soft skills” are essential. Leaders of complex projects derive their power and influence not so much from a position of authority in the organizational hierarchy but as a result of their ability to build relationships. These leaders must be expert, influential, well-connected, held in high regard, indeed, considered indispensable.

Learn how to build and nurture your team
Leaders of complex teams must have an understanding of the dynamics of team development and how teams work; they develop specialized skills that they use to build and sustain high performance. Traditional managers and technical experts cannot necessarily become effective team leaders without the appropriate mindset, training, and coaching. Make a concerted effort to develop team-leadership skills and dedicate considerable energy to transitioning your team members into a cohesive team with shared values, beliefs, and an ethical cultural foundation. The best teams are collaborative and share the leadership role, depending on the precise needs of the project at any given time. The situational team leader understands that varying leadership styles are appropriate depending on the different stages of team development.

Get the “right stuff” on your team – recruit meticulously
Selecting the right members for your team is perhaps the most important decision you will ever make. When you enlist team members, do so not only based on their knowledge and skills, but also because they are passionate, strategic thinkers who thrive in a challenging, collaborative environment. Conventional wisdom tells us to determine what needs to be done first and then select the appropriate person who has the knowledge and skills required to do it. However, in his book Good to Great, Jim Collins emphatically tells us: first who . . . then what. Rather than setting a direction, a vision, and a strategy for your project and then getting people committed and aligned, Collins and his research team found that great companies did just the opposite: They first selected the people who had the “right stuff” and then collaboratively set their course.

Establish an optimal team structure
Structure matters! Typical contemporary team structures suggested by gurus like Jim Highsmith (Highsmith, 2004) and Jim Collins (Collins, 2001) include:
- A core team or “hub” structure. This structure reflects aspects of both hierarchical and network structures.

This model is often comprised of several customer teams, numerous feature teams, an architecture team, a verification and validation team, and a project management team. Teams take on all possible configurations: virtual, co-located, or a combination thereof.

- Self-organization extensions. As the number of teams within the project expands, the organizational structure transitions from a team framework to a project framework within which multiple teams operate. Creating a self-organizing team framework involves: (1) getting the right leaders, (2) communicating the work breakdown and integration strategies, (3) encouraging interaction and information flow between teams, and (4) framing project-wide decision-making. Obviously, as more teams are formed, complexity increases. Managing inter-team dependencies is critical; teams need to fully understand their boundaries and their interdependencies.

- A culture of empowerment and discipline. Behaviors required of teams when working in this structure include: (1) accept accountability for team results, (2) engage collaboratively with other teams, (3) work within the project organization framework, and (4) balance project goals with team goals.

Using Effective Team Collaboration, Communication, and Coordination Practices
For effective team collaboration, communication, and coordination of complex team structures, consider the following practices:
- A standard methodology
- Collaborative planning and decision making
- State-of-the-art collaboration tools

A standard methodology fosters discipline and facilitates communication for complex projects, using a standard methodology—while encouraging each team to tailor it as needed—goes a long way toward eliminating unknown cross-team dependencies. However, a word of caution: Do not overly burden the various teams with standards, but do insist on those that are needed to provide a realistic view of the overall project and to manage cross-team dependencies. Enforce the use of standard collaboration procedures, practices, and tools.

Collaborative planning and decision making promotes commitment
Involve all core team members in the project planning process and seek...
feedback often to continually improve the performance of the team. There is no substitute for face-to-face working sessions during planning meetings, especially for brainstorming, innovating, analysing feasibility of potential solutions, scoping, scheduling, identifying risks and dependencies, and conducting critical control-gate reviews. When preparing your project budget, be sure to include adequate time and budget to bring core team members together for these critical sessions. Be firm about establishing decision checkpoints that involve all core project team members at critical junctures.

State-of-the-art collaboration tools facilitate consensus
Secure best-in-class software tools to enable collaboration and document-sharing. Two general types of collaboration tools are available: professional service automation (PSA), which is designed to optimize service engagements; and enterprise project management (EPM) tool suites, which are used to manage multiple projects.

In addition, provide your team members with personal communication and telecommunications tools so that they feel closely tied and connected. If these tools are an unconventional expense item for projects in your organizational culture, educate your project sponsor on the criticality of collaboration, stress the need to manage the cross-project interdependencies that are known at the start of the project as well as those that will emerge along the way. Also, experiment with social networks and communities. This computer-mediated communication has become very popular with sites like MySpace and YouTube and has resulted in large user bases and billion-dollar purchases of the software and their communities by large corporations.

Summary
The purposed project complexity model is to diagnose the complexity profile of projects, determine the relevant complexity dimensions, and then approach management approaches to manage the complexities.

Great teams do not happen by accident. Hard work, planning, and disciplined effort are required to convert a group of great people into a great team. For complex projects the effort is magnified because multiple large, geographically dispersed, and culturally diverse teams are involved. Leaders of complex projects cease to be project managers and become leaders of teams. Both conventional and adaptive approaches are needed for large, long-duration projects to be successful (Figure 2).

References


Modern risk management (RM) approaches emphasize the human and environmental complexity of risks and the fundamental characteristics of each focal entity (i.e. a firm, a business, or a project). Recent concepts have been enlarged towards or coupled with two-way uncertainty management concepts and they incorporate a sense of foreseeing and proactive doing. It is herein envisioned that modern, non-deterministic, integrated RM concepts will complement, advance, and replace the traditional, reactive approaches to risks. Valuable insights concern the concepts’ systemic holism, foresightedness, human-orientation, simplicity, integration, and experience base of both highly advanced and practical RM concepts.

Introduction

Our article is one of the outcomes of the research program on enlarged RM within the unit of Construction Management and Economics in the Department of Structural Engineering and Building Technology at the Aalto University School of Science and Technology. The article is based on the comprehensive review of the 116 concepts (published between the years 2000-2006) for managing risk, uncertainty, complexity, and crisis. Our perception of the evolutionary trends is in part grounded on a qualitative comparison with the findings of Edward and Bowen’s (1998) review of the 280 traditional (including technological, natural, etc.) RM articles and texts (published between the years 1960-1997).

We argue that many complex challenges of globalizing, environmentally-friendly, and multi-stakeholder construction imply that traditional, mechanistic RM concepts are not anymore realistic, flexible and efficient enough. The latter do not take enough into account embedded or informal RM practices such as managing human interaction, motivation and collaboration. This argument is herein justified by the conducted review, the comparison of the traditional and modern RM, the enlargement of RM along the dimensions of uncertainty and complexity as well as the comparison of our review with Edward and Bowen (1998) as follows.

Search for generic and contextual management concepts

The enlarged RM involves the managing of uncertainty, risk, complexity, and crisis (Palojärvi, 2009). A management concept is herein defined to be an abstraction representing an object, the properties of an object, or a certain phenomenon, e.g. a firm managing risk as part of its operations in international construction markets. Besides RM concepts themselves, eligible references often include one or several methods, techniques and/or tools (Huovinen, 2008). The focal context includes the three levels of managing firms and public organizations, businesses, and projects in construction. A population of firms consists of designers, contractors, suppliers, and other service providers. Contexts are global, international, national, and local.

Relevant enlarged RM literature was sought for via the 23 book publishers’ digital catalogs, the two article databases (EBSCO and ProQuest), and the two websites (Google Book and Google Scholar). The search resulted in the identification of a population of the 116 concepts published in English between the years 2000-2006. Thereof, 49 (42%) RM concepts are related to construction. 68 (59) of the concepts deal with project management and the remaining 48 (41%) with firm and/or business management. The density of the concepts was evaluated along the dual dimensions of theoretical advancement and practical applicability. The three criteria for the search were specified within the dimensions, respectively, as shown in Table 1.

Traditional versus modern approaches to risk management

Traditional RM approaches are straightforward and formal, e.g. presented as a chain of tasks (identify - classify - analyze - respond). Modern RM approaches are less formally presented, they accommodate more consideration to the characteristics of each focal entity (i.e. a firm, a business, or a project) and its stakeholders as well as they are equipped with many informal features such as...
motivation and interpersonal relations.

Along the theoretical dimension, it seems that both generic and construction-related references include fairly holistic approaches vis-à-vis RM. Modern RM concepts are explicit about coupling risks with their negative and positive consequences. This two-way approach defines risk as an uncertainty related to estimated consequences. Risk means that results may be worse or better than expected (Lifson & Scheifer, 1982). Recently, this two-way approach has been adopted like a standard but several traditional concepts still concentrate one-sidedly on responses to the negative implications of risks. In addition, many authors are more foresightful, i.e. proactivity is commonly emphasized. More soft system methodologies are emerging with a focus on stakeholders’ interaction. For example, Weick & Sutcliffe (2007) have designed a mindful management approach that is fully concerned on building a manager’s personal capacity for risk response. Instead, the traditional RM approaches seldom contain the above-mentioned elements.

Along the practical dimension, many authors base their concepts on documented experience on the varying degrees of the functionality of their RM concepts, respectively. Moreover, many concepts have been designed as the integrated parts of firm level, business level, or project level management. The migration is going on from traditional (e.g. mechanistic, straightforward) RM concepts towards modern (e.g. adapted, less formal, yet systematic), enlarged RM models. Hence, the simplicity of concepts has decreased, albeit authors claim that their modern RM concepts are better adapted to real-life complexities and dynamics. Thus, modern concepts may turn out to be more useful from the view of practicing risk managers. Nevertheless, Palojärvi (2009) posits that goal setting be included as the first step of all RM processes, followed by risk identification, assessment (analysis), and response.

Widely used, traditional RM concepts in construction can be exemplified with the Institution of Civil Engineers and the Actuarian Profession’s (2005) RAMP model and Flanagan and Norman’s (1993) systematic RM process. Several concepts, e.g. Chapman and Ward’s (2003) formal, structured RM process fall somewhere between highly traditional concepts and highly modern concepts.

In turn, Loosemore’s (2006) project RM approach is a noteworthy example of a modern RM concept. He provides a flexible, adaptable, and discursive approach that acknowledges uncertainty and complexity stemming from human perceptions and reactions to risks. The five steps of the Institution of Civil Engineers and the Actuarian Profession’s (2005) RAMP model and the seven steps of Loosemore’s (2006) modern RM concept are compared in Figure 1.

**Uncertainty and complexity views within risk management**

There are many natural connections between the three coinciding areas of managing risk, uncertainty, and complexity. Uncertainty is one of the main sources of complexity. Uncertainty management refers to decision making under insufficient or inadequate knowledge (Lichtenberg, 2000), which implies susceptibility to risk. Negative and positive outcomes of uncertainty are taken into account. Complexity refers to dynamic conditions, actors, and non-linear relations (McMillan, 2008). All this and fast pace multiply risks.

Both uncertainty and complexity management concepts are being transformed from generic designs and specific applications towards the holistic and integrated management

<table>
<thead>
<tr>
<th>Theoretical advancement</th>
<th>Practical applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T1.</strong> Systemic holism refers to various areas of encompassing the scope and variety of managing focal entities as systems.</td>
<td><strong>P1.</strong> Simplicity refers to various ways of the actual effective use of one or several enabling, enlarged RM concepts.</td>
</tr>
<tr>
<td><strong>T2.</strong> Foresight refers to various modes of proactive thinking, plans, decisions, and actions as part of total management (including RM).</td>
<td><strong>P2.</strong> Integration refers to (i) the external, integrated use of the concept as part of the focal entity management and (ii) the internal integration of risks, uncertainties, complexities.</td>
</tr>
<tr>
<td><strong>T3.</strong> Soft systems refer to the scope of reliance on informal methods, tacit knowledge, particular competencies, etc. as well as the accommodation of complexity of human interaction and decision making.</td>
<td><strong>P3.</strong> Experience refers to various, cumulative uses of one or several enlarged RM concepts and their positive and/or negative outcomes.</td>
</tr>
</tbody>
</table>

Table 1. Six criteria for the evaluation of the density of theoretical advancement (T1, T2, and 3) and the density of practical applicability (P1, P2, and P3)

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**Figure 1. Comparison of a traditional RM framework and a modern RM framework.**

**TRADITIONAL RM PROCESS**
(The Institution of Civil Engineers and Actuarian Profession, 2005)

1. Process launch (incl. context and objective definition)
2. Risk review (incl. identification, evaluation, and response planning)
3. RM (including response implementation and control)
4. Process close-down (incl. assessment and review)

**MODERN RM PROCESS**
(Loosemore, 2006)

1. Make stakeholders feel involved
2. Maximize information for decision making
3. Equalize perceptions of risks and opportunities among those who can affect the outcome of a project
4. Make everyone understand the basis upon which a decision is made
5. Make people feel involved and valued in the process
6. Make people feel that their interests are being considered
7. Make people understand their responsibilities and role in a RM process
of firms, businesses, and projects. The notion of foresight is embedded into uncertainty and complexity views. Methods for evaluation, prioritization, and response vis-à-vis the sources of uncertainty are increasingly incorporated also into effective, traditional RM concepts (e.g. Chapman & Ward, 2003). Typically, Shenhar and Dvir’s (2007) framework is useful in assessing project complexity and distinguishing between projects and their appropriate management solutions. In turn, Rails et al. (2009) apply complexity thinking to enlarge the scope of traditional PM. As interaction between stakeholders is seen as a major source of complexity, Pryke and Smyth (2006) portray the development of a human-oriented relationship approach (‘soft system’) to complexity management in construction.

Comparison of the earlier and recent research on risk management

The cumulative piles of RM concepts can be linked to a wider time scale by comparing our recent insights and the results of Edwards and Bowen’s (1998) comprehensive review. They analyzed the evolution of risk perception and RM in construction between the years 1960 and 1997 from the three viewpoints, i.e. construction-related applications, systematic approaches, and ‘soft systems’. These are roughly comparable to our three criteria, i.e. experience (practical applicability), systemic holism (theoretical advancement), and soft systems (theoretical advancement). The results of this qualitative comparison are compiled in Table 2.

The clear differences are revealing the on-going migration from the traditional RM toward modern, enlarged RM concepts.

<table>
<thead>
<tr>
<th>Two reviews</th>
<th>RM concepts between the years 1960-1997 (Edwards &amp; Bowen, 1998)</th>
<th>RM concepts between the years 2000-2006 (Lehtiranta et al., 2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epistemology</td>
<td>Risk is seen to include only negative implications of a phenomenon</td>
<td>Risk is seen to include positive and negative implications of a phenomenon</td>
</tr>
<tr>
<td>Systematic approach to RM</td>
<td>In the early decades (from 1960s up to mid-1980s), RM was dominated with mathematical analyses and partial applications. Thus, early systematic approaches remained simple for a long period (from mid-1980s up to 1990s).</td>
<td>RM processes include risk identification, risk analysis, and risk response (Flanagan &amp; Norman, 1993)</td>
</tr>
<tr>
<td>‘Soft systems’ and decision making views</td>
<td>Soft systems are an emerging issue, related to subjective probabilities, the exploration of heuristics and biases, and the surveys of RM practices with only a few applications</td>
<td>A knowledge-based approach by using fuzzy language sets, qualitative reasoning, and knowledge elicitation (Raftery &amp; Ng, 1993)</td>
</tr>
<tr>
<td>‘Soft systems’ and systems complexity management views</td>
<td>Not (yet) identified</td>
<td>Emerging soft systems in managing complex phenomena (e.g. irrational people and non-linear systems) with only a few applications</td>
</tr>
<tr>
<td>Contextual RM concepts</td>
<td>Very rare in construction</td>
<td>Common in construction</td>
</tr>
</tbody>
</table>

Table 2. Comparison of the recent and earlier developments in RM concepts.
References


Stakeholder Engagement in Managing Risk

In the increasingly emotional and regulated business environment, effective risk and opportunity management has become a basic necessity for every organization, as has the ability to communicate effectively with external stakeholders about risk. The potential costs of poor communication with stakeholders during this process are enormous but the potential benefits of effective consultation are even greater. Using a multimedia risk management system called ROMS (www.risk-opportunity.com) and drawing on research in stakeholder management and multimedia this paper presents an in-depth case study of how multimedia technology was used to help a government health department develop a risk and opportunity management strategy to respond to climate change risk to its infrastructure. This research has revealed the practical advantages of using multimedia to engage stakeholders in the risk and opportunity management process. Future research needs to explore the pedagogical advantages of multimedia in helping organizations develop a risk and opportunity management culture.

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The GFC has vividly demonstrated that businesses, institutions and markets are connected in ways which are not fully understood (WEF 2009). This is requiring a paradigm shift from narrow and traditional conceptualizations of risk management which historically have excluded stakeholders to a more inclusive notion of stakeholder engagement in managing risk and opportunity (Barnes 2001). In the future, the implicit question facing any organization will be not just whether it is managing its risks effectively but also whether it is communicating this effectively to its stakeholders. This paper is a response to this challenge. Its aim is to discuss the role of stakeholders in the risk management process and the potential role of multimedia technology as a means to better facilitate this.

Risk management from a stakeholder perspective
Stakeholder management theory conceives an organization as a complex, dynamic and interdependent network of multidimensional relationships with a wide variety of stakeholders. Performance and competitiveness depend on how well firms manage and nurture these relationships strategically in order to achieve corporate objectives and how they are perceived to manage them by the stakeholders, in their interests (Zsolnai 2006). From a risk management perspective the benefits of consulting with these stakeholders are said to be numerous and include: higher levels of trust with stakeholder groups; stakeholders being able to contribute to decisions affecting their future; higher quality information for making business decisions; a wider understanding in the community of constraints upon firms; stakeholders feeling more involved in decision-making processes and feeling their interests are being considered; stakeholders better understanding their risk and opportunity management responsibilities and; greater collective responsibility in managing risks.

In essence, the stakeholder paradigm is based on the premise that people are not rational when thinking about risk but are influenced by cultural and social networks in which they are imbedded. In other words, people form their own subjective perceptions of risk which often differ from the objective assessments made by managers, experts and scientists and their behaviour reflects these perceptions (Berry 2004). Ultimately, it is argued that there is no other way for managers to interpret risks other than in terms of human values, emotions and networks. This position is supported by Barnes (2002) who points out that while risk managers have become more scientifically and technologically sophisticated in their approach to managing and measuring risk, the majority of the public continue to rely on cultural and social explanations of risk events, leading to significant perceptual differences between the community and the private business sector. Therefore, it is likely that in many companies there may remain significant institutional “blind spots” which ignore the contextual experience of risk and the perceptual issues that are relevant to public concern (Loosemore et al 2005).

The power of multimedia in managing risk and opportunity
Multimedia technology can offer a potential solution to stakeholder engagement in the risk man-
Multimedia is a combination of two or more communication mediums such as text, image, sound, speech, video, and computer programs. From a risk management perspective, the main advantage of multimedia compared to traditional mediums of communication is its ability to engage, enthuse and stimulate the stakeholders involved in the learning process which occurs when stakeholder knowledge is effectively integrated (Nonaka 1994). For example, Wright (2004) studied operative and management training in a range of major organisations and found that multimedia offered numerous pedagogical advantages over traditional training methods. Indeed, research indicates that people, no matter what background, retain and understand up to 91% more when using multimedia compared to computer and paper-based management systems (Bailey 2001).

While multimedia is used in industries like mining and power transmission to manage risk (Wu and Che 2008) it is used little in construction and even less in a more general corporate enterprise-wide risk management context. Loosemore et al (2005) argue that most approaches to risk management in construction are unimaginative, pedagogically unstimulating and appear deliberately designed to exclude rather than involve people in the risk management process.

Method

To explore the apparent potential of multimedia to involve stakeholders in risk management, this section presents a case study of an organisation that used a new multimedia approach to risk management called ROMS (ROMS 2009) which is currently being used by Australian and New Zealand Health authorities to develop a national adaptation strategy to enable hospitals to cope with the health impacts of climate change - see www.risk-opportunity.com. This is the first attempt in Australia at developing such a strategy, and ROMS was used because of its ability to bring together a wide variety of health sector stakeholders which are notoriously difficult to manage because of the highly complex political and organisational and cultural characteristics of the health sector (Carthey et al 2008, Chandra 2009). Data was collected in a focus group workshop over two-days which involved stakeholders from clinical, health policy, health sector management, asset and facilities management, government architect and emergency services backgrounds. The aim of the ROMS process was to bring to integrate and synthesize into a coherent risk management strategy, the risk perceptions and occupational aims and objectives of all of these stakeholders in managing potential climate change risks. The ROMS workshops involved eight simple steps and are the focus of this case study. The names of stakeholders have been changed for confidentiality reasons.

Step one - Project information

Step 1 involves identifying different types of stakeholders using a simple stakeholder analysis tool which is provided by ROMS and based on Freeman’s (1984) classic stakeholder classification model. Only key stakeholders are invited to the workshop, other “important” and “minor” stakeholders being consulted in different ways. Figure 1 illustrates the interface in step one for the climate change adaptation strategy without interactive background information which can be accessed by selecting various column and row headings.

Step two - Level of complexity

Step two involves selecting a level of risk management complexity (there are four) which suits the experience of the stakeholders in risk management, the quality of data available, familiarity of the problem, time available etc. Sophisticated users dealing with complex financial issues where there is an abundance of reliable quantitative data can operate at “Level 4” which provides access to a wide range of sophisticated techniques such as simulation and probabilistic analysis. In contrast, a user with no experience of risk management dealing with a routine problem for which there is no data can choose “Level 1”. Figure 2 illustrates the interface in step two with some background information which can be accessed by selecting various column and row headings.
Step three – Stakeholder consultation

In Step three stakeholders have to identify their individual objectives, select five common objectives and define them using measurable KPIs (Key performance indicators). The process of identifying common objectives is critically important to overcome the silo mentality, to enable stakeholders to emerge with a new appreciation of other stakeholder interests and in fostering a sense of collective responsibility and collaboration in managing risk and opportunity. Figure 3 illustrates the interface in step three.

Figure 3. Interface for step three of ROMS

Step four – Identify risks and opportunities

Step four assists the key stakeholders to collaborate in identifying both risks and opportunities which could adversely or beneficially affect their ranked objectives. ROMS provides a range of techniques which correspond to their chosen level of complexity in step 2. At level 1, simple checklists and work breakdown statements are used to identify risks whereas at level 4 more sophisticated users can use techniques such as soft systems analysis and simulation to identify risks and opportunities. Figure 4 illustrates the interface in step four.

Figure 4. Interface for step four of ROMS

Step five – Assess and prioritise

Step five involves key stakeholders collaboratively assessing the magnitude (considering existing controls) of each risk and opportunity associated with each ranked objective. ROMS has an in-built risk matrix which can be adapted to reflect any organisation’s risk appetite and assessment process simply involves selecting pre-determined risk and consequence labels referring where necessary to definitions, advice and guidance provided by the multimedia system. Recognizing the dangers of ranking risks and opportunities on probability and consequences alone (Williams 1996), ROMS provides a three-dimensional ranking process on “risk level”, “urgency” and “controllability”. Figure 5 illustrates the interface in step five with some graphical information in Figures 6, 7 and 8 which can be accessed by selecting various column and row headings.

Figure 5. Interface for step five of ROMS

Step six – Action plan

Step six involves taking forward the ranked list of risks and opportunities into an “action plan” where control strategies to mitigate risk and maximize opportunities are identified and selected using cost/benefit analysis. The impact of different combinations of strategies on existing risk and opportunity profiles can be compared graphically using a variety of tools contained in ROMS.

Figure 6. Risk map from ROMS

Step seven – Implementation

Step seven involves allocating the selected additional controls from step six a “risk owner” and a “deadline”. Figure 10 illustrates the interface in step seven.

Figure 7. Risk Calculator from ROMS

Step eight – Monitor, review and learn

Step eight provides an automated monitoring, review and

Figure 8. Risk profile from ROMS
learning mechanism. This enables the manager in charge of the process to monitor the action plan to ensure it is implemented as planned, to review it if progress does not go as planned and to learn from the process.

Conclusion

The aim of this paper was to explore the relationships between stakeholders and risk management and to discuss the potential role of multimedia technology as a means to better engage stakeholders in the risk management process. Experience of using ROMS across numerous sectors and contexts has shown that a multimedia approach can be valuable in achieving this aim for both large and small organisations involved in simple routine type activities or complex one-off activities. Multimedia can facilitate an unintimidating yet rigorous and consultative approach to risk management which highlights interdependencies and common interests between organizational stakeholders, which recognizes and considers the interests of different stakeholders and which effectively captures and harnesses the knowledge, experience and creative capability of stakeholders in an interactive, engaging and stimulating way.

References

Freeman, R E (1984) Strategic management: A stakeholder approach, Pitman, Boston, USA.
Zsolti, I. 2006 Extended stakeholder theory, Society and Business, 1 pp 37 - 44.

Figure 9. Interface for step six of ROMS

Figure 10. Interface for step seven of ROMS

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Project-based firms employ solution-specific business models for their solution deliveries

The business models of project supplier are increasingly changing from short-term project deliveries to also include the maintenance and even operation of systems. This means also a larger share and responsibility of the customers’ value streams. Design of life-cycle-focused business models in project-based firms can be challenging. This paper presents a solution according the described development avenue and discuss variety of factors affecting on the solution.

Project suppliers extend their businessess towards life-cycle solutions

Project suppliers are taking increasing responsibility for their customers’ businesses by servicing and operating their installed base of equipment. Simultaneously, the locus in value creation in the project suppliers’ deliveries and business models has changed from short-term project deliveries to also include the maintenance and even operation of systems. Project suppliers of capital intensive equipment and systems recognize the importance of services in increasing sales volume, reducing the cyclicality of project business and maintaining customer relationship between projects deliveries. Therefore, many project suppliers attempt to capture a larger portion of the overall value stream between raw materials and final consumer (Figure 1, Davies, 2004). An increasingly long-term business perspective and a change of logic in earning, present challenges for the design of a project supplier’s business model and for their organizational structure (Brady and Davies, 2004).

The traditional business model for many suppliers is to operate in one stage of the value stream in design and manufacturing of subsystems for a total project delivery (Manufacture in Figure 1). Extending the business to turnkey deliveries (Systems integration in Figure 1) requires the capability to coordinate the project network to integrate the numerous subsystems into a functional system that meets the customer’s needs. By occupying a larger share and responsibility of the value stream project suppliers can potentially create more value for their customers and to gain more profits with services such as design, procurement and project management before and during the projects. However, both of these business models focus on the relatively short-term project deliveries and may restrict the project suppliers’ service potential. After project handover, customer relationship is limited to sporadic service transactions. Project suppliers that develop their service offering to provision of operational services (Figure 1) or operational and maintenance (O&M) services can further extend their share in the overall value stream. Operations and maintenance contracts add value for customers as they usually include a performance guarantee. A fixed service fee against a predetermined availability or performance guarantee allow the customers to outsource the operational risks to the party that is most capable of operating the project product; the project product’s supplier. For the project supplier, operations and maintenance service contracts are attractive as they allow the project supplier to maintain the customer relationship and a steady service volume for several years. Operations and maintenance contracts are not insignificant as they can in many cases double the overall sales value of a project. Integrating high-value projects in a seamless solution with a long-term operations and maintenance (O&M) service requires a project supplier to radically extend the time span of its focus from a short-term project delivery to life-cycle care. “Servitization” (Vandermewe and Rada, 1988; Rothenberg, 2007) in the capital goods business refers to the trend to develop and to offer total solutions that seek to reduce the capital goods’ operation and maintenance costs throughout their life-cycle.

In this paper a solution is defined to include both a project component and an after-sales service component. Furthermore, a distinction is made between three different deliveries depending on the role that services play; transactional
project delivery, project-led solution, and life-cycle solution (Figure 2, Kujala et al., 2010b). Both project-led solutions and life-cycle solutions include an operations & maintenance service component. In project-led solutions, the project supplier continues its project delivery business without major changes and builds its service capabilities to offer operational services. Despite the enhanced service capability, the project and the operational services are offered and contracted separately, often by different organizational units. Operational services are an important part of the offering, but the core delivery project is the main focus.

By contrast, in a life-cycle solution the project and service components are offered as a single integrated solution, emphasizing the life-cycle performance of the offering. Designing a life-cycle solution that takes into account the entire life-cycle from the development of the project to the end of the use phase can help to prevent sub-optimization between different participants, creating a win-win situation for both the customer and the solution provider. A significant portion of the solution provider’s revenue comes from the fixed operations & maintenance income against a guaranteed product performance. Thus, the solution provider’s profitability is tied to the organization’s capability to design and supply efficient, reliable and low-maintenance products. In project-led solutions this link between the project and the service phase profitability is often weaker because of the division between the project and the service organizations. Internally, projects remain as the dominant part of the business and it may be difficult to create incentives for the design of life-cycle solutions. By contrast, delivery of life-cycle solutions can optimize life-cycle performance and minimize the total cost of delivery and maintenance for both the project supplier and the customer.

**Figure 1. Value stream for capital goods**

**Figure 2. Features of a project delivery, project-led solution and life-cycle solution**
Figure 3. Framework of a project supplier’s business models for solutions (Kujala et al., 2010a; Oliva & Kallenberg, 2003)

Business models as a tool for evaluating and enhancing a firm’s business performance

As their business focus, timeframe, and revenue creation logic change with the new solution orientation, project-based firms step into new business models. The concept of a business model is a useful tool for analyzing the characteristics of a firm’s business. Although closely related, a business model is a wider concept than business strategy or revenue creation logic of a firm. While business strategy often emphasizes the competitive positioning of a firm, most conceptualizations of business models emphasize the importance of value creation for the customer and call for a customer-oriented approach to a firm’s business. Kujala et al. (2010a) present that the characteristics of a firm’s business model can be evaluated through six key components of a business model that include customer, value proposition for the customer, competitive strategy of the firm, the firm’s position in the value network, the firm’s internal organization and its key capabilities, and its logic of revenue generation.

- Customer
- Value proposition for the customer
- Competitive strategy
- Position in the value network
- Firm’s internal organization and its key capabilities
- Logic of revenue creation

In practice, the discussion of business models is usually strategy-related and subsequently takes place at the organizational or the business unit level. However, it is also suggested that firms should be more careful when designing their businesses for their customers and design profit models in an innovative manner instead of restricting to one general business model. Kujala et al. (2010) argue that in the context of a project-based firm, business models should be studied at the level of a single project solution. Their empirical analysis provides support to the argument by pointing out that different solutions employ different business models within a project-based firm. In many cases multiple business models are needed to meet the customer’s requirements. For example, although a project supplier had developed capabilities to deliver full life-cycle solutions they cannot deliver them for every customer. Indeed, it has been suggested that many of the factors that affect a solution provider’s choice of a business model for a particular solution delivery are fully or partly related to the customer (Kujala et al., 2010b). As an example, a project delivery may be strategically so important for the customer that he wants to keep the operations of the project product in-house. Evaluation of business models at a level of a single solution can help in recognizing the business model elements and in choosing the most appropriate business model for each solution delivery.

Project-based firms employ multiple business models for their solution deliveries

Four main business models for project and solution deliveries can be identified with two dimensions: the value proposition for the customer and the revenue generation logic for the supplier (Figure 3). The framework has its origins in the servitization model presented by Oliva and Kallenberg (2003) and it has been developed further to address the life-cycle view of solutions (see Figure 3 and Table 1).

The four business models are Project delivery with installed base services, Project delivery with customer support services, Project-led solution and Life-cycle solution. The characteristics of each business model can be assessed in a narrower sense through the two axes of the framework or in wider sense through the six components of the business model (see Table 1). The vertical axis in Figure 3 represents the supplier’s revenue creation logic. The move from transactional projects and infrequent services to solutions requires a change in pricing and revenue generation logic from a markup in labor and parts to fixed pricing based on equipment availability and performance (Oliva and Kallenberg, 2003). Consequently, the supplier accepts some of the customer’s operational risks and introduces value-based pricing for the service. The horizontal dimension of Figure 3 displays the offering for either product-oriented or process-oriented services and implies a change in customer value proposition from product efficacy to product’s efficiency in the user’s process. Process-oriented services support the customer in getting the best use of the system. Services such as process design and optimization or the design of a total life-cycle solution may positively impact the customer’s ability to create additional value with its own business. Product-orientation and customer’s process-orientation also separate the project-led solution from the life-cycle solution. While project-led solutions are fairly standardized outsourcing contracts life-cycle solutions are designed to create long-term value for both the supplier and the customer.

Conclusion

Why should business model analysis be conducted at the level of a single solution? Since each project is unique even by definition, and a project-based firm’s solution business is built on unique project deliveries, the solutions are also unique. Indeed, a typical business within a project-based firm is comprised of unique solution deliveries. Thus, the choice of a business model should also be made and evaluated in respect to a particular solution delivery.

Analysis of business models at the solution level adds evidence that life-cycle solutions can positively affect the life-cycle performance of project products (Kujala et al., 2010a). Nevertheless, design of life-cycle-focused business models in project-based firms can be challenging. In product-centric organizations a disintegration of the project and the service delivery into separate organizational units may hinder development of life-cycle focused offerings. Furthermore, a reactive marketing approach may lead to product-centric value propositions that decrease the supplier firm’s ability for long-term value creation both for itself and for the customer.

Co-development of life-cycle solutions together with the
Table 1. The characteristics of solution-specific business models

<table>
<thead>
<tr>
<th>Business model 1: Project delivery with installed base services</th>
<th>Business model 2: Project delivery with customer support services</th>
<th>Business model 3: Project-led solution</th>
<th>Business model 4: Life-cycle solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>Independent strategy and in-house technological know-how</td>
<td>Strong or weak capabilities, will to share supplier's know-how</td>
<td>O&amp;M non-core process, will to outsource for flexibility</td>
</tr>
<tr>
<td>Value proposition</td>
<td>Assistance and spare parts to ensure proper functioning of the system</td>
<td>Efficiency of the of the project product in customer's process</td>
<td>Reduction of initial investment and guaranteed operational cost</td>
</tr>
<tr>
<td>Competitive strategy</td>
<td>Price competition and quick service delivery</td>
<td>Customer support for complex systems, reputation of quality and technological superiority</td>
<td>Cost leadership on operational cost, standardization</td>
</tr>
<tr>
<td>Position in the value network</td>
<td>Network of third party service suppliers, services non-core business</td>
<td>Intimate customer relationship, no network suppliers</td>
<td>OEM's often use network service companies that offer limited customization</td>
</tr>
<tr>
<td>Internal organization and capabilities</td>
<td>Separate service unit with P&amp;L responsibility to promote importance</td>
<td>Replicate professional service capabilities, sales channels to higher management level, know-how of customers' business</td>
<td>Localization and centralization of tasks, service capacity utilization</td>
</tr>
<tr>
<td>Logic of revenue generation</td>
<td>Transactional revenue, possibility of installed base profits</td>
<td>(Differentiated high-margin service, performance guarantee, transactional</td>
<td>Accepting operational risk worth premium, revenue sharing possible</td>
</tr>
</tbody>
</table>

customer can help the supplier to understand the customer’s strategy and long-term business needs and to adapt the business model for the solution accordingly. In addition, the solution provider should assess their internal organization, capabilities, and revenue creation logic to offer high-quality solutions that employ different business models. Concentrating the solution’s value proposition on its use-phase helps in aligning the supplier’s and the customer’s interests and creates synergies that allow the supplier to gain higher profits, and to provide its customers with services that enhance the customer’s own business performance.

References

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This paper presents empirical results from a research on Project Management Offices (PMO) in transition. This research adopted a process view of PMOs in transition. Descriptive data from 17 case studies was primarily obtained through interviews and analyzed using qualitative text analysis methods. Thirty-five factors of change have been grouped in nine categories forming a typology of drivers of PMO change. The major contribution of this research is to gain a better understanding of the dynamic evolution of PMOs. For researchers, these findings contribute to the project management theoretical development within the field of organizational change. For practitioners, it challenges the paradigm of considering the PMO change as a sign of failure.

Introduction
This paper proposes a process model to make sense from the continual change state surrounding Project Management Offices (PMO). Findings from this study put into question the assumption of a PMO being “right or wrong”. The paper rather suggests that changes are a natural mechanism for PMOs to evolve with their dynamic environment.

Many consultants and some researchers have written on PMOs in recent years. The focus of the vast majority of this work has been on identifying the characteristics of PMOs and a limited number of variables that would drive the choice of configurations of new or existing PMOs. The implicit underlying assumptions in the current literature are that there are a limited number of variations of PMOs and that PMOs are relatively stable structural entities.

Conversely, at least three independent surveys have shown that the average age of PMOs is approximately two years (Hobbs and Aubry, 2007; Interthink Consulting, 2002; Stanleigh, 2005). PMOs are, therefore, often not stable structures but temporary arrangements with a rather short life expectancy.

The 17 case studies conducted in this research illustrate the temporary nature of PMOs. This case study also revealed that significant changes in PMOs can be associated with the organization’s internal or external environment. The case study results indicate that focusing on the organizational change process surrounding the implementation or the transformation of a PMO, rather than focusing on the characteristics of the PMO as a static organizational entity can be a fruitful approach.

In light of the current organizational context described above, the high level objective of this research is to understand the forces that are driving the frequent reconfigurations of PMOs. More specifically, this paper intends to answer these questions:

- Why do PMOs change? What are the drivers?
- How does the change happen? Is there a dynamic change process?

To answer these questions, the paper is structured as follows: (1) drawing an overall portrait of the current literature; (2) proposing a conceptual framework to explore the process of PMO transformation; (3) presenting the case-study methodology; (4) classifying the drivers of change.

Literature Review
The present investigation employs a rather broad definition of the PMO in order to capture the variety of form and function (Project Management Institute, 2008a, p. 435). It highlights that PMOs are organizational entities and that their mandates vary significantly from one organization to the next. However, the present study makes a distinction between the multi-project PMO and
the single-project PMO or “project office,” which has responsibility for the management of one large project. The scope of the present investigation includes only PMOs with mandates that cover many projects or “multi-project PMOs.” For the purposes of this investigation, it is not necessary that the organizational unit be called a PMO.

Treatment of the PMO is relatively plentiful in the professional literature (Benko and McFarlan, 2003; Bridges and Crawford, 2001; K. J. Crawford, 2002; Dinsmore, 1999; Duggal, 2001; Kendall and Rollins, 2003), but limited in the scientific literature. These texts deal principally with three themes: the justification of the PMO’s existence, its roles and functions, and steps for its implementation.

The emergence of and the need for the PMO are associated with the increasing number and complexity of projects throughout the business world which led to a certain form of centralization (Marsh, 2000). However, the reality of PMOs is highly divergent. Nearly 75 unique functions have been identified (Crawford, 2004), some traditional some innovative (Duggal, 2001). PMOs are envisioned by some authors as playing an active role in specific functions. Huemann and Anbari (2007) pointed out that PMOs should be more involved in audit functions particularly in the learning from audits and Huemann et al. (2007) identified the PMO as a key actor in human resource management in project-oriented organizations.

The descriptions of PMOs in the literature are often summarized in typologies comprised of a small number of models. Some of the typologies identify the single-project entity of “project office,” which is outside the scope of the present study. Each of the typologies proposes two, three, or four multi-project PMOs, organized in an ascending hierarchy. The progression of PMO is intended to follow an incremental path from a low level to a high level model. Some authors proposed a maturity model specific for PMO (Kendall and Rollins, 2003) where the same assumption of progression is taken for granted. The Organizational Project Management: Maturity Model (OPM3) from Project Management Institute (2008b) is also based upon this assumption. The reality from our case studies doesn’t support a regular progression towards a better PMO.

Conceptual Framework For PMO Transformation Processes

Implementing a PMO or reconfiguring an existing PMO is an important organizational change. This change is often part of a wider organizational reconfiguration. A methodology and an interpretive framework is needed that can capture the dynamic complexity of organizational change. The approach that has been adopted investigates the PMO embedded in its organizational context. The approach can be related to a long tradition of contextual studies in the literature on project organizations from Midler (1994) to Pellegrinelli et al. (2007). History and context are essential to the understanding of what is observed at any one point in space and time in complex systems such as organizations (Engwall, 2003). The theoretical foundations of the social innovation system framework take into account the context in which such organizational innovations take place (Hughes, 1987). Social innovation builds also on a bi-directional relation that conceives of organizational innovations as socially-constructed and society-shaping (Bresnen et al., 2005). Organizational innovations are produced by the interplay between actors in structures and the organization as a whole. The PMO is a socially constructed entity that in turn shapes the organization. The PMO and its host organization co-evolve.

Organizational change occurs in a political environment either inside or around the organization (Mintzberg, 1983). Changes to PMOs are both caused by political forces and shape a new political environment. Tensions within the organization play an important role in determining the path that an organization’s development will follow. In turn, each new structural arrangement realigns the power structure and creates new tensions. The investigation of the creation or restructuring of PMOs will need to integrate the political dimension of organizational change.

In this research, a process view has been developed through the grounded-theory approach (Strauss and Corbin, 1990). A process can be described using three basic components: conditions, action/interaction and consequences. This process repeats itself over time as the consequences become the conditions for the next iteration (Hobbs et al., 2008). In this approach, the PMO

Social Innovation Context

Organizational Context

![Figure 1. Conceptual framework for PMO in transition](image-url)
in one period is seen as a temporary state resulting from previous conditions and generating new consequences. This sequence constitutes the PMO structuring process, which is illustrated in the conceptual framework in Figure 1. This paper looked at one transformation at a time but the framework was built to support a dynamic continuous structuring process.

Methodology
This research is part of a multi-years and mixed-method program dedicated to the study of PMOs. Mixed-method empirical research designs are often more robust (Brown and Eisenhardt, 1997). This paper is specifically investigating the research question by use of a multi-case study approach (Partington, 2000; Eisenhardt, 1989; Yin, 2003). For the purpose of this research that bears on PMO transformation, first implementations of PMOs have been excluded from the study. A first implementation may be a specific context leading to non-generalization of findings. Even if the first implementation is worthwhile research, the present study focuses on existing PMOs.

Data was collected at two different points in time. A first set of seven cases was done in 2006 in the context of a doctoral thesis with a total of 44 interviews. The second set of 10 cases was done in 2008 with 29 interviews. Cases were selected on the basis of maximizing breadth of industries represented. The 17 case studies spread over 10 different industries in two different countries, Canada and Sweden. Details on country, industry, number of interviews, and interviewee role are shown in Table 1.

Empirical Results
So far, we have presented the conceptual framework for capturing the PMO transformation process based on a continuous cycle of conditions, structure and consequences. Conditions act as drivers for a PMO transformation which in turn contains within itself tensions that may be the ingredients for the next transformation. An analysis of the 17 transformations revealed 35 different categories of drivers, which we clustered under six groups of drivers. Figure 2 presents the typology of these drivers.

When looking in more detail at the conditions as drivers of change, not all of them have the same degree of importance. In each case study, significant conditions for a PMO change have been codified in a grounded theory approach, letting categories emerge from what people said. Table 2 presents the most frequent drivers grouped in the six categories under two integrative types: external and internal environments. Altogether, internal factors and issues are part of the internal context specific at each organization.

Results show evidence of the prevalence of internal drivers. Three factors may have led to an underestimation of the importance of external drivers. First, we have selected events from the external environment that had an impact on the PMO. The numbers reflect only a partial view of the global external environmental analysis. Second, we observed that interviewees in higher management positions often linked external events to a PMO transformation. For example, project managers generally focused on their project and were unaware of the global external environment. Third, an external event can

<table>
<thead>
<tr>
<th>Transformation cases</th>
<th>Country</th>
<th>Industry</th>
<th>Number of Interviews</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Canada</td>
<td>Telecom</td>
<td>2</td>
<td>Executive, Project manager</td>
</tr>
<tr>
<td>2</td>
<td>Canada</td>
<td>Telecom</td>
<td>3</td>
<td>Executive, Project manager, Manager in PMO</td>
</tr>
<tr>
<td>3</td>
<td>Canada</td>
<td>Telecom</td>
<td>11</td>
<td>Executive (2), Project manager (3), Manager in PMO (3), PMO director, Finances Manager, HR Manager</td>
</tr>
<tr>
<td>4</td>
<td>Canada</td>
<td>Banking</td>
<td>3</td>
<td>PMO director, Program Manager, PMO employee</td>
</tr>
<tr>
<td>5</td>
<td>Canada</td>
<td>Banking</td>
<td>11</td>
<td>Executive, Program director, Portfolio manager, Program Manager, Manager in PMO, PMO employee (3), Project manager (2), Finances Manager</td>
</tr>
<tr>
<td>6</td>
<td>Canada</td>
<td>Home entertainment</td>
<td>2</td>
<td>PMO director, Manager in PMO</td>
</tr>
<tr>
<td>7</td>
<td>Canada</td>
<td>Home entertainment</td>
<td>12</td>
<td>PMO director, Manager in PMO, Project manager, Finances Manager, HR manager, Manager, PMO employee (6)</td>
</tr>
<tr>
<td>8</td>
<td>Sweden</td>
<td>Telecom</td>
<td>3</td>
<td>Program Manager, Portfolio manager, PMO Director</td>
</tr>
<tr>
<td>9</td>
<td>Sweden</td>
<td>Manufacturing</td>
<td>3</td>
<td>PMO Director, Executive, Manager in PMO</td>
</tr>
<tr>
<td>10</td>
<td>Sweden</td>
<td>Defense</td>
<td>1</td>
<td>Program Manager</td>
</tr>
<tr>
<td>11</td>
<td>Sweden</td>
<td>Health Care</td>
<td>3</td>
<td>PMO Director, Manager in PMO (consultant), Executive</td>
</tr>
<tr>
<td>12</td>
<td>Sweden</td>
<td>Insurance</td>
<td>3</td>
<td>PMO Director, Project manager, Project manager</td>
</tr>
<tr>
<td>13</td>
<td>Canada</td>
<td>Retail</td>
<td>3</td>
<td>PMO Director, Executive (CIO), Manager in PMO (consultant)</td>
</tr>
<tr>
<td>14</td>
<td>Canada</td>
<td>Banking</td>
<td>3</td>
<td>PMO Director, Manager in PMO, Project manager</td>
</tr>
<tr>
<td>15</td>
<td>Canada</td>
<td>Telecom-operator</td>
<td>3</td>
<td>PMO Director, Project manager, Manager in PMO</td>
</tr>
<tr>
<td>16</td>
<td>Canada</td>
<td>Utility</td>
<td>3</td>
<td>Executive, PMO director, Executive (Marketing unit)</td>
</tr>
<tr>
<td>17</td>
<td>Canada</td>
<td>Engineering</td>
<td>4</td>
<td>PMO Director (central), PMO director (on client site), Project manager, Executive (regional unit)</td>
</tr>
</tbody>
</table>

Table 1. Cases and Interviewees
have numerous impacts on the internal context of an organization over a long period of time. Despite these qualifying remarks, it is clear that most people interviewed attributed the changes in PMOs to conditions that are internal to the organization.

It should be noted that there are usually multiple interwoven forces at play at the same time. One condition may be more powerful, but alone, it may not lead to a PMO transformation. Less visible drivers may play an important role, in certain circumstances.

Several executive workshops have been held using this interpretation of PMO changes in Canada, USA, Australia and Europe. The feedback from participants confirmed not only the way the PMO transformation process has been modeled but the relative importance of the drivers as well. Nevertheless, some executives expressed some reservations regarding the word “transformation”. They argue for an evolution instead of a transformation. The drivers may stay the same, but it is acknowledged in the organization that the PMO will evolve and it is managed that way. In such organizations, the change process is seen as an evolution. It is difficult to know whether the organizational realities being described are different or whether the organization or national culture may not accept that there are transformations in the same way that some cultures do not recognize the existence of conflicts. The 17 qualitative case studies were all recognized as transformations. However, there are certainly variations in the degree of change; they may vary from evolutionary to radical and disruptive.

Conclusion
The analysis presented here makes several contributions to the study of organizations and organizational innovation. It confirms that the PMO is deeply embedded in its host organization, and that the two actively take part in the transforming process. This result is in line with the research on the value of project management where a “fit” should exist with the organizational context (Thomas and Mullaly, 2008). The study also shows that internal events and tensions are among the primary drivers behind the reconfiguration of PMOs. The playing out of these drivers brings into focus the importance of organizational politics. The analysis shows that PMOs and more generally the structures put in place to manage multiple projects are part of a political system that plays an important role in organizations (Morgan, 1989). In the project management literature, power and politics are often treated with an instrumental approach through risk management and stakeholder management (Magenau and Pinto, 2004). The analysis here shows that power and politics should be examined at the organizational level and integrated into

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<table>
<thead>
<tr>
<th>EXTERNAL</th>
<th>INTERNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. External factors</strong>&lt;br&gt;Industrial / market factors (13)</td>
<td><strong>3. Organizational context issues</strong>&lt;br&gt;Client and stakeholder relations (11)</td>
</tr>
<tr>
<td><strong>2. Internal Factors</strong>&lt;br&gt;Reorganization (11)</td>
<td><strong>4. Project management process issues</strong>&lt;br&gt;Control of project portfolios (12)</td>
</tr>
<tr>
<td><strong>2. Internal Factors</strong>&lt;br&gt;New CEO (11)</td>
<td><strong>5. Human relations issues</strong>&lt;br&gt;PM Skills development (13)</td>
</tr>
<tr>
<td><strong>2. Internal Factors</strong>&lt;br&gt;New PMO Manager (10)</td>
<td><strong>6. Performance issues</strong>&lt;br&gt;Project performance (11)</td>
</tr>
<tr>
<td><strong>Total: 13</strong>&lt;br&gt;32</td>
<td><strong>Total: 32</strong>&lt;br&gt;23</td>
</tr>
<tr>
<td><strong>Total: 32</strong>&lt;br&gt;32</td>
<td><strong>Total: 13</strong>&lt;br&gt;11</td>
</tr>
</tbody>
</table>

Table 2. Most frequent drivers from case studies
organizational project management.

Theories that seem to be most relevant to explain PMO transformations are associated with the constructive mode of change rather than prescriptive. The PMO could be considered as an organizational innovation in the sense that it is a recent and important phenomenon. But if it is an innovation, it is unstable and still evolving both in individual organizations and in the population of organizations as a whole. If the institutionalization process is at work, the results are not yet visible. Seeing the PMO transformation as a life cycle didn’t fit with what has been observed in our case studies as the changes unfold. PMO transformations happen rather as an answer to drivers coming from external and internal contexts.

Results from these 17 case studies face the limits associated with generalization to a larger population. For this reason, a second phase of this research is going on based upon survey data. It is also suggested that other research be undertaken to solidify the theory foundation of the project management governance school of thought.

References
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Introduction
The construction industry has focused on management, to the exclusion of leadership. Construction project managers are more production oriented, and focus on the achievement of the short-term goals of the project such as conforming to budget, schedule, and quality. Previous works mention several reasons for this situation, for example: technically focused curricula in education for the construction professions, limitations of the standards of performance, the requirements in standards and codes, and budget and time limits (Russell and Stouffer, 2003; Dulaimi, 2005). There is a need for the development of the leadership capabilities of project managers in the construction industry.

Research has shown that the project manager is one of the most important success factors of projects. It is suggested that the quality of the site manager may affect the project cost by as much as 10% (Herbert et al., 1970). Leadership is one of the most important subjects in management studies and a large and growing volume of literature has been built up (de Vries, 1997). However, not much work has been done on leadership in the construction industry (Odusami et al., 2003). Even fewer studies focus on leadership development in construction project managers. Researchers have shown more interest in the subject during the last few years. Toor and Ofori (2007) reviewed empirical work on leadership in construction and found that out of total of 44 publications, more than 50% were published during the last decade. Ofori and Toor (2008) note that the term “project leader” only appeared in construction journals in 2003 although it had been referred to in books on general project management more than 20 years earlier.

The unique features of the construction industry which are widely referred to, makes construction project management a distinct discipline. Moreover, a review by Toor and Ofori (2006) shows that the construction industry is facing an even more challenging socio-economic, cultural, political, and technological environment; and there is a new era of intense competition. This situation calls for fresh perspectives of suitable leadership skills and behaviours for the managers of construction projects, and effective leadership interventions that can help to accelerate the leadership development of such managers. The objectives of this paper are:

- to establish the need for authentic project leadership development for construction project leaders and develop a theoretical framework
- to discuss the research and practical implications of the proposed theoretical framework
- to offer suggestions for measures which can be taken with regard to authentic leadership development in the construction industry.

Leadership Style in Construction Projects
Leadership style is a joint outcome of the leader’s self-related cognitive information, personality traits, the underlying motives, and the leader’s understanding of situational variables (Toor and Ofori, 2006). Research on leadership has resulted...
in the identification of a number of leadership styles such as: democratic and authoritarian (Tannenbaum and Schmitt, 1958), task- and relationship-oriented (Fiedler, 1967), autocratic, consultative, and joint decision making (Blake and Mouton, 1978), servant (Vroom and Jago, 1988), transactional, transformational, and laissez faire (Avolio and Bass, 1991), charismatic (House, 1977), self-leadership (Manz and Sims, 1987), spiritual (Fry, 2003), and authentic leadership (Luthans and Avolio, 2003).

Researchers in the construction industry have also explored leadership styles suitable for construction professionals. The least preferred coworker (LPC) measure of Fiedler’s (1967) contingency model of leadership are most widely used. Many of these have confirmed the task-oriented nature of such managers. Monaghan (1981) observed that project managers who were high in task and low in people consideration produced an acceptable level of commercial performance. Another study described project managers as “socially independent” (Bresnen et al., 1986) although the calculated LPC scores suggested the task-oriented behavior of the subjects. Seymour and Abd-Elhaleem (1991) noted that the effectiveness of project managers is fairly synonymous with task-oriented leadership. Rowlinson et al. (1993) examined leadership styles employed by the same construction managers in different circumstances. They found that the managers tended to use a supportive style in the feasibility study and pre-contract stages of works and a directive style as construction progressed.

Increasingly, studies are showing the limitations of the traditional orientation of construction project managers. Fraser (2000) found that site managers who scored high on the effectiveness scale favoured team-style leadership, those following a production style of leadership scored the lowest of all, and those using a compromise leadership style had middle-range effectiveness scores. Contrary to earlier studies, Ogunlana et al. (2002) found that, in Thailand, the relationship-oriented leadership style was considered to be more important than the task-oriented style for project managers. In their survey of leadership styles of construction professionals in Turkey, Giritli and Oraz (2004) observed that: (i) female and male managers were similar in terms of their transactional leadership behaviour but their transactional leadership practices were significantly different, suggesting the task-oriented style of both sexes in a gender-congruent context, and (ii) managers in higher positions were stronger in pacesetting style than those in lower management positions, indicating that senior managers led by example, yet exerted tight control over the performance of their subordinates.

Chan and Chan (2005) found that all transformational factors—which are charisma, inspirational motivation, intellectual stimulation, and individualized consideration—and contingent reward of transactional factors—which are contingent reward, management-by-exception, active and passive—were highly correlated with the rated outcomes (such as leader effectiveness, extra effort by employees, and employees’ satisfaction with the leader). They recommend that construction professionals should adopt transformational leadership in their interactions with employees in order to realize greater employee performance and satisfaction. Toor and Ogunlana (2006) observed that on mega projects in Thailand, the attributes of transformational leaders were rated high as compared to those of transactional leaders. The use of authority and punishment was rated among the lowest of leadership behaviors.

Therefore, there is no agreement on what leadership style best suits construction project managers. This is understandable because no leadership style can be considered to be the best in all circumstances and at all times (Fiedler, 1967; Blake and Mouton, 1978), and context is a vital factor for the success and effectiveness of any particular leadership style (Fellows et al., 2003). George et al. (2007) note that there can be no absolute trait-profile of leaders for if there was one “cookie-cutter leadership style, individuals would be forever trying to imitate it. They would make themselves into personae, not people, and others would see through them immediately.”

**New Leadership for the Construction Industry**

“Authentic Leadership” is a recent construct. The attributes of authentic leaders encompass positive energy, high sense of integrity, moral character and self-discipline, clear purpose, concern for others, confidence, hope, optimism, resilience, and personal values (George, 2003; Luthans and Avolio, 2003; George and Sims, 2007). Authentic leaders are motivated by the well-being of their subordinates and organizations, and society at large. They have the highest sense of ethics, morality, and personal values. They build an environment of mutual trust, optimism, altruism, transparency, and openness within teams.

This is not to claim that authentic leaders are supernatural and have no shortcomings. Such leaders make mistakes but they take full responsibility for them and accept their weaknesses (George, 2003). This processing of one’s positive and negative aspects, attributes, and qualities helps the leaders to “accurately interpret task feedback, better estimate their own skills, and seek out challenging situations with learning potential” (Ilies et al., 2005). Kernis and Goldman (2005) warn that acting authentically may not always be beneficial and opening one’s self to others may cause disappointment or even betrayal (Kernis and Goldman, 2005; Goldman and Kernis, 2002). However, the benefits of authentic functioning are greater than its costs and carry long-term advantages in terms of healthy psychological functioning, (Kernis and Goldman, 2005) and eudaimonic well-being of the leader as well as the followers (Ilies and Morgenson, 2005). Figure 1 illustrates the case for authentic leadership development and presents the characteristics of authentic project leaders.

Some recent publications propose that the construction industry needs to develop individuals who are not only good managers but who also have passion to lead projects (Toor, 2006; Toor and Ofori, 2006).
In Figure 1, positive mediation of leadership antecedents refers to trigger events which activate the leadership schema in individuals. Toor (2006) describes these antecedents as being: biological, physiological, psychological, socio-cultural, spiritual, economic, educational, occupational, and contextual. Researchers agree that individuals have a choice in the way they manage these events. The combined mediation of these leadership antecedents under positive organizational and environmental contexts is central to the development of authentic leadership characteristics.

Attributes and Impact of Authentic Project Leaders

Figure 1 suggests that authentic leaders are confident, hopeful, optimistic, resilient, transparent, moral/ethical, and future-oriented (May et al., 2003) and having all these characteristics they turn their associates into leaders themselves (Luthans and Avolio, 2003). They have good comprehension of cultural sensitivities, and are highly motivated and self-aware. They possess high levels of integrity, deep sense of purpose, courage and passion (George, 2003). Authentic project leaders fulfill the characteristics in the suggestion that: “the profession of engineering calls for men with honor, integrity, technical ability, business capacity, and pleasing personalities” (Schaub and Pavlovic, 1983).

Authentic project leaders do not only have high human and social capital (Gardner et al., 2005), they also possess high psychological capital (Luthans and Youssef, 2004). Gardner and Schermerhorn (2004) suggest that authentic leaders are committed to building the highest level of organizational capacity through individual performance, which becomes an example for others to follow. They are able to create organizations which de Vries (2001) calls authentizotic organizations. Authentizotic organizations are worthy of trust and reliance and compelling connective quality for their employees in their vision, mission, culture, and structure.

Authentic leaders are influential in enhancing others’ ability to perform better by providing support and creating conditions that stimulate the individuals “to work hard, even extraordinarily hard, to perform at one’s very best” (Michie and Gooty, 2005). They challenge their followers by setting high performance standards through their own examples. George and Sims (2007) claim that authentic leaders have better ability to inspire their followers to follow their vision. The authentic leadership construct emphasizes the development of followers as authentic followers and eventually authentic leaders. Studies have shown that when followers are treated fairly, they are more committed and likely to display positive attitudes (May et al., 2003). This results in positive outcomes for organizations.

Through the wisdom they obtain from their experiences, they are able to reflect on a situation, evaluating and making choices. They are guided by a set of transcendent values which mediate their decisions about what is right and fair for all stakeholders (Luthans and Avolio, 2003; Schaub and Pavlovic, 1983). Michie and Gooty (2005) believe that authentic leaders are concerned with the interests of all stakeholders as they live with self-transcendent values such as benevolence and universalism (equality, social justice, and broad-mindedness). These characteristics show some of the features of transformational, charismatic, servant, spiritual, and ethical leaderships. Thus, the proponents of authentic leadership call it a “root construct” and believe that it underlies all forms of positive leadership although it is distinct from other leadership styles in many respects (Avolio and Gardner, 2005; George, 2003).

Studies have shown positive correlations between authenticity and employee outcomes. Kernis and Goldman (2006) discuss factors that are potentially positively linked to authenticity. These include: satisfaction, performance, well-being, self-esteem, negative affectivity, psychological well-being, optimal self-esteem, and social motivation. They also note that authenticity has influence on performance, interpersonal relationships, effectiveness, and behaviors of individuals. Thus, authenticity has a potential of strong correlations with overall leadership effectiveness and performance. Hence, if a project leader is authentic, it is likely that overall performance on the project will be superior. An authentic project leader develops healthy inter-personal relationships which result in reduced disputes and conflicts and improved social well-being of the followers. Since their
followers trust them, authentic leaders are able to motivate them and create a better working environment through their openness in relationships, concern for their followers, and passion for service of humanity.

Future Directions
Proponents of the authentic leadership construct have proposed several directions in which further research on it should proceed to develop its theoretical base and enhance its empirical validity. For example, Cooper et al. (2005) emphasize that there is further need for defining, measuring, and rigorously researching this construct. Avolio and Gardner (2005) suggest future research on: the relationship between authentic leadership and the levels of self-awareness of leaders and followers; the direct effect of the leader’s positive psychological capacities on followers and their mediating effects on sustained performance.

Luthans and Avolio (2003) stress the need to construct “taxonomies of trigger events” that promote positive leadership development. Such taxonomies may include influential role models and various significant others in one’s life, events and experiences, and various social institutions which influence the behavior of a person (Toor, 2006). Understanding the moments that matter in life that accelerate authentic leadership development and recreating those moments may help to accelerate leadership development. Shamir and Elam’s (2005) life story approach suggests that leaders’ life-stories should be approached as “depositories of meaning” and further analyzed to discover those meanings. Another line of inquiry that Shamir and Elam (2005) suggest is to focus on the process of constructing life-stories by leaders.

Avolio et al. (2004) highlight the importance of context in the study of authentic leadership and its development. They encourage a more thorough understanding of whether different contextual factors foster different identities and moderate the authentic leader’s efforts.

Michie and Gooty (2005) suggest that future research on authentic leadership could examine how the leader’s capacity to experience positive other-directed emotions influences follower outcomes, such as perceptions of the leader’s authenticity, identification with the leader, and follower self-concepts. They also stress the need for research on contextual variables such as: organizational culture, environmental uncertainty, gender, and socio-cultural setup of society.

Various authentic leadership scholars (Avolio et al., 2004; Ilies et al., 2005) also suggest that the future research should examine how authentic leadership relates to other leadership constructs such as transformational leadership, relational leadership approaches, and leader behaviors.

Leadership Research Agenda for the Construction Industry
Future studies should consider the personal demographics of project leaders—such as gender, age, ethnicity, nationality, education, work experience, and job level. Other dimensions are organizational culture, type of organization, size of organization, and focus of organizational activity. Such multi-level and multi-dimensional analyses can help to identify and explain specific leadership needs and demands of organizations in different contexts. Future work can also examine the impact of authentic project leaders on their subordinates, and on the success of the projects they lead.

Comparison of perceptions of ethics and authenticity across various cultures, countries, regions, socio-economic conditions, and other factors can provide additional insights into the culture of the construction industry around the world. This would help to find common solutions and provide a platform of learning for different countries and regions. In addition to cross-sectional studies, authentic leadership should also be studied through longitudinal studies. The finding that construction project managers employ different leadership styles during different stages of the projects needs further exploration through longitudinal research designs to explore how project managers adapt themselves to new projects and what influences their leadership styles in a new environment.

There is a need to evaluate the performance of authentic leaders by objective measurements such as general effectiveness and performance, follower satisfaction, organizational and project performance, influence on managerial and technological innovation, and effectiveness in terms of cost, time, and quality, management and satisfaction of stakeholders. Objective measurement of leadership outcomes will help to estimate return on the investment in leadership development programs.

It is important to explore the antecedents that stimulate the authentic leadership schema and result in leadership development in order to produce results that are useful for designing leadership interventions for developing authentic project leaders.

Due consideration should also be given to research designs. So far, leadership research in the construction industry has utilized the traditional approach of survey questionnaires and interviews. However, there is a need to employ multiple designs that may include life stories, idiographic, historiometric, psychometric, and psychobiographical approaches (Noordergraaf and Stewart, 2000). Ethnographical design of studies on authentic leadership would be beneficial. Psychometric neuro-scientific methods have also generated much interest in the study of leadership behavior (Cameron et al., 2003). Research on authentic leadership can also benefit from these technologically advanced approaches.

Conclusions
The traditional behavior of construction project managers should be transformed if they are to meet the current challenges facing the construction industry. There should be a shift in the way project managers function and lead projects. They need to develop as authentic leaders to successfully operate in the increasingly complex working environment. A major challenge is to develop and implement appropriate leadership development interventions.

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References
Blake RR, Mouton JS. The New Managerial Grid, Houston TX.: Gulf; 1978.
Fry LW. Toward a theory of spiritual leadership. Leadership Qtrly 2003; 14: 693–727
Ogunlana SO, Siddiqui Z, Yisa S, Olomolaiye P.
Factors and procedures used in matching project managers to construction projects in Bangkok. Int J of Project Manage 2002; 20: 385-400.

Rowlinson S, Ho T, Yun PK.

Russell J, Stouffer B.

Schaub JH, Pavlovic K.
Engineering Professionalism and Ethics, Wiley; 1983.

Seymour D, Abd-Elhaleem T.

Shamir B, Elam G.

Simonton DK.

Tannenbaum AS, Schmitt WH.

Toor SR.

Toor SR, Ofori G.

Toor, SR and Ofori, G.

Toor SR, Ogunlana SO.

de Vries KMRF.

de Vries KMRF.

Vroom VH, Jago AG.

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What can project management learn from considering sustainability principles?

Sustainability is relevant for projects and for project management. To gain competitive advantage sustainability principles must be integrated into the core processes of an organization such as the project management process. We define sustainability as environmental, social and economical-oriented, short, medium and long term orientated, local, regional and global-oriented, as well as value-oriented. The paper presents first results of the research project: SustPM, conducted by the Projektmanagement Group and the Research Institute of Managing Sustainability, both WU Vienna, Austria.

Increasing interest in sustainability is observable in companies, but we identify shortcomings. Despite many large companies issue sustainability reports, they consider sustainability rather as a nice to have, as an extra effort. In many project-oriented companies, who claim to consider sustainability, it remains to be the responsibility of the Sustainability Office and is not built into the business processes of the company. Most companies do not consider sustainability principles in their projects, although the management of projects makes an important and significant contribution to value creation globally. To consider sustainability as an additional add on, as philanthropy leads to cutting these activities, as soon as funds get short. Companies lose out the possibility of gaining performance benefits. Research has shown that only by integration of sustainability principles into the core processes the company can gain performance benefits (Wagner 2007). One positive example for considering sustainability is provided by the National Aeronautic and Space Administration (NASA). At the PMI Research and Education Conference 2010, Olga Dominguez, the sustainability officer of NASA showed the vision for sustainable NASA. The vision clearly states to “integrate sustainability into what we do” Thus sustainability principles are not additional, but to be integrated into the business processes and the daily work of all employees.

### Sustainability principles

In literature content related definitions and process related definitions of sustainability are differentiated. We define sustainability with the following principles (Gareis et al. 2010): economic, social, ecologic; short-, mid-, long-term orientation; local, regional, global orientation; value orientation.

### Table 1. Applications of sustainable development in different social systems

<table>
<thead>
<tr>
<th>Social System</th>
<th>Examples for Application</th>
</tr>
</thead>
</table>
| International | Kioto protocol (CO2 emissions 2008-2012)  
                             Millennium development goals (reduce poverty)  
                             ILO standards (international labor standards)  
                             Global compact (UN initiative)  
                             OECD guidelines for multinational companies  
                             ISO standards (ISO 14000, ISO 26000) |
| National      | Awareness raising, education  
                             Sustainability reporting (FR)  
                             Sustainable public procurement (NL)  
                             Socially Responsible Investment (SE)  
                             Cooperate social responsibility strategies (DE) |
| Regional      | Cooperate Social Responsibility consulting programs  
                             SD technology parks  
                             Local Agenda 21 |
| Organization  | Environmental management systems  
                             Industrial ecology  
                             Triple bottom line reporting  
                             Corporate social responsibility |
Economic, social, ecologic orientation

In its essence, sustainability is based on the economic, social and environmental dimension. The objectives of the different dimensions as described by Arnold (2001) are:

- Economic dimension: economical growth, competitive environment, efficiency, full time work and social secure, international economical stability and sustainable investment.
- Social dimension: security, equal opportunities, social justice, health and education.
- Ecologic dimension: Resource and environmental protection, risk and emission limitation, develop higher environmental quality, reduce of energy usage, risk reducing for human and environment.

All three dimensions are equally important. Economic, social and ecologic dimensions are interrelated and influence each other. The ideal is a holistic approach to consider all three principles equally. Corporate sustainable organizations should improve social and human welfare while at the same time reducing their ecologic footprint and effectively achieve organizational goals. We point out the necessity of balancing these three dimensions.

Short-, mid-, and long-term orientation

The sustainability of ecosystems over time as well as the consideration of the needs of future generations are in direct contradiction with the today’s ever shortening time horizon of decision-makers. Increasing complexity of decision situations is quickly making traditional planning, dealing with the future and uncertainty through prediction and preparation, obsolete. Long-term orientation requires improvements in our capacity to address complex, evolving systems which main attribute is uncertainty, shifting to a paradigm of perceiving and adapting to change, with the key elements of social learning, innovation and design. We add to the long term orientation the necessity of short- and midterm orientation and point out the necessity of balancing between these temporal scales.

Local, regional, global orientation

Ecologic, economic and social processes affecting our well-being take place simultaneously at various spatial scales. In order to efficiently address these nested and interlinked processes sustainable development has to be a coordinated effort playing out across several levels, ranging from the global to the regional and the local and institutional responses have to correspond to the problems at hand. We differentiate the local, regional as well as global orientation and point to the necessity of balancing between these various spatial scales.

Value orientation

From the very beginning sustainability has been understood as a normative concept that reflects values and ethical considerations of the society. The underlying assumptions in decisions about trade-offs between the present and future generations (intergenerational equity) and about distribution of welfare in the present generation (intra generational equity) should always be made explicit and legitimized (e.g. through involving relevant stakeholders). We indicate that sustainability is based on values which for instance include participation, explicit risk management, etc.

Project management as business process

We define a project as a temporary organization. A project is a temporary organization for the performance of a relatively unique, short to medium term strategically business process of medium or large scope (Gareis 2005: 41). Different approaches to project management exist. Some project management approaches are method-oriented (PMI 2008), others are competency-oriented (IPMA 2006), or process-oriented (OGC, 2002).

Table 2. Vision for a Sustainable NASA (Dominguez 2010)

<table>
<thead>
<tr>
<th>Vision for Sustainable NASA</th>
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</thead>
<tbody>
<tr>
<td>Move beyond compliance: identify opportunities that meet intent provides long-term benefits</td>
</tr>
<tr>
<td>Effective and efficient use of resources: in operations to minimize waste and carbon emissions</td>
</tr>
<tr>
<td>Supply chains: work with NASA’s contractors to set standards and achieve sustainable goals</td>
</tr>
<tr>
<td>Facilities (e.g. buildings, laboratories, test stands) that go beyond LEED requirements to new designs, which includes net-zero energy &amp; water, green roofs, day lighting, etc. Integration of sustainable practices</td>
</tr>
<tr>
<td>Green principles – green chemistry/engineering: integrated into the design of NASA missions to include operations and hardware</td>
</tr>
<tr>
<td>Integrating Sustainability into what we do</td>
</tr>
</tbody>
</table>

Figure 1. Project management as business process (Gareis 2005: 58)
We consider project management explicitly as a management process distinct from the content processes of the project. Project management includes project starting, continuous project coordinating, project controlling, and project closing down. Figure 2 shows the project management process. The objectives of the project management process are to (Gareis 2005):

- Successfully perform the project according to the project objectives,
- contribute to the optimization of the business case of the investment, initialized by the project,
- manage the project complexity and project dynamics,
- continuously adjust the project boundaries, and
- manage the project-context relationships.

Traditional project management focuses only on the management of schedule, costs, and scope. However, as mentioned before, we consider projects as temporary organizations and as social systems. Based on an identity model to describe social systems (Gareis/Stummer 2008), we derive additional objects of consideration, which are of relevance for project management. A comprehensive list of objects of consideration in project management includes the following:

- project objectives, project strategies
- project scope, project schedule,
- project resources, project income, project costs, project risks,
- project organization, project culture, project personnel, project infrastructure,
- project context, including pre- and post-project phase, the relationships to the relevant stakeholders, to other projects, and to the company strategies.

Project management as process needs to be explicitly designed. In the project start, the project management process is designed in accordance with the specific requirements of the project. Elements for designing the project management process include the application of appropriate project management methods, selection of standard project plans and project management checklists, the selection and the design of appropriate project communication structures (Gareis, 2005).

**Project management and sustainability principles**

**Projects & investment**

The temporary character of projects contradicts the long-term orientation of sustainability. But projects initialise investments in new products, markets, organizations, or infrastructures. By this projects contribute to realize long-term objectives. While in the investment literature, often only an economic perception can be found, a more holistic approach is necessary.

Holistic investment decisions need to consider sustainable principles. Holistic evaluation methods are to be applied in the investment decision process:

- not business case analyses, considering only cash in-flows and out-flows
- not environmental impact analyses, considering only environmental aspects
- but a comprehensive social cost-benefit analyses

**Implicit consideration**

Some project models, for instance the International Project Management Association (IPMA) project excellence model, consider sustainability and social responsibility in project management as well as in the project results. The project excellence model considers the importance of the identification and consideration of relevant project environments in the formulation of the project objectives and advocates the internalization of social interests in the project.

Because of the characteristics of projects (being risky, relatively unique, socially complex, dynamic) sustainability principles are implicitly considered in existing project management approaches. For example the Project Management Body of Knowledge (PMBoK) considers in the business case analysis market demands, organizational needs, customer requests, technological advance, legal requirements as well as environmental impacts and social needs (PMI 2008). The International Competency Baseline (ICB) considers ethics and value appreciation as behavioral competences of the project manager (IPMA 2006).
Depending on the project management approach, some principles of sustainability are implicitly considered in project management. The possibilities to consider sustainability in project management depend on the situation. The project type (e.g., construction project, reorganization project) and the structures and cultures of the companies performing a project influence the project management approach applied.

**SustPM Matrix**

We have developed the SustPM Matrix, provided in Figure 3, to relate sustainability principles to project management. The sustainability principles are economic, social and ecologic-oriented, short, medium and long term oriented, local, regional and global-oriented, as well as value-oriented. Project management is represented by the objects of consideration of project management. The model is used to analyze Project Management approaches, whether sustainability principles are implicitly considered and to make proposals how to apply them explicitly.

First potentials and challenges for project management can be discussed when relating the sustainability principles to project management. Not all relations have potential for further discussion. We have identified a couple of project management objects of consideration, where we see high potential to further develop the related project management methods. Here we present a selection of these.

**Project Objectives**

In the definition of project objectives economic, ecologic and social aspects are of relevance.

Short, mid, and long-term as well as local, regional and global consequences are to be considered. This leads to an internalization of external interests. Table 3 shows a form of a project objective plan, which considers sustainability principles.

**Project context relations: Project Stakeholders**

A comprehensive project stakeholder analysis also considers indirectly effected stakeholders and relationships between the stakeholders. By a participatory project management approach the quality of the relationships with the stakeholders can be improved. Stakeholders participation contributes to commitment, better quality project results, reduction of project risks, and the meeting of dates and budgets. To deal with the increasing complexity new working forms, such as a systemic constellation, for the project stakeholder analysis are required. To acknowledge the expectation of stakeholders and to design the relation with them stakeholder workshops may be appropriate.

**Table 3. Project objective plan, considering sustainability principles**
Project Organization
Elements for the organizational design of projects, such as empowerment, virtuality, integration, and partnering, consider implicitly sustainability principles. The consideration of sustainability leads to more complex decision and communication structures in projects. Figure 4 shows an integrated project organization as an example.

Project Infrastructure
In designing the appropriate project infrastructure, travel times can be limited by working in virtual project organizations and applying for instance video conferencing.

Conclusion
In this paper we provided first results of the research project SustPM, in which we seek to further develop project management by including sustainability principles. We find that in project management some sustainability principles are implicitly considered, when projects do stakeholder analysis, risk analysis. But to explicitly consider sustainability challenges existing project management methods. Following we may summarize some potentials and limits of considering sustainability principles in project management:

**Potentials of considering sustainability principles**
- Better cope with the complexity and dynamics of projects.
- Reduction of project crisis situations, project cancellations and interruptions, and fluctuation of project personnel.
- Creates a competitive advantage and economic benefits.
- Promotion of sustainable project results.

**Limits of considering sustainability principles**
- As different companies with different values cooperate in projects, thus sustainability is of different importance for them. A common project culture needs to be developed.
- Different customers have different expectations regarding the application of sustainability in projects.
- A high social competence and a new self understanding of the project personnel is required.
- The application of sustainability concepts in project-oriented companies influences the implementation of sustainability in projects and programmes.

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About the Research Project: SustPM
The research project: SustPM is conducted by the Projektmanagement Group and RIMAS, both Vienna University of Economics and Business. The project is partly sponsored by the Project Management Institute. The objectives of the research project are:
- Analyzing the implicit consideration of sustainability concepts in different project management approaches.
- Analyzing the relationship between the application of sustainability concepts in companies and in projects.
- Conceptualizing the explicit consideration of sustainability concepts in the project management process.
- Drafting methods for explicitly considering sustainability concepts in the project management process.
- Analyzing the challenges and potentials from the consideration of sustainability concepts in the project management process.
References

Arnold, M., 2001

Domínguez, O.M., 2010
Presentation held in Symposium: Global Sustainability and Projects, PMI Research and Education Conference, July 2010.

Gareis, R., 2005
Happy Projects!, Manz, Vienna.


Wagner, M. 2007

References

Arnold, M., 2001

Domínguez, O.M., 2010
Presentation held in Symposium: Global Sustainability and Projects, PMI Research and Education Conference, July 2010.

Gareis, R., 2005
Happy Projects!, Manz, Vienna.


Wagner, M. 2007
Sensemaking is an essential activity of human beings. In international construction joint ventures it becomes a management task to take responsibility for the process as it pertains to work. A successful sensemaking process helps to define common goals, build an identity, and advance teamwork. Results of sensemaking are stored in the form of cognitive maps and can therefore be transferred from project to project. All this improves effectiveness. While a large body of theoretical work exists from a wide range of scientific perspectives, no empirical data have been published for the case of international construction joint ventures. Data presented here were obtained through ethnographic interviews, grounded theory, and case study research. Comparing theoretical concepts and empirical data allows to confirm findings. Sensemaking itself is not a construct used by managers in international construction joint ventures but they use similar terms. A large number of activities are employed to manage the sensemaking process. It is hampered by lack of structure, ambiguity, and insecurity at the beginning of a project. While identity building is possible, it is not realistic to expect the development of a corporate culture because of the limited project duration. Most international construction joint ventures are formed to implement megaprojects. These are defined by their overwhelming complexity. Delegation of work becomes mandatory accompanied by an increase in coordination. The openly discussed goal of sensemaking management is the advancement of teamwork which in turn allows reducing coordination efforts. In this way a high performance team can reduce complexity. Cognitive maps are implicit knowledge. Making them explicit through qualitative research allows managers to better control the sensemaking process.

Introduction

“The absence of sense is the horror of the existential nothingness. It is that subjective condition in which reality seems to recede or dissolve completely.” (Watzlawick 1967, p. 247, translation by author). Heidegger (1927) differentiates between Dasein which is independent of human awareness, and being as the world we are thrown into. Being exists only in the meaningful understanding of Dasein. Without a meaningful understanding - sense - of Dasein, we cannot answer the question of our existence (1927). Cassirer (1923/25) understands humans most of all as “symbolic animals” relying on their ability to make sense of symbols.

Sensemaking is not only one of the basic problems of philosophy and here especially one of ontology and epistemology, it is also a practical problem. The “Iliad” of Homer is foremost not an historical account of a war but a grandiose design of world interpretation. Not only the old Greeks but all other cultures are based on their own mythology as a first approach to make sense of the human condition.

Later the topic became prominent in different areas of science. Every textbook of psychology deals with: biology underlying behaviour, sensation and perception, consciousness, learning, and intelligence (e.g. Feldman 1994). These are the individual components of sensemaking. Social components are treated in anthropology (Geertz 1973); Weber (1922) postulated the understanding of the meaning of actions as aim of sociology; Weick (1995) researched sensemaking processes in organisations. He names in his text (p. 67) another 55 “important resources for organizational sensemaking”.

It is not a point of discussion whether sensemaking takes place in international construction joint ventures (ICJs) as in all other human endeavours, but rather what form it takes and how to deal with it.

Basics of Sensemaking

Sensemaking is used in two ways: (1) receptive decoding and (2) active encoding. As we watch actions or communicate we have a number of alternatives for interpretation. The selection of one alternative in the process of decoding is the former type of sensemaking. The actor, on the other hands, wants to be understood in a specific way and tries
to create (encode) sense (Mead 1934).

Four assumptions underlie a definition of sensemaking:
1. Human beings search continuously for sense.
2. All individuals are capable to make sense.
3. All individuals have been socialized and acquired a meaningful set of values and norms.
4. Culture is a coherent system of values and norms.

Luhmannian systems theory interprets the world as infinitely complex. In order to survive in such a world we are forced to create systems with a reduced and manageable complexity. This selection process is sensemaking. It is not simple to make adequate choices and therefore selection must be accompanied by risk compensation mechanisms. This again requires a capability and willingness for adaptation and the whole process leads to learning, learning of how to make sense. Accordingly, Luhmann (1971, p. 31, translation by author) defines: “The notion of sense is the structuring form of human experience.” In the same way but adapted to the topic of ICJVs, we will understand sensemaking:

Sensemaking in ICJVs = (def.) Sensemaking refers to all interpersonal activities through which members of an international construction joint venture try to structure their human experiences within such an organization. The term “human experiences” includes work and relational aspects.

Sensemaking in Organizations
According to Weick (1995) there are six properties of sensemaking of which the seventh (identity construction) will be dealt with later in chapter 3.2:
1. Sensemaking is retrospective since it refers to interpersonal activities that necessarily are passed once we reflect upon them (Hartshorne 1962). They must have been encoded previously for us to decode or they must have been thought out to encode them.
2. Sensemaking is enacted and this means that we create part of our environment as a social construction (Berger and Luckmann 1967).
3. Sensemaking is social action and as such it is enacted by groups. This becomes already clear by the use of the sender/receiver model underlying the notions of en- and decoding.
4. Sensemaking is continuous and this finds a parallel in hermeneutics where the model of the hermeneutical spiral is used to illustrate that all interpretations are based on the horizon of previously acquired knowledge (Gadamer 1960). There are no blank sheets. The horizon is the context in which sensemaking takes place.
5. Sensemaking is extracted from cues and focussed by them. Accordingly, Smirch/Morgan (1982) define leadership as an activity to generate points of reference for sensemaking.
6. Sensemaking is plausible and not exact because the processes of en- and decoding is not exact and neither is the ensuing whole of what makes sense.

There are many parallels to the construct of communication. Communication is also continuously enacted social action based on cues and mostly not exact. However, communication takes place in the present. Starting from the sender/receiver model of communication (Dainty et al. 2006) we can build a model of sensemaking. A minimum of two individuals are enacting this process by communicating. The sensemaking process draws upon the en- and decoding that takes place continuously and within the context of the specific organization. Not all verbal or non-verbal information are taken as a cue. The result of sensemaking is a shared sense (idea) about the organization based on plausible cues (fig. 1). Since not everything that makes sense to one person also makes sense to another, there is also a realm that is not shared and of course there are other realms that do not belong to the organizational context.

The sensemaking is negatively influenced by a number of factors (Büchel et al. 1998):
1. Ambiguous or unclear situations
2. Novel situations without structure
3. Lack of group cohesion and acceptance of leaders
4. Conflicts between the sensemaking process and own identity

Research Methodology
Once the contract is signed for an ICJV, managers plan, organize, staff, direct and control them during the build up, main and dismantling phases. Then they move on to the next ICJV. It seems plausible that managers going through these repetitive cycles, perceive, interpret and evaluate their physical, social and institutional world by forming shared sense. Knowledge thus is produced by this group and becomes intersubjective. This is a constructivist view of epistemology (Luckmann and Berger 1967). This constructivist view matches well with the understanding that ICJVs form a specific culture. Weber (1949) strongly advocates that social and cultural research cannot follow the approach of the natural sciences, where laws suffice to describe a static environment following a directly observable causality. A better approach is to discover phenomena as interpreted within the framework by the members of the focal cultural group.

![Figure 1. Sensemaking process](image-url)
Given this background and considering the additional fact that no research has previously been carried out on sensemaking in ICJVs, we used ethnographic interviews (Spradley 1979) to gather data, grounded theory to evaluate (Strauss and Corbin 1998), and case studies to extract theory from the data (Eisenhardt 1989). We conducted 35 interviews in Thailand and Taiwan. An open questionnaire was used to receive comparable answers to some questions while still keeping the opportunities for the interviewees to develop their own ideas. All the interviewees had experience as managers in at least one, and in the majority of cases, in several ICJVs. They came from nine different national cultures and represented ten different parent companies. The interviews lasted on average a little more than one hour.

**Sensemaking in ICJVs**

ICJVs are mostly formed to implement megaprojects. Since sensemaking is retrospective, there exists in the beginning no shared sense with regard to a specific ICJV. The process is difficult because many people meet in an ICJV for the first time. In addition, they often come from different national and professional cultures.

A model for ICJV-management is shown in figure 2 (Brockmann 2009). The model combines complex engineering tasks (organizational planning, design, work preparation, site installation, construction) with management functions (planning, organizing, staffing, directing, controlling), basic functions (project knowledge, trust, sensemaking, commitment), and metafunctions (decision making, communication, coordination, learning). These are influenced by Hofstede’s (2005) cultural dimensions (masculinity, long-term orientation, power distance, uncertainty avoidance, individualism) and the complex environment. The fundamental point of the model is that each task, function, or dimension must be carefully considered for success and that many of them interact.

With regard to the basic functions it seems plausible to assume a strong interaction between sensemaking and the other three. A successful process will enhance project knowledge, trust and commitment. The same holds true for an interaction between sensemaking and the four meta-functions. The influence of culture on sensemaking is evident because culture is being created by sensemaking. In ICJVs there is a conflict of different systems of values, norms, and interpretations.

The start of ICJVs for megaprojects is dominated by an overwhelming complexity. There is no structure, plenty of ambiguity, no group cohesion, leadership is based on trust and not performance, and the starting sensemaking process might well conflict with the identity of some or even most. This is the backdrop of the model.

**Cognitive Maps in ICJVs**

A large number of people might meet in an ICJV for the first time without the benefits of prior cooperation. They still have common experiences; many will have worked in a different ICJV before, on a different megaproject. The experiences are stored in mental programs. These help us structure and understand our world. They provide the basic layer in an ICJV for coordination, decision making, communication, learning and they are the result of sensemaking. We can describe them as cognitive maps. The American Psychological Association (van den Bos 2007, p. 190) defines cognitive maps as “a mental understanding of an environment, formed through trial and error as well as observation. The concept is based on the assumption that an individual seeks and collects contextual clues, such as environmental relationships, rather than acting as a passive receptor of information needed to achieve a goal. Human beings and other animals have well developed cognitive maps that contain spatial information enabling them to orient themselves and find their way in...
the real world; symbolism and meaning are also contained in such maps.” Cognitive maps contain information for decision making in dynamic environments and gain as such utmost importance for ICJV management. Cognitive maps store the result of sensemaking from previous experiences. They provide for learning across the borders of projects. It can be shown that the maelstrom of megaproject experiences in ICJVs leaves rather uniform cognitive maps embossed in the minds of managers. These are a concrete manifestation of the construct “shared sense” in figure 1. Figure 4 is a representation of a cognitive map of managers for sensemaking. Maps are man-made, they are plausible but not exact, and they are subject to change. There are maps for different purposes and of different scale.

**Shared Sense In ICJVs**

Sensemaking supports the process of identity building and thus fulfils a human need (Ring and van de Ven 1989). Identity is a concept for understanding ourselves, it answers the dynamic question of who we are. As such it has an individualistic as well as a group aspect.

At the start of an ICJV, the managers come together with their individual self perceptions. They also share somewhat an idea of what it means to be involved in an ICJV implementing a mega-project in the form of cognitive maps. However, the entity “ICJV” itself has absolutely no identity, its cognitive complexity is close to zero. This lack of identity manifests itself in numerous discussions and rumours as an ongoing process of sensemaking and identity creation. From the viewpoint of encoding a message we can understand an organizational identity as a self-portrayal based on the signals that are sent by its behaviour, communication, and symbolism (van Rekom et al. 1991). With effort at sensemaking and over time an identity can develop into an organizational culture. Unfortunately, ICJVs do not have this time (fig. 3). Thus, the normative goal for ICJVs is to develop as strong an identity as possible.

**Empirical Evidence**

Not one of the managers ever used the word sensemaking in the interviews, the construct itself is not one shared by them. However, they employ different words and concepts to convey the same ideas, one of them being identity building, i.e. the notion of a possible outcome of the sensemaking process.

The interviews were conducted and transcribed by Brockmann (2007, pp. 462-467). Having the choice between an exact transcription and good English, the former was favoured. This avoids tampering with data and adds authenticity. Unfortunately, it sometimes obscures the statements.

Sensemaking is concerned with creating cohesion. This is understood and it is clearly expressed using terms like “same understanding” and “one language”: “The project have to, everyone in the project should have the same idea. It has to be the same idea.” Or: “Yeah, leadership, I think, you know, I think, I can mention this here, you know, when I came here to this project, there were a lot of experts, but there was missing a little bit the combination, the teamwork. Everybody was working and, you know, was trying his best, but there was missing the combined achievement of the target. This had to be sorted out very well and also, you know, there is very important, first of all that the joint venture partners are speaking one language, let’s say, ...”

In agreement with theory there is an understanding of barriers to the sensemaking process: “In the beginning there was a lot of uncertainty and this was quite ambitious here to get this progress and so on, so on. The German side of the joint venture was always saying: Well, we can achieve this and then the Taiwanese side was a bit skeptic.”

Every ICJV starts with some imperative goals and these are laid down in the contract. Among them are a product definition, a budget, and a stipulated construction time. This focuses sensemaking by providing some unambiguous cues. It remains the task to develop additional shared goals for the ICJV: “I don’t know exactly what to tell you, but only my opinion. If I be, I would like to ask all together from beginning and discuss and open mind, discuss what is goal of all of us, everyone have any question, and then we tuning up all together in the same, in the same thing. And then we go together.” The process is not easy because everybody comes with different ideas to the ICJV: “I don’t think so. Very few people have the same idea.” It is the task of management to create a shared understanding and the use of hierarchy is one possible way of implementation: “Not right from the very beginning. At the beginning there were, of course, a lot of people that thought that certain rules and regulations, which we implemented were not right or were not correct, or not the best. But we just ignored them. We just said, this is the way we have to do it. Like I said earlier, you have make sure that everybody on the project understands what the goal is, what the rules and regulation are, and whether he likes it or not, but he has to follow. And pretty much everybody tried to follow. Some didn’t like it up to the very end, but that’s fine.” This quotation does not refer to sensemaking for supporting the adaptation process but the following does so stressing management responsibility: “Oh, that’s the expertise of the senior management, in each of the, and I say in each of the departments. The upper management has to set the goals and procedures to put the organization in place, put procedures in place for the line managers to work to. And then there has to be an education process and in some ways a control process in place to make sure that
what’s happening in the joint venture is, what the joint venture has decided and that you don’t have one section of the company following the procedures and policies of one partner and the other section of the joint venture following the procedures and policies of the other partner. So it’s a management skill, but you have to do it very quickly and you have to develop your procedures and your policies, the blending with the beliefs of both partners and then put them into operation and insist that the joint venture operates to those.”

While common goals are developed, it is impossible to fine tune the agreement on goals but this is not a major concern: “The normal situation is always, wherever you work, that all your people, they may have one big goal, but this is affected by many small individual goals, every worker, every staff have, they have also individual goals. As long as they go in the same direction than the goal of the company is alright, but there is always a slight difference in the direction.”

Sensemaking in ICJVs is supported by communication and makingget-togethers possible: “Well, you work together, you drink together and party together. It is also part of, you have to have a Christmas party, whatever way you get everybody together. Some people only can complain after they drink three beers. So you give them three beers to get their complaints, otherwise you never know. You have to play football against another team, we had baseball.” There are frequent official and unofficial meetings to provide a chance for sensemaking: “Well, technically we have several meetings, like the project control meetings every month. I have meetings in between, so at various levels, but always together with the project management, this is important, and then we have other means like Christmas parties, birthday parties, whatsoever. It’s a mix of the pure management and also the other side of life, yeah.”

The outcome of the sensemaking process is the build-up of an identity with the ICJV. “They should have their identity, they should say, yes, we are working for this joint venture.” Or: “I think as an identity in the sense that there is a pride and a satisfaction of being associated with a successful joint venture, and therefore they are identified being part of [name of ICJV] because especially when they are talking to other people in the industry that this project is recognized as being successful and they like to feel to be part of it.” However identity building is not easy and definitely short of ideal: “Yeah, that’s what I like doing, but I feel it’s very difficult, we had it amongst the senior staff, knowing them for years or being more loyal to the company, coming from the home office. But if you have twentyeight nationalities and two thirds, I don’t know what the numbers are, are hired on the streets you cannot expect that identity. These peoples just have their jobs.” The progress from identification to something similar to a culture can be possible even in relatively short-lived projects: “I think we have had high identification in the joint venture, for all our nationalities. We have more than twenty nationalities here, working here so and then you can feel, you can see that, if you meet families of them or friends who are not related to the project, you hear, oh, yes, they are quite proud. Of course, you define almost every day new goals and they are also defined in the teams, working for the whole project. It’s not like that I command every day, so, this is a new target, and everybody has to follow that. There is some culture developing and this depends on the people and if you have chosen the right people in the respective positions and you exchange ideas with them quite often, so you, and the teamwork and I think the keyword on this project was really the teamwork.” A definite corporate culture cannot develop because of the time restrictions of ICJVs: “I don’t even know what a joint venture culture is because they are never in place long enough. Your corporate culture of a company develops over a very long period, joint ventures as a fully operational joint venture is rarely in place more than three years.”

The goal of developing common goals and identity building is to improve teamwork: “As I tried to explain before, you know, we tried to have a team, where the professionalism is there, and the teamwork and I think the keyword on this project was really the teamwork.”

**Conclusion**

The interviewees never used the term “sensemaking”. This is the theoretically chosen construct to sum up all the ideas uttered by the managers in ICJVs. Theory and empirical data allow putting together a model of sensemaking in ICJVs. Helpful is the contract with the stipulated obligations that form a first set of accepted goals. The lack of structure, ambiguity of tasks and personal insecurity are some typical noise that makes sensemaking difficult. The goal of the sensemaking process is to create a high performance team and thus become more effective. Mentioned components of high performance teams are the development of additional common goals and identity building. The sensemaking process is managed using different opportunities: personal communication, formal and informal meetings, celebrations, events, and intranet. In an abstract way, sensemaking reduces complexity because it reduces the high degree of diversity that characterizes especially the beginning of ICJVs (cf. fig. 4).

**References**


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Lean Project Management
In Large Scale Industrial Project via Standardization

Lean project management is the comprehensive adaption of other lean concept like lean construction, lean manufacturing and lean thinking into project management context. Execution of many similar industrial projects creates the idea of lean project management in companies and rapidly growing in industries. This paper offers the standardization method in order to achieve Lean project management in large scale industrial project. Standardization refers to all activity which makes two projects most identical and unify to each other like standardization of design, reducing output variability, value analysis and strategic management. Although standard project may have minor efficiency decrease, compare to custom built project; but great advantage of standard project like cost saving, time reduction and quality improvement justify standardization methodology. This paper based on empirical experience in industrial project and theoretical analysis of benefits of project standardization.

Introduction
Standardization of large scale industrial projects is new idea which emerged in leading companies in last few years and it is under development in companies and wildly spread through industry. Execution of many similar large scale industrial plants generates the idea of lean project management through standardization of large scale project.

Standardization of project refers to all activity to make a large scale project as identical as to other similar project by means of standardization of design, reducing output variability, strategic planning, project orientation strategy instead of product orientation strategy, standardization of procurement, construction and value analysis. Standardization of large scale industrial project is one of the methods of applying lean philosophy to industrial projects and project management aspects of these projects.

The topic of lean thinking has gain credence over the past decade. Also lean construction is based on lean production idea. Lean construction looks into possibility of bringing successful lean production theories and concept into construction industry.

This paper aims to apply the common principals and feature of the lean manufacturing and lean construction to lean project management and provide real industrial case to introduce standardization methodology.

Background
Standardization
Standardization idea is broadly used in computer and electronic industry since 1980 according to Cusumano (1987, 8) and used in car manufacturing from 1960 and greatly adopted and developed by Toyota in 1980 and flow to other mass production factory like machine tool manufacturing, aircraft and agriculture equipment.

In practice there are three forms of standardization as below;
1. Product standardization
2. Process Standardization
3. Project Standardization: which is main discussion of this article

Womac and Jones (1996) suggested that, standardization of processes can be a means of reducing costs and saving time.

As Cusumano (1987) noted if a customer needs a product, whether it is an automobile, a machine tool, a semiconductor chip, or a software program, there are basically three options:
1. Obtain a fully customized product;
2. Obtain a standardized product;
3. Obtain a semi customized product

Above statement present three options for the purchaser or client in order to procure his goods or project. Of course as the product became more customized the price of the good/project will raise. Providing three options or two options to client in

Figure 1. Lean Concept
the large-scale project will give a chance to client with tight budget or time, in order to proceed with his project.

Process standardization is the next step in standardization, which focus on the process and project standardization is the most comprehensive way of standardization, which focus on making overall project more identical and standard.

Design Standardization
Standard design is the first step and also major step of standardization of project, which results in minimizing waste of material, time and maximization of project value.

For example in Iron ore production industry, assume one client decide to construct five plants with 3.5, 2, 5, 3.7 and 1.5 Mtpa in different location. If the designer design the plants with throughput of 2, 4, 6 Mtpa instead of above capacities, that will be standard plant. In this case the client should be convinced to purchase a plant with 4 Mtpa instead of 3.7 Mtpa or 3.5 Mtpa. Also this client will easily select his future projects from existing standard design.

As noted by Thomas, H.R., et al. (2002) variability is common in project and must be managed effectively. By reducing variability we earned better labor and cost performance. Reducing Variability of project’s output is one of the bases of the standardization theory.

In Iron Ore example, the designer company could limit its plant to three sizes of 2, 4, 6 Mtpa and select all of his new project from these 3 standard plants instead of unlimited number of various throughput like 4.5, 5 and 5.5 Mtpa. After few projects all the design and procurement and construction of these types of Iron Ore projects will be more available in these standard sizes in the market. It should be noted the standard design mainly could be used in companies which have similar project with similar technology. Designing and construction of these standard type projects are much easier than design of unlimited throughput of the plant. By constructing more standard plant, the subsequent construction of plants is also will be designed and built in standard sizes and after few years the whole project include design and construction and procurement will be available in standard sizes in the market.

Construction Standardization
As mentioned by Polesie and Frodell (2009) construction standardization is considered to be structured planning and operational sequence of activities that have been learnt from experience as being the most effective processes for reducing waste and increasing customer value.

According to Green and May (2005), one the most practical methods of applying standardization in construction are off-site manufacturing, prefabrication and modularization. Off-site manufacturing and modularization is broadly used in building construction industry. In this paper we aim to expand these techniques and especially modularization to large scale industrial project like mining industry. Fewer people with less training and skill require for assembly of prefabricated units as per Green and May (2005).
functions by an object.

An object of VA may be a product, a process and their elements as the carriers of certain functions.

It is estimated that 20-30% of any technical system’s cost is related to its main functions, approximately 50% to its auxiliary functions, and 10-20% to functions that are never used. The challenge is how to cut the cost of a product and improve its quality. Using VA we can meet this challenge. (Kosse 2009)

By constructing the standard plant in most heavy industry the basic functions of plant will be satisfied. This standardization will reduce cost and relax time and effort in all stage of project from contract preparation, preliminary design up to construction and commissioning. Custom design of project assures fulfillment of secondary function of project, on the other hand it is more expensive and more complicated to construct.

Summary of Project Standardization
Standardization of project is a technique which has many building elements, which build project standardization concept. These elements are as below;

- Design Standardization - Construction Standardization - Project management standardization - Documents standardization - Strategic management - Value analysis

Lean Concept

Lean Thinking

Lean thinking has come into vocabulary as a title of the book by Womac and Jones, which published in 1996 and attempts to update and expands the concepts developed in the automobile industry.

'Ve have a critical starting point for Lean thinking is value. Value can only be defined by ultimate customer.'(Womac and Jones 1996)

In this book the lean principles introduce as: Value - The Value stream - Flow - Pull - Perfection.

The topic Lean Thinking has gained credence over the last decade. During the 1980’s, the institute of the Automobile at MIT did a comprehensive study of manufacturing process in automobile industry. One of the major ideas which were developed as part of this work was called Lean Production.'(Halpin and Kueckmann 2002)

Lean Design

According to Koskela and Howell (2002), lean construction starts from lean design. Lean design is the first step of lean project management, which results in minimizing waste of material, time and maximization of project value. In this article lean design has the same concept and definition of standard design. Also, lean design is the main ground of lean project management.

Accepting standard project instead of custom build project requires an agreement between all parties involved.

Mainly end user or client of project must agree on standard project instead of custom build project and accept the standard project technical specification in order to benefit from standard project advantages. In this article lean design is substitute by standard design.

As below short definition of similar and standard project which is used in this article are presented.

**Similar Project**: Refer to projects, performing similar task but the physical characteristic of equipment and sub-systems are not identical. For example Iron ore plant with 4.5 and 3.5 Mtpa iron ore throughout are similar. But the sub system and equipments inside plants are different.

**Standard Project**: Project with similar performing task with sub system and equipment as much identical as each other. For example in above example iron ore plants with 4 Mtpa are standard.

By constructing more standard project the more standard design and equipment will be available in the market and standard project will become more common and available in the market.

Lean Manufacturing

In general lean manufacturing has the capability to produce product using the least amount of non-value adding activities that add time and subsequently cost to the manufacturing process. (Hobbs 2003)

Although lean manufacturing does not specify any specific methodology, it has few main principles like reducing waste and adding value which stay constant in all over lean definition like lean construction and lean thinking. This report extends these principles to lean project management definition and techniques.

As noted by Hobbs (2003) there is no single method of lean manufacturing. According to that, our techniques of standardization include value analysis, strategic management and standardization could be one element of lean project management principles.

Standard project will decrease waste and increase value in all stages of project by decreasing design time and cost in overall of project. Thus, one of the methods of approaching lean project management is using standardization methodology.

Lean Construction

As lean construction is a project based process, it is easier to use lean construction principles for lean project management. Thus, in this section the adoptable practices will be taken from lean construction and apply to lean project management.

As noted by Ballard (2000) lean construction tries to reduce variation in every aspect like product quality, rate of work and manage the remaining variation. According to Ballard reducing variation in every project is one of the methods of applying lean construction. This idea is strongly used in project standardization and lean project management.

‘Variability is common on construction projects and must be managed effectively. New management thinking, like that of lean production, has suggested that better labor and cost performance can be achieved by reducing output variability.’(Thomas et al. 2002)

Reducing Variability of project output is one of the bases of the standardization theory. For example reducing the throughput of Iron Ore
plant to 4 Mtpa and accepting tolerance of Iron Ore plant output is an example of reducing output variability of a project.

As mentioned by Green and May (2005), one of the most practical methods of applying lean philosophy in construction are off-site manufacturing, prefabrication and modularization. Off-site manufacturing and modularization is broadly used in building construction industry. In this report we aim to expand these techniques and especially modularization to large scale industrial project like power plant and mining.

Lean Project Management

Lean project management is a comprehensive outcome of other lean principles and has many ideas in common with other lean concept. Still the main definition of lean project management is delivering more value with less waste in project context.

As mentioned by Artitua and Smith (2008) the most widely used sources of project management guidance, bodies of Knowledge and the tools / techniques used in projects in construction sector are also generally focused on achieving single project objectives. More detail review of construction activities shows that many projects are increasingly undertaken in a multi-project context now a day. Against this background, the need for new approaches, processes and techniques suitable for multi-project management is therefore obvious.

‘Projects are temporary production systems. When those systems are structured to deliver the product while maximizing value and minimizing waste, they are said to be ‘lean’ projects. Lean project management differs from traditional project management not only in the goals it pursues, but also in the structure of its phases. Construction is among many types of project-based production system.’ (Ballard and Howell 2003)

Again there is no unique method to achieve lean project management in projects. This article suggests standardization of project as lean project management approach in a lean project.

Summary of Lean Concept

The following schematic summarize the process of the lean idea and developing this idea from lean thinking to lean project management, according to above literature review. The containing elements of each lean concept are shown in related box.

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**Result of Standardization of Large Scale Project**

In order to find out the result and advantage of standardization of large scale project, one industrial case study in power plant industry in subsection of Heller Cooling System has been studied and following tables and chart are employed. These tables and information based on author work experience in power industry and they are indication for comparison for similar and standard project.

These tables are;
- Identicality percentage comparison table for main equipment in Heller cooling system between standard and similar project
- Identicality percentage comparison table between standard project and similar project with breakdown to each discipline i.e mechanical, electrical and etc
- Identicality percentage comparison table between standard project and similar project for each sub system and in different stage of project (Design, Procurement, Construction)
- Percentage of identically with breakdown into sub-system during different stage of project

Due to limitation in space these tables are not presented in this article.

In below the definition of standard Heller cooling system and similar Heller cooling system is stated:

**Standard Heller Cooling System** means two Heller Cooling Systems with identical cooling tower (size & dimension), condenser (size & detail), peak cooler (technical specification) and other main equipment.

**Similar Heller Cooling System** means two Heller Cooling Systems with different capacity for example 250 MW and 280 MW cooling capacity. In similar cooling system, sub systems have different size and technical specification. But perform same task and have identical features.

Performing above industrial case will find out the exact percentage of unification between standard and similar project in different stage of project. However a preliminary study in the report shows the unification percentage of a standard project will increase from 60 to 90 in design phase, 65 to 90 in procurement and 75 to 90 in construction stage among similar project to standard project.

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**Figure 2. Development of lean concept**

Lean Thinking
- **Lean Design**
  - More value
  - Less Waste

Lean Manufacturing
- **Lean Construction**
  - Reducing Variability
  - Prefabricated Unit
  - Off Site manufacturing
  - Modularisation
  - Lean supply
  - Lean assembly

Lean Project Management
**Lean Project Management Procedure**

Following schematic shows the procedure for applying lean project management and standardization methodology. This schematic summarized all the techniques which highlighted in preceding sections.

This is summary and outcome of this article, which shows the road map of standardizing one large scale project.

**Conclusion**

Based on case study, Time and Cost in standard projects are very high identical. Also, standard project provide easier execution and management compare to similar project. This is a great advantage for companies and clients. Very high unification in standard project assist client to know the cost and time of a project at start of project. This information will be very useful for any potential client.

Another advantage of standard project is using existing as built drawing, which greatly reduce the revision and construction mark up.

Although, standard project has many advantages, but here are some political issues against standardization of project among companies.

For example reluctance to change current methods and fear of losing the market to competitor companies, because of easier access to projects technical information and easier method of project execution. Possible, reduction in efficiency of standard project is another disadvantage of standard projects. These disadvantages will be strongly compensated with reduction in cost and time.

Also, company down-sizing and job loss are other possible disadvantages for companies.

In other hand, easier construction and performing of industrial project means decrease in cost and time of project and happier client, which result in companies to win more projects and have more job security. Also advantage of lean project will increase after constructing more standardize project and as time progress.

**References**


Polesie, Pim, Mikael Frodel and Per-Erik Josephson. 2009. "Implementing Standardisation In Medium-Sized Construction Firms." Taiwan.

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An increasing level of regulation on carbon emissions is taking place within the building and infrastructure construction industry. Although the US federal climate and energy policy is still in the early stage, it is becoming clear that both regulatory and market-based methods would be likely implemented to limit greenhouse gas emissions from the construction and operation of facilities. The emerging carbon regulation and market will significantly increase project complexity and profoundly impact project design, planning, construction, and operation. This paper introduces the internal and external complexity caused by carbon regulation. Several dimensions of project complexity under carbon regulation are also discussed, including interaction between carbon emissions and objectives, organization and technological complexity, contracting, and risks.

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Introduction

There are different levels of regulations to control construction project implementation. A successful project should meet all requirements of regulations such as schedule, cost, quality, and safety. In addition to those current regulations, climate change has become a top priority for government, businesses, and the general public. In accordance with this environmental issue, carbon regulation would be added to projects, which means unforeseeable uncertainty and project complexity may increase rapidly (Bennett, 1991; Hamel, 1994; Sommer, 2004). Moreover, previous research has shown that project complexity helps determine planning, coordination, and control requirements (Melles et al., 1990; Austin et al., 2002). Therefore, understanding project complexity and how it might be managed is of significant importance (Baccarini, 1996).

The study of complex systems in a unified framework has become recognized in recent years as a new scientific discipline, the ultimate of interdisciplinary fields (Bar-Yam, 2003). There are several definitions of complexity. Gray (1983) defined a technically difficult task as that with a known method or procedure for doing the work, and one in which implementation of the method and procedure requires all the skills, knowledge, and attention needed from the person concerned with the task to produce the required finished product. Malzio et al. (1988) suggested that a complex process is that which is composed of operations that are innovative and conducted in an uncertain situation or that involve operations that are not clearly defined or lack a complete specification. Baccarini (1996) argued that such conditions often result in variations that demonstrate increased production time and cost. Previous research also indicated different ways to classify the categories of project complexity. Ireland (2007) thought that projects have two primary areas of complexity - the technical aspects of the product, including the degree of difficulty in building the product, and the business scope, which can be called organizational complexity. Other research showed that complexity has two dimensions: system size and the number of interactions among influence variables (Malzio et al., 1988; Schilindwein & Ison, 2005). Unforeseeable uncertainty refers to the inability to recognize influence variables or interactions at the outset. Understanding and addressing complexity in projects is a key to improved planning and project implementation. The effectiveness of the project relies on taking the simplest approach that meets the requirements while avoiding complex situations, both technical and managerial that can impede progress.

In recent years, the U.S. government has started to focus on carbon regulation and trading issues. Many states have begun to execute policies for reducing carbon emissions. Several carbon trading systems already exist in the United States, Europe, and Australia. Carbon regulation and trading have influenced not only the manufacturing and electrical industries but also the construction industry, which must adapt to the new rules (Bird et al., 2007). The new carbon regulation and trading system will significantly increase project complexity and profoundly impact project design, planning, construction, and operation. Additionally, a key element in President Obama’s economic agenda is legislating limits on carbon dioxide emissions to combat the supposed threat of global warming. In his budget outlined for the government’s next fiscal year, the president has proposed a cap-and-trade policy that claims to reduce carbon emissions...
by 14\% from their 2005 levels by 2020, and by 83\% by 2050 (Carey, 2009). Under a cap-and-trade system, the government would assert ownership of the atmosphere over the United States and set a maximum number of permits that it would sell to private companies for the right to discharge carbon dioxide into the air. Over time, the government would decrease the number of permits and increase their price to meet the desired reduction in emission levels. Companies would decide which was cheaper: to buy a permit at the government-set price or incur the expense of introducing technologies to diminish the CO2 emissions (Voss, 2007; Sekar et al., 2007). The following sections will discuss the effects of carbon regulation and trading on projects, and the challenges of project management in different dimensions.

Project System Complexity under Carbon Regulation and Trading

According to the detailed literature review of project complexity (Gidado, 1992, 1996; Baccarini, 1996; Sinha et al., 2001; Laurikkala et al., 2001; Vidal et al., 2008), we decided to utilize the elements that Vidal (2008) summarized. He proposed several factors that could be classified into four groups in two categories. Our research discusses the relationships between these factors and carbon regulation and trading. A brief introduction about these groups and how carbon regulation and trading will influence them follows. The elements of project complexity affected by carbon regulation are listed in Table 1.

<table>
<thead>
<tr>
<th>Project system size</th>
<th>Project system variety</th>
<th>Interdependencies within the project system</th>
<th>Elements of Context</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technological complexity</strong></td>
<td>- Variety of technological dependencies - Variety of the technologies used during the project</td>
<td>- Interdependence between the components of the product - Resource and raw material interdependencies - Technological processes dependencies</td>
<td>- Demand of creativity - Environment complexity - Institutional configuration - Local laws and regulations - New laws and regulations - Scope for development - Significance on public agenda - Technological degree of innovation</td>
</tr>
<tr>
<td><strong>Organizational complexity</strong></td>
<td>- Duration of the Project - Largeness of capital investment - Number of activities - Number of decisions to be made - Number of information systems - Number of objectives - Staff quantity</td>
<td>- Diversity of staff - Variety of financial resources - Variety of organizational skills needed</td>
<td>- Environment complexity - Institutional configuration - Local laws and regulations - Organizational degree of innovation</td>
</tr>
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</table>

Table 1. Elements of Project Complexity Affected by Carbon Regulation
each factor in the group. Some projects will need new technology to control and model emissions. Practitioners may also need to consider utilizing new technologies to reduce their emissions to meet policy requirements. After adopting the new technologies, practitioners may spend more time and money operating these technologies. Those actions will increase the variety of technologies used during the project. In order to face these changes, companies may need to hire new employees who have carbon-related backgrounds, or arrange training for current employees to learn about carbon issues. Another way is for companies to establish new programs that focus on carbon issues. Those activities will increase project complexity in diversity of staff and variety of organizational skills needed. Additionally, the variety of financial resources may increase because the carbon trading market allows companies to buy and sell their permissions for carbon emissions legally. Therefore, carbon emission trading may become a new financial resource for projects.

Interdependencies within the project system

Previous research shows that interdependencies are likely to be the greatest drivers of project complexity, and traditional project management tools are not sufficient to encompass the reality of interdependence (Rodrigues and Bowers, 1996; Calinescu, 1998). In construction production processes, numerous kinds of technologies and trades use varying methods and tools. Each requires access, space, and time to carry out its objectives and can often overlap. The number of roles involved in each of the different technologies may vary and are quite often interdependent with one another in a number of ways, depending on the time and location in which they are carried out on site. Some of these include, but are not limited to, the access provided, size of available working space, working surface, and technical requirements. Therefore, carbon regulation and trading may increase the complexity in technological processes’ dependencies due to adding new carbon-related technologies to projects. Additionally, the team structure of a project is another factor that may be influenced by carbon issues. Carbon regulation and trading need someone who has a related background to join the project team to control the change, so the team structure may become more complex. Moreover, the varying nature of the interdependencies or interfaces of roles may bring about the occurrence of any one or a number of inherently complex and uncertain factors. In cases where one already exists in the system, the nature of interfacing may increase its effect on production time or cost.

Contextuality dependence

Contextuality is an essential feature of complexity, considering it as a common denominator of any complex system (Chu et al., 2003). Because carbon regulation and trading bring a brand new issue to the construction industry, the demand for creativity is a major item that will be of significant influence. Local laws and regulations about construction and infrastructure may be revised in view of the carbon concept. The scope of development may change the direction from an economic issue to more of an environmental issue. Technological innovation may start to focus on green markets. The importance of complexity to the project management process is widely acknowledged. For example, previous research has shown that project complexity helps determine planning, coordination, and control requirements (Melles et al., 1990). Project complexity also hinders the clear identification of goals and objectives of major projects (Morris and Hough, 1987). Moreover, complexity is an important criterion in the selection of an appropriate project organization form. These researchers also indicated that complexity affects the project objectives of time, cost, and quality, which means that the higher the project complexity, the greater the time and cost (Melles et al., 1990; Morris and Hough, 1987). According to the preceding discussion, carbon regulation and trading may increase the complexity of projects significantly, and practitioners may spend more time and money on their projects due to the influence of carbon regulation. It is, however, of no manifest help to owners or contractors if all they know is that costs and duration may increase. Therefore, this paper utilizes project life cycles to explain how these increasing complexities will influence the construction project process.

Project Process Complexity under Carbon Regulation and Trading

Several research articles have defined the phases of project life cycles (PMI, 2004). Essentially, a project is conceived to meet market demands or needs in a timely fashion. After the scope of the project is clearly defined, detailed engineering design will provide the blueprint for construction, and the definitive cost estimate will serve as the baseline for cost control. In the procurement and construction stage, the delivery of materials and the erection of the project on site must be carefully planned and controlled. After the construction is completed, there is usually a brief period of start-up or shakedown when the new facility is first occupied. Finally, management of the facility is turned over to the owner for full occupancy until the facility lives out its useful life and is designated for demolition or conversion (Hendrickson, 2000).

The elements of project complexity may influence different phases in the construction project life-cycle. We summarized those elements that will be affected by carbon regulation, and put them into the appropriate phase that will influence project life-cycle in Table 2. According to Table 2, we see that over half of the elements of project complexity will affect the initial phase in the project life-cycle. There are eight elements that will affect the intermediate phase; and two elements in the final phase. Finally, there is just one factor variety of financial resources that will influence the operative phase. The trend means that the earlier the project life-cycle, the heavier the carbon regulation effect. In an ideal situation, project costs can be recovered by selling carbon emissions. On the other hand, project planners may have extra expenses from purchasing carbon
<table>
<thead>
<tr>
<th>Phase of project life-cycle</th>
<th>Elements of project complexity</th>
<th>Influence on performance</th>
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</thead>
<tbody>
<tr>
<td><strong>1. Initial Phase</strong></td>
<td>Duration of project</td>
<td>Increasing time of project planning in project duration</td>
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<tr>
<td></td>
<td>Number of activities</td>
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<td></td>
<td>Number of decisions to be made</td>
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<td></td>
<td>Variety of financial resources</td>
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<td></td>
<td>Interdependence between the components of the product</td>
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<td></td>
<td>Technological processes dependencies</td>
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<td></td>
<td>Availability of people, materials and of any resources due to sharing</td>
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<td></td>
<td>Dependencies with the environment</td>
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<td></td>
<td>Dynamic and evolving team structure</td>
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<td></td>
<td>Interdependence of objectives</td>
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<td></td>
<td>Processes interdependence</td>
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<td></td>
<td>Demand of creativity</td>
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<td></td>
<td>Scope of development</td>
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<td></td>
<td>Largeness of capital investment</td>
<td>Increasing project cost</td>
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<td></td>
<td>Number of objectives staff quantity</td>
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<td></td>
<td>Number of information systems</td>
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<td></td>
<td>Variety of technological dependencies</td>
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<tr>
<td></td>
<td>Resource and raw material interdependencies</td>
<td>Both increasing project duration and cost</td>
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<td></td>
<td>Local laws and regulations</td>
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<td></td>
<td>New laws and regulations</td>
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<td></td>
<td>Environmental complexity</td>
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<td></td>
<td>Technological degree of innovation</td>
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<tr>
<td><strong>2. Intermediate Phase</strong></td>
<td>Diversity of staff</td>
<td>Increasing communication time in project duration</td>
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<tr>
<td></td>
<td>Variety of organizational skills needed</td>
<td></td>
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<tr>
<td></td>
<td>Variety of technologies used during the project</td>
<td>Both increasing project duration and cost</td>
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<td></td>
<td>Environmental complexity</td>
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<td></td>
<td>Significance on public agenda</td>
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<td></td>
<td>Combined transportation</td>
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<td></td>
<td>Interdependence of information systems</td>
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<td></td>
<td>Variety of financial resources</td>
<td>May increasing the revenue or cost by selling or buying carbon emission.</td>
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<tr>
<td><strong>3. Final Phase</strong></td>
<td>Environment complexity</td>
<td>Both increasing project duration and cost</td>
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<tr>
<td></td>
<td>Variety of financial resources</td>
<td>May increasing the revenue or cost by selling or buying carbon emission.</td>
</tr>
<tr>
<td><strong>4. Operation Phase</strong></td>
<td>Variety of financial resources</td>
<td>May increasing the revenue or cost by selling or buying carbon emission.</td>
</tr>
</tbody>
</table>

Table 2. Elements of Project Complexity and Project Life Cycle
capacity if they could not meet the requirements of the carbon regulations. Therefore, cash flow can be changed.

**Project Management Challenges**

Complexity is one such critical project dimension. Project complexity under carbon regulation and trading also makes a difference to the management of projects. Also, it seems that we do not as yet have a proper understanding of carbon regulation and trading and how it will affect projects and project management in the future. In order to manage the increasing risk of changed construction project life cycles, we have proposed two major challenges that the practitioners should focus on. The first is the change in procurement plans by owners and contractors. Carbon regulation may let owners and contractors buy and sell emissions legally during a project life-cycle, which means that carbon trading may become a factor for increasing revenue or costs in projects. Managers should predict and calculate all phases of a project that may need to buy or sell emissions to get a more accurate idea of project costs. Second, the ownership of carbon emissions is another important issue that managers need to consider in the contract. Different project phases and different kinds of contracts should have different ways of defining ownership of carbon emissions. This is also a factor (like float) that may lead a project to litigation. For example, owners may request contractors use some traditional materials or equipment to reduce their cost but let contractors pay the fees for buying carbon emission capacity if the ownership of carbon emissions belongs to the contractor in a design-build contract. Several complex situations may occur if the details of ownership are not spelled out in the construction contracts.

**Conclusion and Recommendation**

In summary, this paper demonstrates the interaction between project complexity and carbon regulation, and uses project life cycles to explain how the construction process may be influenced by carbon regulation. We have also described the major challenges that practitioners will face in project management. Two major recommendations from the research include the following.

1. Project managers should consider the project complexity when thinking about project planning, especially in the initial phase of planning. In project planning, managers should understand that carbon trading is a financial factor that may either generate revenue for or add costs to a project.

2. Project managers should focus on project risk management. Financial leverage may increase due to adopting carbon regulation, so managers need to spend more on new technologies to meet carbon emissions standards. Therefore, the larger the financial leverage is, the larger the risk to a project there will be.

This is the beginning of a new research area on which the construction industry should focus. Future research might investigate several areas, including innovative contracting with carbon regulation and trading, the construction process with respect to carbon policy, and construction project finance under carbon regulation and trading.

**References**


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PMI (2004)
A Guide to Project Management Body of Knowledge (PMBOK), Project Management Institute, Newton Square, PA.


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