

Developing the practice of governance



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The traditional 'iron triangle' metrics of time, cost and quality alone are believed to be too simplistic for large, complex projects

Executive summary

Good governance is key to establishing a successful project. This report reviews the extant knowledge base on project governance from the academic literature to understand what is known and where gaps in the knowledge base lie. This literature has been combined with expert input from knowledgeable practitioners so that we can create actionable insights. The review has particularly focused on governance of large public-sector projects. The report also provides guidance to project professionals. To ensure that this guidance is relevant and up to date, the knowledge base has been enhanced with expert commentary and this too has informed our recommendations.

Full recommendations are in section 2 of this report, but to highlight:

- The governance and assurance regime needs to be tailored to match the type and phase of the project.
- The focus of governance needs to go beyond project delivery and cover project implementation and project results.
- There are critical aspects of governance in the earliest project phase (that is between the idea and approval) that need to be carefully managed.

This research has been sponsored by the Association for Project Management (APM) and contributes to the government's 'Project X' activity. Project X was developed by the Infrastructure and Projects Authority (IPA) as a way to encourage research in project and programme activities to consider 'real-world' issues that are manifest across the Government Major Projects Portfolio (GMPP).

Large projects operate in complex environments and complexity is important and must be managed through the use of appropriate tools, known as problem structuring methods (PSMs). A tool that is particularly applicable to organisational evaluation is the viable system model (VSM) and its application to a governance system is described more fully in this report.

It is proposed that two types of project exist: (1) 'fixed target', where most of the requirement for the project will remain constant throughout the life of the project; and (2) 'moving target', where large areas of the requirement will change as the project develops. The governance and assurance system will be very different for these projects because they are fundamentally different entities. So, the governance system for a 'fixed target' model should be linear and static. Complex projects are neither linear nor static and any attempt to run them in this manner is likely to result in poor progress of the project. The metrics by which progress, and success, are judged should also be different for the two types of project. It is important that the governance system has a carefully developed model of the dynamic relationships that affect the project and its environment to ensure that the project is being controlled appropriately. Recommendations about how the two types of projects should be organised, reviewed and governed are detailed in this report.

The definitions of governance shown in this report all include assurance; and assurance is seen as a key element of governance.

It is very difficult to establish good assurance systems in the public sector due to the complexity of what needs to be measured and the interests of the staff implementing the systems. Cases of metric manipulation have been reported that range from hiding poor figures in large volumes of data, all the way through to gaming and manipulating metrication systems. The traditional 'iron triangle' metrics of time, cost and quality alone are believed to be too simplistic for large, complex projects, and different, or additional, attributes are needed for stakeholders to gain confidence that a project is progressing well.

A balance of flexibility and process allows projects to maintain the freedom to develop and grow according to the evolving needs of the activity

The shaping of projects during the informal phase is very important. Many problems within major public investment projects have their origins before the final decision to go ahead.

Excessive optimism is viewed by some promoters as an essential ingredient of getting major projects started. To combat this some authors advocate approaches such as reference class forecasting to gain a more realistic early estimate of the true cost of the project. Problems remain with this approach in that members of the early design team can shape and influence the references that are selected for the costing. It is recommended that an independent estimate of costs is obtained to ensure, as far as practically possible, that early cost estimates are unbiased and provide a more solid foundation to take the project forward. A similar approach of independent forecasting is recommended for initial usage analysis, such as estimated traffic volumes for new infrastructure projects.

Projects should be prepared for major risks and shielded as much as possible from unknown 'black swan' risks. A balance of flexibility and process allows projects to maintain the freedom to develop and grow according to the evolving needs of the activity, but process is needed to ensure compliance with the institutional rules.

Benefits realisation is important but its implementation could be improved across the major projects portfolio, this is particularly important as projects are handed over from the IPA to the Government Internal Assurance Agency (GIAA).

There is a lot of literature on some aspects of project governance, particularly major projects and project success, often focused on a small number of case studies. There is less material that offers a view of how some of the most challenging problems can be addressed.

1. Introduction

This report is a review of the knowledge base for the governance of projects, particularly large public-sector projects. The review has three purposes:

1. To synthesise and summarise the knowledge base on project governance and assurance. This is being done as there is evidence that professions develop more quickly when their underpinning knowledge base is better organised and presented. When this happens, individuals can absorb the material more quickly and new thinking and practice is adopted more rapidly.
2. To identify from the academic literature, gaps in the existing knowledge base.
3. To provide the best guidance possible from both knowledge of practice and academic research.

There is a considerable amount of literature available, either directly based on project governance or in areas of importance for governance. The literature that has considered 'mega projects' is particularly relevant and is a popular area of research. However, some areas of governance, such as how to establish an effective assurance system that is well matched to the policy and aims of the governance system, have very limited research. Placing such an assurance system in the public sector both compounds the difficulties in establishing it and reduces the breadth of literature available. This highlights an area in which no firm guidance has been identified within the knowledge base.

The rest of this report is structured as follows:

Section 2 presents the guidance for practitioners and senior leaders. This is drawn from the literature review combined with insights from our expert panel.

Section 3 presents the literature review findings. Our literature review findings have been augmented by expert comment (EC1 through to EC11), which for clarity has been reported separately in boxes.

Section 4 presents gaps that have been highlighted in the knowledge base that will assist in developing a research agenda for governance and assurance.

Section 5 outlines the implications for project governance in practice.

Section 6 provides an overview of the conclusions drawn from the research, including future research directions.

2. Guidance for practitioners and senior leaders

2.1 Introduction

In this section, we simply present our guidance and recommendations.

Projects need to be governed (Cobb, 1995; Williams, 2010). This governance needs to start at the concept phase and should continue throughout the project until after it is delivered (or the point at which it is terminated). So, governance should be seen as a continual process throughout the life of a project.

According to the Government Functional Standard (Infrastructure and Projects Authority, 2018, page 8), governance comprises authorising, directing, empowering and overseeing management. As such, governance is the process used to delegate authority to run a project within limits and to direct the project towards delivering desired outcomes and benefits.

However, there are different types of project, different elements within a project and different phases of a project. All these should have an influence on how governance is enacted in practice.

So, we will start by introducing our view on the different types of project, the elements of a project, efficiency and effectiveness and phases of a project. These views are not the conventional way most projects are seen, but they are helpful for the purposes of categorising our guidance.

Changes in stakeholder perception or political position may complicate what looks (at least at the outset) to be a straightforward project

2.1.1 Types of project

Within government, major projects are often categorised into four distinct types. These are infrastructure projects, digital projects, transformational projects and MoD projects. Although this categorisation creates a set of useful descriptors, here we wish to create a categorisation that is more useful from a systems perspective (Arévalo, 2015; Locatelli, 2014; Hoverstadt, 2008; EC6). In its simplest form, we wish to distinguish between:

1. fixed-goal projects, and
2. moving-goal projects.

In the first case, the goal of the project is understood and not expected to change significantly over the course of the project. An example of this could be a piece of infrastructure, such as building a bridge with the purpose of improving traffic flow. In the second case, the goal of the project may not be fully understood and/or the goal is expected to emerge or change over the life of the project. For these projects we may only be able to state the ultimate goal in general terms at the outset, and the expectation is that things will change. An example of this could be a transformational new computer system that changes the way work is delivered and the users interact.

We make this distinction here because the way we plan, manage and deliver these two basic project categories is different and as a consequence the governance and assurance should be different too (EC1, EC2, EC4, EC5, EC6). It isn't always easy to determine whether a fixed-goal project is really fixed as often the devil is in the detail. Further, changes in stakeholder perception or political position may complicate what looks (at least at the outset) to be a straightforward project.

2.1.2 Elements of a project

Conceptually, we are proposing that a project should be divided into three elements:

1. Project delivery.
2. Project implementation.
3. Project results (outcomes and benefits).

Project delivery is focused on delivering the outputs of the project. These outputs could be a piece of infrastructure, a software application or a piece of military equipment. They are the tangible things that the project team will create and deliver.

Project implementation is all about how the project changes what people are doing or how they do it. This will involve people using the new infrastructure, application or equipment efficiently and effectively to deliver products and services and/or how people (including wider society) change the way they behave.

Project results refers to the outcomes and benefits achieved. Here we use the word outcomes to refer to all the changes that occur as a result of a project (including both the positive and the negative), while the benefits are the results (financial or non-financial) less the cost of delivering them.

2.1.3 Project efficiency and effectiveness

Efficiency and effectiveness are important concepts used in operations, but they are important for projects too. Here we refer to:

- Project efficiency as delivering to the iron triangle, the scope within time and costs.
- Project effectiveness refers to whether the project delivers the planned desired outcomes and benefits.

However, it needs to be noted that for many complex projects there are multiple stakeholders who have different perspectives on the outcomes and benefits. This makes the determination of effectiveness much more difficult to quantify than efficiency.

2.1.4 Project phases

Projects can be considered in phases. We have adopted here a conventional way of breaking down projects. These are:

1. The initial phase that lasts from the concept, or idea, to approval. In the literature this is sometimes called the informal phase.
2. The delivery phase – this lasts from business case approval to the handover to those taking forward the operation following the completion of the project.
3. The operate phase, which technically happens after the completion of the project. We include this here as it is in the operate phase that most of the project benefits are realised.

In reality there is considerable blurring between the different phases, and many projects end up being far messier than this, but we believe the categorisation into these three different phases is useful.

2.2 Governance and assurance

One of the conclusions from our review of the literature and expert panel discussions was that *one size doesn't fit all*. Here we make recommendations for governance and assurance, taking into account the type of project and phase in the project life cycle.

Figure 1 captures, in outline, the structure of what we are proposing.

One of the conclusions from our review of the literature and expert panel discussions was that *one size doesn't fit all*

Type of project	Initial phase <i>Concept to business case approval</i>	Delivery phase <i>Business case to operate</i>	Operate phase
Fixed target	Focus on detailed planning, risks, uncertainties and clarity of end goals	Focus on the balance between project delivery, project implementation and project results	Evaluate the project in terms of both efficiency of delivery and effectiveness in achieving outcomes and benefits
Moving target	Focus on the broader business plan, uncertainties, unknowns, possible project journeys (including indicators of unacceptable risk creep) and desired end-state goal	Focus on the evolution of project delivery, project implementation and project results Ensure that the current aim point and current risks are reviewed regularly and tested against the unacceptable risks developed in the initial phase	Evaluate the project in terms of effectiveness in achieving outcomes and benefits

Figure 1: Outline structure of recommendations

2.2.1 Phase 1 – Concept to business case approval

This phase of the project covers feasibility, initial appraisal, selection of approach and definition of timescales, costs and benefits (Infrastructure and Projects Authority, 2018, page 38). This is a critical phase (Williams, 2010; Samset, 2016).

- The concept should initially be judged as to how well this aligns with government and departmental policy.
- Feasibility – should look at whether the project is deliverable at all and outline timescales, costs and benefits.
- Initial appraisal is refining the timescales, costs and benefits, identifying alternative delivery approaches and assessing risks.
- Selection is further refinement including identifying the preferred delivery approach.
- Definition is creating the business case for approval, with the most appropriate level of detailed planning for judgements to be made on the likely success of the project and to take the decision to proceed or not.

The governance questions that should be asked are as follows:

- Are the appropriate leadership and oversight practices in place?
- How good a fit is the proposed project approach and outcomes with government and departmental policy?
- Has the feasibility study been done to an appropriate level of detail and informed by individuals with the requisite expertise?
- Has soft analysis been undertaken and informed by individuals with the requisite expertise?
- Has a determination been made on whether this project should be classified as fixed or moving and was the determination informed by individuals with the requisite expertise?
- Has the identification of risks been done satisfactorily and has this work been informed by individuals with the appropriate expertise?
- Have the alternative delivery approaches been suitably identified and evaluated and has this work been informed by individuals with the appropriate expertise?

Initial appraisal is refining the timescales, costs and benefits, identifying alternative delivery approaches and assessing risks

An appropriate business case is a case that matches the type of project being considered

- Has the identification of the preferred approach been justified and has this work been informed by individuals with the appropriate expertise?
- Have stakeholder benefits been identified and have stakeholders been appropriately consulted over the approach and the expected benefits?
- Is the business case complete and is it appropriate for the type of project being proposed?
- Has a fully independent estimation been made of the likely scale of costs and likely benefits? Does this align with the internal estimates?

If the project progresses through the sub-phases cited above (feasibility, initial appraisal, approach selection, definition of timescales, costs and benefits), at each of these sub-phases the following questions should be asked:

- Is this project still needed?
- Can this project still be justified in terms of the latest assessment of timescales, costs and benefits?
- Is this the right time to progress this project given competing priorities for resources and high-level oversight and attention?
- Are the resources available to proceed?

An appropriate business case is a case that matches the type of project being considered. Therefore, we expect that fixed-goal projects will have different business cases to moving-goal projects.

Recommendations

For fixed-goal projects the focus should include:

1. Detailed business planning with scheduling and costing
2. Risks with risk mitigation
3. Uncertainties with range estimates
4. Definition of future state with clear measures of success.

For moving-goal projects the focus should include:

1. Broad business plan with ranges of timescales and costings
2. Independent estimation of the scale of the costs and likely benefits
3. Risks with potential risk mitigation where appropriate
4. Uncertainties with range estimates
5. Unknowns with discovery and learning activities and objectives
6. Predefined criteria for 'stop action' and initiating independent review
7. Phased delivery paths, possibly with intermediate deliverables and review points
8. Description of future state with indicators of success.

2.2.2 Phase 2 – Business case to operate

The phase that stretches between the business case approval and operations is the main execution or delivery phase. Traditionally, the emphasis here is on project delivery, but it is a mistake not to focus on project implementation and project results (Cobb, 1995; Bourne et al, 2018; EC5).

- Are the appropriate leadership and oversight practices in place for project delivery?
- Are the appropriate leadership and oversight practices in place for project implementation?
- Are the appropriate leadership and oversight practices in place for delivering outcomes and benefits?
- Are the appropriate leadership and oversight practices in place for delivering outcomes and benefits in the longer term?

For fixed-goal projects:

- Are the risks being identified and managed appropriately?
- Are the uncertainties being reduced?
- Is the project being delivered efficiently?
- Is the project implementation being delivered effectively?
- Are the intermediate deliverables being implemented and used effectively resulting in the expected benefits being realised?
- Are the planned outcomes and benefits still deliverable?

For moving-goal projects:

- Does the project still have clarity of purpose? Are the requirements still fully aligned to the political and technical challenges?
- Do these outcomes and benefits direct the project delivery and implementation?
- Are the intermediate deliverables being implemented and used effectively resulting in the expected benefits being realised?
- Are the discovery and learning activities effective?
- Are the risks being identified and managed appropriately?
- Are the uncertainties being reduced?
- Is the project implementation being delivered effectively?
- Is the project delivery well managed?

The phase that stretches between the business case approval and operations is the main execution or delivery phase

Recommendations

1. Governance should be determined by the type of project (Conant, 1970; EC6).
2. Governance of fixed-goal projects should enable managers to take appropriate and timely decisions.
3. Governance of moving-goal projects should enable managers to have the flexibility to navigate towards the current view of the ultimate goal.
4. The balance between project delivery, project implementation and project results will change over the project life cycle. Assurance should evaluate whether or not this balance is appropriate for the type and stage of the project (EC5).

2.2.3 Phase 3 – Operate

The operate phase occurs after the project handover. So, in this phase the focus is on using the product or service delivered by the project or exploiting the change that has occurred. The focus should also be on evaluating the outcomes and benefits, understanding how they were achieved as well as learning lessons from the project (EC10).

- Are the appropriate leadership and oversight practices in place for operation?
- Are the project outputs delivered in line with expectations?
- Was the handover conducted appropriately?
- Was the operating department prepared for the project handover?
- Did the operating department embrace the project and aspire to achieve the outcomes and benefits?
- Does the operating department have mechanisms in place to guide and track the continued delivery of benefits from this project?
- What was learnt during the delivery of the project?
- What was learnt during the implementation of the project?
- What were the unintended consequences arising from the project?
- What was learnt about the delivery of outcomes and benefits?
- With hindsight, was the project worthwhile and, if not, what should be learnt for the future?

There is a whole literature on project evaluation, so here we wish simply to highlight the key questions to be asked.

However, it should be noted that fixed-goal projects are simpler to deliver than moving goal projects. Effectiveness, in terms of the delivery of outcomes and benefits, is always the most important criterion for evaluation but for fixed-goal projects efficiency is important too.

If projects are moving-goal projects and the solutions have to emerge or be discovered, then the concept of efficiency has little meaning. Work on discovery or developing solutions will inevitably be wasted so the limit of focus should be on asking the question as to whether money was wisely spent or not. These questions should not be asked with the benefit of hindsight, but from the perspective of those running the project at the time they were making the decisions they took.

Recommendations

1. Evaluation should consider the role of the project team as well as the role of the receiving operating unit.
2. Fixed-goal projects should be evaluated on the delivery of results and the efficiency of delivery.
3. Moving-goal projects should be evaluated on delivery and a final evaluation of outcomes for the costs incurred (and not on efficiency).
4. Focus can be lost in operations after project delivery, so the governance and assurance mechanisms must ensure this doesn't happen.
5. Learning lessons will require the evaluation team to understand the entire process, so this should involve not only analysts, but experienced practising project professionals.

If projects are moving-goal projects and the solutions have to emerge or be discovered, then the concept of efficiency has little meaning

The research identified 12 groups of findings that cover the environment in which project governance is situated

3. Findings from the literature review

The literature review has focused primarily on the academic literature, although we have drawn in certain other perspectives from professional bodies in the field.

The research identified 12 groups of findings that cover the environment in which project governance is situated (including factors such as complexity and stakeholders), together with internal activities such as assurance and process. The groups are:

1. Project governance
2. Complexity
3. A systems approach
4. Governance structure
5. Assurance
6. The informal phase
7. Avoiding excess optimism
8. Preparedness
9. The balance of flexibility and process
10. Benefits realisation management and maturity models
11. Stakeholders
12. Organisational learning.

So, in section 3 we will start by discussing project governance, before reviewing the literature and expert insights under each of the 12 categories listed above. The expert insights were captured and refined from the team of practitioners reviewing the literature with us.

3.1 Project governance

In this section we will define governance and explain why governance is important. We will also briefly present the governance theories identified in the project literature.

3.1.1 Definitions of project governance

Let us start by understanding what we are talking about when we use the word governance. A number of definitions of governance exist, including:

"Governance is about the relationships between the board, management and shareholders to set company objectives and monitor performance." Kelly (2010).

At project level governance may be defined in a number of ways. These include:

"Governance provides the structure through which objectives are set and performance monitored." Kelly (2010).

"Aligning project objectives with organisational strategy, achieving set project objectives and monitoring performance." Turner (2001).

Both definitions include assurance and monitoring performance as part of governance.

Practices in project governance are not sufficiently advanced and there is a long way to go before major project governance corresponds to current knowledge relating to large and complex projects

From the profession's perspective:

"Governance refers to the set of policies, regulations, functions, processes, procedures and responsibilities that define the establishment, management and control of projects, programmes and portfolios." APM Body of Knowledge (2019)

"P3 [project, programme and portfolio] assurance is the process of providing confidence to stakeholders that projects, programmes and portfolios will achieve their scope, time, cost and quality objectives, and realise their benefits." APM Body of Knowledge (2019)

So, here again, governance and assurance are very closely related, especially if you consider governance as a key element in project delivery. Therefore, the assurance system needs to be designed with the governance system and as an integral part of governance, not something that is added on after the governance system has been developed.

3.1.2 The importance of project governance

Good governance is key to establishing a successful project. There are many testimonies to this. One that is particularly powerful is "five of the eight common causes of project failure identified by the Office of Government Commerce in 2005 are attributable to weak governance" (IPA, 2016).

The concept of project management is well defined and understood (Too, 2014). Cobb (1995) said "We know why projects fail; we know how to prevent their failure – so why do they still fail?" These issues of systematic project failure are attributed by Cobb to a failure of organisational governance. Too highlights that the art of good governance is maintaining a balance between restrictive processes and allowing management the freedom to support effective growth. This should facilitate achievement of the strategic goals of the organisation.

3.1.3 The importance of reviewing project governance

Practices in project governance are not sufficiently advanced and there is a long way to go before major project governance corresponds to current knowledge relating to large and complex projects (Klakegg, 2016).

3.1.4 Governance theories

This is a short summary of the dominant corporate governance theories from Biesenthal (2014) and also Müller (2009), all of which are applicable to project governance:

■ **Agency theory:** A theory that considers that a principal (owner) has difficulty in motivating an agent (executive) to act in the principal's best interests. The agent may be self-interested and may not share the principal's attitude to risk. The interests of the two actors are aligned, for example, through a performance-based contract that will be monitored and controlled. There are costs associated with creating and monitoring the contract.

■ **Transaction cost economics (TCE):** TCE considers the governance costs of an organisation and suggests that organisations adapt their governance to achieve the lowest possible transaction costs.

■ **Shareholder theory:** Asserts that the purpose of an organisation is to maximise shareholder return on investment. The structures and processes of the organisation then provide assurance that maximum value is being returned to the shareholders.

■ **Stakeholder theory:** Similar to shareholder theory but asserts that a wider group of people is interested in the outcome of the company; the board may include representatives from the stakeholder groups.

Stakeholder theory may be applicable within the public sector in that many groups are interested and feel that they should have input into public projects

■ **Stewardship theory:** Takes a view that managers are stewards and are motivated to act in the best interests of the principals, with a governance structure built on trust to enhance the long-term best interests of the organisation.

■ **Resource dependence theory:** Directors are given control over the resources of the organisation, as the theory suggests that they are critical to organisational success. The directors set priorities through resourcing.

The theories help explain the host organisation's priorities and structure; they also highlight areas of most concern for the organisation, for example stakeholder theory may be applicable within the public sector in that many groups are interested and feel that they should have input into public projects. It is the one theory shown by Derakhshan (2019) that may be applicable at all three organisational levels (project, portfolio and organisation).

EC1

A number of theories are available. One theory does not fit all circumstances in the public sector and each has strengths and weaknesses. Care should be taken in selecting an appropriate theory ahead of deeper consideration of the governance system.

3.1.5 Governing real projects

Two types of project are discussed more deeply at the end of section 2.5; they are static projects (those that are delivering work towards a 'fixed target') and dynamic projects (with a 'moving target'). Conant (1970) shows, through a mathematical proof, that a regulator must include a model of the system to be regulated, known as the Conant-Ashby theorem. So, for a static project, its governance model should be linear and static. Conant does not advocate taking the factors to consider in a governance model from a generic template – they need to be considered for each individual project in each situation.

EC2

The model, within the governance system, must also be an appropriate simplification of reality, including the key 'driving forces' of the situation but not the factors that contribute to insignificant changes in the system.

Complex projects are neither linear nor static, they are dynamic and stabilised or destabilised by a recognisable set of dynamic relationships. Therefore, to comply with Conant-Ashby, the governance model must have in it a model of those relationships and their dynamics. If it doesn't, then the set of behaviours of the project will fall outside of the control set of the governance model and this is likely to lead to setbacks or even failure of the project.

While project managers and governors are used to working in an environment of complexity, problems occur when elements of the system become unpredictable or unstable

3.2 Complexity

Complexity occurs when there are many interactions that all contribute to an emergent behaviour. Complex systems can be thought of as when "the whole cannot be understood by being divided into or reduced to its elements... interaction and connection are non-linear, and non-causal determinism is the rule" (Wulun, 2007). A complex system is more than a complicated system in that it is "an interacting network system, and not a reductive simple system" (Wulun, 2007).

Cristóbal (2018) highlights that there is no consensus on what complexity is, and the main factors considered to be drivers of complexity are: size, interdependence and interrelations, goals and objectives, stakeholders, management practices, division of labour, technology, concurrent engineering, globalisation and context dependence, diversity, ambiguity and flux. Vidal (2011) has developed a metric for project complexity that is based on many similar factors. Four complexity responses have been identified by Kortantamer (2019) in her interviews with project delivery professionals involved in major transformation portfolios. The responses are bridging, positioning, legitimising and adapting.

Arévalo (2015) considers the theoretical approaches to managing complexity in organisations. Three theoretical approaches are possible: (1) Complexity sciences; (2) Complex adaptive systems (CAS); (3) Organisational cybernetics – that considers self-organising systems. Complexity science and CAS have considered natural and artificial complex systems. Arévalo concludes "we consider that organisational cybernetics still provides the most developed theory, methodology and a large amount of empirical results on a wide range of international companies". This approach will be taken forward as the basis for a governance model.

Requirements complexity has been seen to contribute to project failure according to Parsons-Hann (2005) and so careful consideration of complexity is important to the governance of projects. One example of this was the Nuclear Decommissioning Authority's Magnox contract, reported by the National Audit Office (NAO, 2017), in which a long-term decommissioning contract was required. The contract was not awarded correctly (the winning bidder should have been sifted out), and the contract was ended early after substantial cost creep: "... £0.5bn was not expected. The NDA does not know to what extent this unexpected additional cost reflects inaccurate assumptions about the state of the sites in 2012." NAO (2017)

While project managers and governors are used to working in an environment of complexity, problems occur when elements of the system become unpredictable or unstable. A key criterion for viability of an organisation is that the organisation is, or becomes, stable, adapting to the environment or adapting the environment to suit themselves (Hoverstadt, 2008).

EC3

Complexity is found in most situations and needs to be well managed. Failure to appreciate the level of complexity in the internal and external environment will have a massive impact on a project. The type(s) of complexity and mix of complexity can also have a serious impact on a project. Some authors, particularly in the military, refer to: volatility, uncertainty, complexity and ambiguity.

It is important to understand the level of complexity, to try to reduce the impact of complexity on a project and to use testing and iterative design to navigate in a complex environment.

Key elements of a project may become unstable as time moves on. Can this be predicted in advance, ideally in the planning phases?

3.3 A systems approach

"Systems thinking is a discipline for seeing the 'structures' that underlie complex situations, and for discerning high from low leverage change... ultimately it simplifies life by helping us to see the deeper patterns lying beneath the events and the details." Senge (1990)

The use of systems thinking is advocated by Kapsali (2011) as a way of embedding flexibility into project management in the interdependence between the policy's goals and implementation instruments. Kapsali adds that flexibility increases the probability of projects achieving policy goals.

Tools that can help with complexity have been the subject of much academic research. This research began after the RAND Corporation failed to deliver a health service project for the New York City government. RAND had developed its tools and approaches in a military environment, but when these were applied in less hierarchical and planned organisation, the corporation was unable to make progress; this was described by Greenberg (1976) and quoted by Rosenhead (2009). The response to this lack of tools was to develop a new research discipline that considers problem structuring methods (PSMs) for complex situations (Rosenhead, 2009). Many PSMs are now available and may be used separately or in combination (Mingers, 1997).

Kahneman and Tversky (2000) describe the reference class forecasting method. This is a tool for decision-making under uncertainty, and Flyvbjerg (2004) has demonstrated that this tool is useful in supporting large infrastructure projects (Walczak, 2018).

One PSM that has a cybernetics basis and has been applied to organisational structure is the viable systems model, which is presented more fully in section 3.3.1.

Tools that can help with complexity have been the subject of much academic research

EC4

A systems approach should be a prescription for complexity and therefore must be considered (and is likely to be needed) in every major project, in some form. The benefits of the approach are to improve governance, systems, plans and contingency so that they are better 'tuned' to the external environment and more likely to succeed. Through improved tuning it may be possible, in some situations, to enhance the external environment in ways that are desirable for the organisation.

Tuning includes getting the right structure, people and approach in place in an adaptive form to deliver the outcomes needed.

A holistic design and review are particularly important.

The viable systems model (VSM) was created by Stafford Beer to expose the principles of viability for an organisation

3.3.1 Representing governance within a model

The viable systems model (VSM) was created by Stafford Beer to expose the principles of viability for an organisation, and to bring about a more scientific basis for developing an organisational structure (Hoverstadt, 2008). VSM offers a language to map patterns of interaction among core agents within networks (Espinosa, 2011). VSM highlights key structures within an organisation and the relationships between these, as shown in Figure 2.

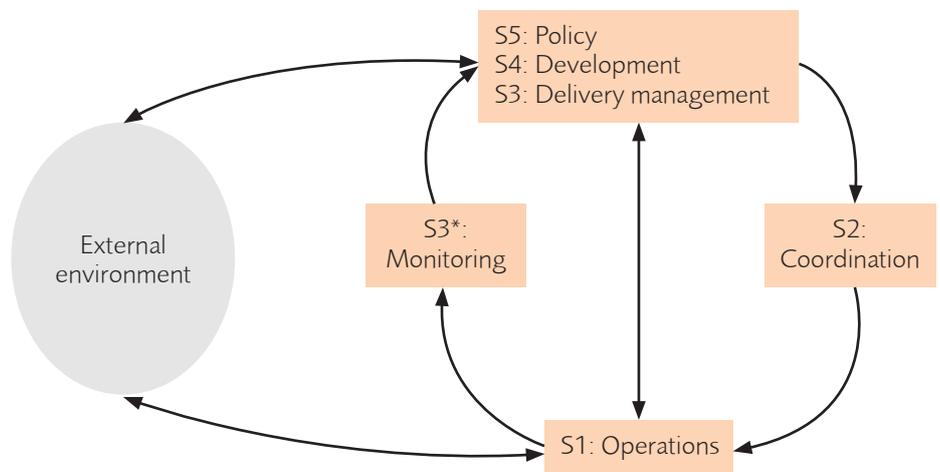


Figure 2: A generic viable systems model

VSM is recursive and may be applied at any level of a system so policy (at the top of the VSM, in Figure 2) could be the education policy for the UK or the policy for a particular school, or even the policy for an individual class.

System numbers in Figure 2 are shown with an S prefix. These are:

System 1: The **Operational** part of the system; if the model was applied to a school then the operational part would be the class teachers teaching students.

System 2: The **Coordination** between operational delivery systems, so in a school a timetable would be used to ensure that the science teachers had one class of students arriving at any one time.

System 3: The **Delivery** management system that is drawing together the activities of the operations system. In the school example, this would be ensuring that the school runs well on a day-to-day basis, that students are making good progress in each class and that the school has enough skilled staff to operate well.

System 3*: **Monitoring** of operations, to ensure that the policy that has been established is being delivered. In the school example, this would include the headteacher checking that the students were making expected progress.

System 4: **Development** – the part of the system that adapts to changes in the world and ensures that the system remains viable. This is also called intelligence, from the military function that considers all the forces that are at work in a key area and considers how to gain advantage over an enemy through use of information. In the school example, this would include governors reviewing the latest government policy and making sure that the school is compliant with the developments in safeguarding, data protection etc.

Assurance systems need to be put in place as part of project governance

System 5: **Policy** – establishing a policy that is right for the system; this will include the direction of travel of the system. In the school example, policy would be set by a governance board that would establish whether the school was to grow or shrink, depending on how its likely population of students will change over the years, how to deal with the weaknesses of the school and how to respond to threats and capitalise on opportunities.

The combination of systems 3, 4 and 5 are used to form a strategy for the system as highlighted in Hoverstadt (2008). VSM can be very effectively applied at the project level and highlights the minimum viable governance structure, but VSM alone doesn't describe how to implement the governance structures.

VSM is helpful in representing the governance system in that the structure for the connections between systems is defined within the model and these connections may be tested in a real project team. VSM highlights what is important, and also highlights what is not needed, eg detailed connections that can be in place within some governance regimes where the senior managers want 'all the information' and do not trust people at the working level to make important decisions.

The role of project governance is to establish the systems within VSM at the top level of the project and then to cascade this approach further down the organisation. The information flows in VSM should be enabled across organisational boundaries.

Assurance systems need to be put in place as part of project governance. Both the assurance mechanisms and incentivisation should be considered, along with the predominant governance theory within the organisation, in order to plan for (and potentially contract) phases of action on the project.

ECS

Examining the governance (including assurance) as part of a holistic review will make sure that each element of the viable system is in place and that the linkages between them are fit for purpose, matched to the environmental risks and balanced for the predominant governance theory.

3.4 Governance structure

A structured approach is proposed for the project governance system and there are many recommendations on what is appropriate.

As highlighted by Zwikael (2015), "The literature does not agree on the structure of a robust project governance model, only that it should be based around four key principles: (1) identify a single point of accountability, (2) ensure a service delivery focus, (3) separate the project and the organization governance structures, and (4) separate stakeholder management and project decision making." The first two principles are embedded in VSM. Principles 3 and 4 need to be considered as a governance system is implemented. Ahola (2014) describes two views within the project governance literature. One group sees project governance as external to a project, the second sees it as internal to a project. The representation within VSM has the project and the project-related governance linked together, as a representation within the model.

Locatelli (2014) advocates using systems thinking to ensure that complexity is appropriately managed and systems engineering to structure the governance system.

3.5 Assurance

One definition that has been proposed by the Project Management Institute (PMI) is that "Project assurance is an independent process that assesses the health and viability of a project. It is designed to provide the executive management with a clear sense of whether a project will accomplish its objectives" (Tilk, 2002). Another definition is that "P3 [project, programme and portfolio] assurance is the process of providing confidence to stakeholders that projects, programmes and portfolios will achieve their scope, time, cost and quality objectives, and realise their benefits" (APM Body of Knowledge, 2019).

This highlights that the assurance system should be designed closely with the risk management approach to a project, ensuring that the governors of the system receive clear and actionable management information about the project, how it is developing within a complex environment, and how it is managing the major risks.

Another definition of assurance that has been used is "a management control system is a means of gathering information that would assist and help coordinate the process of making and monitoring the decisions within the organisation" (Horngren, 1991). It is also highlighted that many authors use the phrases of performance measurement and performance management interchangeably. The two are different; performance measurement analyses data from the past. Performance management utilises these data to provide indications and predictions about the future (Fryer, 2009).

The use of the term 'Performance' is loosely defined (Nalewaik, 2014) and Nalewaik challenges the established standards in their ability to deliver performance audits and highlight the key issues within projects. A similar view is held by Locatelli (2017). 'Traditional success indicators' in project management refers to the so-called iron triangle: cost, time and quality. A common set of operational metrics are based on numerable measures of time, cost and scope of activities (Atkinson, 1999), although the difficulty of measuring these qualities and linking them to policy goals is noted by Guimon (2011). This short-term, contract-based view has been challenged by researchers who consider multiple perspectives of different stakeholders.

Nalewaik (2014) proposes that assessments of a project's success should include cost, schedule and procurement/contracting as the key drivers. The NAO (2010) present the principles for an improved assurance system for high-risk projects. This includes the statement, "Assurance should highlight any breach of time, cost and quality control limits as agreed at approval of the business case and trigger appropriate intervention." But this appears to be a return to the iron triangle approach.

In the literature on performance measurement and management it is suggested that a 'golden thread' can tightly couple top-level performance measures to each business unit allowing individuals and teams a clear pathway to contribute to the corporate objectives (Bourne, 2018). However, there can be considerable complexity in public administration that have central and local policies leading to the view that "it is questionable whether the establishment of a pervasive 'golden thread' would be either feasible or desirable" (Bourne, 2018).

Less research activity has been identified within the assurance area in comparison with other areas of research such as general project governance and 'project success'.

A number of authors provide more detail on the difficulty of establishing good assurance systems in the public sector. Fryer (2009) highlights that it can be very difficult to implement meaningful assurance reviews in the public sector. Fryer talks about 'deviant behaviour' that can occur where people seek to adjust figures so that systems can seem to have improved. Fisher (2008) considers more deeply the problems of 'metric manipulation', which is sometimes widely reported in the press. There are a number of levels of manipulation that range from simply hiding poor performance data among vast amounts of detail, all the way through to gaming a system and complete distortion of the truth through lies. In his review Fisher concluded that "the propensity to manipulate metrics can be quite high although the deception is mostly of a low level of ethical seriousness". Gu (2016)

Less research activity has been identified within the assurance area in comparison with other areas of research

Assurance within the public sector includes peer-level internal review that is performed routinely

highlights how widely gaming has been seen within the British health service metric system. Gu goes on to review the cases of over 200,000 Australian citizens as they access Australian healthcare providers and concludes "there is quite strong evidence of gaming behaviour to produce favourable performance reports". Fisher highlights that trigger mechanisms for deception using metrics include whether measures are externally imposed, whether the targets have internal value and whether there is an informal culture within the organisation tolerant to metric manipulation.

Assurance within the public sector includes peer-level internal review that is performed routinely, the reviews conducted by senior management as part of their duties within a project or management team, and the formal reviews. Xu (2011) highlights the improvements in cost control that have been seen as a result of the introduction of gateway reviews, with financial savings of £890m reported for 2009–2010 (NAO, 2010).

Lehtonen (2014) highlights that "evaluation literature has thus far paid surprisingly little attention to the evaluation of such large infrastructure projects". Lehtonen suggests that "network mapping" may provide a good framework for the evaluation of large projects.

EC6

Metrics should be sought that are more relevant than the fallback of (1) time, (2) cost and (3) quality, and could be enhanced to include (4) deliverable benefit and (5) risk. A well-designed assurance system that is 'tuned' to the governance system will provide regular updates on the project/system and its likelihood of achieving its aims.

There are two types of project:

■ 'Fixed target', eg a new bridge ■ 'Moving target', eg Brexit

The assurance system must be very different for each type. Radical change of requirement is unlikely for a fixed target so a review against the extant requirement should provide confidence that the project is on track. For a moving-target project one of the major problems is identifying what is really needed from the project. In the case of Brexit the change between a hard and soft Brexit will massively change the way that this is delivered.

The definition of assurance might change for the two cases.

3.6 The informal phase

The informal phase is also referred to as the front end of the project. Projects can start their life in many different ways and the early phases are often a time of rapid change as the project is shaped and evolved to include requirements from some of the stakeholders, and, sometimes, exclude other requirements that are considered out of scope or too complex/expensive to meet. The importance of governance in these early stages is mentioned by Williams (2010). Crosby (2017) notes sparse amounts of literature that deal with large-scale complex projects and particularly front-end shaping. Crosby (quoting Archibald, 2013) highlights that the setting of policies and launch conditions at the front end of a project can prepare it for robustness and success. Samset (2016) highlights that Merrow (2011) and Morris (2013) also support the view that the front-end phase is critical to project success. Yet there is evidence that these lessons are not being learned. Williams (2010) highlights that two of the four major projects studied in the research had early-phase governance described as 'ad hoc'.

Crosby (2017) highlights the following key areas that are of particular importance at the front end of a project. These should not be tackled in isolation but considered together.

- Detailed goals should be articulated, and these should include hard and soft definitions of success.
- A realistic assessment of complexity must be the basis for planning resource, cost and risk.
- Procurement is key. It is a strategic enabler and must be treated in this way rather than just admin work.
- Project resilience is achieved through realism and a mission assurance function.
- Preparing for the unknown requires serious consideration through fully resourced contingency plans etc.

Other front-end issues include problems with the early decision-making. Samset (2016) shows that many problems within major public investment projects have their origins before the final decision to go ahead. These issues stem from analytic or political processes.

When activities within projects are provided through outsourcing, another group of risks in the contracting process can be seen that will start to impact the project from the informal phase onwards. Considerable work has been done by Bloomfield (2019) in identifying the relationship between the structuring of a contract and its propensity to induce risk. A mapping tool has been proposed by Bloomfield that highlights where the risks within a contract lie, between the contracting authority and the contractor.

EC7

The portfolio function should screen poor projects.

3.7 Avoiding excessive optimism

As large projects evolve, their supporters often offer lower cost estimates and high estimates of benefit, while those that oppose the project highlight the reverse situation. It is very difficult for project governors to remain realistic; particularly as large projects often face considerable political resistance early in their life cycle. Flyvbjerg (2003) has shown that project promoters believe that delusion about project cost is necessary to get major projects started. Early estimates have been highly inaccurate and these have led to a commitment to projects such as the Channel Tunnel. Contractors and project promoters have a vested interest in underestimating costs and environmental impacts, and overestimating demand and development effects (Flyvbjerg, 2011). The phrase 'conspiracy of optimism' was quoted by Gardener (2008), not to indicate any kind of illegal or unethical behaviour, merely an approach that is taken within the defence community to get major projects started. Using game theory, Gardener has examined the two positions that industry and government could take to projects: optimistic or realistic – and it has been shown that an optimistic strategy is the most rational strategy for each party. It has also been shown that uncertainty presents more opportunity for optimistic estimation of costs. This situation led, in 2010, to a commitment to a national defence programme that was unaffordable. The defence programme was substantially reduced in the Strategic Defence and Security Review 2010 (HM Government, 2010), leading to the cancellation or removal from service of a number of key platforms, including Nimrod in which over £3bn had been invested at the time (although there were very significant creeping risks on the project and it was likely, had the project continued, that the Nimrod aircraft would not have met its key user requirements).

**A realistic assessment
of complexity must be the
basis for planning resource,
cost and risk**

While there are many ways to form initial estimates, such as reference class forecasting (RCF)¹, such approaches necessitate judgement such as identifying the position of the project of interest within a distribution. While the approach is evidence based and will be likely to form a more accurate estimate than an entirely opinion-based judgement, it may still be possible to imbue the assessment with elements of optimism.

EC8

People are naturally biased about certain things, such as 'sunk cost bias', in which people are reluctant to stop an activity because money has been invested in it. This affects most people. Independent review can help to improve the situation. In the USA 'shadow costing' is used to prepare an unbiased view of the costs of a project. Data availability is a problem for this type of review. Contractors may have more data than the government, but accessing the data can be difficult.

Governance of projects involves satisfying stakeholders that are both internal to the project and organisation, as well as external to one or both

3.8 Practical considerations

There are many risks and pressures on large projects. Crosby (2017) shows that meta-risk and preparedness are therefore particularly important and need early and thorough consideration. Crosby notes that it is important to identify boundary threats at the project outset as well as shield the project from the consequences of 'black swans' through resourced contingency plans and pre-prepared task forces.

A governance system can be either very loose, as may be found in a small start-up business, or at the other extreme very tight, as may be found in high-risk safety-critical environments such as the nuclear power industry. For many projects a balance often needs to be found that will allow 'gut feel' to see through complexity (Klakegg, 2016). Frijns (2018) also highlights that a lot of energy is placed in activities that deal with "how to handle the matter procedurally". This results in an ever-increasing hierarchy and bureaucratisation within organisations so that their senior management can feel in control through processes.

Governance of projects involves satisfying stakeholders that are both internal to the project and organisation, as well as external to one or both. Derakhshan (2019) has conducted a rigorous literature review focusing on governance and stakeholders. Derakhshan recommends the adoption of stakeholder theory as an umbrella for all other theories, presented in 2.1.4.

EC9

The selection of an appropriate governance theory will always depend on the type of project that is being delivered.

3.9 Benefits realisation management and maturity models

Benefits realisation management (BRM) is a method of ensuring that the most valuable strategic activities are implemented in a project (Serra, 2015). Through empirical evidence, Serra has shown that BRM is associated with project success; noting that there are many other activities that need to be in place as part of good project management in delivering a successful project. The National Audit Office (NAO) conducted a review into the government's major projects portfolio to assess whether the projects leaving the portfolio had delivered their intended benefits. The review found that 302 projects had left the portfolio since 2011; however there is "incomplete data on the reasons why they had left and what they had delivered by the time of their departure" (NAO, 2018). The review also

¹An application of RCF is shown at www.apm.org.uk/news/de-risking-the-programme-portfolio-with-reference-class-forecasting

concludes that "there is a varied picture as to whether projects have delivered successfully after they leave the portfolio".

It is clear that BRM is not being implemented fully across the major projects portfolio for the life of the projects.

Maturity models originated in the field of total quality management and are usually implemented as a standardisation or business process improvement (Young, 2014). It is believed that process maturity will achieve organisational improvements and many ways of implementing maturity models are proposed (Cooke-Davis, 2004). Young notes that improved levels of maturity can deliver superior performance. However, Young's work was based on 'distant' observation (through freedom of information requests) of 23 Australian agencies. The details of the projects that were observed are not available in Young's paper and it may be that quite a number of these projects were relatively straightforward activities with few competing demands and a much less complex environment than many of the activities within the UK major projects portfolio. There is also a warning from Jugdev (2002) that focusing on what is measured by maturity models might achieve competitive parity but could mean "missing out on capitalising on their intangible assets".

Other assessments are possible. An enterprise maturity model was developed within the Ministry of Defence to provide an evidence-based maturity grid for use when a very large-scale enterprise was to be split into public and private sections (Parr, 2018). The grid was developed to distil the learning from many outsourced enterprises, some of which had achieved great success, while others had resulted in catastrophic failure.

There is much more research needed to understand what types of maturity assessment (if any) may be beneficial and whether benefits may be delivered from maturity models for the types of large-scale activity that are being delivered through the UK major projects portfolio. As Cooke-Davis (2014) notes, the field of maturity models is immature.

EC10

The assessment of the delivery of benefit should be separated from the day-to-day work of delivery of the project to ensure that benefits management remains an important activity throughout the life of the project. From the benefits management work the indicators of project success will be developed.

Tracking of benefits after handover of a project can be difficult and the linkages between the IPA and the Government Internal Assurance Agency (GIAA) could be improved.

3.10 Organisational learning

Samset (2016) highlights the need to learn lessons from projects that have worked well, as well as those that have not. Samset highlights that the evaluation of activities for learning purposes is limited, particularly in the public sector.

EC11

Lessons can be learned individually, but group learning is not widely practised. The best organisation learning can be from 'hard lessons', but lessons are not routinely and regularly shared.

Independent experts can add a lot of lessons from other projects across the government's portfolio. Documenting lessons from project delivery conferences may also add to organisational learning.

Genuine metrics of innovation should be applied to projects. Innovation has risks, and if real innovation is taking place there can't be an expectation that everything will be successful.

4. Gaps in the knowledge base

A number of gaps in the knowledge base have been identified and these are presented, under the headings from the findings section, as a series of questions.

4.1 Complexity

How can the level of complexity in a project be understood? What mechanisms are there to reduce the impact of complexity on a project? What approaches work best, such as iterative design? Key elements of a project may become unstable as time moves on. Can this be predicted in advance, ideally in the planning phases?

4.2 Assurance

How should a good assurance system be aligned to a project's governance system and tuned to the objectives of the project? How can assurance be best implemented within public-sector projects? What behaviours are needed for an assurance system to be effective and is it possible for the assurance system to be aligned from top to bottom in the form of a golden thread? How is complexity best handled within an assurance system?

What metrics should be used to assess a major project? The iron triangle (time, cost and quality) is not applicable for projects that operate in complex and dynamic environments. What metrics, systems and approaches are less open to deception?

4.3 The informal phase

What evidence is there as to best practice in establishing a project? What level of review should be applied to the decisions and activities in the informal phase, before the project is allowed to enter a formal phase?

What is the best way of transitioning a project into the formal phases and then afterwards into routine business?

4.4 Avoiding excess optimism

What approaches are most likely to yield objective and useful data on which to base decisions about the future of major projects?

4.5 Benefits realisation management and maturity models

What types of maturity assessment (if any) may be beneficial? What benefits may be delivered from maturity models for the types of large-scale activity that are being delivered through the UK major projects portfolio?

4.6 More general gaps

Research has been less focused on how to best govern projects (Biesenthal, 2014). The optimal mix of regulations, economic means and information should be considered to improve governance regimes (Samset, 2016).

Ensuring that the leadership and culture support performance management is key. There is a lack of evidence about the interpretation, reporting and statistical validity of indicators (Fryer, 2009).

An explicit theory on the theoretical side of project management is "the crucial and single most important issue for the future" (Koskela and Howell, 2002). This leads to the question "how do we select a single theory and is such a single theory approach appropriate?" Systems theory has been used heavily in this report and this decision was based on how useful such a theory is for practice.

Crosby (2017) highlights that the traditional skills and techniques of a project manager are insufficient to properly plan or manage the complexity of large-scale projects. What skills are the optimal set needed to run these large projects and how are project professionals best trained in these skills?

5. Implications for project governance

The project governance mechanism should be designed around the predominant governance theory of the organisation, and the theory that best fits the project of interest.

5.1 Complexity

Careful consideration of complexity is important. Cybernetics may provide the most developed theory and a systems approach must be considered for all major projects. It is unlikely that a major project will not need this.

5.2 A systems approach

Systems thinking can embed flexibility into project management. PSMs offer a wealth of methods and approaches that can help establish and guide projects that are operating in complex environments. The VSM is founded on cybernetics and offers a structure that can greatly assist in establishing project governance.

The VSM offers a way of ensuring that the right connections are in place for an organisation to govern its projects, and for the projects to be correctly governed. While VSM offers a way of structuring this it doesn't provide a prescription as to how it can be done.

5.3 Governance structure

The following principles should be included in a governance structure: (1) Identify a single point of accountability, (2) Ensure a service delivery focus, (3) Separate the project and the organisation governance structures, and (4) Separate stakeholder management and project decision-making.

5.4 Assurance

An assurance system that is tuned to the governance system is essential for a project to operate efficiently. Careful consideration should be given to the selection of metrics that will highlight a project's real levels of progress.

5.5 The informal phase

It is essential that clear and strong governance is applied, appropriately, at the start of the project. The setting of policies and launch conditions at the front end of a project can prepare it for robustness and success. Many problems within major public investment projects have their origins before the final decision to go ahead.

5.6 Avoiding excess optimism

Some project promoters believe that delusion about project cost is necessary to get major projects started. The lobbying effect of supporters and opposers can leave project managers and governors struggling to see a situation objectively. It has been shown in the defence sector that an optimistic strategy about cost is the most rational for both government and industry staff. Project managers

and governors should seek robust and independent estimates of cost and benefit as the basis for decision-making about the future of the project.

5.7 Preparedness

It is important to prepare a project at the outset for major 'black swan' risks.

5.8 Balance of flexibility and process

A balance needs to be found between rigid and flexible processes. The balance should allow 'gut feel' to see through complexity.

5.9 Benefits realisation management and maturity models

Benefits realisation management (BRM) is important for the success of projects and should be established right at the beginning of a project and maintained throughout its lifetime. Appropriate maturity models should be considered to help establish and guide the project.

5.10 Organisational learning

The evaluation of activities that have worked well, and those that have not, should be expanded within the public sector so that lessons learned are communicated widely. Best practice can then be repeated and pitfalls avoided.

6. Conclusions

Good governance is key to establishing a successful project. Assurance is part of governance and performance monitoring is essential to understand whether a project will accomplish its objectives.

Two types of project exist: (1) 'fixed target', where most of the requirement for the project will remain constant throughout the life of the project; and (2) 'moving target,' where large areas of the requirement will change as the project develops. The governance and assurance system will be very different for these projects because they are fundamentally different entities. So, the governance system for a 'fixed target' model should be linear and static. Complex projects are neither linear nor static and any attempt to run them in this way is likely to result in poor progress. It is important that the governance model has a model of the dynamic relationships that affect the project and its environment to ensure that it is being controlled appropriately.

Large projects operate in complex environments and complexity is important and must be managed through the use of appropriate tools. Many tools are available, and would be selected to suit the environment and the types of decision that need to be made as the project progresses. Requirements complexity has been seen to contribute to project failure. A systems approach must be adopted for every major project. Holistic design and review are also important. A tool that offers a structure to establish a governance system is the VSM. VSM will highlight what entities need to be present and what connections are needed, but it doesn't offer a prescription for implementing this. A key criterion for viability of an organisation is that the organisation is, or becomes, stable so that small changes (from the organisation or environment) do not destabilise it. Due to the recursive nature of VSM the same logic can be applied to projects. Future research should consider how the effects of complexity on a project can be reduced and how the effects of complexity may be predicted in the future.

It is very difficult to establish good assurance systems in the public sector due to the complexity of what needs to be measured and the interests of the staff implementing the systems. Cases of metric manipulation have been reported that range from hiding poor figures in large volumes of data all the way

through to gaming and manipulating metrication systems. Large infrastructure projects have received very little coverage within the evaluation literature. The traditional 'iron triangle' metrics of time, cost and quality alone are believed to be too simplistic for large, complex projects and different or additional attributes need to be measured for stakeholders to gain confidence that a project is progressing well. Future research should consider how a project's governance and assurance system should be tuned to the environment in which it is operating. Future research could establish the best metrics and assurance environment for a major project.

The shaping of projects during the informal phase is very important. Many problems within major public investment projects have their origins before the final decision to go ahead. The governance approach in the informal phase is therefore vitally important, but the need for formality in governance at this stage is not recognised in all projects; the early-phase governance for some large projects is reported as 'ad hoc'. The structure and approach to early-phase governance of major projects are worthy of further research.

Excessive optimism is viewed by some promoters as an essential ingredient of getting a major project started. It is believed that stakeholders are unlikely to undertake a project if the true costs are known at the outset. To combat this, some authors advocate approaches such as reference class forecasting to gain a more realistic early estimate of the true cost of the project. Problems remain with this approach in that members of the early design team can shape and influence the references that are selected for the costing. It is recommended that an independent estimate of costs is obtained to ensure, as far as practically possible, that early cost estimates are unbiased and provide a more solid foundation to take the project forward. A similar approach of independent forecasting is recommended for initial usage analysis, such as estimated traffic volumes for new infrastructure projects. Another key bias is 'sunk cost bias' in which people are reluctant to stop an activity because money has been invested in it. Independent analysis can again provide a valuable input into these activities as long as advice leads to action.

Projects should be prepared for major risks and shielded as much as possible from unknown 'black swan' risks. A balance of flexibility and process allows projects to maintain the freedom to develop and grow according to the evolving needs of the activity but process is needed to ensure that the project complies with the institutional rules.

Benefits realisation is important but its implementation could be improved across the major projects portfolio; this is particularly important as projects are handed over from the IPA to the Government Internal Assurance Agency.

There is a body of literature on some aspects of project governance, particularly major projects and project success. This is often focused on a small number of case studies. There is less material that offers a view of how some of the most challenging problems can be addressed.

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