Project Governance & Controls Annual Review
2017 / 2018

The Project Governance and Controls Annual Review showcases interesting and practical academic papers focused on enhancing the governance and practice of project, program and portfolio management in the Australasian region. Each annual update is published in the months following the Project Governance & Controls Symposium held each year in August, in Canberra; and includes papers received in the preceding year.

To submit your paper for review, see: https://www.pgcs.org.au/academic-papers/

PGCS PROJECT AND PROGRAM MANAGEMENT SYMPOSIUM
⊙ Better Management ⊙ Better Projects

The Project Governance and Controls Symposium (PGCS) is designed to enhance the connection between project and program management, governance and controls. Project management cannot operate effectively without the support of senior management and the information from effective project controls. Frank and fearless reporting of status and issues cannot be assumed if the middle levels of management have the capability to restrict negative information. Conversely, executive management decisions depend on accurate and realistic assessments of risk, schedule and cost. Creating a culture where this type of information is not only available but accepted and used properly is the key governance issue within the project, program and portfolio domain.

For more information on this year's PGCS, see: https://www.pgcsymposium.org.au/

The Walt Lipke Awards

The Project Governance and Controls Symposium (PGCS) sponsors the annual Walt Lipke Award in honour of Mr Lipke's contribution to enhancing the governance and control of projects world-wide.

Walt Lipke, shown here on the right presenting the 2017 award to Peter Slay, is the creator of Earned Schedule, which extracts reliable schedule information from earned value data (resolving the long-standing error in the calculation of SPI and SV).

Mr. Lipke has published articles, and presented at conferences around the world, on the benefits of software process improvement and the application of earned value management, earned schedule, and statistical methods in the management of projects and programs. His contribution to project controls has been recognised by, among other, PMI, The College of Performance Management, and the EVM Europe Conference. Earned Schedule is freely available to the project community from: http://www.earnedschedule.com/

Walt Lipke Award Winners

2017   Mr. Peter Slay

2018   Dr. Raymond Young

2019   To be announced at PGCS 2019, Canberra.

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Contents Edition 1: 2017/2018

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Editorial

Welcome to our first annual review of interesting and practical academic papers is focused on enhancing the governance and practice of project, program and portfolio management in the Australasian region. This edition incorporates the papers accepted as finalists by PGCS for its annual Walt Lipke award in 2017 and 2018.

Of particular interest are the two papers submitted by Dr. Raymond Young, Roger Vodicka and Richard Bartholomeusz mapping the journey undertaken by the DSTO to improve their portfolio decision making and management capabilities.

Going forward, each annual update will be published in the month following the Project Governance & Controls Symposium held in August, in Canberra; and will include all of the papers received in the preceding year. We will also occasionally include non-academic papers of a high quality submitted a part of the Symposium proceedings.

The 'end notes' contain information on submitting your paper for publication.

Patrick Weaver, Editor.

Failure of Public Sector Programs; A Framework to Manage Success Criteria

P.G.R. Slay, A. Abbasi, A. Imran, C.K. Lee,

School of Engineering & Information Technology, UNSW, Canberra

Abstract

Public sector projects/ programs are commonly criticised for having poor outcomes. One reason is that such projects have multiple key stakeholders each with differing opinions regarding what would represent a successful outcome. This paper comes from current research developing an ontology between project success outcome criteria and the personal and technical competencies that may assist in attaining those outcomes. The paper reviews the development of perceptions of project success and presents a framework to assist project managers to develop a broad based success criteria review in consultation with key stakeholders and to manage perceptions of project/ program success throughout the implementation period.

Keywords

Public Sector, Project, program, success criteria, stakeholder

Introduction

There is a perception that many major public sector programs and major projects are beset with implementation problems and much research has been undertaken assessing processes that may improve outcomes. This is reflected in Shergold's report "Learning From Failure" (Shergold, 2015), which noted *"Understanding both threats and opportunities can help to increase the likelihood of effective implementation"* (p. 4) and expressed concern about *"by the numbers of departmental staff, often in senior positions, who had no program management experience or qualifications"* (p. 45).

Whilst Shergold's report conclusions are essential reading, an important issue not covered in the report is the problem of defining success in public sector infrastructure programs. Such programs commonly have multiple key stakeholders, each of whom may have differing perceptions of what will constitute a successful outcome (or conversely a failed outcome). The public sector environment is also different from the private sector as it comes under more intense press scrutiny and a combative political culture.

This paper makes comment on some of the key developmental steps in the project management profession and associated concepts of project success. It challenges the perception that there is, or even should be, a uniform definition of success except in relatively straightforward projects with a limited number of key stakeholders. For major projects and programs in the public sector environment, a clear definition of successful outcomes becomes extremely complex. There is however, structure that can provide an outline for generic approaches to defining successful outcomes and an analysis of the development of such a framework is outlined.

Historic Perspective on Project/ Program Management and Success Definition

The need to manage the implementation of projects goes back far into antiquity (such as the major buildings, monuments and civil structures of Roman, Greek & Egyptian empires) with ancient examples being discussed by Walker (Walker and Dart, 2011) and Garel who outlined the project management expertise used in Florence Duomo project, 1420 to 1436 (Garel, 2013). Despite this historic depth the professional discipline of project management was only established in the 1950s and 60s (Stretton, 2007).

Historically, the management of projects was generally seen in the context of manufacturing and engineering projects and was undertaken by the professional given charge over the project; commonly a Project Engineer/ Architect or Construction Manager. Appropriate tools developed progressively and enhanced the ability to effectively manage processes (Stretton, 2007). These included the Gantt Chart invented by Henry Gantt in 1917, Critical Path Method (CPM) developed between 1956 and 1959, Project Evaluation Review Technique (PERT) developed in 1959 and Precedence Diagramming Method (PDM) developed in 1958.

Stretton (2007) states that the North American Trans-mountain Oil Pipeline project, managed by Bechtel (1951–53) was the first project specifically using a dedicated project manager. In Australia, the first company to start using specific project managers on developments was quoted as being the development company, Civil & Civic between 1954 -1955.

By the 1960's, project management was becoming a recognised profession, leading to the formation of a number of peak bodies including:

- International Project Management Association (IPMA) formed in 1965, now a federation of 55 member associations worldwide including AIPM and APM.
- Project Management Institute (PMI) formed in North America in 1969 but with chapters throughout the world.
- Australian Institute of Project Management (AIPM) initially called the Project Management Forum founded in 1976
- Association for Project Management (APM) founded in 1972 in UK.

Each peak body sought to standardise project management practice and to offer a certification status for suitably qualified and experienced project managers. Certification requirements developed over time to include a combination of qualifications, professional experience and the demonstration of appropriate technical and personal competencies. Project managers would reasonably see the application of these requirements as being implicit in creating successful outcomes for their projects.

Evolution of Perceptions of Project Success

As the project management discipline developed, attention inevitably started to focus on the outcomes that could be considered to demonstrate a successful project. Significant work has been undertaken, both by active practitioners and by academics seeking to clarify this surprisingly elusive target (Tabish and Jha, 2011). The historic development of approaches to project success can be categorised within four chronological periods (Jugdev and Muller, 2005):

Period 1: Project Implementation and Handover (1960s – 1980s). During this period, the primary approaches to success related to compliance to mechanistic criteria. Typical of this was the "iron

triangle" of compliance to time, cost and scope (Atkinson, 1999) relating primarily to the implementation phase of the project and emphasising "hard skills" rather than interpersonal "soft skills" (Munns and Bjeirmi, 1996).

Period 2: Critical Success Factor (CSF) Lists (1980s -1990s). The period emphasised the concept of CSFs (defined as things that must go right for a good outcome). These included "soft outcomes" such as the level of satisfaction of various stakeholders (Lim and Mohamed, 1999) and an emphasis towards quality assurance (Munns and Bjeirmi, 1996). A distinction was also drawn between criteria for project success and project management success (Baccarini, 1999). This focused on the fact that good project processes could indicate a level of success in their own right despite problematic outcomes in the completed project.

Period 3: CSF Frameworks (1990s – 2000s). Atkinson extends the concept of the "iron triangle" to add three additional attributes; the information system, Organisational Benefits and Stakeholder/ Community Benefits to create "The square route" approach to project success (Atkinson, 1999). Other research suggests success be viewed from both a technical perspective and as a contribution to strategic mission outcomes (Jugdev and Muller, 2005) with others extending this to include the customer organization (Kerzner, 1987)

Period 4: Strategic Project Management (21st Century): Building on the previous work this approach includes the essential nature of an interactive relationship between client (project owner) and the project manager and emphasises four requirements as a minimum for success (Turner, 2004, Turner and Müller, 2004):

- The criteria for success should be agreed with stakeholders before the project starts and reviewed throughout the project life.
- A partnership relationship should be maintained between the project manager and client.
- The client should empower the project manager with sufficient flexibility to manage unforeseen circumstances.
- The client should take an active interest in the ongoing performance of the project.

Ongoing research into success factors has led to a broad spread of factors that show some commonality but cannot reasonably be considered to be exhaustive. The factors can be viewed in two broad generic groups:

1. Factors that may lead to an environment more conducive to a successful outcome. A wide range of studies (Inayat et al., 2015, Hwang and Lim, 2013, Yong and Mustaffa, 2013, Alzahrani and Emsley, 2013, Gudienė et al., 2014), being quoted as examples and provide a wide range of factors as diverse as force majeure conditions, latent conditions, project risk, project manager competency and local tolerance to corruption. Although some common themes can be identified there is little overall convergence in the factors identified (Padalkar and Gopinath, 2016).

2. Outcome criteria that facilitates a success target. Broad research has also been undertaken into identifying what outcome criteria may represent a successful project outcome. A summary of outcome criteria from a number of these papers is provided in Appendix A. The structure reflects subcategories suggested by McLeod (McLeod et al., 2012) and Badewi (Badewi, 2016), with three major groups as outlined below:

- Core Outcomes: Direct measurable outcomes many of which would to be integrated into the contract documentation for the design and/or implementation phases such as strategic goals, timeline, cost, scope & quality objectives.

- Compliance to Project Management processes. This group may be considered as an entity or could be integrated into the outcomes for specific stakeholder groups. It will generally relate to required project management control systems and adherence to those systems.

- Stakeholder Satisfaction. This group reflects the measurable satisfaction level expressed by a wide range of stakeholders and can be considered in three subgroups:

   a. Implementation Group: Those directly concerned with the project's design and implementation such as the client, implementation project managers, consultants, contractors & suppliers.

   b. Approval/ Endorsing Bodies: These generally comprise Local, State or Federal agencies having a role in approving or endorsing projects and ensuring that implementation complies with intended legislative outcomes.

   c. Other Effected Bodies: This represents a broad range of people or organisations who will be impacted by the project and consider that they should have a say regarding acceptable outcomes. These may include end users, the general public, local businesses, community groups etc.

Discussion

The progression of the Jugdev & Muller (2005) periods of project success perception shows a clear indication, at least in the academic world, that there cannot be a single clear definable generic project success target. The profession has moved a long way from the early concepts of the iron triangle of a project being completed on time, to budget and to scope although these basics are still fundamental. During the second period there is a move away from simple technical approaches to a segregated approach of project success and project management success and this is reflected in the summary provided in Appendix A.

Success criteria relating to Stakeholders are often attributed to the client based on the "golden rule" principle (he who holds the gold makes the rule). The client is responsible for the original project brief, which becomes the core of later consultancy and implementation contracts and therefore defines acceptable outcomes from a contractual standpoint. Whilst the client's perception of a successful outcome is of course essential, it will certainly not be the only perception. If a client is not well informed or well advised there is a danger that this perception of success will be overshadowed by howls of protest from a range of other stakeholders who do not share those outcomes, as is too often the case in major public sector programs.

Anecdotally some years ago a recently appointed State Minister visited his land management organization and addressed executive and senior project staff. In his introduction, he made the statement "You must understand that your goal is to make me look good". Whilst the comment was made in jest, it was clearly understood that there was a key reality behind it. It is equally clear that the Minister (the office's real client) was not going to sit down and work out what that might mean for any particular program. This would be the responsibility of an organisation reporting to the

Minister, often with senior project management experience, who would represent the Minister and would be regarded as the client organisation. In its simplest

and most generic form, success from the client's perspective may often comprise good core outcomes (on time, budget etc.) and with positive stakeholder responses (or at least with minimal negative press outcomes).

The Minister would not necessarily care about an audit of the implementation organisation's process compliance provided the outcomes were satisfactory. At the same time, the development organisation (in this example) would care deeply that process compliance was well managed. The organisation would also need to plan how to manage relationships with a range of stakeholders to optimise outcomes and their perception of success would add multiple layers to the Minister's broad goal.

This example shows a need to contextualize Turner's "Strategic Project Management Perspective" (Turner, 2004) that each project needs to start with a discussion which will determine success criteria for that specific program/ project not only from the perspective of the client, but also potentially from the perspective of a number of key stakeholders. This paper categorises these stakeholders into three subgroups (implantation group, approving/ endorsing bodies and other effected bodies). It should be noted that past research papers quoted in Appendix A barely comment of approving/ endorsing bodies as relevant stakeholder organisations. This may reflect the generic nature of past research with areas of professional endeavour not requiring such approval/ endorsement. In the construction and development environments, such approval is paramount and the inclusion as a key stakeholder group is considered justifiable.

Within each subgroup there is no suggestion that there would be a common appreciation of what would constitute a successful outcome. For example it would be normal for suppliers and contractors to have a relatively narrow approach to success as relating to achieving the range of outcomes in their specific contracts (including commercial outcomes for themselves) whilst project managers might have a bias towards a broader range including stakeholder satisfaction and successful fulfilment of agreed process outcomes etc.

To add a further degree of complexity, the formation of generic approaches to success perceptions from past research is complicated by a range of other potential confounding variables including:

1. Is success likely to be conceived in a similar manner in all professional environments? Project management is considered a generic profession with the natural implication that a qualified project manager can work equally efficiently on projects from any professional background disciplines. A review of research literature has provided a broad range of professional disciplines that have contributed to research outcomes and is shown in Table 1. It seems unlikely that success would be viewed in a common way in environments that are, for example, as varied as Engineering, Arts, Relief Aid and Education.

Table 1: Areas of Professional Endeavour

Engineering	Medical Research	Agricultural
Pharmaceutical	R & D	Education
Software	Information Systems	Financial Services
Legal Services	Aerospace	Procurement
Logistics	Insurance	Media
Arts	Relief Aid	Telecommunications
Utilities	Oil & Gas	Government

2. What impact does location or culture have on perceptions of success? Research on project phases (initiation, design, execution & termination) in an African and UK context concluded that western project management concepts are not universally valid (Muriithi and Crawford, 2003) and Diallo emphasises the importance of understanding successful outcomes within a cultural setting (Diallo and Thuillier, 2004). The writer's professional background is civil engineering and a couple of examples from direct experience provide an effective illustration of this issue.

   • The Department of Transport and Main Roads, Queensland had (and may still have) a unit in Cairns called the Remote Community Services Unit which worked with Aboriginal and Islander communities in Cape York and the Torres Strait Islands. On receipt of a request from a community the unit would undertake an investigation and design for a new/ rehabilitation project for engineering infrastructure (roads, airstrips, barge ramps, street works etc.). The resulting construction project team would comprise all suitable plant and operators available from the community with supplemental plant, operators and professional staff from the unit working together in a fully integrated manner. From a simple cost / time consideration, this may not have been the most efficient method of working. However, from the perspective of most community elders, one of the highest-level success outcomes of the projects was the level of experience and knowledge transfer that took place in association with the development and implementation phases of the project. The elders would probably not have specifically articulated this at the conceptual project stage unless they had prior knowledge of such benefits from other projects.

   • Whilst working in Namibia, Africa it was not uncommon to see project activities that do not make sense in a western developed environment. An example would be a team of 20 or 30 workers each with a pick or shovel strung at 2m to 3m centres along a verge alignment hand digging a trench for service conduits. The country has plenty of suitable equipment such as ditch witches and backhoes; why resort to such slow, labour intensive practices within projects? The answer was simply that the project would not be considered successful if it did not provide adequate employment opportunities in a country with a major unemployment problem. With no real social welfare system in the country, this project outcome put meals on the tables of a large number of households. The social benefits in the project location more than offset any minor cost and time impacts from such labour intensive approaches.

3. In balancing the various and often-conflicting stakeholder voices there is sometimes a need to take a long term view (Tabish and Jha, 2011, Wilson et al., 1999). Many major infrastructure and development programs cause significant change and disruption to the lives and livelihoods of local residents, businesses and community groups. Perceptions of a good project outcome articulated by these groups at the concept design stage may be very narrow and often negative (don't impact us, don't do anything etc.). It is quite possible that the same groups would have a far more complete appreciation of the level of success some years after completion when real outcomes can be felt by the community.

4. Do perceptions of success even within the fraternity of project managers depend upon the professional backgrounds of the project managers themselves? Within an engineering context (and more specifically a development works context where the writer has worked for many years) it is common for project managers to be drawn from a range of professional backgrounds which can be simplified as those with:

   • Formal project management accreditations

   • Engineering accreditations but without additional project management accreditations

- Other generic management backgrounds

It could be anticipated that the discipline associated with gaining the competencies required for project management accreditation will generate a perception that the use of these competencies will lead to a good project outcome. This would provide a pre-conditioning of outcome success that would not necessarily be present in project managers without accreditation.

Whilst Turner (2004) makes comment on a project starting with a stakeholder discussion on success criteria this is not completely relevant in the context of public sector programs which commonly have multiple stakeholders and wide ranging agendas and perceptions of success. Given the degree of complexity involved in trying to fully assess and define broad based success criteria, particularly in major public sector programs, it is not surprising that few programs extend their criteria much beyond the basic technical attributes of time, cost, scope and quality. The following framework is presented as providing a systematic approach to establishing a more complete assessment and management approach.

Development of a Framework to Assess Success Criteria

A fundamental step in the initial phase of most project management methodologies involves a stakeholder assessment and the generation of a strategy for managing each stakeholder relationship. The proposed framework builds off this work to provide a parallel and interconnected success criteria framework. An example of an appropriate plan is provided in Appendix B.

The framework has the three generic success categories introduced earlier in this article.

a. Core Outcomes: Direct measurable outcomes anticipated to be integrated into the contract documentation such as strategic goals, timeline, cost, scope & quality objectives.

b. Stakeholder Satisfaction expressed in three subgroups –

- Implementation Group: Those directly concerned with the project's design and implementation such as the client, implementation project managers, consultants, contractors & suppliers.

- Approval/ Endorsing Bodies: These generally comprise Local, State or Federal agencies having a role in approving or endorsing projects and ensuring that implementation complies with intended legislative outcomes.

- Other Effected Bodies: This represents a broad range of people who will be impacted by the project and consider that they should have a say regarding acceptable outcomes such as end users, the general public, local businesses, community groups etc.

c. Compliance to Project Management processes. May be considered alone or integrated into the outcomes for specific stakeholder groups.

Within each category, relevant sub-items will be established and success targets and management strategies will be identified. For example; "Stakeholder – Approval/ Endorsing Bodies" may include the Environmental Protection Agency (EPA) as a sub-item. Initial stakeholder discussions may lead to the following success targets generated from the EPA's perspective and acceptable to the client to fit in the project scope:

- Early and ongoing regular liaison

- Preparation of an environmental impact report early in the concept development to enable concept design work to integrate necessary report outcomes

- Agreed reporting processes throughout the life of the program

- Co-ordination prior to release of media statements on environmental issues

It is anticipated that a high percentage of outcomes will relate to the modes and timeliness of ongoing interaction with stakeholders as this is a common failure area in project delivery. The process has the advantage that it requires early discussions with stakeholders and focuses on achievable outcomes that can be accommodated within the project scope. The resulting project scope documentation then ensures that agreed outcomes are embodied into following design and implementation tender documentation.

Feedback on compliance to the criteria can be sought from stakeholders during meetings or electronically and should preferably use a scaled (Likert style) response with a comments range rather than a simple Y/N approach to allow a richer understanding of stakeholder perceptions.

An essential function of the success criteria framework is that it should be an ongoing management document allowing regular reporting, review and updating at key points as necessary to reflect changes that inevitably occur in all significant programs. Some preferred outcomes may be subject to later concept or detailed design confirmation that may lead to modification or abandonment at that time.

Conclusion

There is no simple generic set of success criteria that can be applied to complex projects or programs, particularly those in the public sector. In association with the preparation of a stakeholder management strategy, a success criteria framework can be developed which will help to clarify expectations of the broad variety of stakeholders commonly associated with public sector programs and assist in the management processes to ensure that stakeholder satisfaction is maximised.
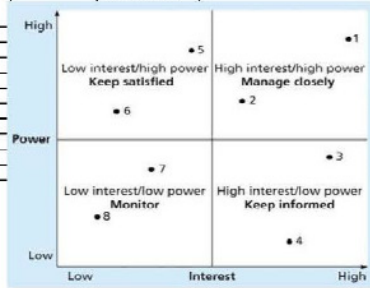
Appendix A

Summary of Project Success Criteria

Criteria	Muller 2010	McLeod, Doolin & MacDonell (2012)	Bryde & Robinson 2005	Bryde (2005)	de Wit 1988	Geoghegan 2008	Zwikael 2006	Pankratz & Basten 2014	Westerveld 2002	Bakhsheshi & Nejad 2011	Atkinson 1999	Thi & Swierczek (2010)	Kerzner 1987	Belassi & Tukel 1996	Dvir, Sadeh & Malach-Pines 2006	Muller & Turner 2007	Muller & Jugdev 2012	Przemysław 2013	Pankratz & Basten 2014	Cserhait & Szabo 2014
Core Project Outcomes																				
On time	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
On budget	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
On Quality	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
Within scope		✓										✓	✓							
Meeting user requirements	✓	✓	✓			✓	✓			✓	✓						✓	✓	✓	✓
Reoccuring business	✓																✓			✓
Reliable product																		✓	✓	
Compliance to Processes																				
Good project processes			✓			✓	✓	✓											✓	
Good post audit analysis													✓							
Stakeholder Satisfaction																				
a) Implementation Group																				
Supplier satisfaction	✓					✓		✓	✓		✓					✓	✓	✓	✓	
Team satisfaction	✓		✓		✓		✓		✓		✓					✓	✓			✓
Achieves its purpose	✓					✓	✓	✓		✓	✓					✓	✓	✓	✓	✓
Client satisfaction		✓		✓								✓								✓
b) Approval/ Endorsing Bodies																				
																				✓
c) Other Effected Groups																				
Other stakeholder satisfaction	✓		✓						✓		✓					✓	✓			✓
End-user satisfaction	✓	✓				✓	✓	✓	✓		✓	✓				✓	✓	✓		✓
Customer satisfaction	✓		✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓		✓	
Community benefit															✓					✓

Appendix B

Sample Stakeholder Management Strategy

STAKEHOLDER MANAGEMENT STRATEGY

Log Ref	Organisation	Name/ Contacts	Position	Power/ Interest	Strategy	Interaction	Desired Involvement	Desired Success Criteria	Agreed Success Criteria	Client Approval	Stakeholder Feedback
1	A B Developments	Mr. C. Lient	MD Development. Client	5/4	Ensure all stakeholders identified Discuss Consultancy Brief early	see log	Regular progress reports No surprises	All requirements of consultancy brief Early intervention with issues No bad press	As desired	Y	Seek satisfaction response 3 monthly Yr 1 then 6 monthly
2	Internal	Mark Jones	GM/ Project Services	4/3	Compliance to company PM processes	Regular compliance meetings	Monthly project reports. Periodic process audits	Pro-active management demonstrated Nil non-conformances	Ad desired	Y	Response to regular progress reporting
3	EPA	John Smith jsmith@epa.gov.au	Snr Liaison Officer, Development	5/5	Involve pre-concept design. Seek united approach.	see log	Early involvement + regular updates	See comment	Design to best practice Community perceptions to be well managed Regular meeting with EPA		
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											

Power / Interest grid:

- High
  - Low interest/high power — **Keep satisfied** • 5
  - High interest/high power — **Manage closely** • 1
  - • 6
  - • 2
- Power
  - Low interest/low power — **Monitor** • 7
  - High interest/low power — **Keep informed** • 3
  - • 8
  - • 4
- Low
- Low — Interest — High

Project Title: Development AB Industrial Lands

Log Ref: 1 — Stakeholder Register

Organisation: EPA

Name: John Smith

Position: Snr Liaison Officer, Development

Email: jsmith@epa.gov.au   **Phone:**

Address:

Interest Rate: 5   **Comment:** Very high. John sees site as being potentially very problematic

Power Rate: 5   **Comment:** EPA can stop approval process and/ halt works if issues are not well managed

Interaction Strategy: Involve John at concept stage
Seek regular update meetings
Seek united approach for media interactions and community strategy

Interaction Log: *[Log of all informative interactions. Reference associated file documents.]*
3/4/16: Initial phone call. John happy for briefing
10/4/16: Initial meeting outlining proposed interaction strategy. John happy but needs approval for formal response.

Desired Involvement: *[investigate extent of involvement sought by stakeholder without committing to allow this without Client support]*
John generally happy with strategy but EPA needs to demonstrate independence. They will advise us of media responses only.

Desired Success Criteria: *[Consider each outcome group: Core Outcomes, Compliance to Processes & Stakeholder Satisfaction]*
Design catering for management of contamination and other EPA sensitive issues
No registered environmental events
No bad community perception

Agreed Success Criteria: Design outcome subject to best practice approach
Community perceptions to be well managed
Regular meeting with EPA to control process

Agreed Satisfaction Feedback: 6 monthly satisfaction survey + end of project survey

Client Agreement: Feedback:

Satisfaction Feedback:

Report by: **Log:**   **Date:**

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Implementing Strategy through P3M and Benefits Management

A Case Study of the Defence Science and Technology Group

Raymond Young[1], Roger Vodicka and Richard Bartholomeusz[2]

1 University of New South Wales Canberra and corresponding author: Raymond.Young@unsw.edu.au
2 Defence Science and Technology Group, Department of Defence.

Abstract

The problem of project failure has persisted despite concerted efforts to overcome the issue. Project, program and portfolio management (P3M) and benefits management are being promoted as a solution. However, the uptake of benefits management has been low, even in the countries that are thought leaders in this area. This paper addresses the call for further research to be undertaken to identify the key factors that may enable the uptake of benefits management and also to explore how benefits management fits within P3M approaches in organisations. This paper has explored these issues using an action-research case study within the Defence Science and Technology Group, Department of Defence (DST Group). It has confirmed that P3M and benefits management are organisation-wide initiatives and found that implementation is difficult because it requires a change in organisational culture driven by the top management team. Technically benefits management appears to be difficult because it is necessary to reconcile the many strategy documents produced at the various levels within a large organisation. Benefits management was found to be compatible with P3M approaches but it seems extensive technical training is necessary to introduce benefits management tools into an organisation. Despite these difficulties, the case study is producing promising results and further research is needed to form a definitive view on the key factors for the uptake of benefits management.

KEYWORDS:

Benefits management, strategy, PPM, P3M, project portfolio management

Introduction

The problem of IT project failure has persisted over the past 50 years despite intensive efforts to try to resolve the issue (Caminer, 1958; PMI, 2016; Standish, 2013). This problem affects business more generally because projects are undertaken to implement strategy (Kwak and Anbari, 2009) and substantial amounts are being invested on projects without much evidence that strategic goals are being realised (Kiechell, 2010; PMI, 2016; Young and Grant, 2015). Nobel laureate Daniel Kahneman reports disappointing results in all types of large projects in areas as diverse as manufacturing, marketing and mergers and acquisitions (Lovallo and Kahneman, 2003).

It is argued that increasing control can help deliver the outcomes needed to realise strategic goals (Tjahjana et al., 2009). The types of controls that have been tried in the past are mainly at the project level and include project steering committees and project management methodologies and processes (Office of Government Commerce, 2009; PMI and Cleland, 2008). More recently the controls that are being advocated are at the program and portfolio level and one promising development is in the area of benefits management (Badewi, 2016; Bradley, 2010; Breese et al., 2015; Chih and Zwikael, 2015; Ward and Daniel, 2012). This may show promise because projects

tend to focus on the delivery of outputs, whereas programs focus on the delivery of outcomes and benefits management is an integrative discipline that links outputs to outcomes and can link outcomes to strategy (Jenner, 2012; Laursen and Svejvig, 2016; Zwikael and Smyrk, 2012).

However, the uptake of benefits management has been low, even in the countries that have been thought leaders in this area, and Breese et al. (2015) suspect there are barriers to adoption. In many cases effective benefits management requires a change in organisational culture, something that is notoriously difficult to achieve. Breese et al. (2015) have suggested further research be undertaken to identify the key factors that may enable the uptake of benefits management and also to explore how benefits management fits within P3M approaches in organisations. The opportunity to research these questions presented themselves when DST Group embarked on an organisation-led strategic initiative to implement P3M as its approach to investment and explore through action research the viability of benefits management to prioritise, manage and assure its capabilities and the value of its work program. This paper reports on the work-in-progress.

Methodology

An action research methodology was adopted because DST Group has a practical problem that needs a solution which may be better delivered by trialling or testing the viability of the approach rather than by theoretically based academic research (Brydon-Miller et al., 2003). Furthermore, the theory on project failure has been found to be ineffective. More specifically the action based research methodology is appropriate as it allows for theory to emerge as the intervention is adapted to the specific context of the issue to be addressed and as the participants reflect on their theories-in-use (Eden and Huxham, 1996; Schön, 1983).

The action research was informed by the designs applied by Middel et al. (2005) and Coughlan & Fergus (2009) and one or more cycles in what is known as a "hermeneutic spiral" were used to clarify understanding and generate theory (Figure 1) (Gummesson, 1991).

Figure 1: A Hermeneutic Spiral

Each cycle consisted of four overlapping stages: plan, act, observe, and reflect.

- STAGE 1: Clarification: The status of the DST Group P3M initiative was reviewed with key DST Group and Defence of Department documents such as the DST Group Strategy, Domain S&T strategies[1], Defence White Paper and associated documents. Researchers were also trained

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[1] With its Defence clients, DST Group has developed S&T strategies that describe for each domain (Maritime, Land, Aerospace, Joint and Intelligence) the key focus areas for S&T and the military objective that may be realised through research.

on Investment Logic Mapping (Victorian Department of Treasury and Finance, 2017), the preferred DST tool for business case development. The objective of this cycle was to try to find a common understanding of the desired outcomes.

- STAGE 2: Planning: This cycle involved development of a benefits management framework. Theory was drawn from best practice and matched with DST Group and Defence Department conceptual frameworks whenever possible.

- STAGE 3: Act & Observe: The proposed benefits management framework was presented to key stakeholders and refined based on feedback. More work is planned to develop this framework.

- STAGE 4: Reflect: Benefits management and P3M theories were developed based on the degree that the actions matched expectations.

- Minutes and reflective notes were kept during the project to document the possible richness and complexities. In addition to formal meetings for reflection, the research constantly included informal reflection as part of the process.

Case Study: Implementing Benefits Management to improve P3M in the DST Group

Stage 1: Clarification

DST Group provides scientific advice and innovative technologies to meet Australia's Defence and National Security challenges. DST Group is part of the Department of Defence and DST Group is Australia's second largest publicly funded research organisation with approximately 2,100 scientists, engineers, IT specialists and technicians. DST Group is organised into 37 Major Science and Technology Capability (MSTC) areas that have been developed to deliver outcomes against Defence and National Security strategies.

DST Group provides value through its capacity to reduce and mitigate strategic and operational risks and to create and maintain a capability edge. DST Group has a need to explain how it adds value and an audit report found that "it is difficult for the Group to demonstrate quantitatively the extent to which its portfolio of work aligns with Defence's strategic priorities."(ANAO, 2015, p. 10). In addition, the 2016 Defence First Principles review identified a recommendation that DST Group "be required to clearly articulate its value proposition". In response to these reviews a formal report was developed to articulate the value delivered to Defence through science and technology capability and a new investment process to align work with strategic priorities was initiated.

DST Group makes considerable effort to liaise with each of the Defence and National Security client domains. The client feedback is positive but issues related to prioritisation of the DST Group capabilities and the research program have been raised. In the past DST Group scientists prioritised work in consultation with clients using primarily a bottom-up process across a large number of requirements (over 1000 in total). The large number of client requirements made it difficult to evaluate and agree the overall priorities across a large number of Defence stakeholders.

Project, Program and Portfolio Management (P3M)

DST Group's Science and Technology Program Office (PO) has implemented a formal investment process to try to redress the balance and allow senior management and the client more input on where resources should be allocated. In 2015-16 the 37 DST MSTCs were allowed to make up to five bids for funding to develop and sustain the capability and deliver to the client domains. Decisionmakers initially considered and ranked around 170 proposals addressing the client requirements. When the bids were consolidated at the MSTC level it became difficult to easily resolve the investment needed for capability sustainment from that needed for delivery to the

client. DST Group also undertakes strategic research in alignment with nine research themes as outlined in the DST Group Strategic Plan and these were considered separately to the MSTC bids.

In 2016-17 the investment process was refined using a P3M approach (Figure 2 and 3) where investment was first decided at the Portfolio and Program level before undertaking S&T Project prioritisation within a Program later. In this way a smaller number of bids may be considered in separate steps. The investment process is being supported by using Investment Logic Maps (ILM), a tool that had been developed by the Victorian Government in the early 2000s, to provide a standard means to outline the business case for investment proposals (Jenner, 2012). A business case is being produced to identify the raise, train and sustainment needs for each MSTC (37 capabilities in total), one business case for each strategic research initiative (SRI) area (nine in total) and around 20 to 25 business cases for each client domain (approximately 100 to 120 in total). DST Group is delivering ILM training and aims to develop all their business cases over a 2-month period. Investment reviews will be undertaken in late March and April 2017 where investment will be prioritised and allocated. The Program Office recognised DST Group may not get it right initially, but received agreement from the leadership team that the organisation would learn by doing.
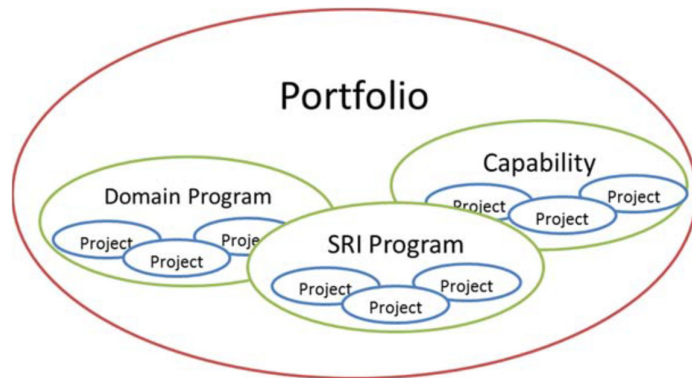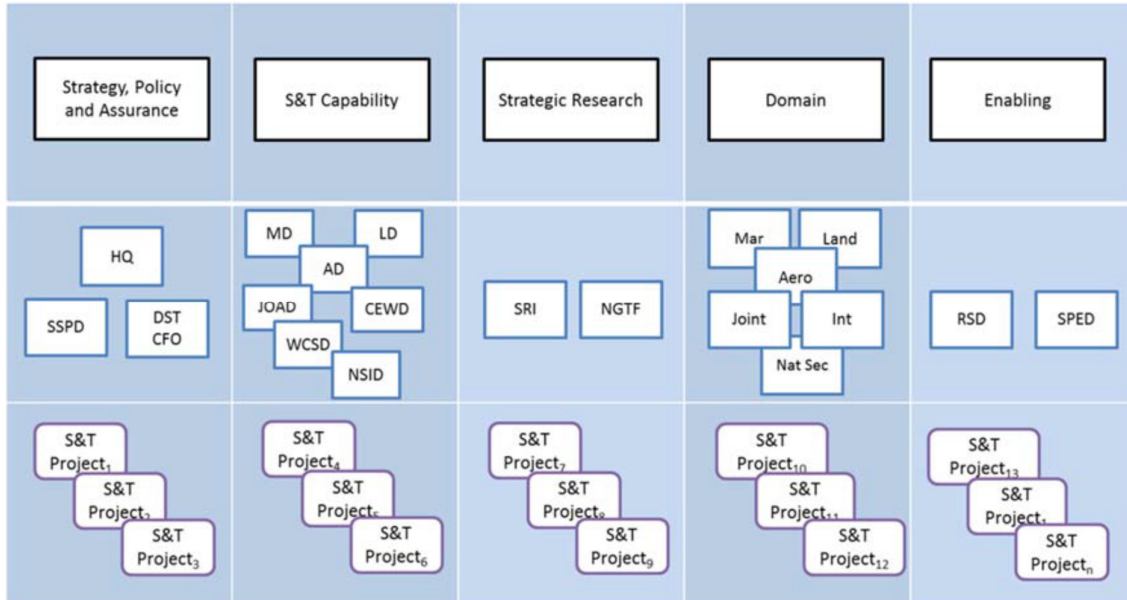

Figure 2: DST Group P3M Approach

Figure 3: DST Group Portfolio, Program and Project framework[2].

Stage 2: Planning

The researchers in this project realised they may add value by developing a benefit framework[3] that could be used as an input for developing the ILMs or business cases. Young had conducted research in the State of Victoria and found that the delivery of the state's strategic goals had not improved in a 10-year period of study despite a long history of usage with ILMs (Young et al., 2012). Benefits management has been introduced in the State of Victoria to manage its projects, and the researchers postulated that the introduction of such a framework may also assist DST Group in both showing the value of its capabilities and program, but also to ensure the outputs aligned to the strategic goals of Defence.

The researchers turned to the Defence White Paper[4] to look for an organisation-wide set of benefits. The White Paper states an objective to have a regionally superior defence force and also specifies Preparedness, Capability and Future Capability as criteria for measuring superiority. The White Paper also highlighted an innovative defence industry and international engagement as objectives so the benefits framework proposed in Figure 3 was used to capture all of these criteria.

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[2]   HQ – Headquarters; SSPD – Science Strategy and Program Division; CFO – Chief Finance Officer; MDMaritime Division; LD – Land Division; AD –Aerospace Division; JOAD – Joint Operations Analysis Division; CEWD – Cyber and Electronic Warfare Division; WCSD – Weapons and Combat Systems Division; NSID – National Security and Intelligence Surveillance and Reconnaissance Division; SRI – Strategic Research Initiative; NGTF – Next Generation Technologies Fund; Mar – Maritime Domain; Land -Land Domain; Aero – Aerospace Domain; Joint – Joint Domain; Int – Intelligence Domain; Nat Sec – National Security Domain; RSD – Research Services Division; and SPED – Science Partnerships and Engagement Division.

[3]   https://www.vicroads.vic.gov.au/~/media/files/documents/planning-and-projects/benefit-managementframework-new-09012017.pdf?la=en

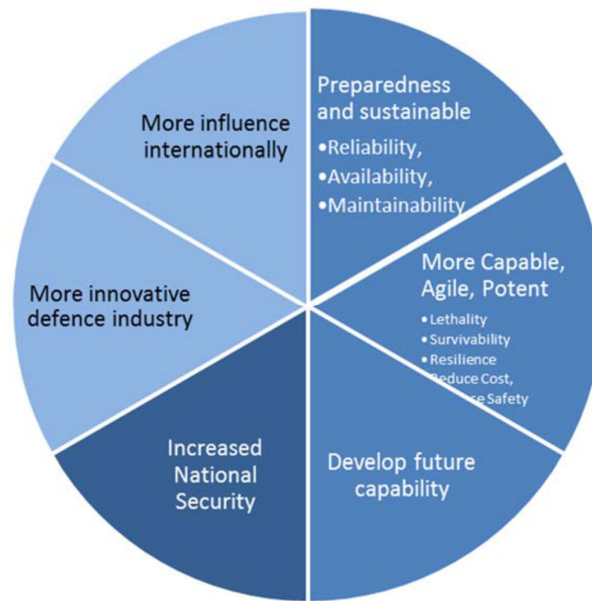[4]   http://www.defence.gov.au/whitepaper/

Figure 4: Benefits Framework - first draft

The benefits framework in Figure 4 was initially tested with stakeholders and while the framework was observed as being a good reflection of the priorities in the White Paper a view of benefits that was more closely aligned with Defence client domains was also sought. The researchers noted that the DST Group Domain S&T strategies may provide such a mechanism.

A review of investment and management approaches in other Defence organisations[5] found such organisations appear not to have developed an explicit benefits framework to evaluate their projects. This meant DST Group would probably have to pioneer a benefits management approach for integration with their P3M approach.

Two conceptual breakthroughs occurred to the team. The first was that outputs, and hence benefits, were delivered by cross-functional projects that sometimes also required input from multiple technical areas (Figure 5). Benefits tracking and assessing the contribution of each MSTC to Defence outcomes is therefore not straightforward. In addition, there is often a long time delay between the delivery of outputs from an S&T project and benefits realised within the Defence client domains. In long-range strategic research areas this lead time can be decades long. Tracking benefits well after a project has ceased to exist is therefore a significant challenge for the organisation.

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5   http://www.onr.navy.mil/About-ONR/science-technology-strategic-plan.aspx
     http://www.defenseinnovationmarketplace.mil/resources/2014_AFRL_Strategic_Plan_Final_PA_Approved.pd
     https://www.gov.uk/government/publications/dstl-corporate-plan-2014-2019
     http://www.arl.army.mil/www/pages/172/docs/ARL-S%26T-Campaign-Plans-FINAL.pdf
     http://www.acq.osd.mil/osbp/sbir/docs/DoDSBIRStrategicPlanFinal.pdf
     http://www.darpa.mil/work-with-us/opportunities
     http://www.darpa.mil/work-with-us/office-wide-broad-agency-announcements
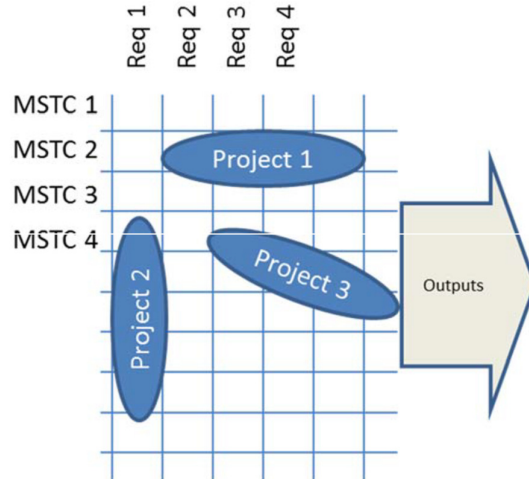
Figure 5: Outputs delivered through cross-functional input areas

The second conceptual breakthrough was to realise that in a research and development environment, not every project will have customer benefits as some projects are undertaken to develop the fundamental scientific knowledge and facilities needed to improve the capability of a MSTC and prepare it to respond to Defence needs at short notice. This relationship is shown schematically in Figure 6. The categories in the capabilities framework (left circle in Figure 6) were based on the categories used in periodic DST Group external benchmarking assessments of the MSTCs.

The benefits framework in Figure 6 was tested against a key DST Group strategy document which defines the capability of each MSTC (DST S&T Capability Portfolio[6]). This document describes the capabilities of each MSTC. It was found that all the key capability descriptors corresponded to one or more of the segments in the benefits framework.
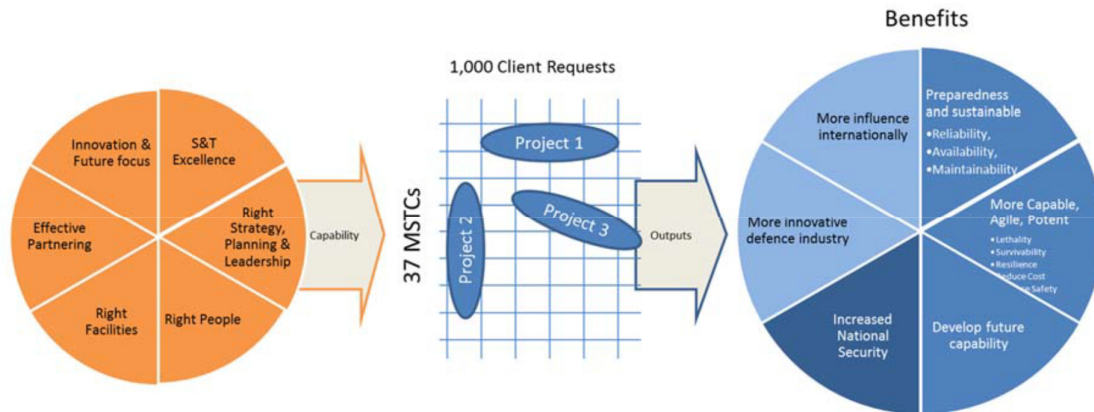

Figure 6: Benefits framework in an R&D organisation

Stage 3: Act and Observe

The benefits framework was consulted with stakeholders within DST Group to seek feedback. It was agreed that the framework may be useful and should be tested during the action research. An alternative is to allow benefits to be identified independently during the development of each

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6   https://www.dst.defence.gov.au/

business case rather than pick a benefit from a predefined framework. It is noted that, VicRoads, one of the exemplars of the Investment Management Standard used an organisation-wide benefits framework. In addition, the novelty of the capabilities framework (left circle in Figure 6) was noted and accepted because it leveraged the existing DST Group MSTC benchmarking assessment criteria.

The benefits framework was then presented during an ILM training workshop with DST Group managers. It provoked discussion and attempts were made to apply the framework during a workshop exercise to produce some example business cases. The benefits framework was found to be helpful but the capability framework was more problematic. A second half-day workshop was held to further develop the example business cases. This second workshop found the benefits framework of some use in guiding thinking (rather than providing a pick-list of possible benefits), but found the capability framework was more useful in guiding potential solutions than suggesting benefits. Conceptually the problem may be because there is an overlap between the business cases produced to represent the technical areas (MSTCs) and those produced to describe the delivery of S&T outcomes to clients.

The next step is to roll out training and develop business cases in each of the 37 technical areas. Progress will be monitored closely to see if the benefits framework adds any value and whether it has to be revised to reflect learnings.

STAGE 4: Reflection

This paper has been written to identify some of the key factors in the uptake of benefits management and to explore how easily benefits management may fit within the approach to project, program and portfolio management (P3M). The case study is of an R&D organisation that has a high level of motivation to implement both P3M and benefits management because they wanted to thoroughly address the recommendations of the First Principles Review and the ANAO audit. What has been found is that despite this high level of motivation, benefits management may not be that easy to implement.

Organisational Change

Firstly, organisational culture was identified by Breese et al. (2015) as a crucial factor for benefits management to be successful. DST Group had a major driver to implement P3M and benefits management: they want to avoid any negative findings from future audits and Defence reviews.

The senior management group had bought into the P3M initiative, but the case suggests a lot more is required than a superficial level of top management support (TMS). The P3M initiative was part of a broader strategic initiative called 'D2 - Strategic engagement with client focus' which was designed to improve client focus and engagement. This was one of ten strategic initiatives identified in the DST Group S&T Strategy and was led and managed by two senior executives. The strategic initiative was given significant management support and resources and was subject to scrutiny through quarterly progress reviews. The team responsible for the D2 Strategic initiative placed a high degree of emphasis on communication and consultation with staff at all levels within the organisation to identify how P3M may be successfully adopted. A change management plan was also developed which included an emphasis on organisational culture. The executive leadership team also requested briefing sessions on how the new P3M processes would work and they thoroughly discussed all of the details before committing to continue with the initiative. The case confirms previous findings that TMS is crucial for projects to succeed and provides a specific example of the need for TMS for P3M and benefits management projects (Young and Jordan, 2008; Young and Poon, 2013).

Key factors in the uptake of Benefits Management

The P3M initiative at DST Group is a work-in-progress and it is not yet possible to claim Benefits Management has been adopted. What has been done to date is the development of a benefits framework to inform the development of business cases (ILMs).

The case suggests that the holistic implementation of benefits management is quite difficult. It was possible to develop a benefits framework, but to develop a framework which would gain widespread acceptance was difficult. The researcher had theorised that the benefits framework would emerge from a reconciliation of all the existing strategy documents. What was found was that there were a large number of strategy documents that were difficult to reconcile due to specific terminology and jargon adopted, for example within each of the Maritime, Land, Aerospace, Joint and Intelligence domains. The benefits framework that was developed guided some business cases and was not used for other business cases. It is not yet clear whether business unit business cases can align with high level Defence objectives specified in the Defence White Paper in the way the framework assumes or whether benefits need to be set at a more tactical level, perhaps at the level of the objectives identified within each of the specific client domains.

Breese et al. (2015) have suggested the tools used have to be easy to use and deliver results. In this case, this meant reusing data within DST Group and introducing as few new concepts as possible. For example, DST Group MSTC benchmarking assessment criteria was incorporated into the benefits model even though the benchmarking criteria were not benefits as traditionally understood (Figure 6).

What this experience highlights is that the development of a useful benefits management framework is likely to be technically difficult. We believe a holistic framework is necessary because it has been shown to be the best practice of the Victorian government and because a holistic framework is likely to overcome the issue of projects outputs not leading to strategic outcomes (Young et al., 2012). A large effort is likely to be needed to socialise the resultant benefits framework and gain widespread acceptance in an organisation. Again, it is likely that TMS will be necessary for a benefits framework to be accepted and implemented in an organisation. This will need to be tested in future cycles of the action research.

Benefits Management and P3M

The final research question was to explore how easily Benefits Management fitted into P3M processes. The case was quite clear and showed that benefits can be one of the key criteria in deciding where to allocate funds.

The Investment Logic Map (ILM) was adopted as the tool to assess project business cases. Benefits management does not have to use ILMs, but it does need a tool of some sort to understand the relationship between projects and benefits (Jenner, 2012). In this case, the ILM had distinct advantages because the structure of the ILM resembles the structure used in the DST Group program domain strategy documents which link military objectives to science and technology requirements (Figure 7). The second column of the ILM is specifically focussed on the benefits and key performance indicators that are being targeted. The ILM only required solutions to be added (the two right columns of Figure 7) to develop an investment proposal for consideration by decision makers.
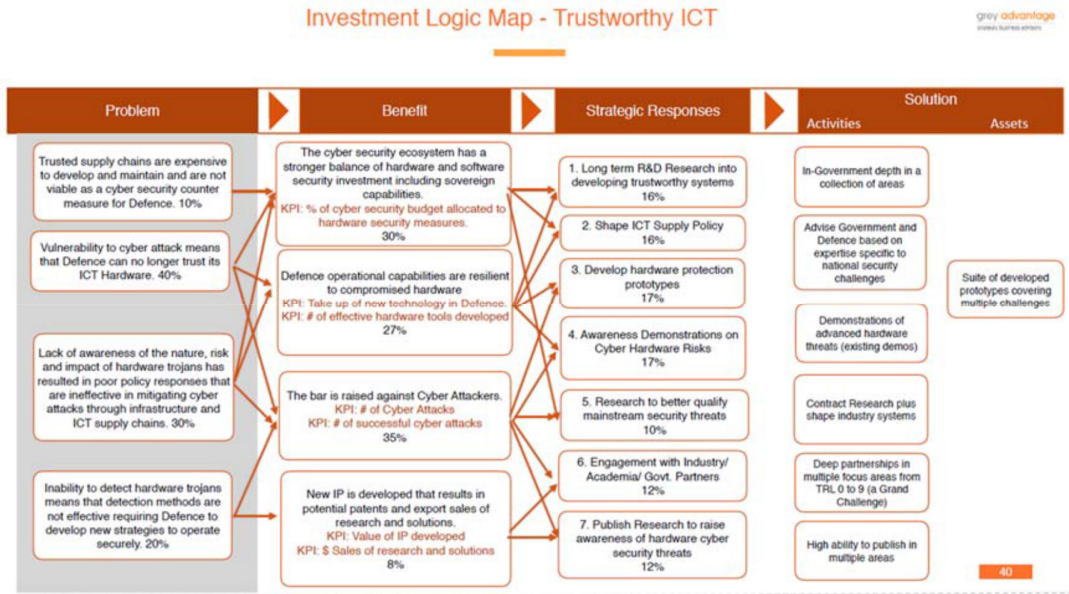
Figure 7 Example ILM that describes cyber research related to information and communication technology (ICT)

However, the adoption of the ILM was no trivial matter because it required training and extensive communications to ensure understanding and compliance. In addition, it was important to understand how to apply ILMs in the DST Group environment and to develop exemplars for the organisation to use when drafting business cases. The case showed adoption of a tool can be labour intensive and conceptually a significant hurdle for an organisation to overcome.

Conclusion

The problem of project failure has persisted despite concerted efforts to overcome the issue. Project, program and portfolio management (P3M) and benefits management are being promoted as a solution. However, the uptake of benefits management has been low, even in the countries that have been thought leaders in this area, and Breese et al. (2015) suspect there are barriers to adoption. This paper addresses the call for further research to be undertaken to identify the key factors that may enable the uptake of benefits management and also to explore how benefits management fits within P3M approaches in organisations.

This paper has explored these issues using an action-research case study. It has confirmed that P3M and benefits management are organisation wide initiatives and found that implementation is difficult because it requires a change in organisational culture driven by the top management team. Technically it appears to be difficult because it is necessary to reconcile the many strategy documents produced at the various levels within a large organisation. High calibre insider knowledge is needed to identify the relevant strategy documents and reconcile them with benefits management concepts. Benefits management was found to be compatible with P3M approaches but it seems extensive technical training is necessary to introduce benefits management tools into an organisation. Despite these difficulties, the case study is producing promising results and further research is needed to form a definitive view on the key factors for the uptake of benefits management.

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Strategic management of the Defence S&T Portfolio: Are we there yet?

Raymond Young[1], Roger Vodicka and Richard Bartholomeusz[2]

1 University of New South Wales Canberra and corresponding author: Raymond.Young@unsw.edu.au

2 Defence Science and Technology Group, Department of Defence, Australia

Abstract

This paper studies an exemplary case of strategy implementation in the Defence Science and Technology Group (DST), a group within the Australian Government Department of Defence. Through three action research cycles between 2016 and 2018, the study has found that DST progressed from an organisation where it was considered difficult to demonstrate strategic alignment of its work to Defence needs to an organisation that manages its portfolio strategically. The lessons for other organisations is to manage improvements in the investment allocation process not so much through the introduction of new tools but as a change management project driven through top management support. A technical lesson is that decision-making about budgets needs to be at the level at which strategy is implemented, that is at a program rather than at a project level. Further research is recommended within Defence and other organisations to evaluate whether strategic benefits can be realised if resources are allocated strategically.

Keywords:

Strategy implementation, project program portfolio management, resource allocation.

1 Introduction

1.1 Difficulty ensuring resources are strategically aligned

Research studying organisational performance over long periods has found little evidence that strategy is being implemented and goals realised (Kiechell, 2010). Research in the public sector has found that projects contribute little to strategy (Young et al., 2012; Young and Grant, 2015). Like any large organisation, Defence needs to ensure its resources are focussed on delivering its strategic goals, articulated in the 2016 Defence White Paper (Department of Defence, 2016).

One difficulty is that large organisations have a tendency to be bureaucratic and unable to respond to turbulent environments and emergent conditions. Defence historically was organised around traditional army, navy and air force structures with independent chains of command. In 1976, the government made a strategic change and established the ADF to place the services under a single headquarters. In 2016, a review of Defence from first principles took this one step further and concluded "that a holistic, fully integrated One Defence system is essential if Defence is to deliver on its mission in the most effective and efficient way" (FPR, 2016, p. 7). This First Principles Review has been quite influential with a recommendation that "implementation of the changes required to deliver One Defence is in place in two years [2018]" (FPR, 2016, p. 7).

1.2 Size of the Defence Portfolio

The Australian Government allocated A$34.7 billion to the Australian Defence Organisation in the 2017–18 financial year. This level of expenditure is equivalent to approximately 1.9% of Australian

Gross Domestic Product (GDP) and 7.28% of total Australian Government expenditure. In terms of people, Defence consists of approximately 60,000 staff in the ADF permanent force and 18,000 civilian staff in the Department of Defence. It is one of the largest organisations in Australia. Within that, DST manages a Portfolio consisting of 2100 civilian staff and a total budget of approximately $450 million.

1.3 DST: a Group within Defence

This paper will present an action-research study of one organisational unit, DST, within Defence and evaluate progress in aligning resources towards Defence's strategic goals. DST is an exemplar organisation that provides scientific services to all areas of Defence.

In 2015 DST received an audit recommendation to improve its resource allocation processes because "it is difficult … to demonstrate … the extent to which its portfolio of work aligns with Defence's strategic priorities" (ANAO, 2015, p. 10). DST formally satisfied this recommendation by developing and implementing innovative processes to allocate resources strategically and is starting to be recognised for this within Defence. The lessons learned may apply to any large organisation trying to improve its effectiveness in implementing strategy.

The paper firstly presents the methodology followed to study how to implement strategy, then presents a case study of three action research cycles within DST, and finishes with some reflections and a conclusion.

2 Methodology

An action research methodology was adopted because DST has a practical problem that needs a solution which may be better delivered by trialling or testing the viability of the approach rather than by theoretically based academic research (Brydon-Miller, Greenwood and Maguire, 2003). More specifically the action based research methodology is appropriate as it allows for theory to emerge as the intervention is adapted to the specific context of the issue to be addressed and as the participants reflect on their theories-in-use (Schön, 1983; Eden and Huxham, 1996).

The action research was informed by the designs applied by Middel et al. (2005) and Coughlan & Fergus (2009) and one or more cycles in what is known as a "hermeneutic spiral" were used to clarify understanding and generate theory (Gummesson, 1991). Each cycle consisted of four overlapping stages: plan, act, observe, and reflect. The research is ongoing and started two years ago in 2016 with the lead academic researcher on site for up to two to three days per week. This paper reports on the intervention after three action research cycles from 2016 - 2018.

3 Case Study

3.1 Background

DST provides scientific advice and innovative technologies to meet Australia's Defence and National Security challenges. DST is part of the Department of Defence and is Australia's second largest publicly funded research organisation. DST is organised into seven research divisions and three enabling divisions. Within the research divisions there are 37 Major Science and Technology Capability (MSTC) areas that have been developed to deliver outcomes against Defence and National Security strategies. DST predominantly delivers outcomes across five Defence domains (Maritime, Land, Aerospace, Joint and Intelligence) and one broader National Security domain.

DST Group provides value to Australia's defence and national security through its capacity to reduce and mitigate strategic and operational risks and to create and maintain a capability edge (DST, 2016). However, while DST has successfully delivered high value outcomes to Defence it has needed to improve the way it strategically manages its Portfolio which was highlighted in a recent recommendation made by the 2016 Defence First Principles review which stated that DST "be required to clearly articulate its value proposition". The Australian National Audit Office (ANAO) undertook an independent performance audit into DST's management of science and technology work for Defence. The audit found that DST had begun a process of implementing initiatives for improving the effectiveness of program planning through its strategic plan. It recommended DST build on these to more effectively manage at a more strategic level.

DST responded to these reviews by introducing a new Project, Program and Portfolio Management (P3M) framework and investment process to better align the resources available within its Portfolio with Defence strategic priorities. Table 1 summarises three action research cycles DST have undertaken to date to manage its portfolio more strategically.

3.2 2015 – 2016 Action Research Cycle 1

DST makes considerable effort to liaise with each of the Defence and National Security client domains through direct engagement by its science and engineering workforce as well through scientific advisers assigned to each major area within Defence. DST identified areas of work in consultation with clients using primarily a bottom-up process consisting of gathering detailed client requirements (over 1,200 in total from the Defence Groups and Services). The large number of client requirements and the bottom up process of resource allocation made it difficult to agree the overall priorities across multiple Defence stakeholders.

In the first action research cycle, a new investment process was initiated to try to raise the level of abstraction for decision making from 1,200 client requirements to 37 MSTCs. The 37 MSTCs were allowed to make up to five bids for funding to either develop and sustain the capability or deliver to the client domains. Decision-makers initially considered and ranked around 170 proposals aiming to address the 1,200 client requirements. However, when the bids were consolidated at the MSTC level it became difficult to easily resolve the investment needed to develop S&T capability from that needed for delivery to the client. In addition, the bids considered only funding and did not attempt to prioritise staff effort.

3.3 2016 – 2017 Action Research Cycle 2

The investment process was refined and a Portfolio, Program and Project (P3M) approach was introduced as the means to provide a hierarchical structure for investment decision-making. This meant that priorities were first decided at the Portfolio and Program level before undertaking individual project prioritisation within a Program. The Portfolio was divided into five streams that separated investment into the MSTC capability, direct delivery to Defence domains, long-range strategic research as well as enabling functions covering policy, strategy and research services. This approach now provided a framework that enabled decisionmakers to prioritise internal funding to maintain S&T capabilities (MSTCs) separately from client requirements. The net result was that a smaller number of project-level business case proposals were considered in separate steps and a more strategic overview was provided for senior decision makers. Each project-level business case aggregated a number of related client requirements and was presented using an Investment Logic Map (ILM) that clearly captured the value proposition of each project (Victorian Department of

Treasury and Finance, 2017). In the first iteration of this process only three of the five streams were considered:

- A single business case was produced to identify the raise, train and sustainment needs for each MSTC (37 capabilities in total);

- One business case for each investment in the two programs that comprise the strategic research stream (21 in total); and

- A total of 61 business cases covering the client domains (Maritime, Land, Aerospace, Joint, Intelligence and National Security).
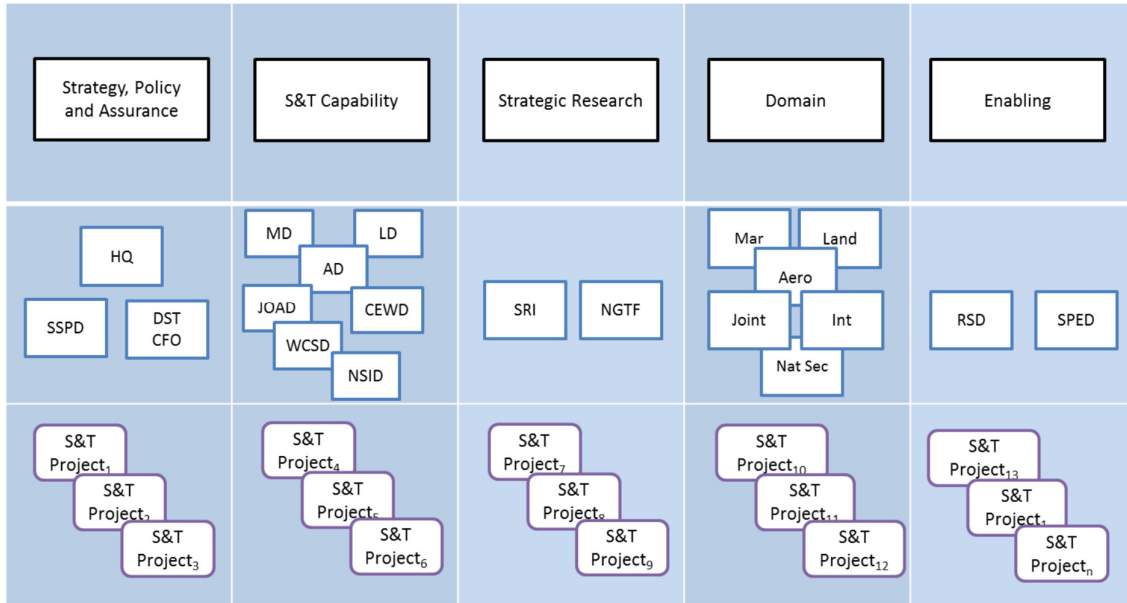

Figure 1: DST P3M Framework.

The investment process included a series of reviews that considered the projects related to a given Program within the P3M framework. The reviews consisted of panels made up of DST leadership and one-star and two-star Defence stakeholders. Defence panel members commented favourably on the high level of visibility provided by the new process and they were able to advise DST managers where to decrease work on some projects and increase work in others. In this iteration, a maximum change of 5% funding for each project was considered, as staff were still transitioning from planning by client requirements to stating project-based business cases using ILMs. One notable outcome occurred when a Defence stakeholder identified an opportunity to share a major Defence asset which would create a large cost saving in delivering a particular program.

However, the P3M process was undermined to some degree because it was not fully aligned with the budgeting process. Not all of the projects that required funding were captured in the first iteration and it was later identified that additional funding was required to fund projects that were agreed outside of the investment process. The result was that the total commitment now exceeded the available budget and every business unit had to accept a cut in their budget even when the P3M process had identified projects where the budget should be increased.

3.4 2017 – 2018 Action Research Cycle 3

By 2018, the P3M process was now accepted across the entire organisation. A decision was made to undertake the agreed investment process across all of the five streams within the Portfolio. DST senior management and finance managers made a commitment to ensure that all investment decision-making would be captured using the investment process to ensure that the process could prioritise the entire Portfolio budget. Despite the success of the investment process in allocating funds to projects within a given program, it was decided that there needed to be a mechanism to more strongly instil a culture of prioritisation and re-allocate funding more broadly across the Portfolio streams and programs. To respond to this need a modified zero-based budgeting (ZBB) step was now introduced where 15% of the funding was removed from every program. These funds were then reallocated to the highest priority projects and programs across the entire Portfolio, as identified by the priorities from each individual investment review. Program leaders were given the authority to reallocate the remaining funds within their program to the projects with the highest strategic priority. This step reinforced the role of the Program manager, who now had to make difficult strategic investment decisions that they had to negotiate with their stakeholders. One-star and two-star Defence stakeholders saw the strategic nature of the decision-making and commented that the DST process provided a structured and efficient approach to the reallocation of resources across the streams within the P3M framework.

A weakness of this process was that it was not able to easily reallocate staff resources to the area of highest strategic need in the same way as funds. The re-allocation of staff is inherently more difficult as the skillsets of available staff may not be readily applied to priority delivery areas without an additional investment in recruitment or re-skilling (to develop new or increase capacity in S&T capabilities). Defence outcomes in these priority areas may therefore not be realised in the short term, despite additional funding available to them. Consideration of staff reallocation will be undertaken in the next iteration of the investment process along with a stronger link between workforce planning and investment decision outcomes.

Planning is now starting to focus on institutionalising the P3M processes by upgrading project management software and management information systems. This will require further change to the way DST conducts its business and will need additional skills to be developed through tailored training in program and project management.

Table 1: Summary of Action Research

	2015-16	2016-17	2017-18
Overview	Attempted to prioritise 1,200 client requirements. Requirements formed the basis of work allocation and reporting.	Project level investment: consolidated client requests into 120 projects for prioritisation – Defence clients saw a strategic view for the first time.	Zero based budgeting with balancing at program & portfolio level – Defence clients provided positive feedback on the investment process.
Key Details	First Principles Review, and recommendations from ANAO report. 1,200 client requirements.	Research delivery business units only. 119 projects (ILM) / 3 out of 5 Portfolio streams: Up to 17 projects assessed in each program. Investment adjusted ±5% @project level.	All business units. 130 projects (ILM) / All 5 streams. Zero based budget -15% @program level.

People	Senior Management introduced a change initiative to engage Defence more strategically. PROSCI change management training.	Stakeholder roadshows: many P3M presentations and extensive consultation. Program Office gave feedback to improve ILM & presentations	Program management introduced (but role not clarified).
Perspective	P3M introduced within Defence S&T Program Office. Domain S&T Strategies developed with client. Investment process introduced to prioritise MSTCs.	Investment was first decided at the Portfolio and Program level before undertaking Project prioritisation within a Program. Senior management: (re)allocation of funding to highest priority projects within a program. Entire budget not considered	Program and Portfolio level budgeting. Senior management: explicit (re)allocation of funding to program with highest strategic priority. Staff were not prioritised
Tools	ILM train-the-trainer delivered.	Extensive ILM training.	New project management tools and information systems to be introduced.

4 Reflection and Generalisation

DST is an interesting case study because it provides a context not too dissimilar to the Manhattan Project and the origins of modern day project management. DST scientists like the Manhattan Project scientists are not generally interested in project management as a discipline. It is interesting to reflect on how much of the project management body of knowledge that has developed over the past eighty years should have been taught at Los Alamos if it were possible. Lenfle & Loch (2010) suggest the answer is very little because project management has come to emphasize control over the flexibility and novelty needed for the Manhattan Project. In DST's case, the need is not so much new tools to control processes, but to demonstrate alignment of effort with Defence's strategy and delivery of value.

Another insight is had by reflecting on the DST corporate initiative to introduce improved investment management and client focus. It has been quite successful to date but this result is much more than a case of introducing a P3M framework and standard business case formats through investment logic maps. The recommendations from a recent audit (ANAO, 2015) and the change in strategic direction within Defence (FPR, 2016) provided the catalyst for action and the success of the initiative was due in large part to the strong support of top management to address these issues. Top management realised that if the situation was untreated there was an unacceptable risk that DST could lose support from its Defence stakeholders and fail to deliver its full potential in meeting the strategic goals of Defence. This case is an example of successful change management and it suggests success for P3M initiatives is heavily dependent on ongoing top management support for strategic investment process changes. Extensive consultation is necessary and staff at all levels within the organisation have to be supported as they make fundamental changes to their existing business practices.

A lesson that was learnt through the three action research cycles is that funding needs to be allocated at the level where the strategic decisions need to be made. Initially decisions were made to

prioritise 1,200 client requirements. Then decisions were made to prioritise projects and finally decisions were made to prioritise at the portfolio and program level. DST took a relatively cautious approach by lifting the level of decision making to a more strategic level as they gained experience. In addition, the amount of funding that was re-allocated was also increased. Initially a change of only 5% in funding was considered at the project level but then the process moved to the modified zero-based budgeting approach which removed 15% of the budget from each program. The impact of this cut at the program level and the empowerment of the program managers to reallocate project funding within their programs had the greatest impact in aligning the Portfolio towards the highest value areas for Defence.

5 Future Research

The title of this paper asks "are we there yet?" In the case of DST, it is probably one to two action research cycles away from where it needs to be. Budget was prioritised in the last cycle, and staff also need to be allocated to the most strategic capabilities to have assurance that the desired outcomes, articulated at the strategic level of the Defence White Paper (Department of Defence, 2016), are being realised.

Further research within DST is recommended to study whether the strategic allocation of resources leads to an improvement in achieving superior Defence capabilities. This research should contribute to the benefits management literature as well as the portfolio management literature.

Further research should also be conducted within other Defence organisations. It takes more than DST's S&T to have superior capabilities; it needs to be embedded and operationalised within Defence as a whole because the desired outcome is a Defence capability rather than a DST capability. Further research should also be conducted within other organisations in general. The issue being studied in this action research is how to implement strategy and realise strategic goals (Kiechell, 2010; Young and Grant, 2015). DST has shown one promising way forward, perhaps the lessons can be transferred to other organisations outside the Defence context.

6 Conclusion

There is little evidence that organisational strategies are implemented effectively (Kiechell, 2010) and the public sector has been found to be particularly ineffective (Young and Grant, 2015). This paper studies the implementation of strategy between 2016 – 2018 in DST, a group within Defence.

Through three action research cycles, the study has found that it is possible to go from an organisation where it was considered difficult to demonstrate the extent to which its work contributes to strategic priorities to an organisation that manages its portfolio strategically. The lessons for other organisations is to manage improvements in the investment allocation process not so much through the introduction of new tools, but as a change management project driven through top management support. A technical lesson is that decision-making about budgets allocation needs to be at the level at which strategy is implemented, that is at a program rather than at a project level.

Further research is recommended within Defence and other organisations to evaluate whether strategic benefits can be realised more effectively if resources are allocated strategically.

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Benefits Realisation Management Practices: Are they worthy?

Authors: Troy Allen, Saeed Munir

Abstract

This research provides evidence of the practical application of benefits realisation management in an exemplary organisation. It considers 16 practices identified in the literature and conducts a qualitative deep dive into a single case study to consider which of the 16 practices were undertaken in a complex project and how successful they were in delivering benefits to the organisation.

Introduction

In the delivery of projects there is often a disconnect between the benefits described in the business case that initiates a project, and the realisation of benefits following project delivery. Typically projects have a tendency to focus on the delivery of the outputs of the project while the harvesting of benefits is not undertaken. This may be caused by the common understanding that benefits are mostly realised after project delivery and are therefore not the concern of the project itself but rather fall under program management responsibility (Musawir, Serra, Zwikael, & Ali, 2017). This typical approach leads to large numbers of projects being delivered that do not realise strategy for the organisation. This represents a failure of decision-making in organisations and poor use of available resources to achieve strategic outcomes.

Good project governance and benefits management have a positive effect on project success when tested against three criteria: project management delivery; performance in realising a business case; measuring the value generated by projects (Musawir, Serra, Zwikael, & Ali, 2017). Therefore project governance and benefits management practices should form an essential component of better management practice.

This paper seeks to develop an understanding of how benefits management practices are engaged in an exemplar organisation. Are the benefits management practices described in the literature being introduced in project management in practice and are these effective? Which of the benefits realisation management practices are most effective and aid in delivering the strategic outcomes sought by an organisation? This research will seek to ask these questions through a study of a recent Defence project to develop an outcome-focused, goal-based regulatory system for the Defence maritime community. This case study provides the opportunity to develop an understanding of how benefits management practices were employed throughout the project life cycle and if benefits management practices provide utility in decision making and delivering a project that contributes benefits to organisational strategic outcomes.

Literature review

Project realisation vs. benefits realisation

Within the field of project management and management more generally, the topic of benefits realisation management is still maturing (Aubry & Sergi, 2017). In recent years organisations have had an increased emphasis on benefits realisation management practices, but continue to inadequately link delivered benefits with the planned benefits from the project business case (Marnewick, 2016). The historical emphasis in project management has been on the well-known triple constraints of scope, schedule and cost (Zwikael & Smyrk, 2012). This continued focus on

project management performance has left a vacuum in the important tasks of identifying outcomes that align with organisational goals, developing projects to deliver outputs that will achieve those outcomes, and measuring the successes of these projects against the benefit outcomes stated in the business case. The literature does not provide significant practical guidance on how to form benefits at the initiation of projects or how to appraise and harvest benefits at the conclusion of projects (Chih & Zwikael, 2015).

The approaches to benefits realisation management in the literature differ greatly. While some models suggest that benefits realisation management should be identified and measured at the portfolio level, others have taken the view that benefits realisation management should be conducted at project level, or even at all levels. There is a lack of consensus in the literature on how benefits realisation management should be undertaken (Aubry & Sergi, 2017). As a result of this ambiguity, interest in benefits realisation management is growing among both professionals and academics. Professionals are looking for benefits realisation management processes that have proven successful.

Why aren't benefits realisation management practices working yet?

Many organisations are now engaging in some form of business realisation practices, predominantly at the project initiation stage where benefits are being articulated for the purpose of demonstrating the need to initiate projects. In practice, benefits are often overstated in business cases in order to secure project funding (Aubry & Sergi, 2017), the outcomes are typically not assessed at the conclusion of the project (Marnewick, 2016), and the expected benefits are not delivered (Aubry & Sergi, 2017). The literature suggest that this can happen for a number of reasons:

- An assumption that once project outputs are delivered that the benefits will not be realised until sometime after project delivery (Musawir, Serra, Zwikael, & Ali, 2017)

- Organisations fail to link delivered benefits to the business case (Marnewick, 2016)

- The benefits are not articulated and measured during project execution (Patanakul, Kwak, Zwikael, & Liu, 2016)

- Projects are often declared successful if the outputs are delivered, even when there are no associated benefits (Zwikael & Smyrk, 2012).

The literature has not yet reached consensus on a consistent way of forming or appraising target benefits (Zwikael & Chih, 2014), and where attempts to measure benefits are made at the end of projects, the measures of benefit success are frequently determined after delivery of the project outputs (Aubry & Sergi, 2017). Moving from the academic view to the pragmatic organisational view and understanding how benefits realisation practices are being engaged in a real organisation will contribute to the literature by closing the gap between academic theory and professional practice.

The need to conduct deep research into a case study

With the overall poor understanding of how to successfully achieve benefits realisation management in practice, and conjecture among researchers on how to conduct benefits realisation management, it is clear that a robust and consistently successful business realisation management practice could provide a significant competitive advantage to organisations. On reviewing the research, the literature lacks focus on ways in which organisations actually practice benefits realisation management (Aubry & Sergi, 2017) and whether they are successful. This gives rise to the research question in this paper: which of the elements of benefits realisation management practices are

actually being utilised for the delivery of a project and program in an exemplar organisation? A deep dive into a working example of how benefits realisation management has been conducted in practice will serve to test contemporary models and contribute to understanding the utility of the components of these models.

Methodology

A deep dive into a single case study will be undertaken using an explanatory qualitative positivist methodology (Shanks, 2002) that will provide a basis for empirical testability of 16 benefits realisation practices put forward in the literature.

This methodology has a distinct advantage over alternatives such as a survey or experiments because it permits a deep dive into a practical example of benefits governance practices in an experienced government agency. Defence has been chosen for this case study as it is an exemplary organisation, highly experienced in delivering a variety of programs and projects in a government context. Governance practices are well established in Defence and therefore it likely that the research will observe practices that may not be seen in smaller and private organisations.

Evidence was gathered through formal governance documents, interviews and observation of program activities. Interviews were conducted with four interviewees who were involved with the project delivery. The interview question was "what do you understand of the benefits of the seaworthiness management system and how were these described, monitored and measured for success?"

Rigor was maintained through corroborating evidence from multiple sources. This research is guarded against biases by using impartial assessment criteria to minimise subjective analysis during the gathering of evidence. The research sought to confirm through evidence the presence of 16 specific practices of benefits realisation management.

Case study

In response to a number of reviews on the governance of maritime activities, in particular the Rizzo review (2011), Defence initiated a new regulatory and assurance system, the Defence Seaworthiness Management System (DSwMS), to better oversee governance and assurance of Defence maritime objectives and materiel.

DSwMS is an outcome-focused, goal-based regulatory system that establishes 6 regulatory goals with 32 functional objectives ranging from having risk management strategies in place through to having controls for the structural integrity of vessels, navigation and competence of personnel. Where maritime systems are deemed compliant with the functional objectives, Defence has justified confidence that maritime mission systems will maximise operational effect while minimising safety and environmental risks. DSwMS reduces risk and provides a system of due diligence for capability managers in Defence.

The project to define this regulatory system and establish the Office of the Defence Seaworthiness Regulator responsible for compliance and assurance against the system, and representing Defence regulatory and legislative maritime interests, took approximately 4 years at a cost of $27.8 million dollars. Complex activities included establishing a regulatory manual, training personnel across multiple Groups in Defence, engaging with legislative agencies, delivering information technology, accommodation and recruitment for an office of approximately 70 people. The Office is engaged in ongoing delivery of a program of education, compliance and assurance against DSwMS for all

Defence maritime activities. Implementing DSwMS is a significant cultural change in the delivery of Defence maritime capability.

Table 1 – 16 benefits realisation management practices

Identify target benefits	Disciplined governance	Project owner – single point of accountability	Continuous improvement
Project outputs integrated into the business	Objective measurable outcomes	Service delivery focus	Stakeholder management
Baseline measures	Know measures collection methods	Strategic fit	Benefits harvested
Benefits tracked	Project plan achieved	Realised business case	Would fund project again?

Analysis of the case study against the 16 benefits realisation practices in table 1 that recent literature champion as making strong contributions to successful project delivery, reveal that target benefits were identified at the outset of project and articulated clearly in a formal business case initiated by the project sponsor, the Chief of Navy. The target benefits were intangible and strategic in nature. The business case clearly described the accountabilities for project participants including the single accountable senior officer responsible for delivery of the strategic project outcomes and the project manager responsible for project outputs as well as significant stakeholders and project committee members.

The project used PRINCE2 management principles and the MIT90 model to determine significant project outputs that aligned with the strategic benefits. Governance practices were engaged significantly at the project level with weekly reporting by the project manager to the senior officer responsible for delivery. Project delivery was split into two discrete components running concurrently; implementation and transition. The implementation component was responsible for developing the regulatory system including the minutiae of the 32 functional objectives that comprise the regulations, and assisted mission system capability managers developing compliance strategies to adhere to DSwMS. Implementation was responsible for developing the complete system including a DSwMS operating model. The transition component was responsible for implementing the cultural change across Defence. This included establishing the Office of the Defence Seaworthiness Regulator (ODSwR) to implement the operating model. The transition team achieved success through developing a learning and training initiative known as 'suitably qualified and experienced personnel'. This learning system developed the skills and knowledge of DSwMS amongst stakeholders at all levels in Defence as well as the staff employed in the ODSwR.

Major project milestones were aligned with the capacity for Defence to undertake project outcomes as ongoing activities in core Defence business. A leader-follower model was used whereby the project would lead the development of a capability as a project output until it had matured to a level where it could be transitioned into a sustainable practice in Defence. At that time responsibility would be handed to Defence and the project team would follow providing lag support. Project milestones were established at the outset of the project and were reviewed at the point in time when they were scheduled to be achieved.

To harvest and measure benefits, as a project outcome the ODSwR includes an analysis and continuous improvement team responsible for analysing the enterprise risk to Defence and identifying risk trends uncovered through the implementation of DSwMS. This analytical team was not expected to be able to produce analysis against the benefits of implementing DSwMS for

approximately 12 months following project closure. It is acknowledged that determining if there are improvements to the cycles of reform in Defence will take 5 to 10 years to uncover.

To measure benefits during the project, a review of the cycles of reform in Defence over the past 30 years was undertaken. This review considered whether the regulatory changes delivered through DSwMS would have likely achieved a better outcome during those reforms. The project also measured the number of changes to DSwMS regulatory framework in the first 12 months following its creation reasoning that less change would indicate that a stable and comprehensive framework had been delivered.

During project delivery there were some occasions where stakeholder engagement was low or waning, particularly by senior leaders in Defence. At these times engagement was invigorated by the project sponsor reinforcing the importance of the project outcomes and alignment with Defence strategic outcomes and the accountabilities of key of stakeholders.

At the conclusion of the project a formal handover report was developed and provided to the ODSwR. At that time, while the project was considered closed there were some outstanding implementation deliverables where stakeholders had not fully developed compliance strategies within the project timetable. Responsibility to assist with the development of these deliverables was passed to the Office.

Success of the implementation can be observed throughout the organisation through changes in language used in the maritime community aligning with DSwMS language and planning activities being mindful of DSwMS considerations.

Results and discussion

Summary of results

Table 2 provides a summary of results, describing the 16 benefits realisation practices championed in the literature, and identifies which of these were engaged in the case study and at what level in the organisation they were managed (portfolio, program or project level).

Table 2 – Results summary

Management Practice	Was it evident in the case study?	Management layer engaged in practice	Notes	Literature
Identify Target benefits	Yes	Portfolio	Intangible and without measures	(Musawir, Serra, Zwikael, & Ali, 2017) (OGC, 2009) (Chih & Zwikael, 2015)
Disciplined governance	Yes	Project Program	Prince2 methodology Formal design processes (MIT090) used to determine some project outputs Weekly reporting against the project plan	(Musawir, Serra, Zwikael, & Ali, 2017) (Zwikael & Smyrk, 2015)
Project owner - Single point of accountability	Yes	Project Program Portfolio	Clear single accountabilities at all levels. Formally documented	(Musawir, Serra, Zwikael, & Ali, 2017)

				(Zwikael & Smyrk, 2015)
				(Chih & Zwikael, 2015)
Continuous review of target outcomes	No	Project	Outcomes once identified were never adjusted or modified. Focused on achieving project milestones on time Major project milestones were reviewed and adjusted once achieved at the project level	(Musawir, Serra, Zwikael, & Ali, 2017) (Musawir, Serra, Zwikael, & Ali, 2017)
Project outputs integrated into the business	Yes	Project	Well planned and deliberately programmed as project outcomes at the project level Integration was a major consideration in definition of all major milestones	(Musawir, Serra, Zwikael, & Ali, 2017)
Objective measurable outcomes	No	Project	Outcomes were clearly described but intangible No useful quantifiable measures Project milestones were qualitatively measurable as capability maturity	(Musawir, Serra, Zwikael, & Ali, 2017) (OGC, 2009) (Chih & Zwikael, 2015)
Service delivery focus	Yes	Project	Developed and implemented a formal program to educate project team and stakeholders on the outputs of the project and cultural change	(Zwikael & Smyrk, 2015)
Stakeholder management	Yes	Project Program	Project integration stream primarily focused on stakeholder management Evidence of project adjusting methods to gain stronger stakeholder engagement with a major stakeholder Significant attention on education of stakeholders and developing stakeholder buy-in to cultural change	(Zwikael & Smyrk, 2015) (Musawir, Serra, Zwikael, & Ali, 2017) (Mossalam & Mohamad, 2016)
Baseline measures	No	Project	Theoretical efficacy of proposed organisational change was quantitatively assessed against previous major reviews that had occurred in the past 30 years	(OGC, 2009)

Know measures collection methods	No	Project	Project recorded potential measures for the future but did not consider ways of gathering evidence in support	(OGC, 2009)
Strategic fit	Yes	Portfolio	Benefits developed and endorsed by portfolio sponsor in alignment with organisational strategy	(Chih & Zwikael, 2015)
Benefits harvested	No	Project Program Portfolio	Intangible benefits can be seen across the organisation however have not been formally identified Acknowledgement at the program/portfolio level that it will take a significant period of time to harvest benefits (5+ years) and an analysis team was designed to measure and harvest	(Musawir, Serra, Zwikael, & Ali, 2017)
Benefits tracked	No	Project	Outcomes of project were tracked against major milestones as a description of project output maturity only	(Musawir, Serra, Zwikael, & Ali, 2017)
Project plan achieved	Yes	Project Program	Formal project closure documented and communicated	(Zwikael & Smyrk, 2012), (Zwikael & Smyrk, 2015)
Realised business case	Yes	Program Portfolio	ODSwR provide ongoing delivery of DSwMS Ongoing reporting of change implementation at portfolio level	(Zwikael & Smyrk, 2012), (Zwikael & Smyrk, 2015)
Would Fund project again?	No	Nil	The question of whether this is a good use of resources has not been asked throughout the organisation	(Zwikael & Smyrk, 2012)

Discussion

Overall the results of this case study support many findings of previous research. Of 16 practices, 9 are being engaged meaningfully and predominantly at the earliest stages of the project.

Measuring benefits may not be necessary for projects with intangible benefits

The project determined during the design phase that measuring benefits would be of little value throughout the project lifecycle. This contrasts with the conventional view of benefits management practice suggesting benefits should be measured in order to link strategic target benefits with project results, but is supported by previous research that found benefits were often not determined till after project delivery (Aubry & Sergi, 2017). This case study demonstrates that where

the benefits are intangible, measuring the benefits may be determined to provide little strategic value until well after project delivery. It therefore may be acceptable to lower the priority of benefits measuring practices. This may especially be the case in public sector projects where the strategic benefits are opaque and difficult to assess (Chih & Zwikael, 2015).

In the case study where they attempted to measure benefits (stability of regulations over 12 months, theoretical impact of framework during past 30 years of reform) there appeared to be little strategic decision-making value derived from the conclusions apart from reinforcing the desire to continue delivering the project.

It is crucial for senior managers to consider the strategic value of projects

In the case study the project sponsor articulated and communicated the benefits they sought through supporting and initiating the project. This shows that senior leaders were concerned with the project creating value that is in strategic alignment with organisational goals (Zwikael & Smyrk, 2012) even when they were not precisely understood and measurable. It was of critical concern for senior leaders to link project benefits to organisational goals despite methods of measuring being unknown (Musawir, Serra, Zwikael, & Ali, 2017). This implies that the project sponsor accepts that benefits may not be apparent until many years after project delivery and had confidence that the delivery of project outcomes would deliver benefits in time.

A single point of accountability at the portfolio level is critical for success

The confidence described above suggests that having clear single points of accountability to the portfolio level is a critical success factor for the harvesting of benefits over the long term. In the case study, the ability for the senior portfolio leader to reinforce the strategic alignment of the project with the organisation (Musawir, Serra, Zwikael, & Ali, 2017) and commit stakeholders to continued engagement with the project was a decisive factor in keeping the project outputs on track. Therefore, those at the portfolio level need to understand the critical nature of their accountability and role in leading projects and programs and more actively engage with projects and project links to organisational strategy (Young & Jordan, 2008). This is a critical enabler for projects to create value, which should be an ongoing concern for senior leaders (Zwikael & Smyrk, 2012). The case study suggests that continued engagement and governance by those at the portfolio level improves project outcomes and harvesting of benefits for cultural change management and ensure that the benefits continue to be pursued after project closure.

Integrating outcomes into core business has a strong influence on delivering benefits

During the course of the case study some project deliverables were delayed and created risk of delivering the project on time and scope. The practice of integrating project outcomes into the core business through the learning and training program delivered by the transition team enabled the project to hand over responsibility for these deliverables to Defence. This enabled the project to continue delivering on time, scope and cost. The case study suggests that the integration of project outcomes into core business can strongly contribute to delivering benefit for the organisation. The first benefits observable in the case study were the integration of language change in the organisation. It follows that for a change management project with intangible benefits, integration practices should be considered one of the most important practices to undertake and commit resources towards.

Benefits management practices are not normalised after the project initiation stage

Benefits management practices engaged by the case study tended to align with the literature at the earliest stages of the project - identify benefits, disciplined governance, single point of accountability, strategic fit - but were under utilised during the later stages of the project. The implication is that the benefits management methodologies in practice are not normalised as is

typically championed in the literature, and that a single benefits management methodology may not be adequate for organisations (Musawir, Serra, Zwikael, & Ali, 2017). Flexibility may be more useful in practice.

Conclusion

This research agrees with previous research showing that benefits practices are not being widely implemented (Musawir, Serra, Zwikael, & Ali, 2017). Overall this research shows that benefits management practices are not yet normalised in a large Australian government organisation. This is likely to be a conscious decision based on the nature of the intangible benefits the organisation is seeking when conducting widespread change management. The organisation is deliberately targeting benefit harvesting practices to be conducted well after the delivery of the project. The implications suggest that where organisations are engaging in benefits harvesting they are doing so with a long lens. This may contribute to understanding why organisations focus on project outputs over benefits delivery. In the case study there was a strong focus early in the project lifecycle on ensuring that project outputs would deliver outcomes aligned with the organisational strategy to harvest benefits over the long term. Single and clear accountabilities from project delivery to project sponsor enabled this goal and the specific benefits management practices engaged during the project contributed.

Limitations and further research

The findings of this research are constrained significantly by the methodology. The case study chosen may not be indicative of other projects delivered in Defence or throughout government and therefore the benefits realisation management practices may not be typical. The practices in a change management project may differ significantly from other projects such as materiel or information technology.

This research presents evidence suggesting that further study into organisational benefits management practices from a practical perspective is justified. It provides a comprehensive positivist methodology, but research into a single case study is insufficient to draw strong conclusions.

Further research into the ways in which organisations engage in benefits harvesting and measuring over the long term would be useful; a follow up on this case study in two to five years would uncover if the projects intent to measure benefits in the future were undertaken and successful.

If benefits measures are intentionally being ignored during project delivery, it would be useful to undertake research to understand what the implications of this are, in particular, what information are they missing in strategic decision-making by not engaging benefits harvesting throughout the project life cycle. The obvious implication is that delivering projects over a period of four years (the case study was a four year project) where the strategic value is not revisited during that time may find that the project does not deliver value to the organisation even where senior leaders felt that it would do so at the outset. This may lead to projects only sometimes delivering value at a high material cost to the organisation.

Conflict of interest

The author Troy Allen began working in the Office of the Defence Seaworthiness Regulator in August 2017 and therefore has an interest in the ongoing program in this case study being delivered successfully. It is not possible to remove all conflicts of interest under this circumstance but the author has followed the methodology presented and was not responsible for any project deliverables in the case study.

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Handling Uncertainties and Preparing for the Unexpected in Real-life Project Scheduling

Ripon K Chakrabortty[1]*, Alireza Abbasi[2] and Michael J. Ryan[3]

1, 2, 3   Capability Systems Centre, School of Engineering and Information Technology,
University of New South Wales, Canberra 2600, Australia

E-mail: 1 r.chakrabortty@student.adfa.edu.au *Corresponding author
2 a.abbasi@unsw.edu.au
3 m.ryan@adfa.edu.au

Abstract

Managing resources in different simultaneous, and often interrelated, projects is the principal goal for any solution to the Resource Portfolio Problem. To maximise the project gain, optimal allocation of limited resources is essential and is the principal goal of a typical resource constrained project scheduling problem (RCPSP). The early work reported here demonstrates the utility of RCPSP over traditional critical path method by scheduling one large real-life project. We employ the most relevant types of uncertainties in real-world scheduling problems and outline some important propositions or guidelines for practitioners. To do so, we consider a RCPSP in which resource availabilities and resource requests may vary from period to period for each of the activities, which may also have uncertain durations. After successfully solving using one existing meta-heuristic approach, some useful insights are available.

Keywords

Project Scheduling; Uncertainties; Resource Constraints

Introduction

The use of a project-based approach in organisations is increasing such that many organisations are involved in managing several projects and/or programs (groups of relevant projects) at the same time. The traditional approach to project management (PM) is to consider corporate projects as being independent. Yet, the relations between projects within the multiple-project environment have been recognized as a major issue for corporations (Payne, 1995). Therefore, research in this field has recently shifted towards project portfolio management (PPM). Although a number of studies have been developed to understand how PPM affects project performance, the core processes of any typical PPM approach are still not well formed. Padovani and Carvalho (2016) identified core processes in PPM, among which they considered resource allocation and management (RA&M) as an important activity to be included in the prioritization step. Considering these findings, the basic functions of PPM can be categorized in three domains (see Fig. 1): RA&M, time scheduling, and cost planning. As shown in Figure 1, the core functions of RA&M encompass selecting, prioritizing, optimising and sequencing of portfolio of projects, while considering optimal allocation of resources (Padovani & Carvalho, 2016). These optimizing and sequencing steps in RA&M resemble RCPSP, which is a rudimentary scheduling problem in a deterministic project framework.
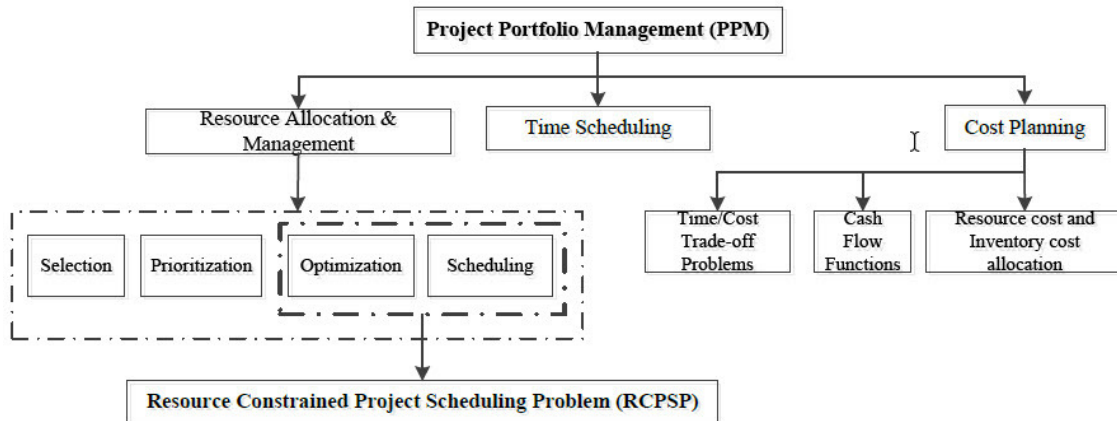
Fig. 1: RCPSP, as a branch of PPM (part of this figure taken from Padovani and Carvalho (2016))

Until recently, research on RCPSP has mostly considered fixed resource capacities and deterministic activity durations. In real-world environments, however, it is impracticable to obtain only deterministic information. Consequently, uncertainty has become an inevitable aspect of project scheduling in recent decades, which also stems from the necessity of considering stochastic resource constrained project scheduling problems (SRCPSP). A SRCPSP is defined as a problem that involves scheduling project activities with uncertain durations, in order to achieve a predefined objective, such as to minimise expected project makespan, minimise project schedule instability, and/or minimize some other predefined objective, subject to precedence constraints and renewable resource constraints (Tseng & Ko, 2016). Moreover, in real world applications, resource requests and capacities can vary over time along with the activity processing times or durations. Though appealing, this sort of extension has never gained any attention in the scientific literature, apart from some earlier works of Hartmann (2012, 2015). In those papers, a priority rule is developed for the study on RCPSP with time-dependent resource capacities and requests (referred to as RCPSP/t).

This paper aims to investigate and show the effectiveness of RCPSP techniques over traditional methods by considering one real-life scheduling problem. In the later part, in lieu of assessing all possible types of uncertainties in real-world scheduling problems, we consider an important variant of RCPSPs in which resource availabilities are given for each period of the planning horizon, and resource demands are given for each period of an activity's duration, which itself is uncertain. Furthermore, resource capacities and demands are also considered to vary with time parameters. The resulting problem is referred to as RCPSP/t$\tilde{d}$ to represent the time-dependency of resource parameters and durational uncertainty. After successfully solving that RCPSP/t$\tilde{d}$ setting, some important guidelines or propositions are also outlined for the practitioners. Those propositions will help them to handle this kind of adverse situations by predicting the project completion time and other important scheduling parameters under dynamic situations.

Effectiveness of RCPSP methods for Project Scheduling

To illustrate the effectiveness of RCPSP methods, we consider one real-life scheduling problem, the Highway Bridge (HB) project, which consists of 44 activities with varying daily resource demands. Three types of renewable resources (e.g., workers, machine A and machine B) are considered with the maximum availability limit of each resource being 12, 8 and 8 per day, respectively. Figure 2 shows the precedence relationships (network diagram) of the HB project. The duration of each project activity is indicated above the corresponding circle node. The amount of required resources

is indicated below the circle node. The precedence constraints among activities are described using arrow lines. To schedule that project, this paper employs the evolutionary local search heuristic approach (ELSH) from Chakrabortty et al. (2017).
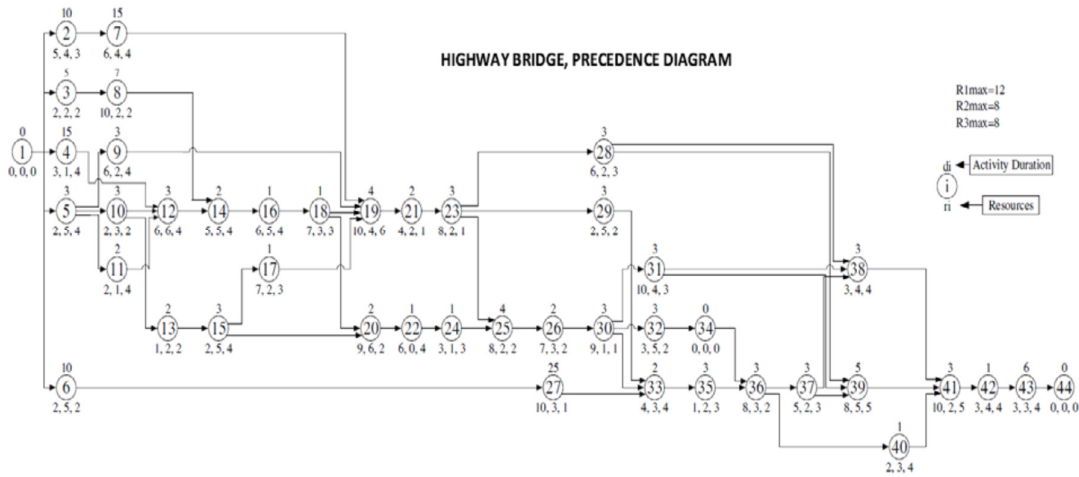

Fig. 2: Network diagram of the Highway Bridge project (Tran et al., 2016)

Traditionally practitioners most often consider critical path method (CPM) to predict project completion time, which ignores resources availability and constraints, which violates practicability. As can be observed for the HB project, the completion time can be 69 days (as shown in Figure 3), if a project manager neglect resource considerations. Second scenario could be while a project manager considers resource constraints using resource-levelling techniques but does not apply RCPSP principles. In that case, his planned project completion time will be 126 days, as shown in Figure 4. Meanwhile, as can be observed from Figure 5, after applying RCPSP concepts or optimising resource-levelling problem, the project completion time drops to 117 days. Hence, application of RCPSP principles with an optimised way of resource allocation or levelling is very useful for the practitioners in predicting more accurate project completion times. In a nutshell, without precise knowledge on RCPSP, a project manager can plan or predict project completion time. However, on most cases their prediction is either too restrictive or too lenient.
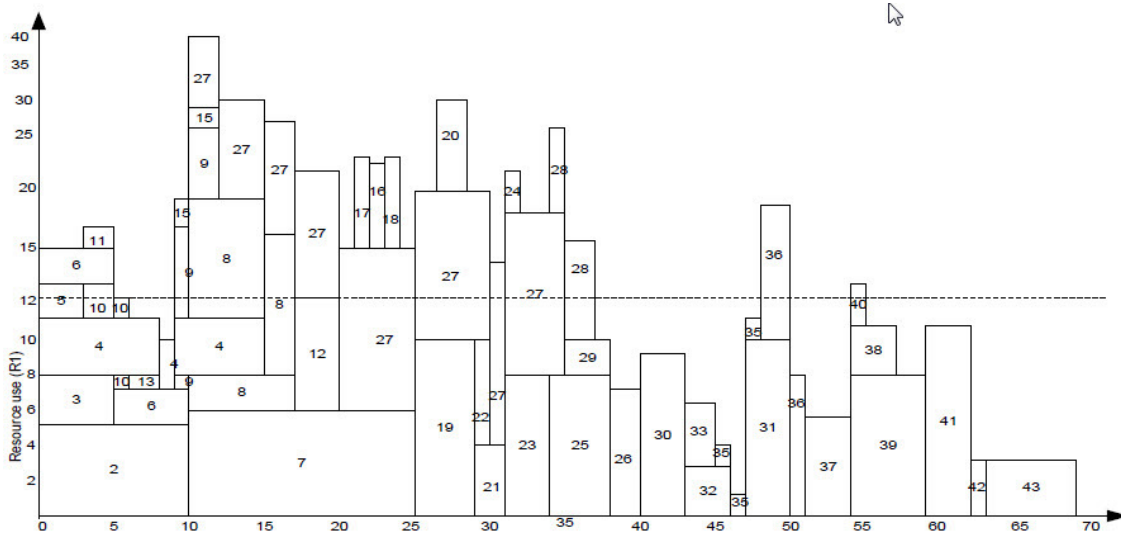

Fig. 3: Planned resource histogram for resource R1 (ignoring resource constraints)
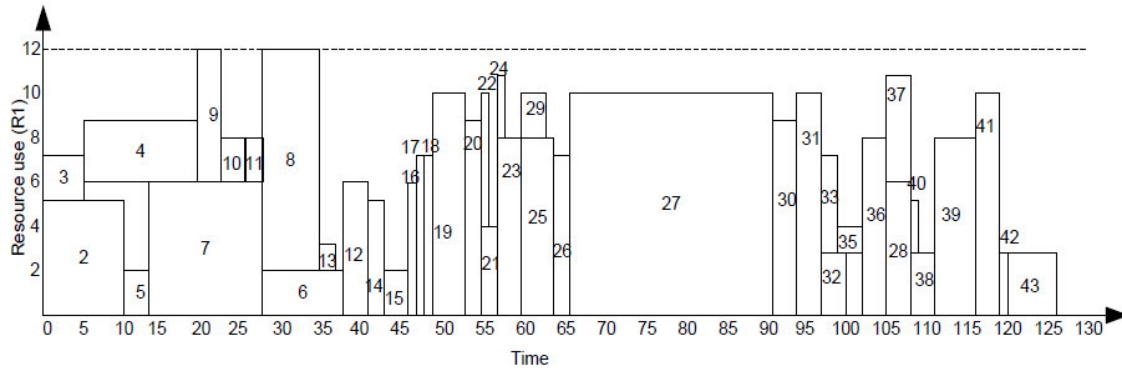
Fig. 4: Resource histogram for resource R1 (considering resource constraints: applying basic resource levelling)
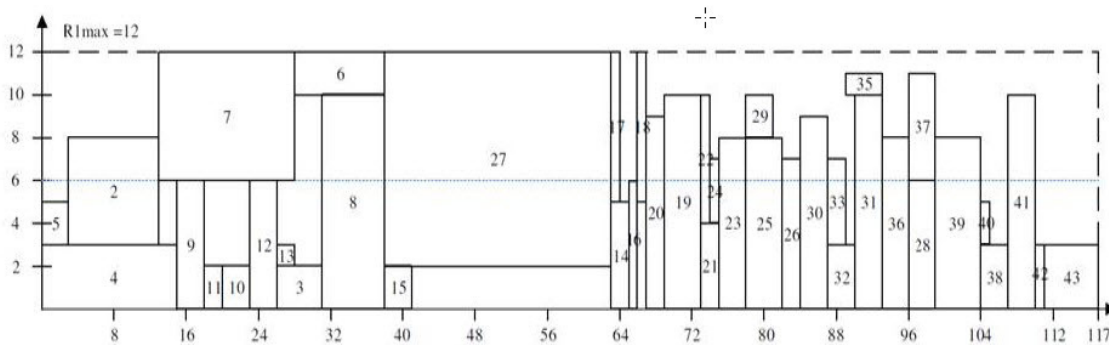

Fig. 5: Optimised resource histogram for resource R1 (using a RCPSP method)

RCPSP/tď

In this section, we present a model that extends the standard RCPSP by applying uncertainties and risk involves after considering three additional concepts: 1) time-dependent resource availability, 2) time-dependent resource request, and 3) uncertain activity duration (i.e., RCPSP/tď). We assume that each activity j requires r_{jkt} units of resource k in the tth period of its uncertain processing time, $t = 1,...,ď_j$. Each resource capacity R_{k1} is replaced by a list $R_{k1},..., R_{kT}$, with $T = \Sigma_j ď_j$ being the sum of all realized durations. We consider the objective is to minimise the completion time of the project, such that the time-dependent resource constraints are fulfilled.

For better demonstration of this RCPSP/tď setting, consider the following example. Figure 6 shows a deterministic RCPSP with 6 activities (0 and 8 are dummy activities) and where every single resource has a capacity of 6 units, with the activity numbers inside the nodes and the activity durations and resource requirements next to them. Figure 7 represents a sample example of RCPSP/tď for the same project while activity durations are uncertain, and the resource requirements and demands are time-dependent. As with Figure 6, the activity numbers are inside the nodes and the activity durations and the list of time-dependent resource requirements are next to them. For instance, for activity 1, 3/{1,0,1} means only 1 resource is needed in day 1 and 3 (0 for day 2). Also, as with standard RCPSPs, the resource demands for any activity j should be extended up to its uncertain processing time $ď_j$, and are mentioned in the braces just beside durations. Meanwhile, the time-dependent resource availabilities are also mentioned in brackets, which are extended up to the value of $\Sigma_j ď_j$. The resource demands and availabilities were further treated as unstable and may take different numbers, even 0, and the uncertain durations were allowed to increase by a certain percentage more than their deterministic durations.
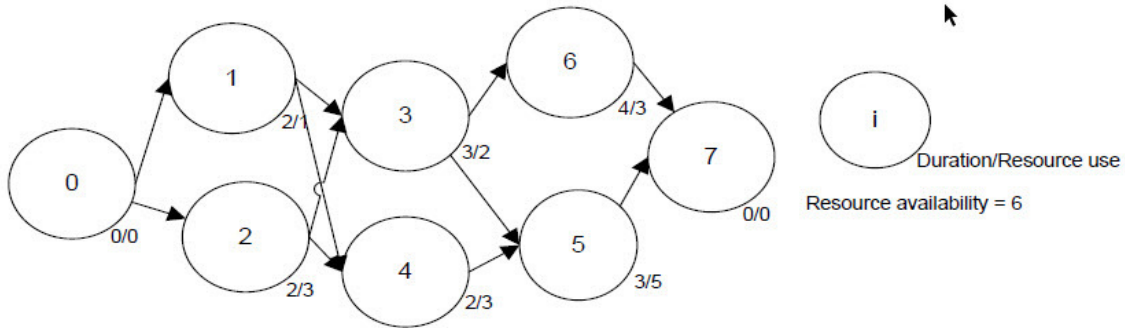
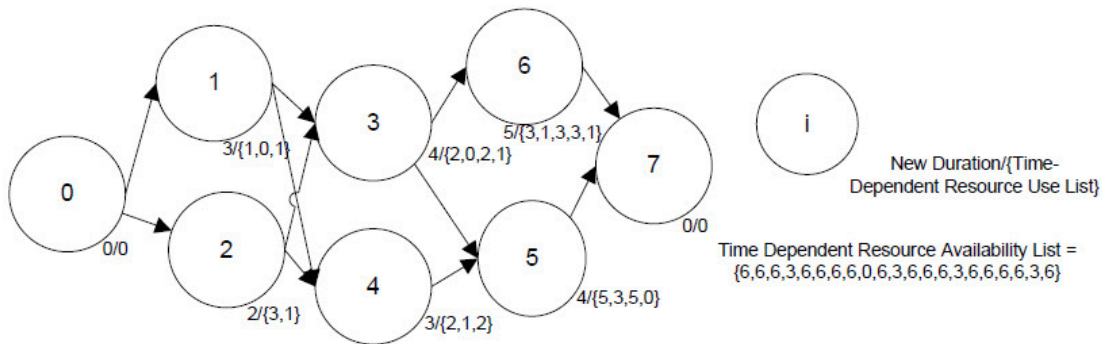**Fig 6:** Sample deterministic-RCPSP example

Fig 7: Sample RCPSP/t$\tilde{d}$ example

After solving with the ELSH algorithm, the resource histogram for the optimized schedule under both deterministic and dynamic resource usage condition is shown in Figure 8 (the number in the box is the activity number). As can be seen, instead of 11, the make span for this updated schedule is 15 units of time, while resource usages (i.e., height of those rectangles), activity durations (i.e., length of those rectangles) and maximum resource availability line (i.e., the red dotted line) are varied or dynamic.
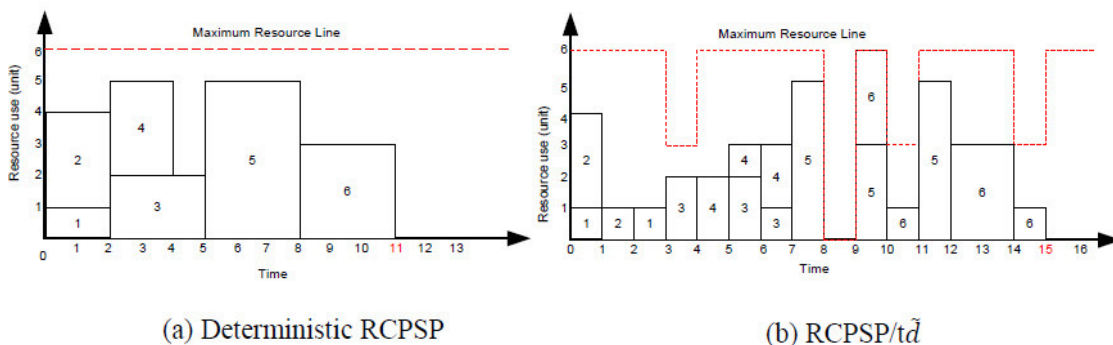

(a) Deterministic RCPSP

(b) RCPSP/t$\tilde{d}$

Fig 8: Resource histogram for deterministic RCPSP and RCPSP/t$\tilde{d}d̃$

Generation of test instances for the RCPSP/t$\tilde{d}$

As we do not have the uncertain values for resource usage and duration at the beginning of a project (when planning and scheduling the activities), we need to come up with some realistic estimated

values. Having a near-perfect estimation will help the practitioners to predict more reasonable makespan, even in adverse situations. To estimate the consequence of having different uncertainties (e.g., duration and resource uncertainties), we propose a pragmatic approach to generate realistic instances for our considered RCPSP/t$\overset{\smile}{d}$ setting. Despite of having several instance generators for project scheduling, to the best of our knowledge, time dependent resource parameters with uncertain activity durations are not considered by any of the generators. For generating different instances, we extended the standard RCPSP instances found in PSPLIB by varying the originally constant activity durations, resource availabilities and resource requests. The basic outline for generating test instances is given below:

i. Each resource request r_{jk} is replaced by a list $r_{jk1},…, r_{jkd}$. Note that the number of resource requests (r_{jk}) for any activity j depends on the magnitude of the uncertain activity duration $\overset{\smile}{d}_j$ for that activity.

ii. Each resource capacity R_k is replaced by a list $R_{k1},…, R_{kT}$, with $T = \Sigma_j \overset{\smile}{d}_j$ being the sum of all realized durations.

iii. If the realized duration of any activity j (i.e.,$\overset{\smile}{d}_j$) becomes larger than its deterministic duration (d_j), then we need to extend the relevant resource demands (r_{jkT}) list up to its new realized duration (i.e. each resource request r_{jkT} is replaced by a list $r_{jk1},…, r_{jkdj}$). To do so, we employed two different parameters to control the variation of the resource availabilities and requests. Probabilities $PPRR$ and $PPrr$ control whether or not a reduction is applied to the availability and the request, respectively. Factors $FFRR$ and $FFrr$ determine the strength of the reduction for the availability and the request, respectively. To further understand the functionality of those parameters, interested readers are referred to the research work of Hartmann (2012).

iv. For better representation of real world problems and motivated from Bruni et al. (2011), we considered two different types of statistically distributed duration sets; discrete and continuous. In particular, for the continuous conditions, we have assumed that the real activity duration is a uniform random variable $U(0.75d, 2.85d)$, where d has been set equal to the deterministic duration, and for the discrete condition, a Poisson distribution with mean dd was considered. Meanwhile, for the continuous types, the obtained random numbers from uniform distribution were discretised to fit this problem setting. All activity durations are assumed to be independent.

v. These reductions are applied to periods (either of the project tenure or of activity's realized duration) as a whole. That is, if it is decided that the capacity or resource request is reduced in a period, this reduction is applied to all resources.

As a foundation, we used the same HB project for generating realistic test instances. Six sets of test instances for each of two types of statistically distributed activity duration sets were generated, and are denoted as $HBt1dd,…, HBt6dd$ and $HBt1cd,…, HBt6cd$, respectively, where t indicates the time dependency, cd represents activity durations following a discrete distribution, $cccc$ represent activity duration following a continuous distribution and the number refers to the parameter setting for the calculation. The reduction probabilities have been varied between 0.05 and 0.2. The probabilities are the same for availability and request, that is $P^R = P^r$. The strength of the reduction is either half of the original capacity or down to 0. Here also, the factors are the same for capacity and demand ($F^R = F^r$). The design of the test sets is displayed in Table 1, which will assist any practitioners to generate more realistic test instances under similar settings.

Table 1: Parameter settings for generation of RCPSP/t$\tilde{d}$ test sets

Set no.	Discrete condition, $\tilde{\tilde{d}} = poisson(d)$						Continuous condition, $\tilde{cd} = U(0.75d, 2.85d)$					
	t1dd	t2dd	t3dd	t4dd	t5dd	t6dd	t1cd	t2cd	t3cd	t4cd	t5cd	t6cd
P^R	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.2
P^r	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.2
F^R	0	0	0	0.5	0.5	0.5	0	0	0	0.5	0.5	0.5
F^r	0	0	0	0.5	0.5	0.5	0	0	0	0.5	0.5	0.5

Propositions for Handling Uncertainties

After successfully handling and solving those generated RCPSP/t$\tilde{d}$ instances, some very important findings for the real-life schedulers are summarized in the following remark. This summary primarily highlights some structural similarities and differences between RCPSP and RCPSP/t$\tilde{d}$. For RCPSP/t$\tilde{d}$, the following propositions hold:

(i) An activity is only eligible for scheduling, if it can be feasibly started (in accordance with precedence and resource availability) at the schedule time t_g, while the resource availability and demands change with time.

(ii) Under any schedule time t_g, the resources might be 0 units, which impedes the generation of active schedules for any schedule generation scheme packages.

(iii) For some instances, due to uncertain duration and time-varying resource parameters, the solver might not find an existing optimal solution (Hartmann, 2012; Sprecher et al., 1995).

(iv) At any schedule time t_g, even if the resource availability turns to 0, there still a chance to generate active schedules only if the resource demands for all resources for that time period t_g are also 0.

(v) If for any activity i, the realized uncertain duration $\tilde{d}_i$ is greater than its deterministic duration d_i, the expected makespan for any realized schedule will likely be higher. This may be further reinforced if this case is true for a large number of activities. However, due to the effect of time-dependent resource demands, the increment of expected makespan may be affected, which may sometimes even decrease makespan. This is because, for time-dependent resource demands, sometime those demands may generate lesser values than before, including even zero.

(vi) For any activity set J, if their realized duration sets $\tilde{d}_J$ is lower than their deterministic duration sets d_J, the expected makespan for any realized schedule will likely also be lower. But, if the list of time-dependent resource availabilities are tighter (i.e., decreased significantly than their original capability), even for $\tilde{d}_J < d_J$, the expected makespan can increase.

(vii) If for any particular time period tt, $RRkkkk = 0$ and $rrjjjjjj = 0$, then the effect of timedependent resource demands and capacities, or even the effect of uncertain durations, is insignificant.

Conclusion

Initially this paper demonstrates the effectiveness of resource constrained project scheduling problems over the traditional critical path methods. The contribution of optimised resource allocation or levelling along with their relationship with project portfolio management is also explained. We then consider an extension of the resource constrained project scheduling problem (RCPSP) with time-dependent resource capacity and demand, while activity durations are assumed to have uncertain durations (RCPSP/t$\tilde{d}$). Because of the practical relevance of RCPSP/t$\tilde{d}$ to modern industry, efficient algorithms are valuable. The proposed guidelines for RCPSP/t$\tilde{d}$ can meet the requirements of handling large projects under dynamic environments, with minimum computational complexity. Practitioners can benefit from the proposed approaches, because they can be easily implemented in generating realized schedules under varied conditions on a real-time basis. Organisations can also reduce significant financial and time losses by applying these approaches if any duration uncertainty is experienced. Further extensions of RCPSP/t$\tilde{d}$ are also possible, in terms of considering multiple modes to reflect alternative speeds of the production processes, considering multiple projects, and taking into account different objective functions such as the maximization of the net present value.

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End Notes

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