Client Guide for Improving Infrastructure Project Outcomes

By Ronald Watermeyer

ENGINEERS AGAINST POVERTY 20 YEARS
UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
SCHOOL OF CONSTRUCTION ECONOMICS & MANAGEMENT

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RONALD WATERMEYER

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Forewords

Professor Paul Jowitt

CBE, PhD, DIC, CEng, CEnv, FRSE, FREng, FICE, FIPENZ, Chairman, Engineers Against Poverty

Engineers Against Poverty (EAP) is delighted to co-sponsor this Client Guide for Improving Infrastructure Project Outcomes. The Guide is the first of EAP's celebratory projects marking our 20th Anniversary in 2018. Infrastructure provides the underpinning platform upon which society depends and yet in many cases the causes of infrastructure failure can be traced back to a lack of good governance, poor procurement and inadequate delivery management practices, all of which are under the control of the client. Successful infrastructure delivery isn't just down to effective project management and the built environment professionals. The role of the client is crucial in terms of setting the direction and providing effective governance. And whilst there is plenty in the literature to support and guide the project manager, there is very little to assist the intelligent client. This Guide fills that gap comprehensively, and for the first time brings together and provides vital guidance for the Client to positively influence successful project procurement and delivery.

Engineers Against Poverty (EAP) was established in 1998 by the Institution of Civil Engineers (ICE) and the Institution of Mechanical Engineers (IMechE), with support from the Royal Academy of Engineering and the Institution of Chemical Engineers (IChemE). Financial support was provided by the Department for International Development. The original name given to the Charity was the *Telford Challenge*, after Thomas Telford, the first President of the ICE. Its initial activities were focussed on how the engineer could help reduce poverty and it sought to do this through small-scale 'appropriate technology' projects. It soon realised that these were best left to other specialist charities and that there was a more strategic role for an Engineering Charity to play.

This new role initially involved better aligning the core business of contractors and consultants with the development priorities of the low-income countries where they worked. This was later extended to include influencing the policy and practice of governments and international agencies in areas such as governance, health and safety and labour standards.

EAP is not a 'tin-rattling charity', but it still does what it says on the tin – *Engineers Against Poverty*. In EAP's first twenty years it has made some landmark achievements. It was pioneering for example in establishing 'local content' guidelines in oil, gas and mining and advised various industry bodies and the IMF. It was also instrumental in helping to establish the Construction Sector Transparency Initiative (CoST), the leading global transparency initiative for infrastructure. And it has consistently worked to improve the livelihoods of construction workers in Africa and the Middle East.

If you want to keep in touch with *EAP*, contact **info@engineersagainstpoverty.org** or go to **http://www.engineersagainstpoverty.org**.

Professor David Root

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The School of Construction Economics and Management is located within the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg. The School strives to produce quality

research, deliver effective teaching which is informed by and integrated with research findings and engages with industry and our stakeholders in useful ways. The School is delighted to co-sponsor this publication which fills an important gap in our knowledge and understanding of how infrastructure projects outcomes can be improved upon should the client function as the leader of the delivery process.

Much of what is written in this Guide has been tried and tested in the University's capital expansion programme which commenced during 2008 and during the first phase of the delivery of two new universities in South Africa, namely the University of Mpumalanga (Nelspruit) and the Sol Plaatje University (Kimberley), between 2011 and 2016 (see www.wits.ac.za/ipdm). These projects have consistently demonstrated that a wide range of infrastructure projects can be delivered with a close tolerance between intended and achieved outcomes should a strategic approach to procurement be adopted and rigorous project governance and effective delivery management practices be embraced. This has been achieved through strong client leadership, a client team with the right chemistry and skills, a culture of collaboration, a shift away from traditional procurement and delivery management practices, the bold adoption of several procurement innovations and active cost management.

The School commends this information rich Guide to all who have an interest in infrastructure projects i.e. practitioners, professionals, students, lecturers, researchers, decision makers and stakeholders.

Professor Yunus Ballim

PhD(Witwatersrand), MSc(Witwatersrand), BScEng(Witwatersrand), MCSSA

Vice Chancellor and Principal, Sol Plaatje University, and former Deputy Vice Chancellor (Academic) and the Vice-Principal, University of the Witwatersrand

This publication arrives at a time when there is global crisis in the trust and confidence that citizens hold in the ability for their social institutions to deliver on the promise of a dignified life to all. The reasons are not that hard to find: corruption, irresponsible corporate behavior, governments undermining their own social institutions as they are brought into the service of settling political scores, financial efficiency placed ahead of all considerations of social responsibility and a persistent shrinking of the reach of social justice to the most marginal of our societies – are but some of the causes. An important reason for this has been a generalised neglect to overlay negotiated and agreed institutional values on all the areas of institutional operations.

An important part of the argument offered in this Guide is that the 'client', as custodian of the social institution – corporate, business, public, state, etc. – must unashamedly bring institutional values into the planning and implementation of infrastructure. In its physical manifestation as well as in its management and implementation, infrastructure must 'live' the values of the institution. This means a commitment to proper and hygienic governance processes, unhesitant commitment to quality and socially developmental relationships between all people involved in the process of infrastructure development. On top of proper technical and financial management, it is also in our ability to defend our institutional values that the successful infrastructure project must be judged. This is essential if we are to rebuild the trust that citizens are to have in their social institutions.

The Guide draws from a long and shared history of developmental experience with infrastructure provision. The approach locates the client at the correct site of responsibility for a developmental approach to infrastructure provision and the visionary client will find fertile ground for using infrastructure projects to strengthen the role and meaning of institutions as serious contributors to social development.

Executive summary

Chapter 1: Introduction

All too often the gap between what was planned for and what was achieved in an infrastructure project is significantly different. There is a direct linkage between the role played by a client and the outcomes of an infrastructure project, regardless of its size, complexity and location. The root causes of infrastructure project failure can frequently be attributed to the lack of governance and poor procurement and delivery management practices, all of which are under the control of the client.

There is a dearth of literature on the role of the client which explains how a client can positively influence the success of a project. Several national and international standards covering aspects of governance, management and procurement have been published in recent years. This Guide draws on these standards to provide a guide on the role of the client and how a client can positively influence the outcomes of a project, regardless of its size, complexity and location.

Chapter 2: Client functions and practices

The principal role players in the delivery of infrastructure are the client team, the delivery team and stakeholders. The client team needs to provide effective leadership and direction to the delivery team (project managers, designers, specialist professional service providers, manufacturers and constructors) and meaningfully engage with internal and external stakeholders. The client team performs a "buying function" whereas the delivery team performs a "selling" or "supplying function." Both of these teams are driven by different objectives in the "buying" and "selling" exchange.

The principal role of the client is to ensure that a solution to the business case for a project is achieved. The client owns the business case of the project and is accountable for project outcomes. The client needs to provide effective leadership of the project throughout the project life cycle, commencing at a strategic level and ending at the close out of a project after the beneficiary of the project has accepted or operates the infrastructure that is delivered.

The activities directly related to the provision of infrastructure take place within product controls (budget, schedule, function, quality, conflict, health and safety and the environment). Such activities are informed by delivery constraints which in turn are shaped by an underlying context. One of the key tasks of the client team is to provide leadership in boundary-spanning actions and flows between the underlying context and the delivery constraints as well as between the product controls and the delivery constraints to achieve an optimal balance of the project benefits, risks and costs.

The client needs to establish a client team to own the business case, procure and pay resources to deliver the project, lead the project, manage relationships, oversee aspects of delivery and provide client direction. A client delivery manager (named individual) needs to be appointed to lead the client team and be held accountable for project outcomes. A client also needs to put in place project governance arrangements to provide the framework within which decisions are made in the delivery of infrastructure projects and for securing the buy-in of key players.

This Guide identifies the principal role players in the delivery of infrastructure projects and outlines their basic functions. It describes the pivotal role that the client plays in the delivery of infrastructure and what a client ought to do in doing so. It also offers guidance on how to go about establishing the client team and structuring project governance arrangements.

Chapter 3: Critical knowledge areas for effective delivery

The client team needs to have an understanding of delivery management, procurement, portfolio, programme and project management and governance in order to effectively delivery infrastructure projects. This Guide maps out the supply chain associated with infrastructure delivery management. Each of the tasks in the supply chain are linked to the next in sequence tasks via a decision gate. The supply chain represents the flow of information from one set of tasks to the next while the decision gates which form the link between tasks provides the opportunity for ensuring that the proposed project remains within agreed mandates, aligns with the purpose for which it was conceived, and can progress successfully.

The Guide also outlines the thrust of a number of recently published standards which cover the knowledge areas which client teams need to get to grips with to effectively perform its delivery management role. These standards address construction procurement (ISO 10845), project, portfolio and programme management (ISO 21500, ISO 21503 and ISO 21504), risk management (ISO 3100) and governance (BS 13500 and ISO 21505).

Chapter 4: Controlling work flows

Control systems are necessary to regulate work in relation to its context which may change from time to time. Control systems accordingly involve the comparing of progress against requirements, objectives or targets and where necessary taking some corrective action such as taking steps to change the performance of the activity to bring it closer to what was planned or changing the plan so that it more closely reflects the changed situation brought about by the departure from the plan.

The Guide describes a control framework for the delivery of infrastructure projects which deals with the generic work flow associated with the planning, design and execution of infrastructure projects. This control framework is structured in such a manner that the viability of a project may be tested, monitored and controlled by the client team as it progresses. It generates information which informs decisions at particular points in the process. It links governance activities to the milestones in the delivery process. The Guide also provides a control framework for procurement which links milestones in the procurement process to governance activities.

Chapter 5: Procurement strategy and tactics

Procurement outcomes in infrastructure projects are sensitive to the decisions made during the planning, design and execution of such projects as well as during procurement processes. Procurement strategy is all about the choices made in determining what is to be delivered through a particular contract, the contracting arrangements, how secondary procurement objectives are to be promoted and which selection method will be employed to solicit tender offers. Procurement tactics on the other hand typically relate to the selection of the other party to a contract who is most likely to deliver best value or a cost-effective solution through the performance of the contract. They also relate to the setting up of contracts to not only allocate specific risks but also to incentivise performance to achieve best results.

Clients and their agents need to understand the range of options, tools and techniques that are available and what criteria need to be considered in order to make informed choices. The Guide establishes a generic framework within which procurement strategy and tactics can be developed.

Chapter 6: Improving project outcomes

Value for money can be regarded as the effective and efficient use of resources or the optimal use of resources to achieve intended outcomes. The Guide outlines and discusses the concept of value for money. It also discusses inhibiters and enablers associated with the improvements in project outcomes (and hence value for money) including optimism bias, strategic misrepresentation, collaborative working and digital technologies. This Guide also outlines the culture and mindset which may be required to embrace new and emerging practices.

Chapter 7: Designing an effective delivery management system

This Guide concludes with the outlining of steps associated with best-value procurement to reduce waste and error. It also outlines what clients can do to improve project outcomes in addition to adopting and embracing the practices contained in Chapters 2 to 6. It also briefly looks to the future direction that clients may take in making further improvements in infrastructure project outcomes.

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CHAPTER 1
Introduction

Communities are surrounded by infrastructure (the basic physical and organisational structures and facilities needed for the operation of a society or an enterprise) including the homes in which they live, the offices and factories in which they work, schools which are essential for the education of their children, and hospitals and clinics which are fundamental for their health and wellbeing. They are also surrounded by economic infrastructure which supports the economy in its totality. Road and railway infrastructure not only enable travel between homes and places of work, schools and hospitals but also distribute goods and services to communities. Border posts, harbours and airports are the physical links with neighbouring countries and the world. Dams provide water not only for human consumption but also for agricultural and industrial purposes. Power stations generate electricity. Networks deliver water and electricity to homes, places of work, schools and hospitals and convey industrial effluent and waste water to treatment works. Infrastructure is foundational to a better life for all.

Investment in economic infrastructure occurs in expectation of demand or in reaction to demand for capacity. When this happens, it has the following three impacts (Watermeyer, 2011a):

1. an initial growth in demand for people, equipment, plant and materials on the project, which lasts as long as it takes to create the asset;
2. a demand on resources over the lifespan of the project to maintain the asset; and
3. a productivity impact in the overall economy, either producing more or producing it better due to more efficient infrastructure (or simply the availability of capacity like harbour capacity and electricity).

Expenditure on infrastructure will not necessarily lead to economic growth. Infrastructure which provides improvements or efficiencies in services, production or export capabilities and which is delivered and maintained in a manner which minimises waste of materials, time, and effort to generate the maximum possible amount of value, is most likely to contribute to economic growth. Infrastructure is generally expensive, and therefore due diligence needs to be done on the planning and prioritisation of infrastructure projects to optimise their contribution to economic and social objectives. Poorly planned and under-utilised infrastructure can be a drain on the economy rather than contributing to economic growth.

Although many infrastructure projects are similar in nature, each project is unique. This is due to several important project variables including what is delivered, the client's value proposition for projects, stakeholder influences, resources employed, constraints, processes and procurement practices that are employed in delivering the required infrastructure. Infrastructure projects need to be set up and delivered. Once decisions are made on what the project needs to deliver, who will deliver it and how will it be funded and governed, the remaining decisions centre on how it will be managed through to completion.

All too often disappointing project outcomes are experienced. The gap between what was planned and what was achieved can be significant. Merrow (2012), for example, considers a project to have failed if the schedule slips or the project overspends by more than 25%, the execution time is 50 % longer, or there are severe and continuing operational problems into the second year of the project. His findings, following a review of large data base of international projects, shows that megaprojects around the world fail by a staggering rate of 65% compared to a failure rate of 35% for projects under the $500 million mark. McKinsey and Company (2017) asset

that on average, projects with budgets above US $1 billion are delivered one year behind schedule and run 30 percent over budget. Hawkins and McKittrick (2012) in their report on the pilot countries in the Construction Sector Transparency Initiative (CoST) programme found that in the 145 projects sampled in eight countries, 31% exhibited poor management of time and cost with at least 55% being over budget and 8% being more than 100% over budget. Foster (2008) examined infrastructure in 24 countries that together account for more than 85 % of the GDP, population and infrastructure aid flows of Sub-Saharan. Foster found that countries typically only manage to spend about two thirds of the budget allocated to investment in infrastructure while about 30% of infrastructure assets require rehabilitation.

The high demand for rehabilitation in Sub-Saharan Africa points to a systemic lack of maintenance. The maintenance of infrastructure is critical to ensuring that best value is obtained from the initial expenditure and the life of the infrastructure is extended as cost effectively as possible. Attention to maintenance can significantly reduce the demand for rehabilitation.

According to the Office of Government Commerce (2005) in the UK there are 8 common causes of project failure as indicated in Table 1.1. The root causes of failure, which can be ascribed to these 8 common causes, relate to lack of governance, and to poor procurement and delivery management practices, all of which are under the control of the client.

Table 1.1 Common cause of project failure

	Common causes of project failure (Office of Government Commerce, 2005)	Issue	Ascribed underlying cause
1	Lack of a clear link between the project and the organisation's key strategic priorities, including agreed measures of success	Purpose	■ Lack of governance ■ Lack of planning due diligence
2	Lack of clear senior management and ministerial ownership and leadership	Client leadership	Lack of governance
3	Lack of effective engagement with stakeholders	Stakeholder engagement	Lack of governance
4	Lack of skills and a proven approach to project and risk management	Execution strategy	Poor procurement and delivery management practices
5	Too little attention to breaking the development and implementation into manageable steps	Control	Lack of governance, lack of standard operating procedures
6	Evaluation of proposals driven by initial price rather than long term value for money (especially in securing the delivery of business benefits)	Values	■ Lack of governance ■ Poor procurement practices
7	Lack of understanding of, and contact with, the supply industry at senior levels in the organisation	Procurement arrangements	Poor procurement practices
8	Lack of effective project team integration between clients, the supplier team and the supply chain	Integration	■ Lack of governance ■ Poor procurement and delivery management practices ■ Lack of standard operating procedures

ISO 6707-2:2017 defines a client as "*the person or organisation initiating and financing a project and approving the brief*". The principal role of the client, which can be a public or private sector organisation or individual, is to ensure that a solution to the business case for a project is achieved. The client as such owns the business case of the project and needs to provide effective leadership of the project throughout the project life cycle, commencing at a strategic level and ending at the close out of a project after the beneficiary of the project has accepted and operates the ensuing infrastructure.

Kershaw and Hutchison (2009) make the observation that "*the role of the client is the single most important factor in determining the success of construction projects and capital works programmes, regardless of their size, complexity and location.*" Much is written on project management and the roles and responsibilities of built

environment professionals. There is, however, a dearth of literature on the role of the client which explains how a client can positively influence the success of a project.

In recent years several national and international standards have been published which provide clients with a toolbox to overcome deficiencies in governance, management and procurement practices, all of which enable clients to adopt and implement a strategic approach to the delivery of infrastructure projects. This publication draws on these standards to provide a guide to the role of the client and how a client can positively influence the success of a project, regardless of size, complexity and location. It also outlines current and emerging best practices, particularly those relating to governance, procurement and delivery management practices, which clients can embrace to improve infrastructure project outcomes.

CHAPTER 2
Client functions and practices

2.1 THE PRINCIPAL ROLE PLAYERS IN THE DELIVERY OF INFRASTRUCTURE PROJECTS

The physical delivery of infrastructure necessitates that a delivery team be put in place using an organisation's own resources or contracted resources comprising as necessary:

- a project management team which manages the development and implementation of the project and has overall management of the members of the delivery team;
- a design team which provides as necessary, architectural, landscape architectural and engineering services in integrating the client's requirements into workable solutions;
- a support services team which provides specialist support services in areas such as health and safety, condition assessments, environmental compliance, cost planning and control, geotechnical investigations, traffic studies etc.; and
- a supply team which manufactures, maintains, repairs, constructs, installs, provides, alters, refurbishes or rehabilitates infrastructure or parts thereof.

Organisations requiring infrastructure need to perform the following basic client functions as necessary:

- initiate and finance projects, approve or change the project brief or requirements and own the business case;
- put in place the delivery team that is required to deliver infrastructure;
- pay contracted resources on time;
- provide client leadership and direction to and accept the outputs of the delivery team;
- set the delivery team up for successful delivery and remove obstacles or blockages to progress;
- ensure that adequate maintenance regimes and protocols are put in place to ensure long term sustainability of the infrastructure;
- ensure compliance with legislative provisions including those relating to health, safety and the environment;
- oversee the management of scope (demand), budgets and cash flows, procurement of implementation resources, payment of contracted persons, accounting for expenditure, compliance with legislation, etc; and
- lead engagements with internal and external stakeholders and utilities.

ISO 21500:2012 defines a stakeholder as a "*person, group or organisation that has interests in, or can affect, be affected by, or perceive itself to be affected by, any aspect of the project.*" Stakeholders may include financiers, custodians (caretakers of infrastructure throughout its life cycle), end users (beneficiaries of the business case) and affected communities. Stakeholders need to:

- make known their requirements and expectations;

- commit the necessary resources to ensure that the project is successful;
- take ownership of appropriate deliverables;
- share project information with those who need to be informed; and
- identify and resolve any project issues and risks, especially those associated with managing change.

The principal role players in the delivery of infrastructure are the client team, the delivery team and stakeholders as indicated in Figure 2.1. The client team needs to provide effective leadership and direction to the delivery team and meaningfully engage with internal and external stakeholders. The delivery team needs to deliver the required infrastructure and manage the interfaces between the client team and stakeholders in doing so. The client team accordingly performs a "buying function". The delivery team, on the other hand is responsible for supplying the goods and services which are necessary to delivery infrastructure projects and as such performs a "selling" or "supplying function." Both of these teams are driven by different objectives in the "buying" and "selling" exchange.

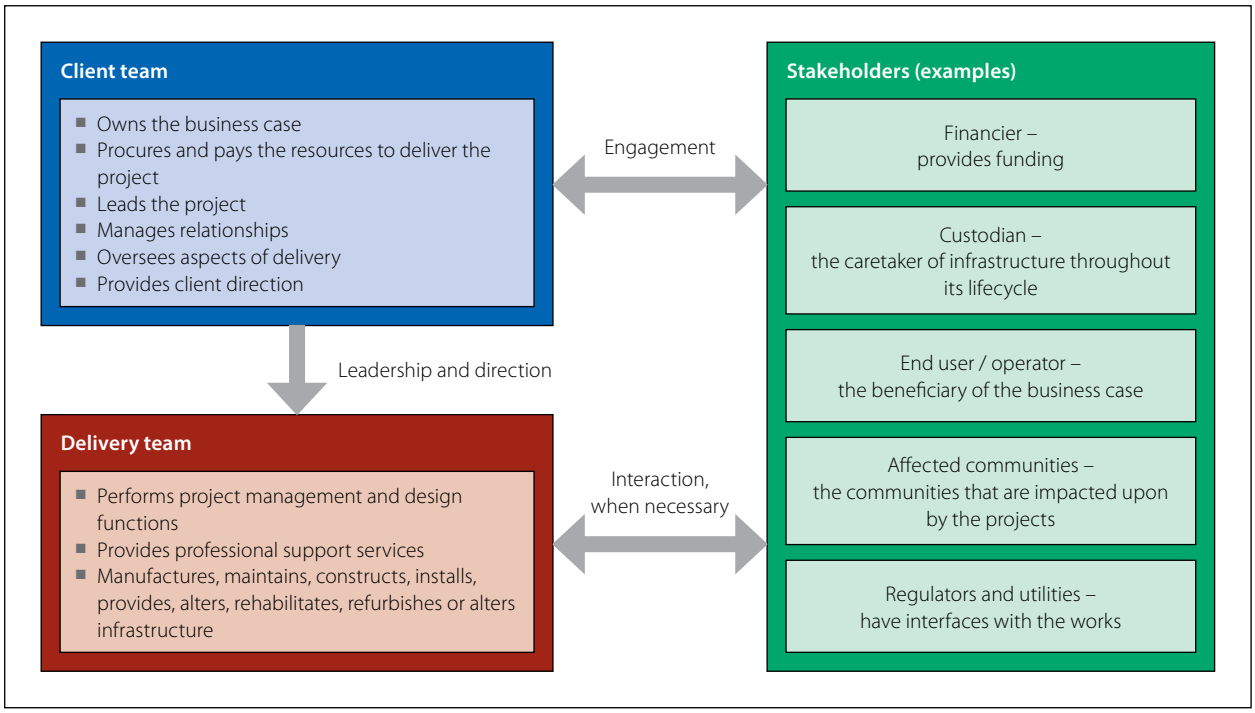


Figure 2.1 **The principal role players in the delivery of infrastructure**

2.2 THE ROLE OF THE CLIENT

A client initiates, commissions and pays for infrastructure projects. The principal role of the client is to ensure that a solution to the business case for a project is achieved. The client, as such owns, the business case of the project and is accountable for project outcomes. The client needs to provide effective leadership of the project throughout the project life cycle, commencing at a strategic level and ending at the close out of a project after the beneficiary of the project has accepted or operates the infrastructure that is delivered.

Client leadership is vital to the success of a project as it establishes the culture within which the delivery team functions (Client Construction Group, 2013). Vision and values are two important tools in the exercising of client leadership. Vision provides direction and a sense of purpose while values provide trust and appropriate behaviours for team success. Client leadership creates an enabling environment for teams to perform at their best.

A client needs to (Kershaw and Hutchison, 2009; Fitzgerald and Hodgson, 2017 and Client Construction Group, 2013):

- establish a clear business case, which captures intent, at the inception of a project, and constantly revisit the business case to verify its assumptions, objectives and ongoing validity;
- create and communicate a clear vision for the project, which may unfold over time, that enables all participants to understand its purpose;
- decide on the project delivery route that is to be pursued as well as the procurement strategy and tactics associated with each procurement (see Chapter 5);
- procure on a long term and overall best value bases rather than on a short-term capital lowest cost;
- create an enabling environment with a clear structure and responsibilities within which decisions and authorisations can be made to progress projects in an efficient and effective manner (see Chapter 4);
- apply effective leadership and governance in the way in which a project is authorised, conducted and overseen in order to create a platform for successful delivery;
- provide strategic thinking, intent and approach in delivering infrastructure projects;
- set the priorities between cost, time, quality (see Figure 2.2) and the attainment of secondary or developmental objectives to provide crucial direction to the delivery team when hard choices need to be made to steer a project through the complexities of decision making;
- carefully monitor objectives and remain vigilant for changes throughout the life cycle that can impact on a project and its business case;
- gain insight into and find ways where possible to satisfy the requirements of stakeholders;
- ensure that:
  - the budget contained in the business case is realistic and provides value for money;
  - the schedule is not only realistic but is also likely to be attractive to the market and attract competitive prices; and
  - clear briefs are provided to the delivery team before design commences;
- focus on strategy, the project environment, the context, the business case, high level progress, corrective action, communication, managing internal and external stakeholders and feedback from continuous improvement reviews;
- assess relevant risks and agree the management measures within both client and delivery teams;
- proactively manage risks and changes to what was planned; and
- insist that projects are commissioned and properly tested prior to completion and handover.

Client priority (constraint)	
1	Cost / budget
2	Delivery / time
3	Quality / performance
4	Cost / budget and delivery / time
5	Quality / performance and delivery / time
6	Cost / budget and quality / schedule

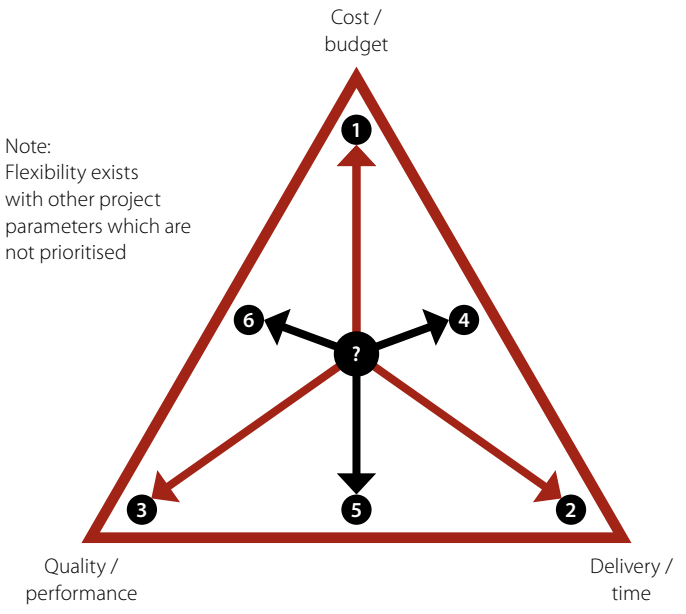


Figure 2.2 Delivery / schedule, cost /budget and quality / performance triangle

Clients in addition need to identify what is valuable to the organisation (core values), as well as what values should be reflected in their infrastructure projects. This is important as values serve as broad guidelines in all situations where choices need to be made regarding which path to follow. They enable those responsible for delivering projects to understand the difference between what is desirable and what is not desirable. They also serve to shape the outcome of the investment in an infrastructure project.

"Quality" has a pragmatic interpretation captured in the term: "fitness for purpose", which embraces a balance of features such as the architectural aesthetics and functionality, material and functional robustness, maintainability, user comfort, environmental sustainability and lifecycle costs, all of which are generally benchmarked against the cost of the delivered product (NUMPT, 2018). Design quality is much more than style or appearance. It is a combination of (Orr, 2007):

- functionality – how successful is the project in achieving its purpose?
- impact – how does it contribute to the sense of place i.e. does it have a strong identity that is deeply felt by inhabitants and visitors?
- build quality – how well does it perform in service?

Good design is critical to the success of any infrastructure project. Just as important is the need to communicate these design ideas to stakeholders. John Ruskin (1819–1900) said that *"quality is never an accident; it is always the result of intelligent effort. There must be a will to produce a superior thing."* Client leadership is needed in the quest for design quality.

The client's business case, vision, values and project priorities collectively make up the client's value proposition i.e. the promise of measurable benefits resulting from the project. Delivery teams should be trained, socialised and acculturated to understand the core values and processes of the client organisation in relation to the project. Clients should engender the following in the delivery of infrastructure projects (Ballim 2017):

- decisions should be based on properly consulted and formally agreed policy;
- the lines of accountability should be clearly identified and delegations of authority carefully considered;
- an "*eyes on – hands off approach*" should be adopted when dealing with the delivery team i.e. the client team should point to the problems and allow the delivery team to provide solutions so that the responsibilities and accountabilities are not blurred;
- the relationship between the delivery team and the end users within an organisation should be carefully managed;
- the response to conflict and blockages deriving from within the organisation should be swift;
- scope creep (changes, continuous or uncontrolled growth in a project's scope, at any point after the project begins) should be approached with great caution; and
- legal compliance should be approached conservatively.

A client also needs to:

- be bold enough to make timely decisions such as to press the "start" button if corrective action is necessary and to push the "stop" button if the project becomes unviable, or there is insufficient budget to complete the project or related projects (Kershaw and Hutchison, 2009);
- manage demand (e.g. insistent and peremptory requests for modifications and additions) and scope creep (e.g. additional features or functions not authorised);
- ensure that goods, services and construction works which are delivered are required to support the business case and are aligned with strategic and operational commitments and are within mandates and agreed budgets;
- oversee the commissioning, fine tuning and handover of completed infrastructure including record information to the end user or operator;
- obtain the required statutory permissions;

- consider how resources are to be demobilised and have an exit strategy for a premature exit should the need arise (Kershaw and Hutchison, 2009); and
- perform post implementation reviews on the differences between intended and actual outcomes and document the lessons learned.

2.3 MANAGING SYSTEM BOUNDARIES

The activities directly related to the provision of infrastructure take place within product controls, the focus of which is primarily on budget, time, function, quality, conflict, health and safety and the environment (see Table 2.1). Product controls are informed by delivery constraints which in turn are shaped within an underlying context as indicated in Figure 2.3. The underlying context describes aspects which are beyond the system boundaries for delivery constraints and product controls e.g. cultural, ethical, societal, political, economic and physical risks (threats and opportunities) which are prevalent within the region where the infrastructure is required.

Decisions made at decision gates or control points within processes are informed by delivery constraints such as financial, policy, technological, institutional, legal and values (see 4.2.1). Delivery constraints are in turn shaped by the underlying economic, political, physical, societal, ethical and cultural context.

Values determine the ethos, vision and core values of a project. They shape not only the culture for the project but also the "delivery intent" of a project and are established by the client. They typically comprise several competing aims relating to the delivery process and the product itself. Values also establish the client's aspirations for a project which needs to be reflected in not only the delivery processes but also in the product itself. Legislation establishes minimum requirements relating to issues such as equity, health and safety and protection of the environment. Values establish aspirations or desirable outcomes which are beyond requirements embedded in legislation and policy.

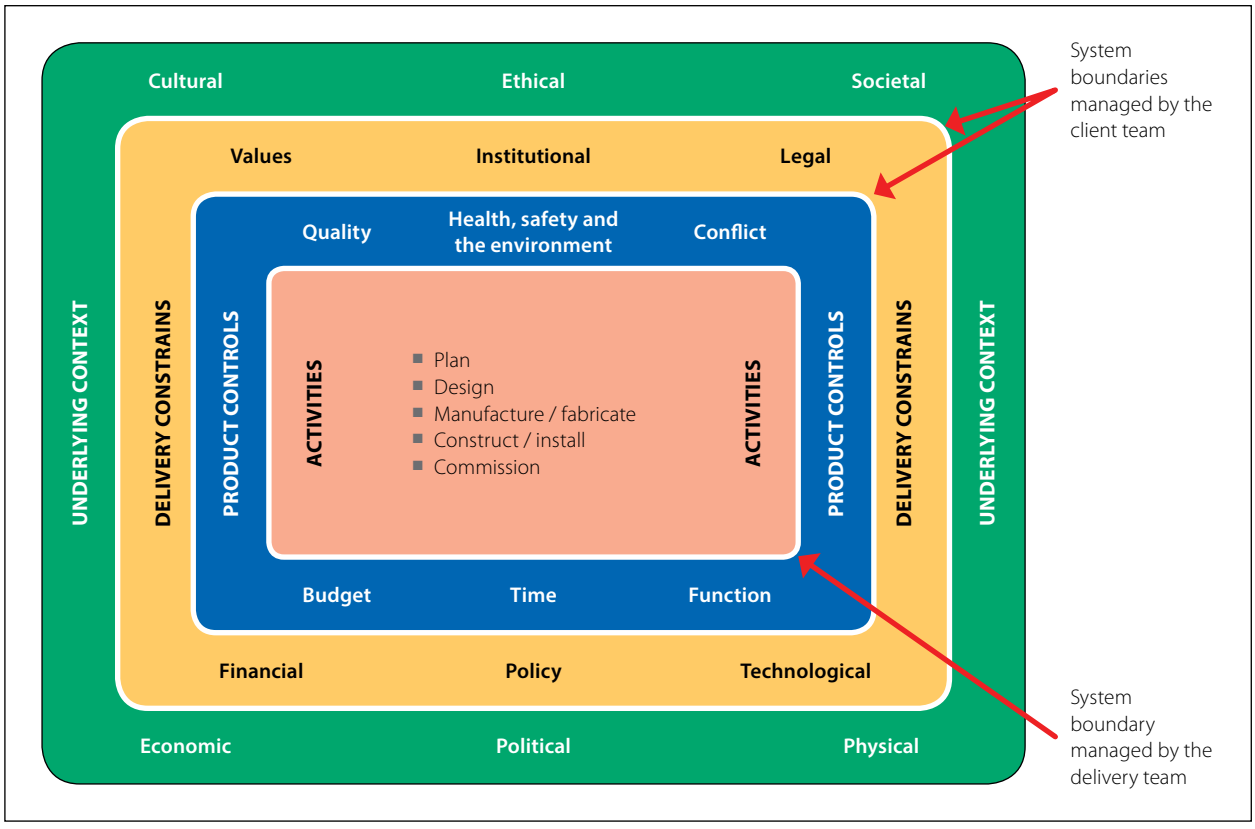


Figure 2.3 The underlying context, delivery constraints and product controls within which infrastructure projects are delivered (after Hughes, 1989)

Table 2.1 Focus in common interfaces with the product process controls

Area of interface	Comment
Budget	Infrastructure projects are usually planned, designed and delivered over relatively long time frames during which changes, both in terms of requirements and availability of resources, can take place Construction contracts make provision for changes to the initial price to accommodate changes in the scope of work (variations) to enhance quality, performance or to address any shortcomings, price adjustment for inflation, the cost of risk events for which the contractor is not responsible, etc. The final amount paid in terms of the contract can be very different from the initial starting price of the contract or order issued in terms of a framework contract What is paid for construction works is but a part of what the client pays for the project as a whole. There are other project costs such as site (land, bulk service contributions etc.) costs, professional fees, service and planning charges, applicable taxes, etc. which need to be taken into account, whether or not they are outsourced Life cycle costs also need to be taken into account during the design process. This also has an impact on the budget
Time	A programme or schedule is commonly used to control time on a project. The timing of a project, however, impacts not only on resources controlled by the constructor or manufacturer, but also on resources controlled by the client. Delays in schedule may result in increased costs and delayed project benefits
Function	Function relates to the purpose or activity of users and other stakeholders for which infrastructure or parts thereof are designed, used, or required to be used. Function is concerned with functionality (suitability or usefulness for a specific purpose or activity) and functional performance (behaviour in use to support required function under specified use conditions).
Quality	Quality can be defined as the totality of features and characteristics of a product or service that bears on the ability of the product or service to satisfy stated or implied needs. The satisfying of stated needs can be viewed as compliance with requirements or specified performance whereas compliance with implied requirements can be viewed as the degree of excellence Quality includes, aesthetics, robustness, durability, maintainability, user comfort and environmental sustainability. A client is usually concerned with all forms of quality
Conflict	Conflict can be both positive and negative. Conflicts can create value through controversy and passion. Projects need to embrace different agendas which can be introduced through a large range of specialists. Conflict of this kind is not only inevitable but expected and can be resolved through constructive discussions Contractual disputes are negative and arise for several reasons. The three main drivers of contractual claims commonly relate to inherent risks materialising, project change management and defects (work not in accordance with the provisions of the contract). While these aspects are not unique to infrastructure projects, the scale of each project is typically large and failure to achieve a financially secure outcome from a project may jeopardise the solvency of one or more of the parties or members of their supply chain.
Safety, health and environment	The focus is on the identification of workplace hazards and the reduction of accidents and exposure to harmful situations and substances. It also relates to compliance with legislative requirements and authorisations

Product controls are located within a specific project context which is shaped by the delivery constraints and influenced by the underlying context. These controls are the interface between the activity associated with the delivery of a product by the delivery team and the client's value proposition and aspirations.

Delivery constraints shape and inform the delivery of the product. Examples of delivery constraints which shape and inform the delivery of the product include:

- equity (giving people what they need to be successful) which is commonly linked to community expectations regarding who is to benefit from the construction activities and what can be promoted through the project;
- health and safety and environmental legislation constrain the manner in which a project is delivered; and
- values resonate with the extent to which what is produced through the project reflects public value i.e. it not only benefits an organisation or a community but it is also valued by society.

Examples of product controls include:

- the functional characteristics which form the specification of the work relate to the specific technological environment of the project and are constrained by financial and policy considerations;
- the time limits which are allocated for the project are set within the context of project policy;

- the budgetary limitations relate specifically to the financial context of the project which is often informed by policy considerations;
- subjective quality sought within the project specifications which relates to the appeal or attractiveness of a finished project that is interpreted in terms of values; and
- the nature of conflict control when conflict is seen as a threat by one or more parties, relating specifically to the legal and institutional framework within which the project operates.

One of the key tasks of the client team entrusted with the delivery of infrastructure is to provide leadership in boundary-spanning actions and flows between the underlying context and the delivery constraints as well as between the product controls and the delivery constraints. Project value is the outcome of client decision making to achieve an optimal balance of the project benefits, risks and costs (Hodgson, 2018). The client team needs to constantly scan the environment and anticipate potential problems beyond the range of the delivery team who are focused on the product controls which enable projects to be delivered in accordance with client requirements.

2.4 ESTABLISHING THE CLIENT TEAM

2.4.1 Different client team functions

The client team typically performs two distinctly different functions when delivering infrastructure projects, the focus of which can be broadly categorised as follows:

- Function 1 where the focus is typically on the funding and project outcomes and the provision of high level strategic direction when corrective action is necessary to effect change to bring a project closer to what was planned, or when decisions regarding a significant departure from the plan need to be taken.
- Function 2 where the focus is typically on what needs to be delivered on an infrastructure project, the provision of strategic, technical, financial and operational direction in order to realise the client's value proposition, what information is required to effectively oversee the implementation of the project by the delivery team and to settle what is due in terms of the various contracts.

Function 1 relates to ownership of the investment in infrastructure and the enabling of the realisation of benefits by ensuring continuity of focus on the value proposition, having clear authority and actively managing risks and stakeholders. Responsibility for ensuring the strategic alignment of the project or programme is retained in Function 1. Function 1 is sometimes referred to as a "sponsor function" or "an "owner" function. The Infrastructure Client Group (2017), for example, considers the owner to be "*the organisation that owns and operates the infrastructure, promotes the investment in the infrastructure programme and receives the completed facilities and puts them into operation.*"

Function 2, on the other hand, relates to the specifying of requirements to the delivery team and managing delivery outcomes with the intent that the client value proposition is realised. Fundamental to this is the procurement and payment of the required external resources and the management of those relationships to maximise value. Function 2 in summary relates to the capability and capacity to manage the process of translating policy to outcomes during the "buying process". Those responsible for Function 2 accordingly need to ensure that:

- specified requirements will achieve the required benefits of the business case and provide value for money;
- momentum is maintained for the investment appropriate to the needs of the stakeholders and the delivery team for the efficient delivery of outcomes;
- requirements are translated into project or, if relevant, programme purpose, delivery principles and roles before the detail;

- value is added through the establishment of relationships and the incorporation of best practice;
- a clear governance structure, founded on the principles of honesty, accountability and integrity, is established and maintained;
- interface management occurs which aligns all stakeholder organisations so as to maximise the potential of the project or programme to deliver on the required outcomes;
- high-level progress is monitored, focusing on prognosis rather than detailed progress; and
- expenditure can be accounted for and assets can be readily capitalised in financial accounting systems.

Function 2 is sometimes referred to as an "intelligent client function" a "delivery management function" or an "integrator function". The Infrastructure Client Group (2017), for example, considers the integrator to be "*the organisation that plans and delivers the infrastructure programme. It manages the supply chain, co-ordinates design and construction, commissions the completed facilities and hands them over to the owner*"

2.4.2 Client delivery manager

A client delivery manager (named individual) needs to be appointed and held accountable for project outcomes. Such a manager also needs to lead the client team involved in Function 2 activities with single point accountability and have direct access to the senior client management responsible for Function 1 activities (see 2.5).

The client delivery manager's primary function should be to:

- own the business case of a project on behalf of the client so that there is no ambiguity about who is acting in the client role;
- perform an oversight and governance role, providing effective and strategic leadership, within the client team which permeates through all levels of the supply chain;
- set the team up for successful delivery and remove obstacles or blockages to progress;
- direct the project in such a manner that the value proposition that is expected at the end of the project is realised as far as is possible;
- intervene when necessary e.g. when relationships begin to break down, stakeholder interference or lack of performance threatens objectives, recurring issues are not being dealt with, unforeseen risks begin to manifest, risk mitigation measures are not yielding the required results, etc.
- take corrective action where necessary to align projects with what was planned or change the plan to reflect the changed circumstances; and
- develop a strategy to approach the market and make decisions as to when the market should be approached for resources.

The client delivery manager does not necessarily need to get involved in the details of a project. Such a manager nevertheless needs to understand how to mobilise the supply chain through a clear vision and an effective procurement strategy, preferably one that fosters a culture of collaboration and teamwork. Such a manger needs to ensure a culture of governance and accountability which (Hodgson, 2016):

- resonates with a high standard of professional ethics and standards and the efficient, economic and effective use of resources;
- balances the competing needs of cost effectiveness, affordability, sustainability and the use of procurement as an instrument of socio-economic policy;
- caps project scope and costs;
- avoids prohibited practices, improper conduct and maladministration whether by act or omission;
- avoids political interference resulting in improper conduct;
- balances project benefits, risks and costs; and
- delivers not only value for money and but also achieves results.

Reporting to the governing body, recommending and the recording of decisions are crucial activities led by the client delivery manager.

2.4.3 Technical and administrative teams

A client delivery manager usually needs to be supported by both a technical team and an administrative team. The technical team may be required to:

- provide advice on a range of matters, including compliance with legislative requirements, advice on contractual matters that may arise and the gathering, processing and storage of information that is necessary to manage the delivery of projects;
- manage activities associated with the initiation of projects;
- formulate, shape and document the client's specific architectural, urban planning, engineering, ITC etc. requirements during the initial stages of the project as well as to monitor and evaluate the outputs of the delivery team;
- establish financial and cost controls and reporting systems; and
- procure the resources which are necessary to deliver the project.

The administrative team needs to process payments and may be required to develop and maintain the following for project governance purposes:

- a procurement plan which contains a record of each procurement that is undertaken together with the necessary governance approvals;
- a contract register which contains particulars of all contracts and orders issued in terms of a framework agreement entered into through the procurement process, together with information regarding the approved shifts in the total of the prices and the time for completion or delivery and particulars of payment certificates; and
- a purchase order register which links contracts and payments to the organisation's financial system.

2.4.4 "Hard" and "soft" abilities

McKinsey and Company (2017) conducted interviews with 27 people with a collective project delivery experience in excess of 500 years to understand more about ultra-large projects i.e. projects exceeding US$ 5 billion. They segmented interviewee insights into best practice into "science" and "art" as indicated in Table 2.2. They thereafter synthesised 4 mindsets and 8 practices that define the "art" of project leadership and identified the "deadly sins" (practices that are best avoided) as indicated in Table 2.3. Interviewees spent roughly 50 percent of the time talking about the "science" and 50 percent on the "art".

Table 2.2 Segmenting of interviewee insights on best practice (McKinsey and Company, 2017)

The "science" – well understood			The "art"–an opportunity		
Process	Design	Methodology	Leadership	Culture	Fulfilling promises
Stage gate	Engineering	Quality assurance	Judgement	Purpose	Personal growth
Technical skills	Estimate	Specification	Investor relations	Identity	Coaching
Plan	Official path	Standard	Delegation	Behaviours	Attitude
Risk	Scope	Tolerance	Accountability	Role modelling	Inclusiveness
Schedule	Documentation	Work package	Decision making	Values	Community engagement
Cost	Gantt	WBS	Partnership	Missions	
			Mindset	Training	

Many of the McKinsey and Company's mindsets and best practice are applicable to all projects, notwithstanding that their research was aimed at ultra-large projects, as people delivery projects. Client teams need to have not only the "hard" technical abilities but also the "soft" organisational and leadership elements of project delivery to successfully delivery projects. Leadership, organisational culture, mindsets, attitudes and behaviours of the client team impact on project performance i.e. the effectiveness, economy, efficiency of and public value delivered by a project i.e. doing the job "right" (product) and in the "right way" (process). It is particularly important a client delivery manager has the requisite "soft" abilities to lead the client team.

Table 2.3 Defining the "art" of project leadership for ultra-large projects (after McKinsey and Company, 2017)

Art of project leadership		Deadly sins (practices that are best avoided)
Mindsets	Lead as a business, not as a project (CEO-level leadership and judgement to address a broad range of organisational issues)	Failing to inspire the team to operate like a business rather than a traditional project ("This is the way we have always run projects"')
	Take full ownership of outcomes (remain well informed throughout and be ready to step in to make tough decisions in a timely manner)	Believing that you can delegate delivery (*"It is the contractor's job to bring in the project on time and on budget"*)
	Make your contractor successful ("win together or loose together")	Blaming the contractor and not solving the problem (*"The contractor is underperforming; we need to ramp up the pressure"*)
	Trust your processes, but know that leadership is required (processes alone will not solve every challenge)	Blindly following processes (*"I like your idea but I know the project manager won't consider it because it is not following process"*)
Practices (Set up)	Define purpose, identity and culture (unique and shared identity, and create a culture of mutual trust and collaboration)	Failing to inspire the organisation with a meaningful purpose (*"Our people are driven by return on capital for investors"*)
	Assemble the right team (appropriate blend of leadership qualities, cultural and local awareness for the task ahead to compliment the requisite technical skills and experience)	Taking false comfort in a lump sum contract (*"That risk is no longer a problem as the contractor is looking after it"*)
	Carefully allocate risk and align incentives (delegate only those risks that the contractor is better positioned to manage)	Hiring individuals who do not have the right mindsets and behaviours (*"He is the best choice for technical expertise; we can manage his behavioural issues"*)
	Work hard on relationships with stakeholders (invest in stakeholder management as a core activity)	Under-investing in community engagement (*"Community consultation was completed prior to FID. We can now build and not worry about it"*)
Practices (delivery)	Invest in your team (leaders need to think deeply about how to develop and challenge their people throughout)	Managing, not leading and investing in the team (*"The team will deliver the results; their development is the experience itself"*)
	Ensure timely decision-making (delegate decisions to the lowest appropriate level)	Failing to delegate decision making authority to the lowest possible level (*"This is above my pay grade; you need to talk to my boss"*)
	Adopt forward looking performance management (use fact based performance dialogues to strengthen trusting relationships and instil accountability	Creating over-cautious behaviour by over-reacting to bad news (*"Let's get a better understanding of that issue before we tell the owner"*)
	Drive desired behaviours consistently (define, communicate, and role model expected attitudes and behaviours)	Starting a "review" of the project after every setback (*"Let's start a review; that will keep our board and partners satisfied"*).

2.4.5 Assembling the client team

The precise scope and quantum of work associated with Function 2 depends upon the project delivery route and the procurement strategy that is adopted (see Chapter 5). A client can adopt a procurement strategy which minimises the number of contracts that it needs to put in place to match its capacity.

Clients need to either have in-house resources or procure the resources necessary to perform both the aforementioned client functions. Function 2 responsibilities and associated services may be undertaken by units or departments within an organisation with appropriate capabilities or, as is frequently the case in the public sector in some parts of the world, a government department (e.g. a public works department) or a state-owned enterprise which has the capability and capacity to do so is assigned or delegated Function 2 responsibilities. Function 2 responsibilities may also be procured from a service provider on an agency basis. Table 2.4, for example, indicates the stages and associated deliverables in a South African industry standard agreement for the services of a development manager for building projects i.e. an entity appointed by the client to execute the development requirements on its behalf (PROCSA, 2012). However, Function 1 responsibilities cannot be transferred as the client is ultimately accountable for project outcomes.

Table 2.4 Standard development manager deliverables provided on an agency basis (PROCSA, 2012)

Stage	Broad definition of stage	Deliverables
Stage 0 (Project initiation)	Establish the need, desirability and viability of undertaking a property development together with the securing of the land and rights to undertake such a development in accordance with the project initiation programme	Project vision, market research information, first business case, record of environmental decision, other consultants' signed agreements, development of master plan, payment to project creditors and decision to proceed with the project
Stage 1 (Inception)	Establish the client requirements and preferences, assess user needs and options, appointment of the necessary consultants, establish the project brief including project objectives, priorities, constraints, assumptions, aspirations and strategies	Baseline project viability, project brief, project procurement policy, initial marketing strategy, initial requirements of primary end users and other consultants' signed agreements
Stage 2 (Concept and viability)	Prepare and finalise the project concept in accordance with the brief including the scope, scale, character, form, function, development programme and viability of the project	Project financial viability, approved concept and viability report, end user operator agreements and approved project finance
Stage 3 (Design development)	Develop the approved concept to finalise the design, outline specifications, cost plan, financial viability and documentation programme for the project	Other consultants' signed agreement, health and safety representative as applicable, design costs and time decisions, end user/ operator's requirements, facilities/ maintenance management policy, marketing an income reports, management reports, design development report and approved design/ development report
Stage 4 (Documentation and procurement)	Prepare the construction and procurement documentation, confirm and implement the procurement programme, strategies and procedures for effective and timeous procurement of necessary resources for the execution of the project	Signed principal and direct contracts, appropriate insurances, project specific tender and contract conditions, appropriate operating, sales and end user agreements, end user direct procurement schedule, signed service agreements with local authorities and regular management reports
Stage 5 (Construction)	Manage, administer and monitor the contracts and processes, including the preparation and coordination of the procedures and documentation to facilitate completion of the works	Payment to project creditors, regular client project report, regular operations, leasing and sales schedule and end user coordination and installation schedule.
Stage 6 (Close out)	Fulfil and complete the project close out, including the preparation of the necessary documentation to facilitate effective completion, handover and operation of the project	Completed project, report on project income, report on operational costs, report on end user installations and operations, report on facilities management implementation and close out report

Components of function 2 can also be outsourced to a number of individuals. This enables a client to secure the expertise required to perform Function 2 responsibilities that it lacks and to build a team to do so (NUPMT, 2018).

An agency agreement should be entered into where different organisations undertake Function 1 and Function 2 responsibilities i.e. a legal contract creating a fiduciary relationship whereby the first party ("the Principal") agrees that the actions of a second party ("the Agent") are and binds the Principal to later agreements made by the Agent as if the Principal had himself personally made the later agreements. Agreement needs to be

reached as to what precisely is addressed by the one organisation and what is addressed by the other organisation so that collectively the two organisations function as a client team. The allocation of roles and responsibilities between the two organisations and the governance arrangement needs to be such that:

- the "Principal" is able to retain ownership and control over the business case and the "Agent" is able to efficiently deliver infrastructure through the delivery team; and
- there is little or no duplication of effort.

An agency agreement should as necessary deal with requirements relating to fees associated with the rendering of the service, claims for payment made on an agency basis, the settling of claims for payments and the documentation required to accompany such claims, overall aims, objectives and priorities, governance structures, reporting requirements, dispute resolution procedures etc.

The structure and composition of the client team depends upon the project delivery route that is followed, the procurement strategies that are adopted, the resources at the disposal of the client and the appetite for the client to undertake Function 2 activities.

Careful thought needs to be given to the assembly and composition of the client team which supports the delivery manager as it is important to have not only chemistry and synergy between members of the team, but also the necessary technical knowledge, skill and competence as well as the necessary organisational and leadership skills (see Table 2.2). Individuals can be contracted on a part time or full-time basis to provide technical support and expertise as members of the client team to fill any gaps. Such individuals should effectively function as staff members of the organisation assuming responsibility for Function 2 activities.

The appointment of companies, particularly the larger companies, to provide agency and technical advisory services needs to be approached with caution as they frequently have high turnovers in staff which can disrupt the working of the client team. It is not good practice to appoint a company to provide services relating to Function 2 on an agency basis in addition to services relating to the delivery team as this can result in conflicts of interest and loss of focus on the client's interests. A separation of duties is preferable.

The compartmentalisation of the procurement process into one focusing on the soliciting and evaluation of tenders and the other in seeing the project through or one dealing with the drafting of the conditions of contract ("commercial" component) and one scoping and specifying the goods, services or works ("technical" component) should be avoided. This lack of continuity can cause a breakdown in the effective execution of strategy and tactics and makes it harder to build up trust with the delivery team. It can also lead to ambiguities and disjuncture in the formation of contracts that are entered into with harmful consequences.

2.5 PROJECT GOVERNANCE

A client needs to put in place project governance arrangements (see 3.6) to provide the framework within which decisions are made in the delivery of infrastructure projects. Such arrangements provide an organisation with a structured approach to conduct both its business as usual activities and its business change, or project activities. Project governance sits above and outside of the project management domain.

Project governance is particularly important where client team responsibilities sit between two different organisations, where projects are large and complex, involve several disciplines or are sensitive to inputs from stakeholders and external role players. Project governance is all about leadership and provides a way for senior management and key stakeholders to exercise oversight and ensure that strategic outcomes are realised. It is a mechanism for engaging the client organisation in a project, for securing buy-in of key players and for driving executive decision making.

Project governance is also about increasing the success rate of projects. Governance, which includes boards, monitoring systems, delegations of authority, etc., provides strategic support and expert oversight which keeps any leader and all teams on the right path. There can be no effective leadership without governance.

There is no 'one size fits all' governance structure. Project governance needs to be appropriate to a particular project and client organisation. Figure 2.4 nevertheless indicates a common project governance arrangement.

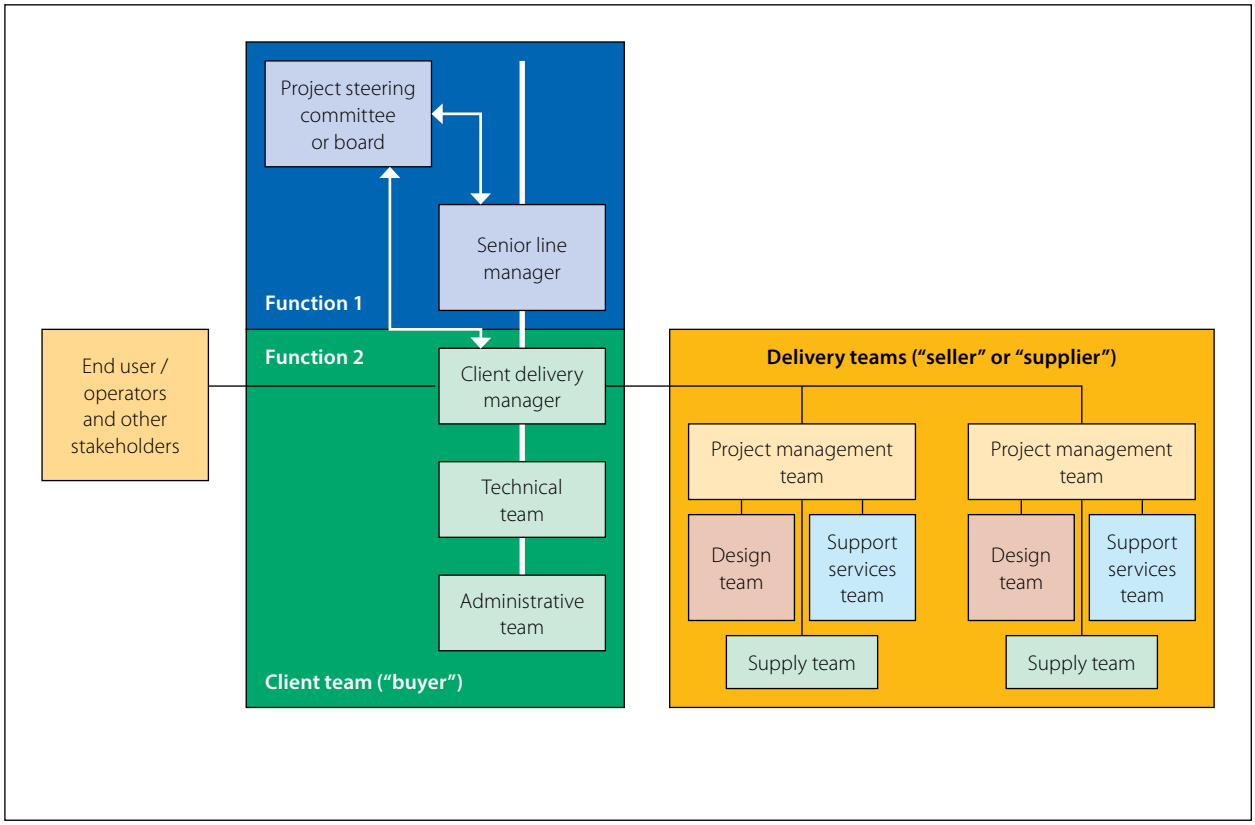


Figure 2.4 Common project governance arrangements

CHAPTER 3
Critical knowledge areas for effective delivery

3.1 INTRODUCTION

The client team including the client delivery manager need to have an understanding of the following knowledge areas in order to effectively delivery infrastructure projects:

- delivery management;
- procurement;
- portfolio, programme and project management;
- risk and change management; and
- governance.

3.2 DELIVERY MANAGEMENT

3.2.1 Introduction

ISO 26000:2010 defines a supply chain as "*the sequence of activities or parties that provides products or services to the organisation.*" ISO 44001:2017 offers a more expansive definition, namely, the "*relationship of organisations, people, activities, logistics, information, technology and resources engaged in activities and creating value from point of origin to point of consumption, including transforming materials/components to products and services for end users.*"

In infrastructure projects there are usually several supply chains required to produce different parts of the works associated with a project, each of which need to be managed to realise required project outcomes. Delivery management may be regarded as the organisation, administration, and supervision of processes which when combined into a comprehensive plan, provides the business and technical functions needed to successfully achieve the required project outcomes. These supply chains form the backbone of the delivery management system.

Figure 3.1 outlines the delivery management system for infrastructure projects involving the provision, maintenance, rehabilitation, refurbishment or alteration of infrastructure. Each of the tasks in the supply chain are linked to the next in sequence activity via a decision gate. The supply chain represents the flow of information from one set of tasks to the next while the decision gates which form the link between tasks provides the opportunity for ensuring that the proposed project remains within agreed mandates, aligns with the purpose for which it was conceived, and can progress successfully. The procurement of goods and services or any combination thereof takes place anywhere within the supply chain whenever resources are required to advance a project.

Delivery management activities commence with the initial, and subsequent recurring updating of planning processes at a portfolio level flowing out of an assessment of needs for more infrastructure or to modify or to maintain the functionality of existing infrastructure in order to support an organisation's business objectives. Thereafter it involves, in the case of the provision, rehabilitation, refurbishment or alteration of infrastructure, planning at a project level, and the procurement and management of a network of suppliers, including subcontractors, to deliver, rehabilitate, refurbish or alter construction works on a site. Detailed design processes

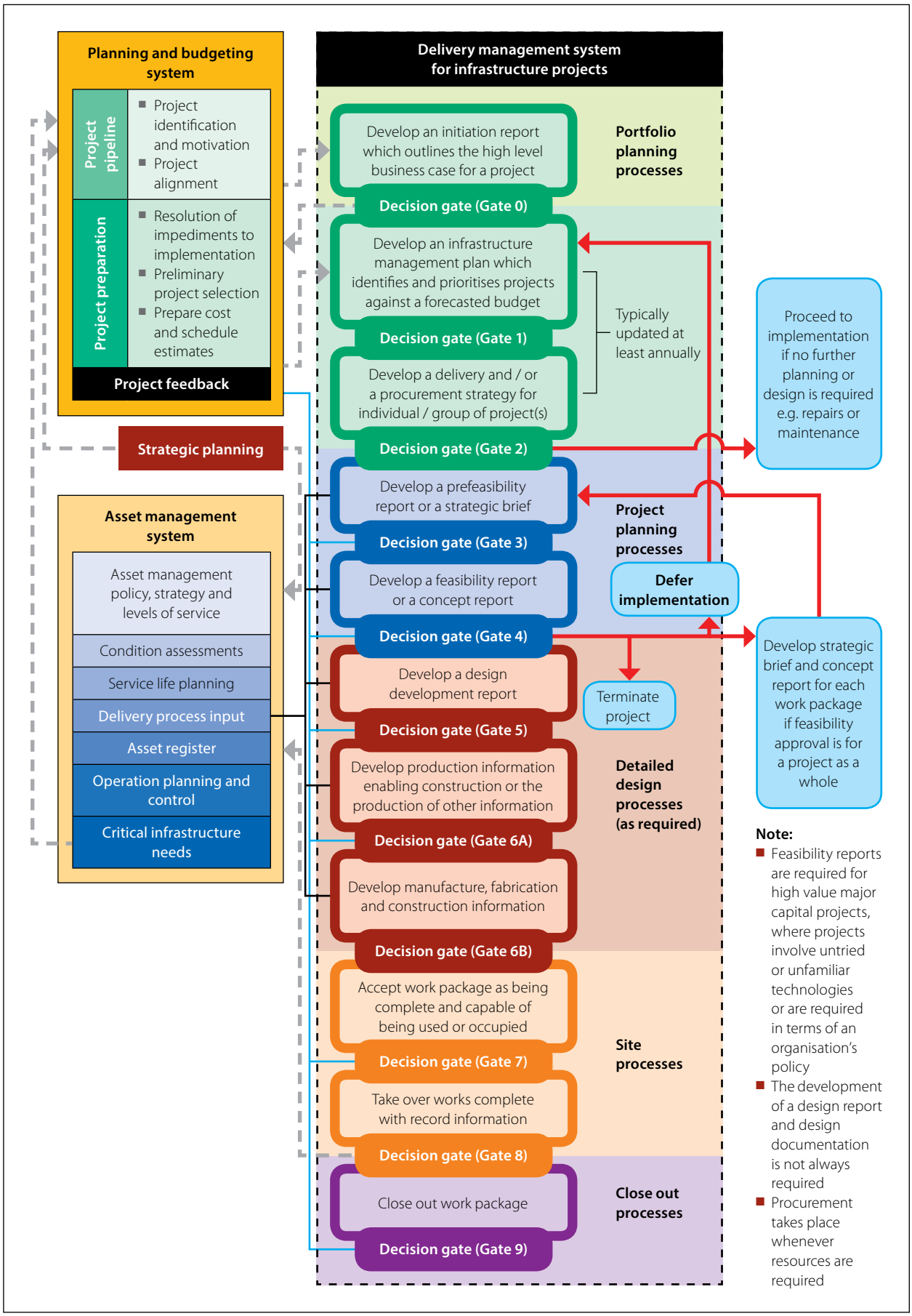


Figure 3.1 Delivery management system for infrastructure

may be required thereafter. There is no need to store and issue materials or equipment unless these are issued to employees responsible for the maintenance or operation of construction works or are issued free of charge to contractors for incorporation into the works.

Delivery management is commonly linked to an asset management system and a budgeting and planning system, particularly where an organisation owns and maintains a portfolio of infrastructure. The asset management system informs demand management. The planning and budgeting system prioritises projects and releases funding for projects. There are accordingly forward and backward linkages between these three core systems as indicated in Figure 3.1.

3.2.2 Linkages with an asset management system

Asset management for infrastructure considers the entire lifecycle (service life) of the asset and the associated costs, from the identification of a need through to the final decommissioning of the asset. Asset management is not simply a matter of maintaining existing assets. It is a strategic approach to infrastructure provision that provides direction on decision making throughout the infrastructure planning, delivery, operation and disposal processes. It follows a risk based approach in all asset management decisions in order to achieve a balance between cost, risk and performance.

An asset management system for infrastructure, which feeds into the demand management component of a delivery management system, comprises a number of activities which can be grouped together into 6 basic sets of tasks or components, namely asset register, asset management policy and levels of service, condition assessment, service life planning, critical infrastructure needs and delivery process inputs as indicated in Figure 3.2.

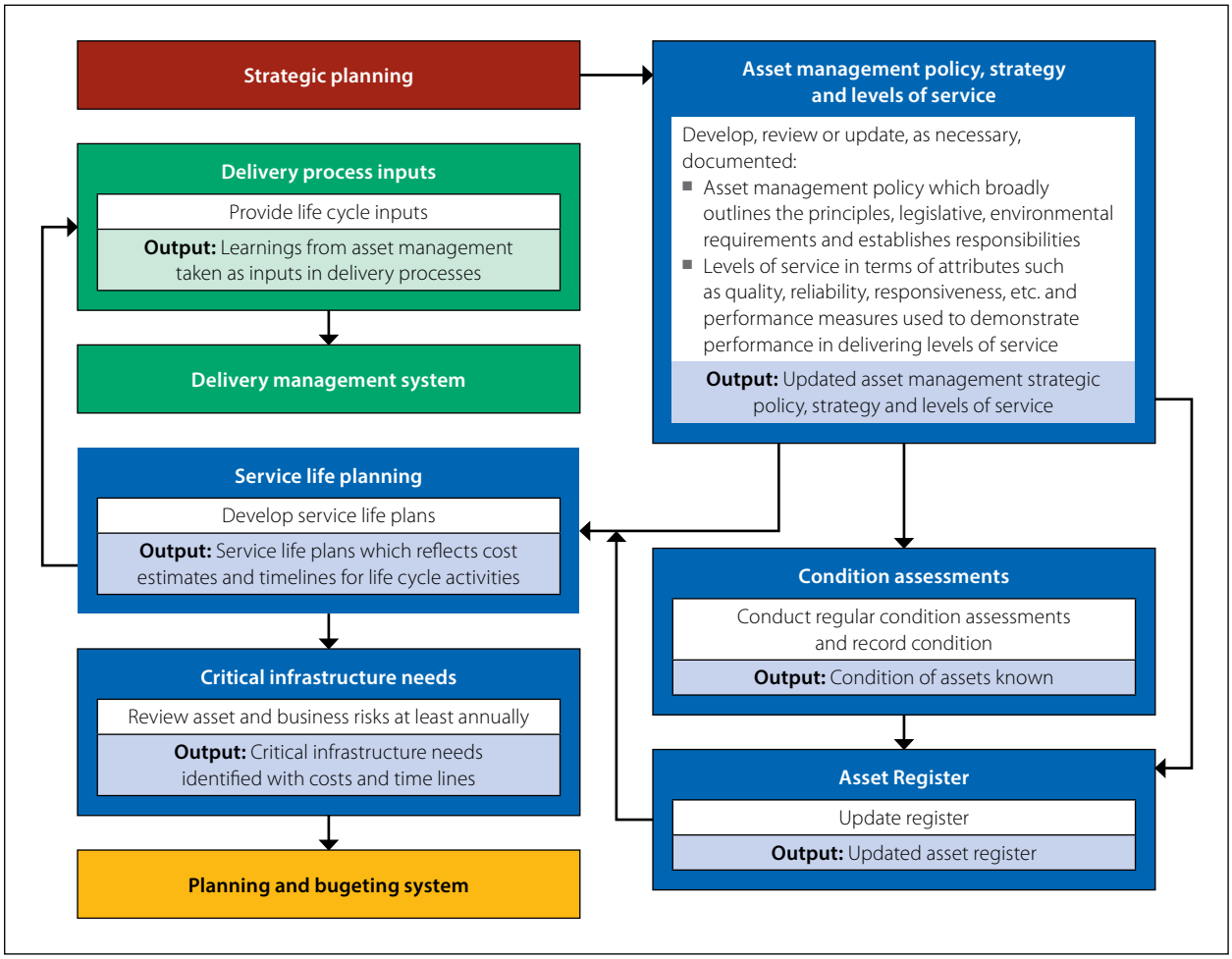


Figure 3.2 Interacting elements of an asset management system

One of the major starting points for asset management is the identification of all existing assets. This can be developed incrementally, based on the level of accuracy needed versus affordability, and can precede finalisation of an asset management policy. In addition to identifying assets, there is a need to determine an acceptable level of service, so that the asset performance can be measured against a set yardstick. Levels of service are informed by a combination of customer needs, legislative requirements and internal business objectives, and need to be sustainable over the service life of the asset.

Knowledge of the condition and remaining useful life of an asset is a key part of understanding the future need for rehabilitation, replacement, or disposal and informs financial decision making. Timeous rehabilitation of existing infrastructure can generally extend the useful life of an asset far more cost effectively than replacement. Levels of service and future demand cannot be looked at in isolation from each other. Future demand not only informs what budgets will be required over time, but also gives an indication if the current levels of service are sustainable and is a key input into strategic planning decisions.

Critical and important assets can be identified by considering the consequences of failure in terms of health and safety incidents, additional costs of deferring repairs and maintenance, impact on the business and image of the entity and the effect on the environment. This can be done using a typical risk evaluation matrix based on probability and impact of occurrence. Once identified, prioritisation of any new capital or rehabilitation work needed to ensure critical assets remain operational becomes a governance issue strongly informed by the level of risk. Identified critical work then needs to be fed into the planning and budgeting process to be prioritised together with any proposed new capital work.

There needs to be alignment between those that design and construct infrastructure with those that subsequently occupy, use and manage it. Accordingly, there needs to be open channels of communications between the different role players during many of the supply chain tasks which are indicated in Figure 3.1.

3.2.3 Linkages with a budgeting and planning system

A planning and budgeting system for infrastructure projects comprises a number of activities which can be grouped together into 3 basic sets of tasks or components, namely, project pipeline, project preparation and project feedback as indicated in Figure 3.3.

A project pipeline in the context of infrastructure projects means that a need has been identified but not yet met. Such projects range from simply having been identified to being ready to implement.

Projects in the first instance need to be identified. Thereafter projects need to be motivated by considering the benefit of the project and / or consequences of not undertaking the project. Although many of the identified projects are a direct response to specific planning needs, others will be in response to drivers associated with broader and more strategic project needs.

The impediments to implementation and the timelines required to resolve them need to be known. Such impediments may relate to land identification and ownership (e.g. servitude ownership / acquisition, land usage / zoning and the presence of informal dwellings or graves on the site) and environmental and other legislative approvals.

Once the project pipeline has been established and prioritised, alignment with broader and strategic planning processes needs to be confirmed and impediments to implementation identified. Although the project pipeline will contain high level estimates and project timelines, projects that fall within the preliminary selection for an infrastructure management plan need to have more detailed timelines and estimates to ensure that the budget estimates are realistic and the timelines are achievable. This project preparation stage is a critical phase of the planning process as the likelihood of implementing proposed projects within the proposed budgets and schedule put forward in any infrastructure management plans needs to be understood.

Proper feedback on projects ensures that all the role players are fully aware of everything taking place and are in a position to take any corrective action that may be required (see Figure 3.1). Such information is not only required for performance management but also to inform future decisions and choices, leading to an ongoing improvement in planning and budgeting as well as to improve project estimates in future budgets, particularly where projects straddle a number of financial years.

3.3 PROCUREMENT

3.3.1 Introduction

Procurement is defined in ISO 10845-1:2010 as "*the process which creates, manages and fulfils contracts.*" Procurement commences once a need for goods and services or any combination thereof has been identified and it ends when the goods are received and the services are completed and contracts closed out. There are accordingly three phases to the procurement process associated with infrastructure, namely:

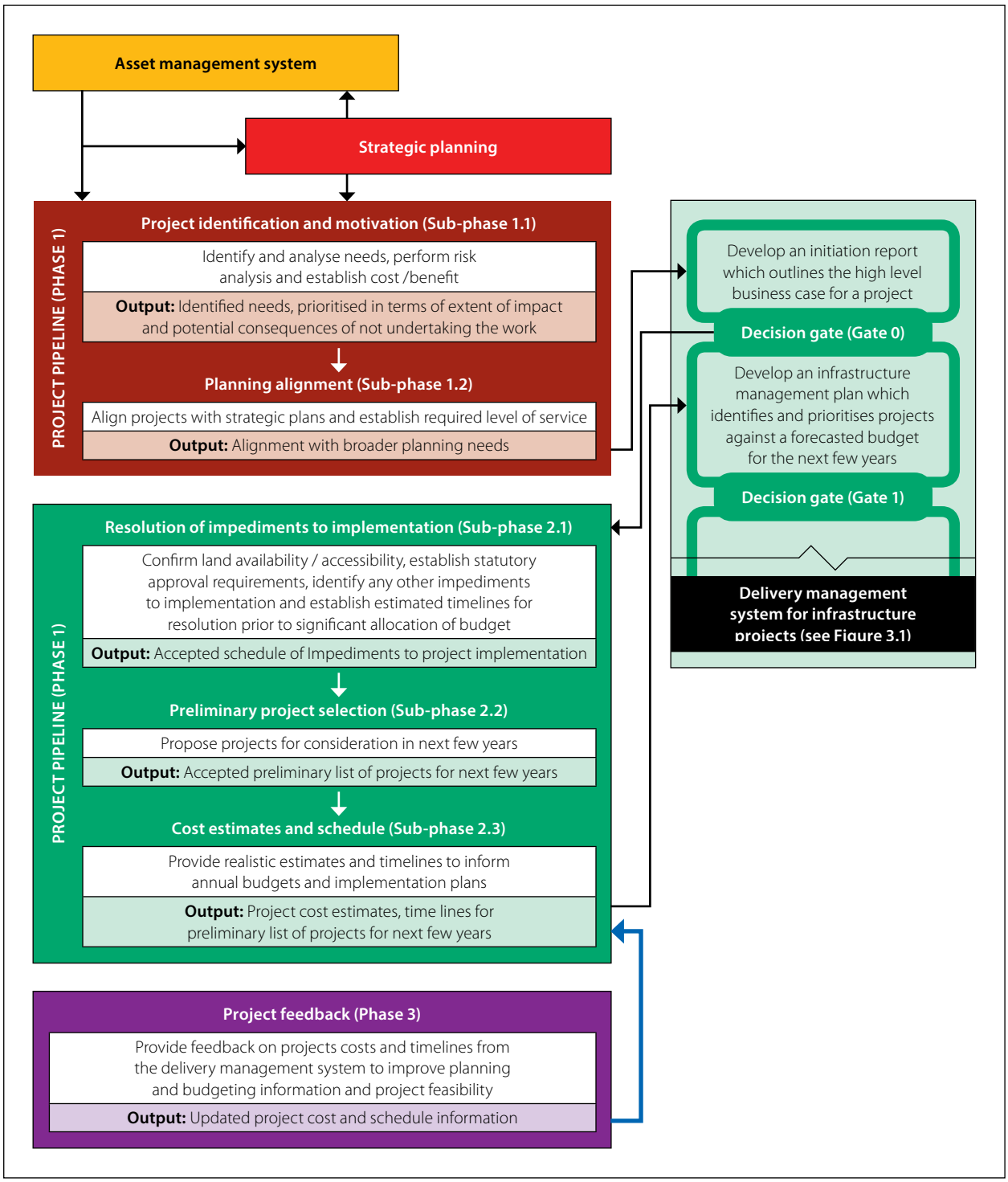


Figure 3.3 Interacting elements of a planning and budgeting system

- a planning phase during which decisions are made as to what, where and when goods and services are required, which project delivery route (see 5.4) is to be pursued and what is the number, type, nature and timing of the required contracts;
- an acquisition phase during which contracts are entered into following the execution of a selection procedure; and
- a contract management (or contract administration) phase during which compliance with requirements, changes in requirements and risk events which manifest during the execution of contracts are managed.

3.3.2 Basic procurement tasks

There are six basic tasks associated with procurement processes which establish actions and deliverables / milestones associated with the procurement process as indicated in Figure 3.4 (Watermeyer, 2011b).

The establishment of what is to be procured (task 1) initiates the procurement process. Procurement strategy (task 2) is all about the choices made in determining which of the required goods and services or combinations thereof are to be delivered through a particular contract, the contracting arrangements, how procurement is to be used to promote secondary procurement objectives, if any, and the selection methods used to solicit tender offers

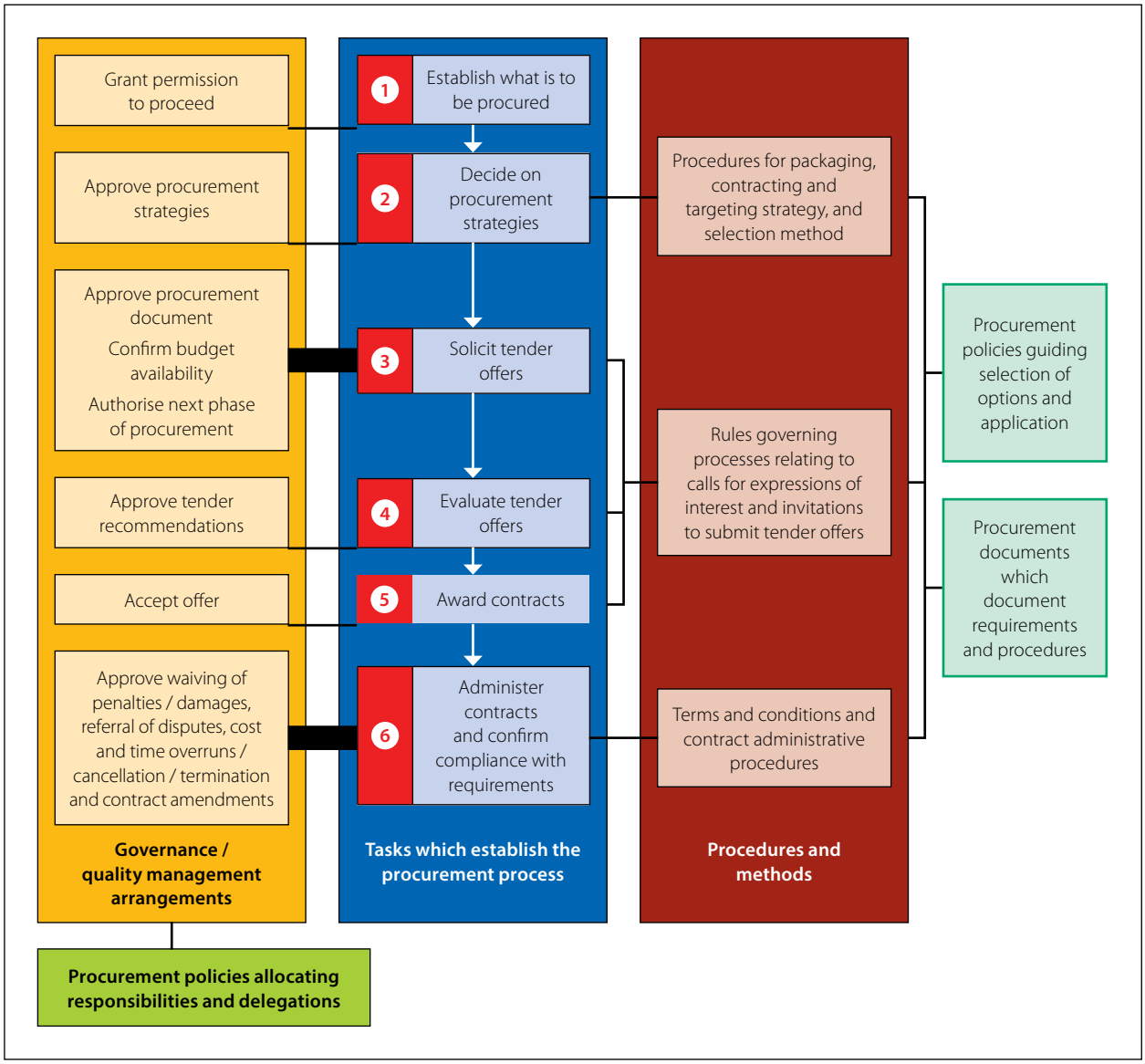


Figure 3.4 Tasks, processes and controls associated with a procurement system

(see chapter 5). Conditions for the calling for expressions of interest to prequalify respondents to participate in a specific contract, project or programme and conditions of tender govern tasks 3 to 5. Conditions of contract (i.e. terms that collectively describe the rights and obligations of contracting parties and the agreed procedures for the administration of their contract) govern task 6.

Procurement documents relating to calls for expressions of interest identify procedures and returnable documents required for evaluation purposes and, where appropriate, indicate the nature of what is to be delivered. They identify in the case of a tender, tender procedures and returnable documents required for evaluation purposes and contain the draft contract that will be entered into. Such documents in the case of a contract, contain the agreement which is concluded, the conditions of contract, pricing data and scope of work, and where relevant, provide site information (ISO 10845-2:2011).

3.3.3 Procurement systems

A system is a set of interrelated or interacting elements. It is an established way of doing things that provides order and a platform for the methodical planning of a way of proceeding. Systems are underpinned by processes (sets of interrelating activities which transform inputs into outputs), procedures (specified ways to carry out an activity or process) and methods (documented, systematically-ordered collections of rules or approaches).

A procurement system comprises (Watermeyer, 2011b):

- rules and guidelines governing the procedures and methods that can be applied;
- procurement documents which:
  - establish what a respondent or tenderer is required to do to make a compliant submission
  - establish the evaluation criteria for submissions;
  - contain terms and conditions that collectively describe the rights and obligations of the contracting parties and the agreed procedures for the administration of the contract,
  - establish how contractors are to be remunerated for the goods that are supplied or services rendered; and
  - specify and describe the goods or service that are required and any other requirements and constraints relating thereto;
- governance arrangements which authorises, directs, empowers, provides oversight and limits the actions of management; and
- organisational policies which amongst other things:
  - assign responsibilities for authorising processes or activities and confirming conformity with requirements;
  - establish delegations for the awarding of a contract or the issuing of an order;
  - establish ethical standards for those engaged in procurement processes;
  - limits choices in the usage and application of particular procurement procedures;
  - provides procedures for dealing with specific procurement issues; and
  - establishes secondary procurement goals and procedures.

The starting point in the standardisation of procurement methods and procedures is to determine the objectives for the system. Objectives associated with a procurement system typically relate to good governance (primary objectives) and to the use of procurement to promote social and national agendas (secondary, non-commercial objectives or developmental).

The ISO 10845 family of standard for construction procurement, the whole or parts of which have been adopted by countries including Albania, Bosnia and Herzegovina, Czech Republic, Kazakhstan, Mongolia, Netherlands, Russia, South Africa, United Kingdom and Zimbabwe, is framed around the following system objectives:

- the procurement system is fair, equitable, transparent, competitive and cost-effective; and

- the procurement system may, subject to applicable legislation, promote objectives additional to those associated with the immediate objective of the procurement itself.

The objective of the ISO 10845 series of construction procurement standards (Parts 1 to 8) is to create a framework for the development and implementation of procurement systems that facilitate fair competition, reduce the possibilities of abuse, improve predictability of outcomes and allow the demonstration of best value or cost effective outcomes.

ISO 10845-1:2010 describes generic procurement processes around which an organisation can develop a procurement system, establishes basic requirements for the conduct of those involved in an organisation's procurement activities, including integrity and the avoidance of conflicts of interest, establishes the framework for the development of an organisation's procurement policy and establishes generic methods and procedures that are used in soliciting tender offers and awarding contracts. ISO 10845-2:2011 establishes a uniform format for the compilation of calls for expressions of interest, tender and contract documents, and the general principles for compiling procurement documents for supply, services and construction contracts, at both main and subcontract levels. This standard is based on the principle that each subject within a procurement document can only be addressed once and only in one component document.

ISO 10845-4:2011 establishes what is required for a respondent to submit a compliant submission, makes the evaluation criteria known to respondents, and establishes the manner in which the procuring entity conducts the process of calling for expressions of interest. ISO 10845-3 establishes what a tenderer is required to do to submit a compliant tender, makes the evaluation criteria known to tenderers, establishes the manner in which the client conducts the process of offer and acceptance, and provides the necessary feedback to tenderers on the outcomes of the process.

ISO 10845-2:2011 enables ISO 10845-3:2011 (standard conditions of contract), ISO 10845-4:2011 (standard conditions for the calling for an expression of interest) and standard forms of contract to be readily referenced in procurement documents.

Parts 1 to 4 of ISO 10845 can be readily incorporated into procurement systems by reference in organisational policies or in legislation (Watermeyer, 2011c).

ISO 10845-1 describes a number of techniques and mechanisms associated with targeted procurement procedures i.e. the process used to create a demand for services or goods (or both) of, or to secure the participation of, targeted enterprises and targeted labour in contracts in response to the objectives of a secondary procurement policy. These techniques and mechanisms are designed to promote the participation of targeted enterprises and targeted labour in contracts. Key performance indicators (KPIs) relating to the engagement of enterprises, joint venture partners, local resources and local labour in contracts are needed to implement many of these procedures. Parts 5 to 8 of ISO 10845 establish KPIs to measure the outcomes of a contract in relation to the engagement of target groups, and to establish a target level or performance for a contractor to achieve or exceed in the performance of a contract.

3.3.4 Difference between categories of procurement

The procurement of general goods and services usually involves the direct acquisition of products and services which are standard, well-defined and readily scoped and specified. The process normally involves the production of a specification which then forms the requisition. An immediate choice can be made in terms of the cost of goods and services satisfying the specified requirements, which can be paid for upon delivery.

There are many more risks to manage in infrastructure procurement than that for general goods and services, due to unforeseeable and foreseeable risk events which can manifest during the delivery of the project. In addition, infrastructure requirements are often established from a perspective of desired performance, rather than a well-defined specification. A range of different combinations of goods and services with differing characteristics such as initial cost, reliability, life-cycle costs, and operating costs may satisfy performance requirements. A construction product is also usually delivered and paid for incrementally over a period and is "manufactured" on a site.

Table 3.1 Significant differences commonly encountered between the procurement of general goods and services and the procurement of infrastructure

Characteristic / consideration	General goods and services	Provision of infrastructures
Satisfying the business need	The business need is commonly achieved through the production of a specification, which then forms a requisition for goods or services	The business need is frequently satisfied though multiple contracts which need to be procured and managed in such a way that the anticipated benefits are progressively realised
Demand management	The demand is usually determined and managed through inventory / bin levels or the frequency of the required service	Demand is most often determined and managed through service life plans which are based on an assessment of current performance against desired levels of service or functionality and strategic infrastructure plans which provide a credible forecast of current demand and net demand for services or requirements for functionality over a period of time Demand also needs to be proactively managed through the planning, acquisition and contract management phases to prevent scope creep
Risks	Risks are relatively low as they are typically linked to the ability of the contractor to timeously supply the required goods or to provide the required service to the standard demanded by the client within the tendered amount. The consequences of late delivery are usually low.	Risks are high due to uncertainties at the start of a contract which include economic circumstances, human behaviour, natural events, weather, inherent site conditions, political circumstances, community unrest, technology and technical issues, management activities and controls and individual activity. Risks can also manifest in commercial and legal relationships and weak clients as well as in the difference between estimated quantities at tender stage and final quantities at the completion of the works and the manner in which contractors are compensated for risk events for which they are not responsible for.
Interdependencies and interfaces between contracts	Interdependencies and interfaces between contracts are rare as the procurement commonly involves off the shelf products or readily available commodities or standard, well defined and scoped services	There are several interfaces and interdependencies between contracts as works (products) are developed or maintained on a site. A supply chain frequently needs to be contracted and mobilised to provide the necessary professional services, manufacture and supply materials, products, components and assemblies, provide the necessary equipment and labour to provide the works
Final contract price of contract	The final contract price typically equates to the quantum of goods or services which are consumed multiplied by the agreed rate	The final contract price in works contracts equates to the sum of the initial contract price for work which is known, the cost of changes in scope of contract (variations) to enhance quality performance or to address shortcomings which can impair performance, the amount of contract price adjustment for inflation provided for in the contract and the cost of risk events that materialise in the execution of a contract for which the contractor is not responsible
Budget, contract price and purchase order value	Contract price is commonly adjusted to fit the budget or the budget reduced to the contract amount when it is known. The purchase order (financial control) amount typically equals the contract price which in turn equals the budget	The budget needs to include contingences to fund changes in the scope of works associated with a contract to enhance quality or performance, or to address shortcomings which can impair performance, and risk events for which the contractor is not responsible. The purchase order amount may need to be adjusted to enable contingencies to be accessed. The budget, the amount due in terms of the contract and the purchase order amount are rarely the same
Conditions of contract	Conditions of contract describe the rights and obligations of the parties and commonly lack agreed procedures for the administration or management of the contract Frequently a contract or a service level agreement is negotiated after the evaluation of tenders, based on the tender submission	Conditions of contract provide terms that collectively describe the rights and obligations of contracting parties and the agreed procedures for the administration of the contract A standard form of contract is used which provides fixed terms and conditions which are usually not varied. This is necessary to allocate risks to the parties and to provide the methodology by which adjustment to both the prices and the time for completion can be made for changes in the scope of work and for risk events for which the contractor is not at risk. This enables tenderers to price for such risk
Value for money (cost effectiveness)	Reducing the cost of resources, increasing output for a given input or minimising input for a given output while maintaining quality	The optimal use of resources or the effective, efficient, and economic use of resources to achieve intended project outcomes. It speaks to the cost effectiveness of the outputs of the procured resources in the delivery of project outcomes

Table 3.1 outlines the significant common differences between the procurement characteristics associated with the provision, alteration, refurbishment and rehabilitation of construction projects and those for general goods and services.

3.3.5 Framework agreements

ISO 10845-1:2010 defines a framework agreement as *"an agreement between an employer and one or more contractors, the purpose of which is to establish the terms governing contracts to be awarded during a given period, in particular with regard to price and, where appropriate, the quantity envisaged"*. Framework agreements, which are usually entered into following a competitive selection process, allow the client to procure work on an as-instructed (call-off) basis over a set term without necessarily committing to any quantum of work. This may be achieved by issuing orders in terms of a framework contract during the term of the contract, i.e. an instruction to provide works, goods or services within a stated period of time for an agreed price (Watermeyer, 2013a, and National Treasury, 2015).

Framework agreements do not bind a client to make use of such agreements to meet needs. The market can be approached for goods, services and works whenever better value in terms of time, cost and quality may be obtained.

Price in the context of a framework agreement may be considered to be a sum of money for which something is purchased, the actual cost of acquiring something calculated according to some specific measure, or an estimate of what the transaction is worth. Accordingly, framework contracts contain prices for work to be executed over a term or cost parameters which enable prices to be determined once the scope of work has been determined. They may also contain a combination of prices and cost parameters.

Framework contracts need to contain terms which establish:

- the rights and obligations of the contracting parties and the agreed procedures for the administration of the contract and the issuing of orders;
- the term of the agreement during which an order may be issued;
- the scope of work which may be included in an order to enable decisions to be made as to what is covered in the agreement and what needs to be procured outside of the agreement; and
- the basis by which contractors will be remunerated for work performed in terms of an order, if and when such an order is issued.

Orders that are issued may (National Treasury 2015):

- only cover goods, services and works work falling within the scope of work associated with the agreement,
- may not be issued after the expiry of the term of the agreement (see Figure 3.5); and
- may be completed even if completion of the order is after the expiry of the term (see Figure 3.5).

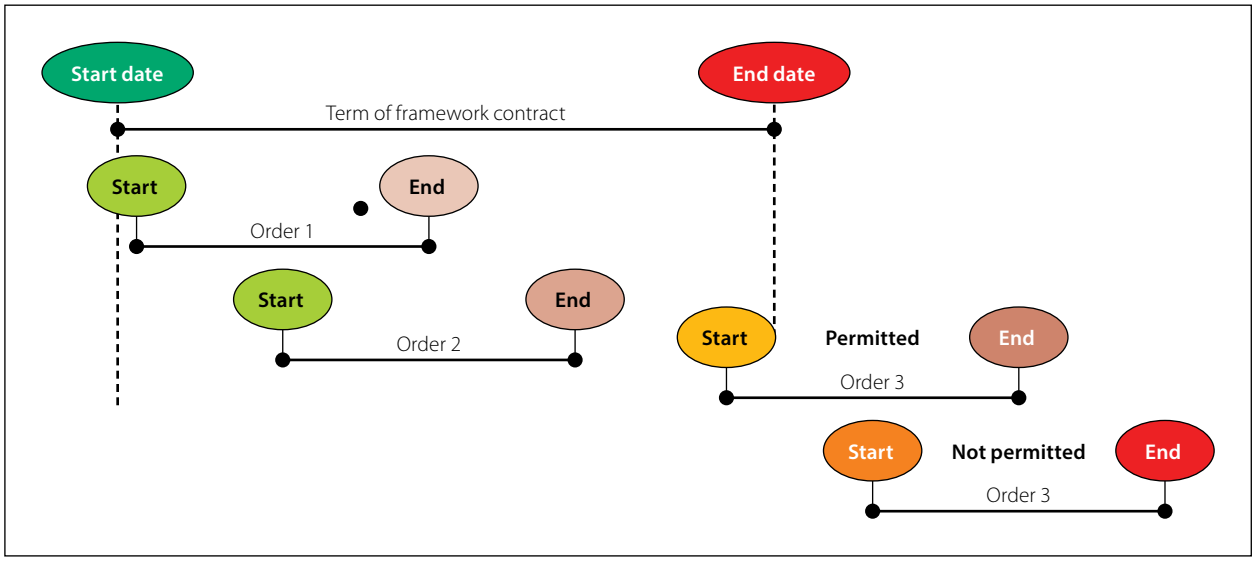


Figure 3.5 Timing of call offs in a framework agreement (Watermeyer, 2013a)

Framework agreements are only entered into with contractors who have the resources and the capability to carry out work that is likely to be instructed for a term usually not exceeding 3 to 4 years. Framework agreements can be entered into with a single or a limited number of contractors (typically not more than 5), based on the projected demand and geographic location for goods, services or works. The issuing of orders from framework agreements where a number of framework contractors have agreements covering the same scope of work may be made with and without requiring competition amongst such contractors. Competition amongst framework contractors for orders needs to take place where there is no justifiable reason for issuing an order to a particular framework contractor.

Framework agreements enable lessons learned in one order to be taken to the next order and enable a team to work together on an integrated approach over a period of time. It also enables performance, including that of promoting secondary objectives, to be improved upon over time.

3.3.6 Forms of contract

ISO 6707-2:2017 defines conditions of contract as "*the document that contains the detailed provisions incorporated in a contract, laying down the rights and duties of the parties, the functions of the people connected with the contract and the procedures for administering the contract.*" A standard form of contract or standard contract is commonly used on infrastructure projects. Such contracts are usually published by an authoritative industry body. They provide fixed terms and conditions which are deemed to be agreed and are not subject to further negotiation or amendment when applied to a particular tender. They commonly make provision for matters such as:

- procedures for making changes to the scope of work (documents that specify and describe the goods, services, or works which are to be provided, and any other requirements and constraints relating to the manner in which the contract work is to be performed) after the formation of a contract;
- procedures to address the impacts on time, cost and quality or performance of changes made to the scope of work after the formation of a contract and the occurrence of events for which the contractor is not at risk;
- the seeking of instructions on how to proceed when particular events occur or circumstances arise;
- the risks which are bone by each party and how the contractor is compensated for risk events for which he is not at risk;
- how defects (parts of the goods, services or works which are not in accordance with the provisions of the contract) are to be dealt with;
- procedures for termination and the determination of what is due to the contractor upon termination;
- the certification of amounts due in terms of the contracts;
- the certification of delivery or completion of the works;
- the actions of an agent of the employer; and
- the resolution of disputes.

Standard forms of contract make provision for the adjustment to both the prices and the time for completion for changes in the scope of work and for risk events for which the contractor is not at risk. Increases in the prices after the award of a contract or the issuing of an order arising from changes in the scope of work or risks events does not constitute an amendment to the contract.

Standard forms of contract enable tenderers to take into account the allocation of risks embedded in such contracts when preparing tenders for infrastructure projects and enables tenders to be evaluated on a comparative basis. There is also no need for tenderers who are familiar with a particular form of contract to price risks arising from uncertainties as to how particular issues will be viewed or handled in terms of the contract. Accordingly, standard forms of contract should be used with minimal contract amendments which change their intended usage and should only be amended to accommodate special needs.

Standard forms of contract can be drafted around significantly different objectives and principles e.g. master – servant relationship or collaboration between two experts, risk sharing or risk transfer, independent or integrated design, short term relationships based on one sided gain or long-term relationships focused on maximising efficiency and shared value, etc. Forms of contract may also support open book approaches to the costing of changes due to the occurrence of risk events, foster collaborative working relationships, provide pricing structures that align payments to results and reflect a balanced sharing of performance risk and deal with delays and disruptions efficiently and effectively (Watermeyer, 2013b).

Standard forms of contract tend to be country specific as they are developed by bodies within a particular country. There are, however, two international families of standard forms of contracts, namely those published by the International Federation of Consulting Engineers (FIDIC) and the Institution of Civil Engineers (NEC). These standard forms of contract cover a range of contract types and contracting strategies.

3.4 PORTFOLIO, PROGRAMME AND PROJECT MANAGEMENT

3.4.1 General

Organisations generally establish strategy based on their mission, vision, policies and factors outside the organisational boundary. Organisational strategy identifies opportunities which are then evaluated and documented. Selected opportunities are further developed in a business case or other similar document, and can result in one or more projects that provide deliverables which are used to realise benefits as illustrated in Figure 3.6.

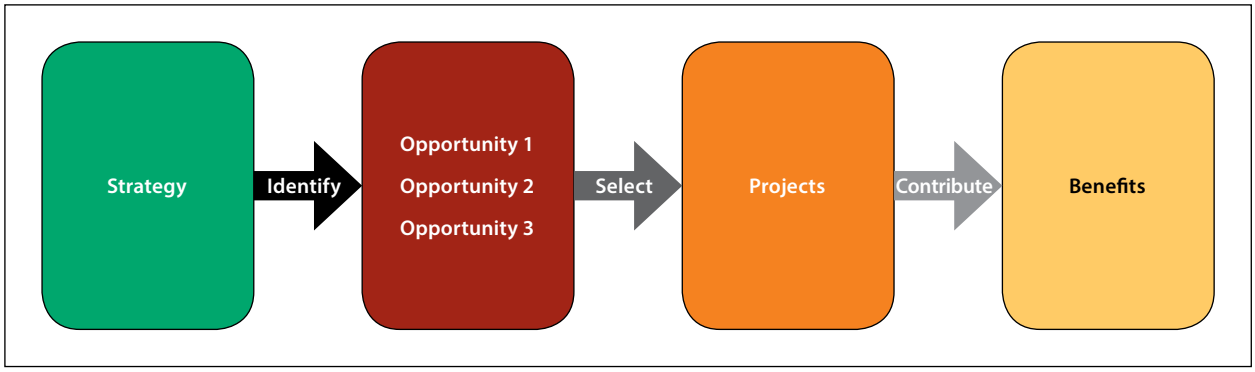


Figure 3.6 Value creation framework (ISO 21500:2012)

Projects are often the means to accomplish strategic goals. ISO 21500 suggests that a project "*consists of a unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve project objectives. Achievement of the project objectives requires the provision of deliverables conforming to specific requirements.*"

Projects may be organised within:

- programmes–the grouping of a set of related projects in order to deliver outcomes and benefits related to strategic objectives which would not have been achieved had the projects been managed independently; and
- portfolios–collection of projects or programmes and other work that are grouped together to facilitate effective management of that work to meet a strategic objective.

The contribution of projects, programmes and portfolios to organisational goals are highlighted in Figure 3.7.

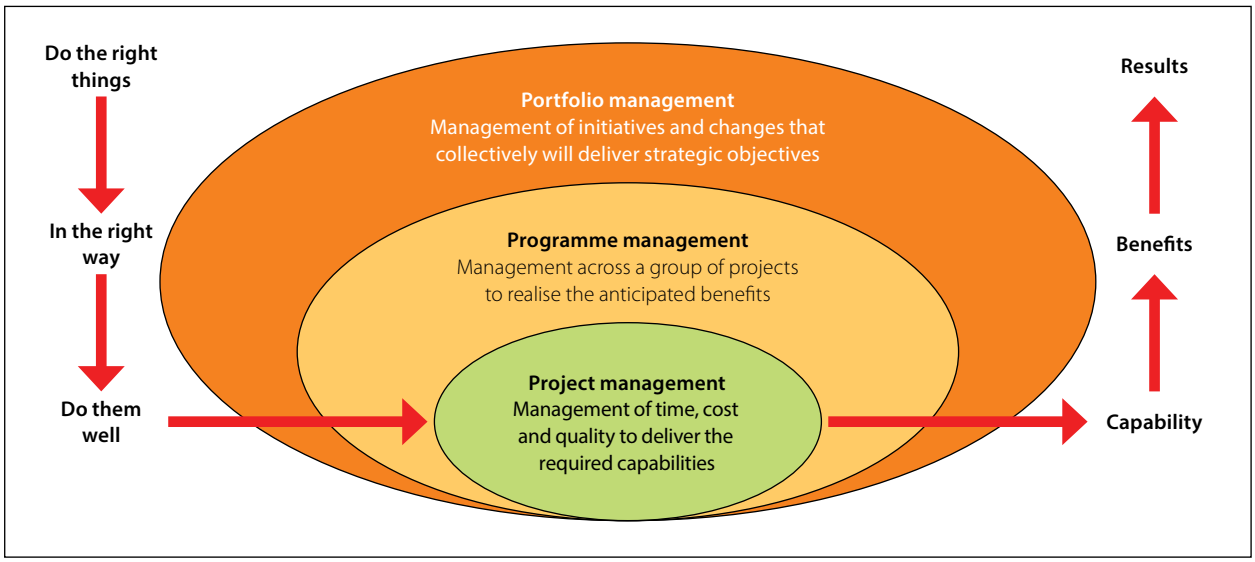


Figure 3.7 Contributions of the different types of management to strategic goals

3.4.2 Portfolio management

ISO 21504:2015 suggests that portfolio management aligns the portfolio components (project, programme, portfolio or other related work) with an organisation's strategic objectives, stakeholder priorities and values as indicated in Figure 3.8. Portfolio management may also be described as a continuous decision making process whereby an organisation's list of portfolio components is subject to periodic review for alignment with the organisation's strategy. In this approach, new opportunities or threats are evaluated, selected, prioritised and authorised.

ISO 21504:2015 recommends that the following prerequisites be considered in setting up and maintaining portfolio management:

- the justification for portfolio management which addresses the need, the benefits and the cost of the investment as well as the alignment to one or more strategic objectives;
- the portfolio management framework which addresses issues such as how prioritisation of components takes place, how components are included or removed and how resources will be allocated to components;
- the types of portfolio components i.e. the types of work (projects, programmes, other portfolios and other related work) included or excluded in portfolio components as well as the criteria used to identify them;

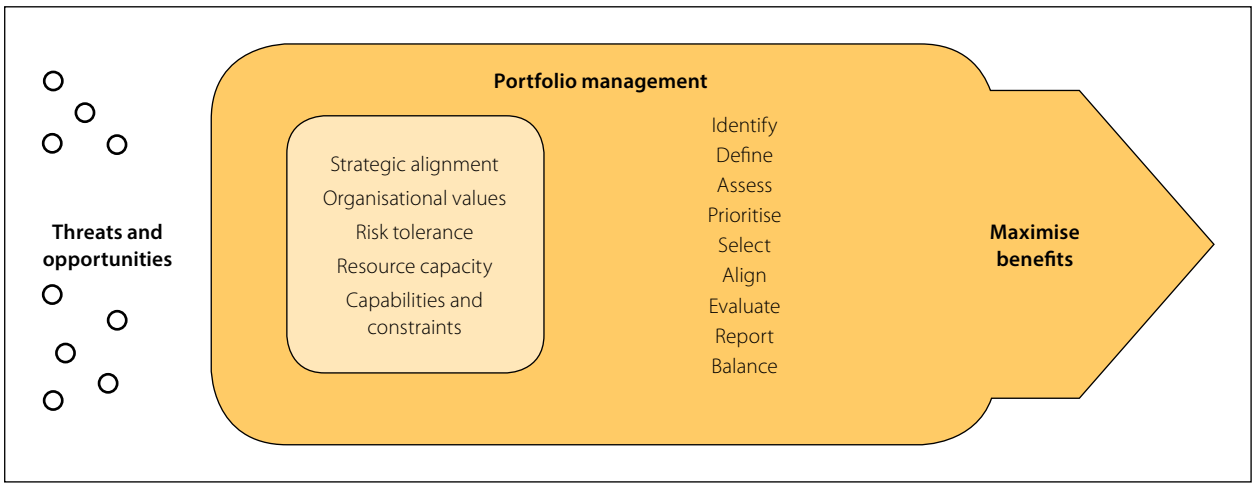


Figure 3.8 A view of portfolio management (ISO 21504:2011)

- the criteria for selecting and prioritising portfolio components which should be defined and verifiable and reflect portfolio objectives which are aligned with organisational strategy and reflect the values, principles, other organisational policies and targeted benefits;
- the alignment with organisational processes and systems such as performance reporting, resource management, risk management, financial management and project and programme management and communication methods and cycles;
- the visibility of the portfolio i.e. the management system which provides visibility and relevant information to decision makers in terms of status;
- the portfolio performance and reporting structure which monitors achievement of portfolio objectives and organisational objectives for the portfolio as a whole and each component;
- the improving of portfolio management aimed at continually improving the suitability, adequacy, effectiveness and efficiency of portfolio management; and
- the governance of portfolios.

ISO 21504:2015 points out that governance provides the policies, authorities, processes, procedures, standards and accountability necessary to conduct the management and leadership of the portfolio. Portfolio management undertaken by a portfolio manager, who may be supported by a portfolio management team, needs to be undertaken within the boundaries established by governance. Governance of portfolios needs in turn to be aligned with organisational governance.

Governance may be developed, provided or maintained through several possible structures acceptable to the organisation. However, the overall purpose of the selected structure needs to provide the necessary governance mechanism to enable successful portfolio management. It should consist of executive and senior management of both decision-making and advisory capacity within the organisation.

3.4.3 Programme management

ISO 21503:2017 defines programme management as "*co-ordinated activities to direct the interrelated programme components (project, programme or other related work) to achieve programme objectives and realise benefits.*" Accordingly, programmes should be undertaken to:

- deliver benefits aligned to strategic and operational objectives;
- achieve benefits not available when components are worked as individual components, such as projects, multi-organisational needs or objectives, as well as, to meet contractual terms and conditions; and
- improve efficiency and potentially to reduce risk.

Programme deliverables should contribute to the realisation of programme objectives.

ISO 21503:2017 recommends that activities such as the following should be considered when making the decision to establish a programme:

- *developing a common approach to be used across multiple programme components;*
- *managing stakeholders' views and interests;*
- *communicating internal and external aspects of the programme;*
- *improving benefits realisation, particular in scheduling earlier delivery of benefits;*
- *optimising the use of resources across, and within several programme components;*
- *optimising cost, schedule and quality;*
- *managing programme risks;*
- *steering and aligning the programme components;*
- *supporting a business rationale, which defines the objectives for the programme;*
- *identifying benefits to be realised from managing the individual components as a programme; and*

- *aligning with one or more of the organisational objectives.*

Programmes may be established in a single organisation, across multiple organisations, or within a project and programme portfolio.

There is potential for achieving significant economies of scale by spreading the cost of common aspects or components of similar repetitive projects across a programme. Some examples of these potential economies of scale include:

- using the continuity of work across the programme to implement more sustainable capacity building, training or development programmes, and spreading the cost of developing such training and development programmes across a number of projects;
- spreading the cost of standard designs over a large number of projects, reducing the cost per project of the design services;
- grouping projects together for procurement processes, to reduce the procurement cost per project;
- the development of management, supervision, monitoring and reporting processes and systems across a series of projects, reducing the cost of developing these processes and systems per project; and
- developing a single business plan for the programme, reducing the cost of planning per project.

These economies of scale make it possible to develop much more thorough and effective processes, systems and training in a programme than would be possible for a single project (because it would be too expensive for a single project).

Executive and senior management should assign and define the programme management roles, responsibilities, accountability and limits of authority. Programme management needs to be aligned with organisational governance so that it has a strategic rationale and relationship to achieve synergistic outcomes within the organisation or across the participating organisations.

3.4.4 Project management

ISO 21500:2012 describes project management as "*the application of methods, tools, techniques and competencies to a project*" which can be applied to a project as a whole or to an individual phase or to both. Project management differs from other management disciplines by the temporary and unique nature of projects. Managing a project typically includes:

- identifying requirements;
- addressing the various needs; and
- balancing competing project constraints including:
  - scope (the work that must be performed to deliver a product, service, or result, with the specified features and functions):
  - quality (the degree to which inherent characteristics meets requirements);
  - schedule (the planned dates for performing schedule activities and the planned dates for meeting milestones);
  - budget (the approved estimate for a project);
  - resources (skilled human resources, equipment, services, supplies, commodities, materials, budgets or funds); and
  - risk (an uncertain event or condition which if it occurs, has a positive or negative effect on the project objectives.

Project management is performed through processes. The generic project management processes may be viewed from two different perspectives, namely as process groups (see Table 3.2) or subject groups (see Table 3.3).

Table 3.2 Project management process groups (ISO 21500:2012)

Process group	Description
Initiating	Used to start a project phase or project, to define the project phase or project objectives and to authorise the project manager to proceed with the project work
Planning	Used to develop planning detail sufficient to establish baselines against which project implementation can be managed and project performance can be measured and controlled
Implementation	Used to perform the project management activities and to support the provision of the project's deliverables in accordance with the project plans
Controlling	Used to monitor, measure and control project performance against the project plan. Consequently, preventive and corrective actions may be taken and change requests made, when necessary, in order to achieve project objectives
Closing	Used to formally establish that the project phase or project is finished, and to provide lessons learned to be considered and implemented as necessary

Table 3.3 Project management subject groups (ISO 21500:2012)

Subject group	Description
Integration	Includes the processes required to identify, define, combine, unify, coordinate, control and close the various activities and processes related to the project
Stakeholder	Includes the processes required to identify and manage the project sponsor, customers and other stakeholders
Scope	Includes the processes required to identify and define the work and deliverables, and only the work and deliverables required
Resource	Includes the processes required to identify and acquire adequate project resources such as people, facilities, equipment, materials, infrastructure and tools
Time	Includes the processes required to schedule the project activities and to monitor progress to control the schedule
Cost	Includes the processes required to develop the budget and to monitor progress to control costs
Risk	Includes the processes required to identify and manage threats and opportunities
Quality	Includes the processes required to plan and establish quality assurance and control
Procurement	Includes the processes required to plan and acquire products, services or results, and to manage supplier relationships
Communication	Includes the processes required to plan, manage and distribute information relevant to the project

The project organisation invariably includes the following roles and responsibilities:

- the project manager, who leads and manages project activities and is accountable for project completion;
- the project management team, which supports the project manager in leading and managing the project activities; and
- the project team, which performs project activities.

ISO 21500 suggests that project governance may include subjects such as the following:

- *defining the management structure;*
- *the policies, processes and methodologies to be used;*
- *limits of authority for decision-making;*
- *stakeholder responsibilities and accountabilities; and*
- *interactions such as reporting and the escalation of issues or risks.*

3.5 RISK AND CHANGE MANAGEMENT

Risk is defined in ISO 31000:2018 as the "*effect of uncertainty on objectives.*" An effect is a deviation from the expected, which can be positive or negative which can address, create or result in opportunities or threats. An event (an occurrence or change of a particular set of circumstances) can be a source of risk.

Risk is characterised by reference to:

- likelihood i.e. the chance of something happening (possible occurrence or change of a particular set of circumstances or something not happening); and
- consequences i.e. the outcome of an event affecting objectives.

Risks in an infrastructure context can be categorised into (Macdonald, 2017):

- **known risks** (total certainty) which include items such as type of project, site location, process requirements, and items where variability is known and is well understood;
- **known unknown risks** (specific uncertainty) which include items relating to accuracy, growth and design development of the work and elements which cannot be fully defined or assessed at the time of estimate preparation i.e. degree of project definition, estimating methodology, design / take-off allowances, escalation and impact of unusual but foreseeable aspects and circumstances;
- **unknown known risks** (general uncertainty) which include those which can be foreseen or are known to exist with varying degrees of credibility and assessed considering their potential impact and probability of occurrence; and
- **unknown unknown risks** (totally uncertain) which are risks that have never been heard of or are either so rare and unlikely to be unforeseeable, cannot be predicted, are unquantifiable and completely outside the client team's or delivery team's control.

Accordingly, risk taking is necessary in infrastructure projects. Risks that are known (known unknown or unknown known risks) can generally be identified by the parties in the risk management analysis. Unknown unknown risks are generally new and emerging risks and will in all probability not be predicted or included in the risk analysis. These risks will only become evident with time on the project.

Risk management is defined in ISO 31000:2018 as "*coordinated activities to direct and control an organisation with regard to risk*." The 8 elements of risk management which contribute to value creation and protection in risk management processes are indicated in Table 3.4. The effectiveness of risk management depends upon its integration into the governance of an organisation including its decision making (ISO 31000:2018).

Table 3.4 Elements of risk management (ISO 31000:2018)

Element	Explanation
Integrated	Risk management is an integral part of all organisational activities
Structured and comprehensive	A structured and comprehensive approach to risk management contributes to consistent and comparable results
Customised	The risk management framework and process are customised and proportionate to the organisation's external and internal context related to its objectives
Inclusive	Appropriate and timely involvement of stakeholders enables their knowledge, views and perceptions to be considered. This results in improved awareness and informed risk management
Dynamic	Risks can emerge, change or disappear as an organisation's external and internal context changes. Risk management anticipates, detects, acknowledges and responds to these changes and events in an appropriate and timely manner
Best available information	The inputs to risk management are based on historical and current information, as well as on future expectations. Risk management explicitly takes into account any limitations and uncertainties associated with such information and expectations. Information should be timely, clear and available to relevant stakeholders
Human and cultural factors	Human behaviour and culture significantly influence all aspects of risk management at each level and stage
Continual improvement	Risk management is continually improved through learning and experience

The risk management process involves the systematic application of policies, procedures and practices to the activities of communicating and consulting, establishing the context and assessing, treating, monitoring, reviewing, recording and reporting risk as indicated in Figure 3.9. Such processes put in place measures that maintain or modify risk and need to form an integral part of management and decision making. Risk management is an iterative process (ISO 31000:2018).

Risk management in the context of an infrastructure project relates to the management of risks emanating from activities in providing infrastructure which take place within the product controls, delivery constraints and underlying context described in 2.3. Risk management is all about identifying the salient risks that can be determined at a given point in time, by assessing their likelihood and deciding on how best to manage the project in the light of this information. The focus in the distribution of risk is invariably on the payment and responsibility for the cost of the event, should it materialise. Risk management means taking deliberate action to shift the odds by:

- reducing the odds of bad outcomes (negative or undesired); and
- increasing the odds of good outcomes (positive or desired).

Risk management is critical throughout the project life cycle. Risk need to be identified by both the client team and the delivery team as both these teams have different but complimentary objectives. Their impact needs to be analysed, measured, evaluated and treated.

Change is any deviation from the way work was planned, designed, budgeted or scheduled. It can arise from design changes, scope of work changes, delays in finalising / issuing production information, unforeseen site conditions, regulatory changes, inadequate specifications / production information, schedule changes and subcontractor performance. Change is expected on any project. These changes are often as a result of evolving circumstances and requirements.

The impact of project changes needs to be taken into account to ensure the outcomes of the project are in line with expectations. The absence of diligent implementation of change management can have dire consequences resulting in cost and schedule overruns, lost profits and ruined relationships.

A clear understanding of the impact of change is required to support an informed, proactive, ideally collaborative decision on changes. Change can be either positive or negative. Positive change comes about when it enhances the project outcomes or to rectify circumstances that would otherwise harm a project. Negative change results in project overruns and associated impacts.

The impact of change consists of two fundamental categories of change (Macdonald, 2009);

- **Direct impacts**
  This is the direct cost of implementing or accommodating a change. The direct impact of any change includes for the impact of added scope, and delays, and is likely to have multiple dimensions, but needs ultimately to be translated into impacts of cost and time. Design uncertainty, whilst resulting in a direct impact, is generally not a direct cost source, but is one of the best early indicators of 'disruption' or the secondary impacts of change.

- **Secondary impacts (disruption, cumulative impact, ripple effects, etc.)**
  This is the additional, or effect on the cost of performing work which is not directly changed, that is the unchanged work. This is the added cost due to lowered productivity or increased rework on the unchanged work. These impacts are as a result of out of sequence working, engineering rework, reduced productivity, hiring new staff with the requisite qualifications / experience to recover the programme time lost, increased overtime, night shifts, management / oversight stretch and attention span, workforce morale, out of sequence flow of information to vendors, partners, etc.

The secondary impacts of change on a project are difficult to address and define as they:

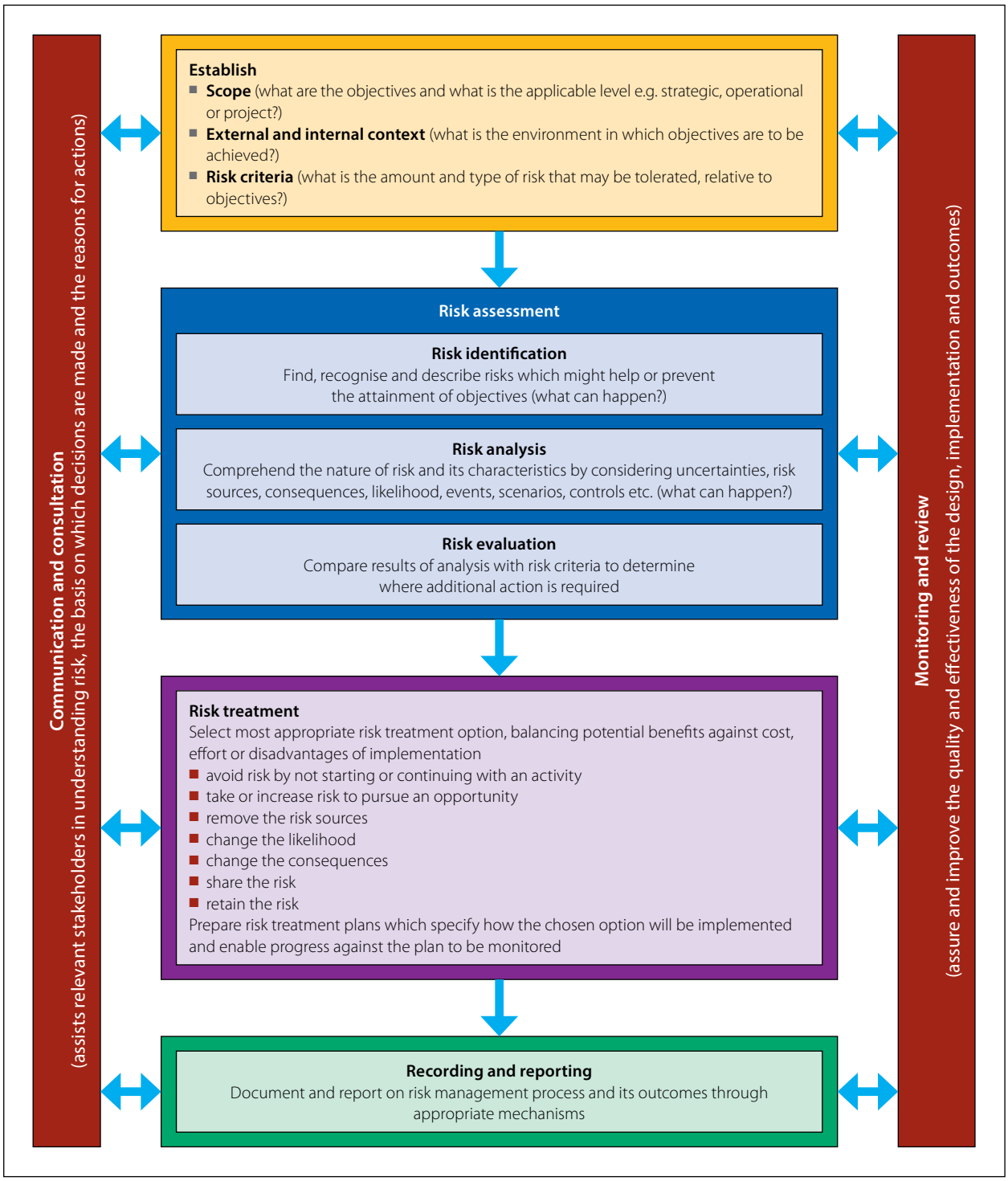


Figure 3.9 Risk management process (after ISO 31000:2018)

- can be widely separated in space and time from the cause, but need to be tied to their source;
- can be cumulative across large numbers of individual impacts;
- are fundamentally about productivity and rework, which are hard to measure; and
- present a challenging analytical task to quantify.

The secondary impacts of change can have a far greater impact on the project than the direct impacts of change. This is due to the fact that they grow disproportionately over more and more changes, they can appear sometime after the incident change event has occurred and variations in project conditions drive different secondary

impacts. Early resolution can cut their impact significantly. Secondary impacts are significantly reduced by less tight project schedules.

3.6 GOVERNANCE

3.6.1 Fundamentals of governance

Governance, according to BS 13500:2013, *is the system by which the whole organisation is directed and controlled and held accountable to achieve its core purpose over the long term.* Management, on the other hand, is the act of bringing people together to accomplish desired goals and objectives, using available resources in an efficient, effective and risk aware manner.

Governance authorises, directs, empowers, provides oversight and limits the actions of management (ISO 21505:2017). Management needs to work within the constraints set by the organisation's governance framework to achieve the organisation's' objectives. Accordingly, management is about getting the work done whereas governance is about ensuring that the right purpose is pursued in the right way and that the organisation continuously develops overall to fulfil its purpose. While governance and management are different, everyone involved in governance and management need to work proactively towards achieving the objectives of the organisation.

Governance, according to BS 13500:2013, exists to ensure that organisations fulfil their purposes successfully on behalf of those to whom they are accountable. Delivering effective governance should therefore involve:

- clarifying the organisation's purpose and values in consultation with those on whose behalf it exists;
- identifying the risks involved in fulfilling the organisation's purpose in alignment with its values; and
- directing and controlling the organisation in a manner that enables proper reporting.

An effective governance system integrates the components of accountability, direction and control, based upon the organisation's purpose and values in a continuous process as indicated in Figure 3.10 and Table 3.5.

Governance and management functions may be performed at different levels and in different parts of an organisation. The governing body nevertheless remains accountable for the performance of the organisation.

The governance of projects, programmes and portfolios should be an integrated part of the organisation's overall governance.

3.6.2 Project, programme and portfolio governance

An organisation should have an integrated governance framework which covers projects, programmes and portfolios within the organisation. ISO 21505:2017 suggests that the governance of projects, programmes and portfolios should:

- *reflect the values and principles of the organisation or organisations responsible for the projects, programmes and portfolios being governed;*
- *facilitate the achieving the organisation's objectives, while complying with the constraints set by its governance framework; and*
- *consider the cultural and ethical norms of any other organisations involved and communities in which the organisation operates.*

Project governance describes the way in which projects are authorised, conducted and overseen, by the client and significant interested parties. It:

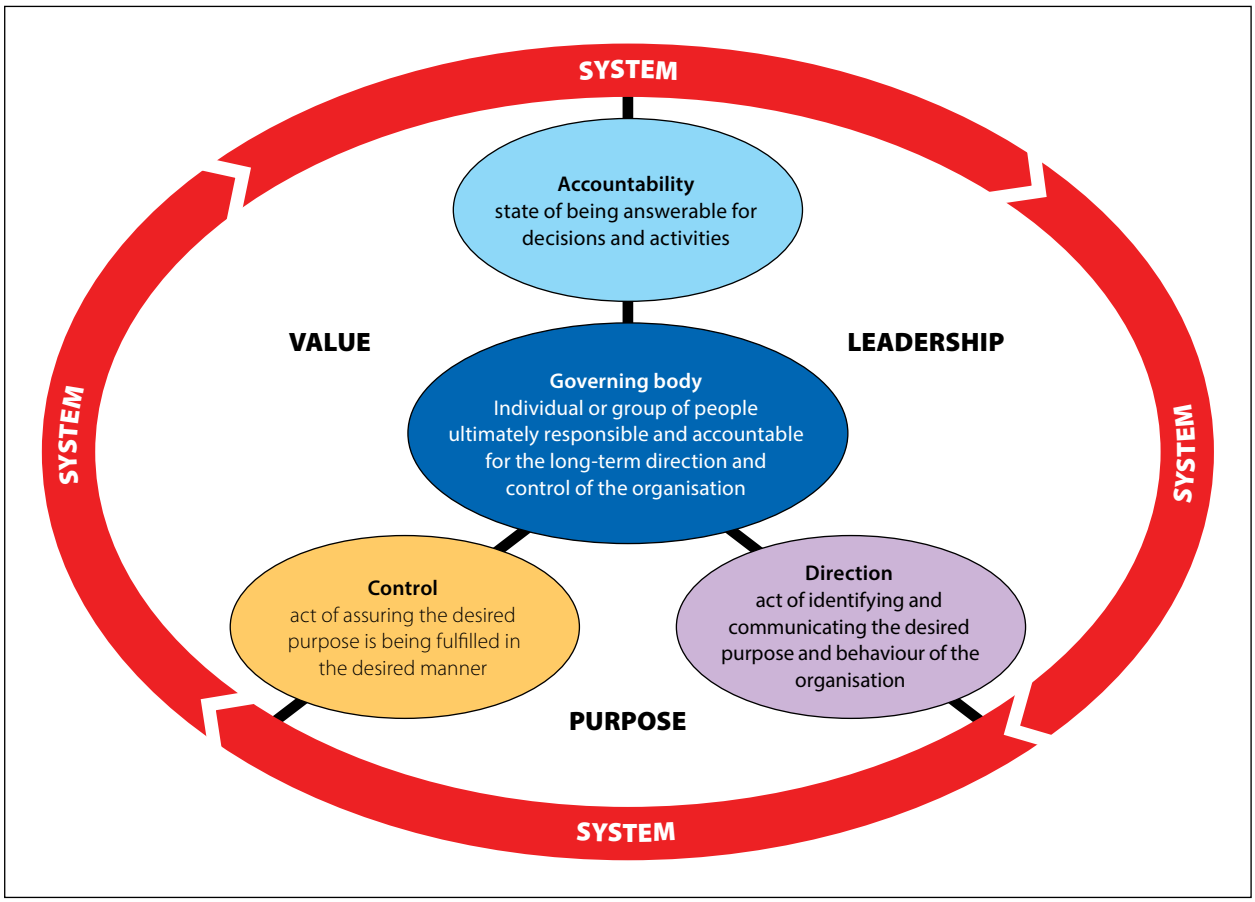


Figure 3.10 Integrated components of an effective governance system (after BS 13500:2013)

Table 3.5 Principles of accountability, direction and control (after BS 13500:2013)

Area	Principles
Governance accountability	The governing body needs to: ■ Identify, consult with and report to relevant stakeholder ■ Exhibit leadership ■ Determine the organisation's best long-term interests ■ Sustain clarity on the organisation's purpose and values ■ Establish an effective governance culture ■ Establish governance competence and capacity ■ Recognise and respond appropriately to governance performance ■ Demonstrate sufficient transparency for accountability
Implementing governance direction	The governing body needs to: ■ Understand and ensure the integrity of founding documentation ■ Understand the organisation's context ■ Establish and regularly review governance policies ■ Ensure that governance policies set standards for all aspects of organisational performance ■ Establish governance role clarity ■ Uphold good delegation principles ■ Ensure that the ownership of policies is clear
Implementing governance control	The governing body needs to: ■ Set out and embed governance controls ■ Ensure governance policies are monitored ■ Ensure appropriate response to monitoring results

- comprises those areas of governance that are specifically related to project activities;
- is a mechanism for engaging the client in a project, for obtaining buy in of stakeholders and for driving executive decision making;
- provides a comprehensive, consistent method of controlling the project and ensuring its success; and
- includes the establishment of appropriate and effective delegations of responsibility.

Project governance is the framework within which project decisions are made. The role of project governance is to provide a decision-making framework that is logical, robust and repeatable to govern the delivery of construction projects.

ISO 21500:2012 suggests that project governance may include subjects such as defining the management structure, the policies, processes and methodologies to be used, limits of authority for decision-making, stakeholder responsibilities and accountabilities and interactions such as reporting and the escalation of issues or risks.

ISO 21500:2012 points out that projects are usually organised into phases that are determined by governance and control needs. Such phases should follow a logical sequence, with a start and an end, and should use resources to provide deliverables. In order to manage the project efficiently during the entire project life cycle, a set of activities should be performed in each phase. Project phases are collectively known as the project life cycle. ISO 21505:2017 suggests that decision gates be established in the project life cycle with criteria that enable the authorisation of the project continuation, suspension, termination or modification (see Chapter 4).

A programme similarly operates in an environment through a programme life cycle. The governing body needs to establish the relationship between the programme and the organisational programme management framework. Such relationships allow the executives and senior managers to have oversight of programme management, enables strategic alignment and the selection of programme components.

ISO 21505:2017 suggests that decision gates (see Chapter 4) should be established in the programme life cycle with criteria to:

- authorise continuation, termination or modification of programme and programme components;
- facilitate decision making and assess and validate benefits realisation; and
- validate alignment of the programme with the organisation's strategy, goals and objectives.

The governance of portfolios should be supported through processes, procedures and standards, as appropriate, and is frequently undertaken through a committee or board consisting of executive or senior managers established and granted authority by the governing body of the organisation.

CHAPTER 4
Controlling workflows

4.1 INTRODUCTION

Workflow may be regarded as the sequence of activities with explicit start and end points to describe a task. An activity as a series of operations (sequential, parallel, mixed) is punctuated by decisions as illustrated in Figure 4.1.

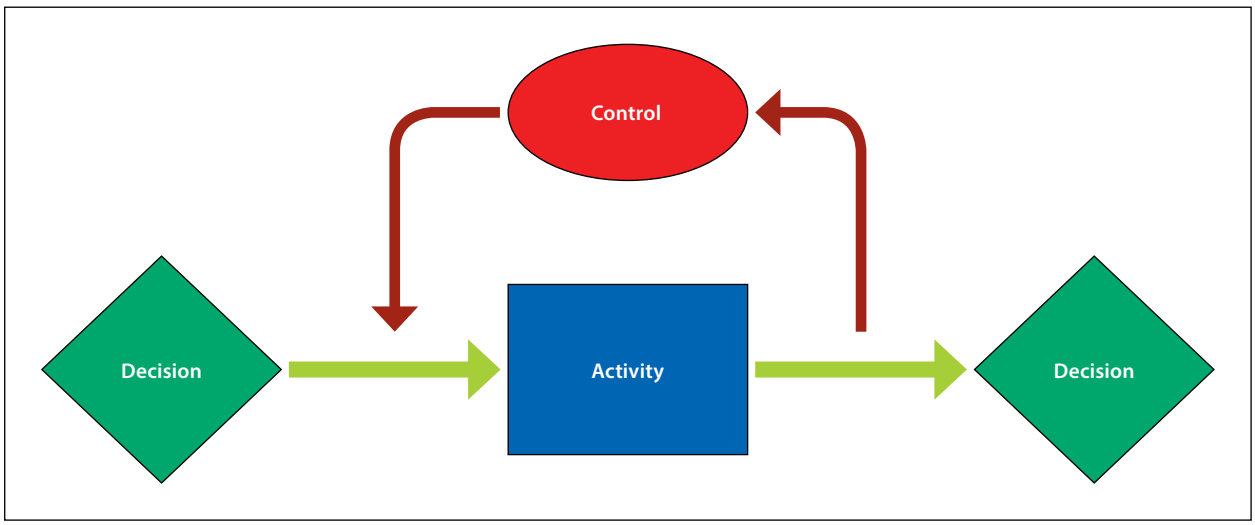


Figure 4.1 The context of project activity (Hughes and Murdoch, 2001)

In order for an infrastructure project to progress meaningfully, its objectives and their achievement need to be closely allied to the decision structure. Decisions give purpose to activity. A project begins and ends with decision points.

Decision points (controls or decision gates) form the major boundaries to activities. Decisions can be broadly categorised as being policy, strategic, tactical and operational. Decisions not only give purpose to activity but also ensure that activities are undertaken in accordance with an organisation's system of governance or quality management system.

Decision gates provide an opportunity to:

- authorise the proceeding with an activity within a process, or the commencing of the next process;
- confirm conformity with requirements before completing processes; or
- provide information which creates an opportunity for corrective action to be taken.

Control systems are necessary to regulate work in relation to its context which may from time to time change in order to match performance against objectives. Such systems are also the mechanism that deals with the boundary between project context and project activity as indicated in Figure 4.2.

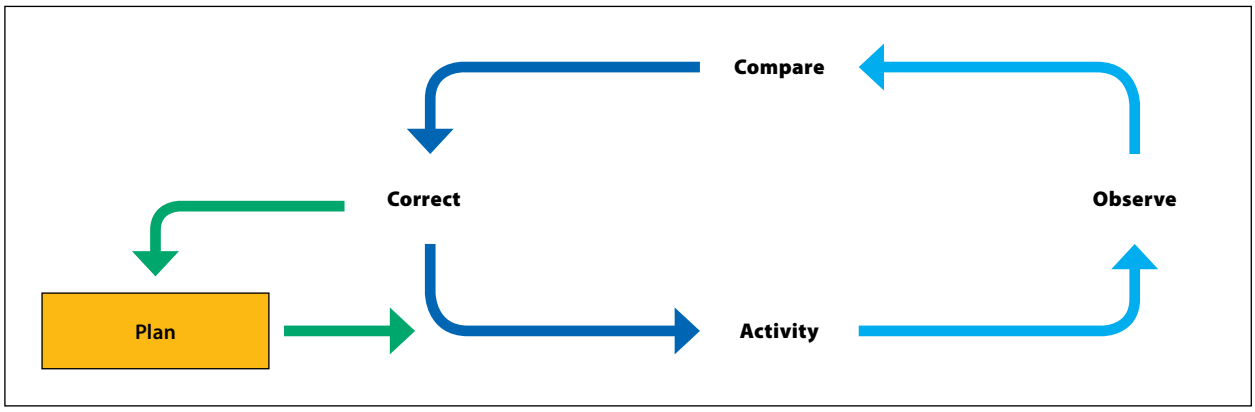


Figure 4.2 Control system (after Hughes and Murdoch, 2001)

Control systems accordingly involve the comparing of progress against requirements, objectives or targets and where necessary taking some corrective action such as:

- taking steps to change the performance of the activity to bring it closer to what was planned; or
- changing the plan so that it more closely reflects the changed situation brought about by the departure from the plan.

4.2 CONTROLLING THE WORK FLOW FOR THE DELIVERY OF INFRASTRUCTURE PROJECTS

4.2.1 Work flow stages and decision gates

A stage is a collection of logically related activities in the delivery cycle of infrastructure projects that culminates in the completion of a major deliverable. The workflow for the delivery of infrastructure projects comprises the applicable stages indicated in Figure 4.3. Each of these stages are linked to tasks mapped out in the supply chain indicated in Figure 3.1. The key deliverables associated with each task informs the decisions which are made at each decision gate described in Table 4.1.

The control framework shown in Figure 4.3 deals with the generic work flow associated with the planning, design and execution of infrastructure projects i.e. the project life cycle for the delivery of infrastructure projects. It is structured in such a manner that the viability of a project may be tested and monitored and controlled by the client team as it progresses. It generates information which informs decisions at particular points in the process. It is not aligned to any particular funding or organisation specific project life cycle. The framework is furthermore independent of the procurement strategy (see Chapter 5) that is pursued to appoint construction contractors. It is also not dissimilar to local and modern international work stages for infrastructure projects as indicated in Table 4.2.

Infrastructure planning is a continuum and not an event. It is a highly iterative process involving the rationalisation of demand and prioritisation against available resources while maintaining required service levels with linkages to the planning and budgeting system for infrastructure and the asset management system for infrastructure (see 3.2.2 and 3.2.3). It is not a step by step process where the analyses are independent of each other and can be performed in sequence. Information needs to flow between the different analyses and constant feedback mechanisms need to be put in place to ensure coherence. Such planning can be supply-driven by addressing the difference or gap between a desired state and a current state, or demand-driven by adopting approaches which change the perceptions and hence requirement as to what should be supplied.

Stage 0 admits projects into the pipeline of projects so that they can be further prepared prior to a decision being taken to implement them. The infrastructure management plan (stage 1) is not a static document as project parameters relating to cost and schedule of a pipeline of projects need to be adjusted as projects unfold, and in

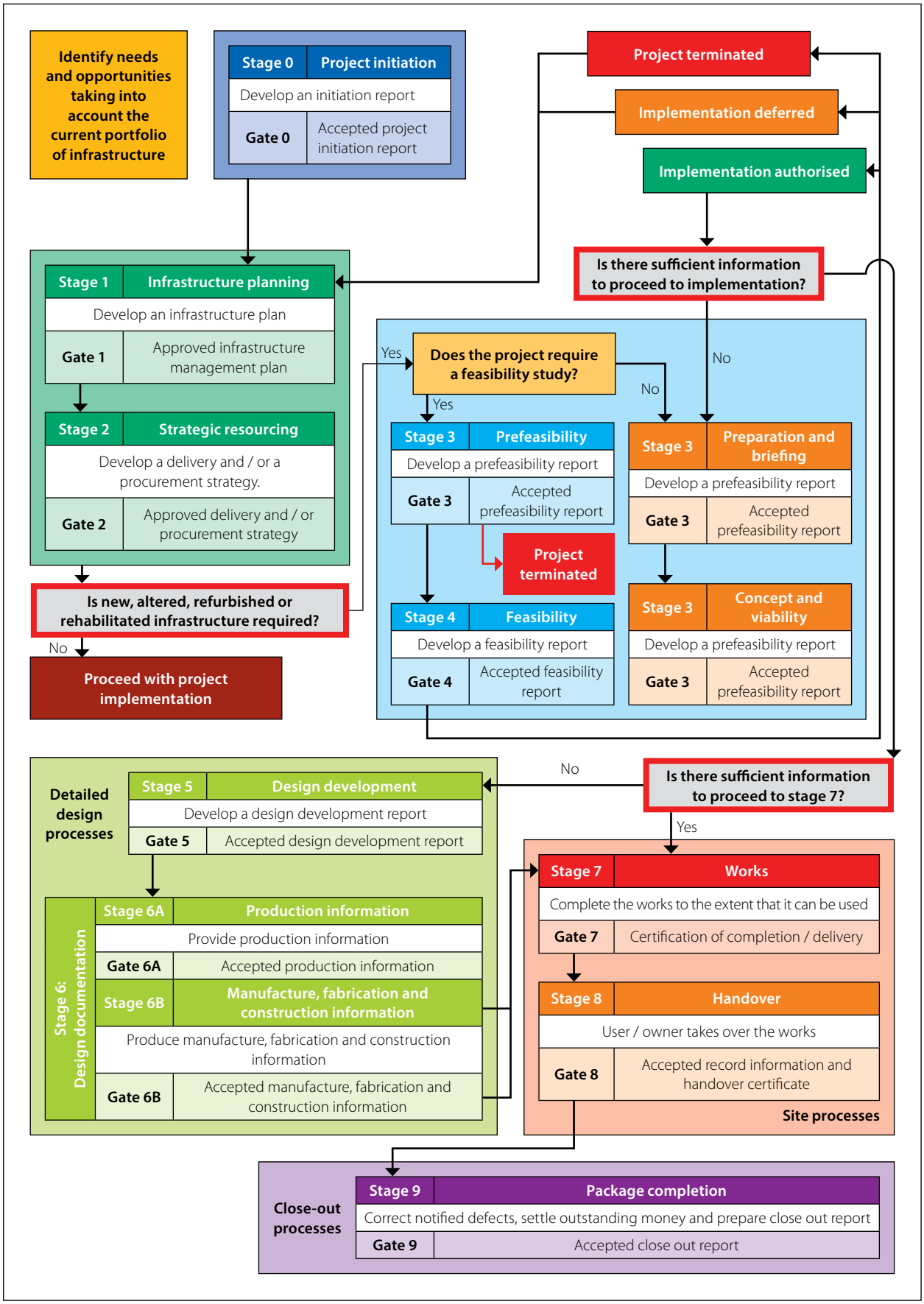


Figure 4.3 The control framework for the planning, design and execution of infrastructure projects (after National Treasury, 2015)

organisations which have ongoing projects to meet their business needs, new initiation reports are accepted at stage 0 to the pipeline of projects on an ongoing basis. Such a plan accordingly needs to be reviewed and updated regularly, at least once a year to reflect revised information, emerging business needs and changing priorities. This also necessitates revisions to deliverables associated with stage 2 (strategic resourcing).

Stage 4 is the stage where a decision is taken on whether or not the project is likely to yield the desired outcome. Accordingly, a view needs to be taken on the following:

- deliverability (the extent to which a project is deemed likely to deliver the expected benefits within the declared cost, time and performance envelope);
- affordability (the extent to which the level of expenditure and financial risks involved in a project can be tolerated, given the organisation's overall financial position, both singly and in the light of its other commitments); and
- value for money (see 6.1)

The decision taken at the end of stage 4 may authorise implementation, defer implementation or terminate the project (see Figure 4.3).

Table 4.1 End-of-stage deliverables (after National Treasury, 2015)

Stage		End-of-stage deliverable	
No	Name	Description	Considerations
0	Project initiation	An initiation report which outlines the high-level business case together with the estimated project cost and proposed schedule for a single project or a group of projects having a similar high-level scope	The initiation report for a project should as a minimum: ■ provide a project description and high-level scope of work; ■ outline key issues and solution options that were interrogated and the options that were evaluated; ■ indicate the high-level business case; and ■ provide the estimated project cost and indicative high-level time schedule The decision-making criteria, findings, assumptions and recommendations should be documented
1	Infrastructure planning	An infrastructure management plan which identifies and prioritises projects and packages against a forecasted budget over a period of at least three years but generally not more than 5 years	The infrastructure management plan, which should be described by the high-level scope of work for each project, the proposed time schedule, the estimated total project cost and annual budget requirement, the geographical location, any known encumbrances and estimated timeframes for removing these encumbrances, should: ■ identify the infrastructure requirements to meet the organisation's strategic objectives within available resources; ■ cover the organisation's whole infrastructure portfolio for all types of infrastructure, including new infrastructure, as well as plans for operation, maintenance, refurbishment and rehabilitation of existing infrastructure, and disposal of infrastructure which is no longer required to meet the organisation's objectives; ■ include short and medium-term plans as well as longer-term plans where required for alignment to the organisation's long-term strategic objectives and for life-cycle asset management considerations; and ■ be informed by life-cycle infrastructure asset management planning This medium-term infrastructure management plan should be aligned to the organisation's long-term and five-year strategic plans and, if relevant, annual performance plan and the organisations infrastructure management policy
2	Strategic resourcing	A procurement strategy for each project and package in at least the first year of the infrastructure management plan together with the structure and composition of the client team to oversee the implementation of such strategy	The procurement strategy should: ■ describe the primary and secondary procurement objectives; ■ outline the outcomes of any spend, market, organisational and stakeholder analysis; ■ identify the project delivery route, as necessary; and ■ indicate the packaging, contracting and targeting strategy and selection method for a procurement The manner in which the client team fulfils the necessary client functions should be described as well as how resources which are required are to be sourced

Stage		End-of-stage deliverable	
No	**Name**	**Description**	**Considerations**
3	Prefeasibility	A prefeasibility report which determines whether or not it is worthwhile to proceed to the feasibility stage	The following activities, as necessary, should be undertaken, if a feasibility report is required or warranted: ■ document the owner or user requirements specification; ■ shortlist the options that were considered; ■ provide a preliminary design for study options, provide preliminary capital estimates and the proposed schedule; and ■ present the study outcomes
	Preparation and briefing	A strategic brief which defines project objectives, needs, acceptance criteria and client priorities and aspirations, and which sets out the basis for the development of the concept report for one or more packages	The following activities, as necessary, should be undertaken: ■ confirm the scope of the package and identify any constraints; ■ establish the project criteria, including the performance and reliability requirements, design life, service life of components, function, maintenance and replacement requirements, mix of uses, scale, location, quality, value, time, safety, health, environment and sustainability as well as the control budget and schedule for the package or series of packages; and ■ identify statutory permissions, utility approvals, applicable policies and strategies to take the package forward, risks that need to be mitigated as well as interfaces between packages
4	Feasibility	A feasibility report which presents sufficient information to determine whether the project should be implemented	The feasibility report should, as necessary and if a feasibility report is required or warranted, include: ■ details regarding the preparatory work covering a needs and demand analysis with output specifications and an options analysis; ■ a viability evaluation covering a financial analysis and an economic analysis; ■ a risk assessment and sensitivity analysis; ■ a professional analysis covering a technology options assessment, an environmental impact assessment and regulatory due diligence; and ■ implementation readiness assessment covering institutional capacity and a procurement plan
	Concept and viability	A concept report which establishes the detailed brief, scope, scale, form and control budget, and sets out the integrated concept for one or more packages	The following activities, as necessary, should be undertaken: ■ document the initial design criteria and design options or the methods and procedures required to maintain the condition of infrastructure; ■ establish the detailed brief, scope, scale, form and cost plan; ■ develop an indicative schedule for documentation and required services; ■ develop a site development plan or other suitable schematic layouts of the works; ■ identify the statutory permissions, funding approvals or utility approvals required to proceed with the works; ■ develop a baseline risk assessment and a health and safety plan required in terms of legislative requirements; ■ develop a risk report linked to the need for further surveys, tests, other investigations and consents and approvals, if any, during subsequent stages and indicates how identified health, safety and environmental risk are to be mitigated; ■ develop an operations and maintenance support plan; ■ confirm the financial sustainability of the project; and ■ establish the feasibility of satisfying the strategic brief within the control budget established during stage 3 and, if not, motivate a revised control budget
5	Design development	A design development report which develops in detail the approved concept to finalise the design and definition criteria, sets out the integrated developed design, and contains the cost plan and schedule for one or more packages	The following activities, as necessary, should be undertaken: ■ develop in detail the accepted concept to finalise the design and definition criteria; ■ establish the detailed form, character, function and costings; ■ define all components in terms of overall size, typical detail, performance and outline specification; ■ describe how infrastructure, or elements or components thereof, are to function, how they are to be safely constructed, how they are to be maintained and how they are to be commissioned; and ■ confirm that the works can be completed within the control budget or propose a revision to the control budget

Stage		End-of-stage deliverable	
No	**Name**	**Description**	**Considerations**
6	Design documentation	Production information and manufacture, fabrication and construction information	**6A Production information** Provide production information which provides the detailing, performance definition, specification, sizing and positioning of all systems and components enabling either construction (where the constructor is able to build directly from the information prepared) or the production of further information for construction
			6B Manufacture, fabrication and construction information Provide manufacture, fabrication and construction information produced by or on behalf of the constructor, based on the production information provided for a package, which enables manufacture, fabrication or construction to take place
7	Works	Completed works which are capable of being occupied or used	■ Undertake, as necessary, activities in relation to the works such as the provision of temporary and permanent works, manage risks associated with health, safety and the environment on the site, confirm that design intent is met and correct notified defects which prevented the client or end user from using the works and others from doing their work ■ Certify completion of the works or that the goods and associated services as delivered are in accordance with the provisions of the contract
8	Handover	Works which have been taken over by the user or owner complete with record information	Finalise and assemble record information which accurately reflects the infrastructure that is acquired, rehabilitated, refurbished or maintained and hand over the works and record information to the user or owner and, if necessary, train end user's or owner's staff in the operation of the works Issue the handover certificate **Note:** The record information should, as relevant: ■ accurately document the condition of the completed works or the works as constructed or completed; ■ contain information on the care and servicing requirements for the works or a portion thereof or instructions on the use of plant and equipment; ■ confirm the performance requirements of the design development report and production information; ■ contain certificates confirming compliance with legislation, statutory permissions and the like; and ■ contain guarantees that extend beyond the defects liability period provided for in the package Arrangements should be put in place to secure and safeguard the works from the time that the contractor's liabilities for damage to the construction works end until such time that the works are handed over to the end user or owner who accepts such liabilities

9	Package completion	Works with notified defects corrected, final account settled and the close out report issued	The following activities, as necessary, should be undertaken:
			■ correct all defects that are detected during the defects liability period;
			■ complete the contract by finalising all outstanding contractual obligations, including the finalisation and payment of amounts due after the expiry of the defects correction period, and the issuing of certificates required in terms of the contract;
			■ evaluate package outcomes; and
			■ compile a completion report for the package making suggestions for improvements and outlining what was achieved in at least the following:
			  ■ the performance parameters specified by the organisation or success factors outlined in the strategic brief;
			  ■ unit costs of completed work or major components thereof; and
			  ■ the value of key performance indicators relating to the objectives of a secondary procurement policy that were achieved

Table 4.2 The approximate equivalence of a range of different project cycle stages

Control framework for delivering infrastructure projects (generic project life cycle)	Project life cycle stage					
	Engineering Council of South Africa (ECSA)	**Transnet SCO Ltd** (South African state- owned rail, port and pipeline company)	**PetroSA** (South African state-owned oil company)	**Construction Industry Council (UK) (2007)**	**ISO 29481-1 (2010), Building Information modelling**	**Royal Institute of British Architects Plan of Work (2013)**
0 Project inception		FEL 1: Concept	Framing / opportunity identification		0 Portfolio requirements	0 Strategic definition
1 Infrastructure planning						
2 Strategic resourcing						
3 Preparation and briefing or Prefeasibility	1 Inception	FEL 2: Prefeasibility	FEL 1: Prefeasibility / identify and select	1 Preparation	1 Concept of need	1 Preparation and brief
					2 Outline feasibility	
4 Concept and viability or Feasibility	2 Concept and viability (preliminary design)	FEL 3: Feasibility	FEL 2: Feasibility / definition	2 Concept	3 Substantive feasibility	2 Concept Design
					4 Outline conceptual design	
5 Design development	3 Design development (detailed design)	FEL 4: Execution	FEL 3: Design and plan / develop	3 Design development	5 Full conceptual design	3 Developed design
6A Production information	4 Documentation and procurement		Implementation and execution	4 Production information	6 Co-ordinated design and procurement	4 Technical design
					7 Production information	
6B Manufacture, fabrication and construction information				5 Manufacture, fabrication and construction information	8 Construction	
7 Works	5 Contract administration and inspection					5 Construction
8 Handover			Operations and handover	6 Post practical completion		6 Handover and close out
9 Closeout	6 Close out	Finalise / close out				
					7 In use	

Prefeasibility and feasibility reports are usually only required as end-of-stage deliverables for stages 3 and 4, respectively, where one or more of the following applies:

- the value of the project exceeds a threshold stated in the organisation's policy (e.g. major / mega project or projects with high annual expenditure over a number of years);
- the project comprises infrastructure which requires special design considerations (e.g. new / untried technologies); or
- the organisation's policy requires that such reports are required (e.g. to secure the project finances).

Feasibility reports may also be required when infrastructure has significant staffing and operation costs, the implications of which need to be understood before a decision is taken to proceed with a project.

Stages 3 (preparation and briefing) and 4 (concept and viability) should be repeated for each package if the acceptance at stage 4 (feasibility) is for the acceptance of a project comprising a number of packages which are to be delivered over time or there is insufficient information to proceed to stage 5. It is necessary, particularly with projects spanning a number of years, to revalidate the parameters which informed decisions to proceed to implementation in a feasibility report so that visible and conscious decisions can be made should adjustments be necessary to reflect changes in the project environment in different packages. Stage 4 (concept and viability) results in a solution for an infrastructure project. The design or solution is accordingly "frozen" at the end of stage 4.

Detailed design during stage 5 includes the selection of materials and components. At this stage there will often be an iterative process of proposing a component, checking its predicted performance against the brief, and amending selections if required. The design development report translates the concept report into a document which paints a picture of what is to be delivered. The report needs to describe how structures, services or buildings and related site works, systems, subsystems, assemblies and components are to function, how they are to be safely constructed, how they are to be maintained and, if relevant, how they are to be commissioned.

The design development report relates to what is to be delivered. Record information relates to what has been delivered. Accordingly, the record information is an updated version of the design development report (see Figure 4.4).

Production information is developed during stage 6A of the design documentation stage i.e. the detailing, performance definition, specification, sizing and positioning of all systems and components enabling either construction (where the contractor is able to build directly from the information prepared) or the production of

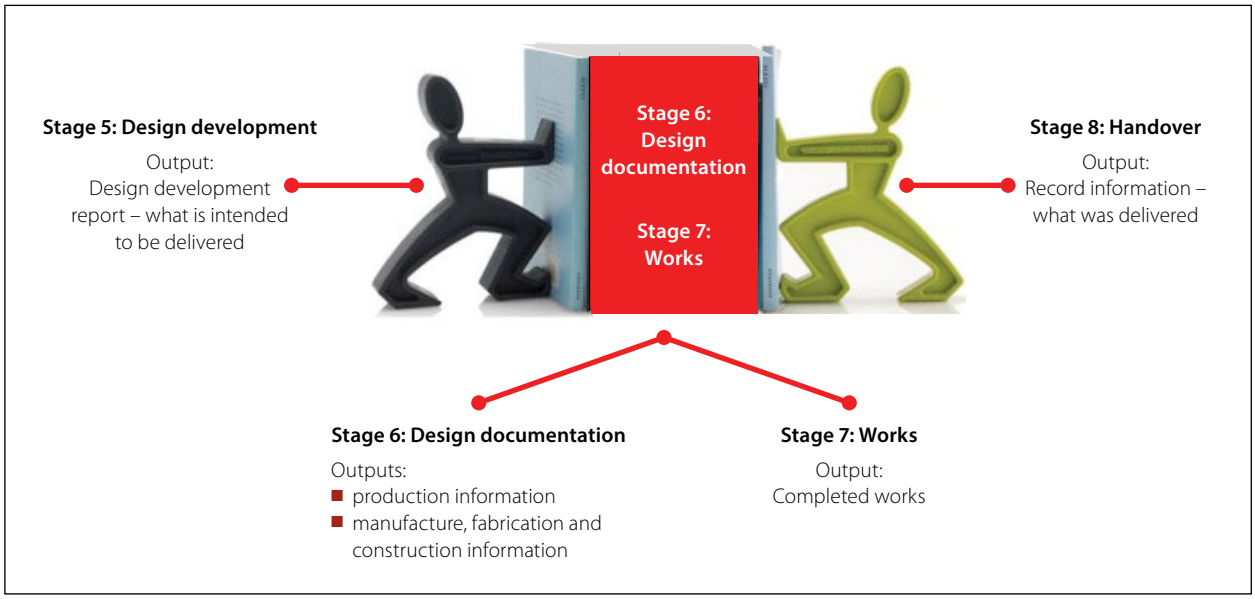


Figure 4.4 The bookends of implementation–design development report and record information

manufacturing and installation information for construction. This information enables manufacture, fabrication and construction information to be produced during stage 6B by or on behalf of the contractor, in response to the production information that is provided.

Stage 7 can also include the design, supply and installation of plant which is incorporated into the works.

It must be stressed that there is a difference between achieving completion of the works in accordance with the provisions of the contract (stage 7) and the handing over of the works to the owner, end user or those responsible for the operation and maintenance of the works (stage 8). Upon completion or soon thereafter, risks associated with loss, of or wear or damage to the works are no longer borne by the contractor. Arrangements may need to be put in place to safeguard the works from the time that the contractor's liabilities cease until the time that the works are handed over.

Stage 9 (close out) closes out not only the contract or order issued in terms of a framework contract but also the project. Such a report needs to outline what was achieved and make suggestions for improvements on work of a similar nature. It also needs to comment on the performance of the contractor.

Stages 5 and 6 may be omitted if sufficient information to proceed to stage 7 is contained in the stage 4 deliverable.

Decisions to proceed to the next stage at each gate are based on the acceptability or approval of the end-of-stage deliverable as indicated in Figure 4.3. A stage is only complete when the deliverable at the end of a task is approved or accepted. Activities associated with stages 5 to 9 may be undertaken in parallel or in series, provided that each stage is completed in sequence.

The level of detail contained in a deliverable associated with the end of each stage should be sufficient to enable informed decisions to be made to proceed to the next stage. In the case of stages 3 to 6, such detail should, in addition, be sufficient to form the basis of the scope of work for taking the package forward in terms of the selected contracting strategy (see 5.5.3).

4.2.2 Aligning the decision gates with the governance of an organisation

An organisation's procurement and delivery management policy needs to assign responsibilities for approving or accepting deliverables associated with a gate in the control framework indicated in Figure 4.3. Decisions to proceed to the next stage need to be based on the acceptability (receive as adequate, valid, or suitable, or give an affirmative answer to a proposal) or approval (officially agree to) of the end of stage deliverable. They may also be based on certifications made in terms of a contract or order issued in terms of a framework agreement (see 3.3.5) as indicated in Table 4.3.

The decision gates embedded in the workflow indicated in Figure 4.3 enables projects to be authorised and directed, oversight to be exercised and the actions of management to be limited. Accordingly, these gates provide the necessary governance at both a portfolio and project level as they provide the opportunity for ensuring that the right purpose is pursued in the right way. They also provide a means for assigning accountability to those controlling and directing projects.

Gate 0 (project initiation) ensures that projects that are admitted to the pipeline of projects are aligned with the organisation's strategic plans. Acceptance of a project at decision Gate 0 authorises the committing of resources to resolve impediments to implementation and to refine cost and schedule estimates prior to taking a final decision to proceed with implementation.

Gate 1 (infrastructure planning) ensures the outputs of the budgeting and planning (see Figure 3.3) and asset management (see Figure 3.2) systems in the form of a medium-term infrastructure management plan, is aligned to the organisation's long-term and five-year strategic plans and annual performance plan, as relevant. Such a plan identifies project requirements (provision, maintenance, refurbishment and rehabilitation of infrastructure and the disposal of infrastructure which is no longer required) to meet the organisation's strategic objectives within available resources in the medium term. The approval of this plan authorises expenditure and the mobilisation of resources necessary to implement the plan i.e. it commits resources to implement the plan.

Table 4.3 Responsibilities for approving or accepting end of stage deliverables

Stage			Person assigned the responsibility for approving or accepting end of stage deliverables
No	Name		
0	Project initiation		Designated person** accepts the initiation report
1	Infrastructure planning		Designated person** approves the infrastructure management plan
2	Strategic resourcing		Designated person** approves the procurement strategy and the structure and composition of the client team
3	Prefeasibility		Designated person** accepts the prefeasibility report
	Preparation and briefing		Designated person** accepts the strategic brief
4	Feasibility		Designated person** accepts the feasibility report
	Concept and viability		Designated person** accepts the concept report
5	Design development		Designated person** accepts the design development report
6	Design documentation	6A Production information	Designated person** accepts the parts of the production information which are identified when the design development report is accepted as requiring acceptance
		6B Manufacture, fabrication and construction information	The contract manager* accepts the manufacture, fabrication and construction information
7	Works		The contract manager* certifies completion of the works or the delivery of goods and associated services
8	Handover		An authorised representative of the owner or end user accepts liability for the works
9	Package completion		■ The contract manager* or supervising agent certifies the defects certificate in accordance with the provisions of the contract ■ The contract manager certifies final completion in accordance with the provisions of the contract ■ Designated person** accepts the close out report

* persons responsible for administering a contract in terms of the contract
** person designated in term of an organisation's procurement policy

Gate 2 (strategic resourcing) ensures, as relevant, that appropriate delivery management approaches, project delivery routes and procurement strategies for projects are authorised in order to effectively implement the infrastructure management plan and reduce organisational risk in doing so.

Gate 3 (prefeasibility / preparation and briefing) and Gate 4 (feasibility/ concept and viability) provide an opportunity for engaging the client in a project, for obtaining buy in of stakeholders and for driving executive decision making. This is necessary to mitigate the negative impacts of key variables on the delivery of construction projects over time as indicated in Figure 4.5.

Gate 5 (design development) provides an opportunity for stakeholders to confirm that their requirements have been satisfied or understand what precisely is intended to be delivered.

Stage 6 (design documentation) is the stage where the developed design is documented prior to being implemented. Stage 6A (production information) establishes production information which is either sufficiently detailed to enable direct construction or is sufficiently specified to enable the contractor to prepare detailed information for manufacturing, fabrication or construction so that construction can take place. There is a need to confirm that some of the details that are provided in such information satisfies stakeholder requirements. Gates 6A and 6B enable this to take place. However, requirements for such confirmation of specific information is established at Gate 5. Stakeholders need to specify the specific information, if any, that they wish to review and confirm as a condition to the acceptance of the Stage 6 deliverables.

Stage 7 (works) is the stage where the works are delivered or brought to a condition whereby they are capable of being occupied or used. This confirms that the works have been completed or delivered, and, in construction works contracts, that risks and liabilities for the site are no longer the responsibility of the contractor.

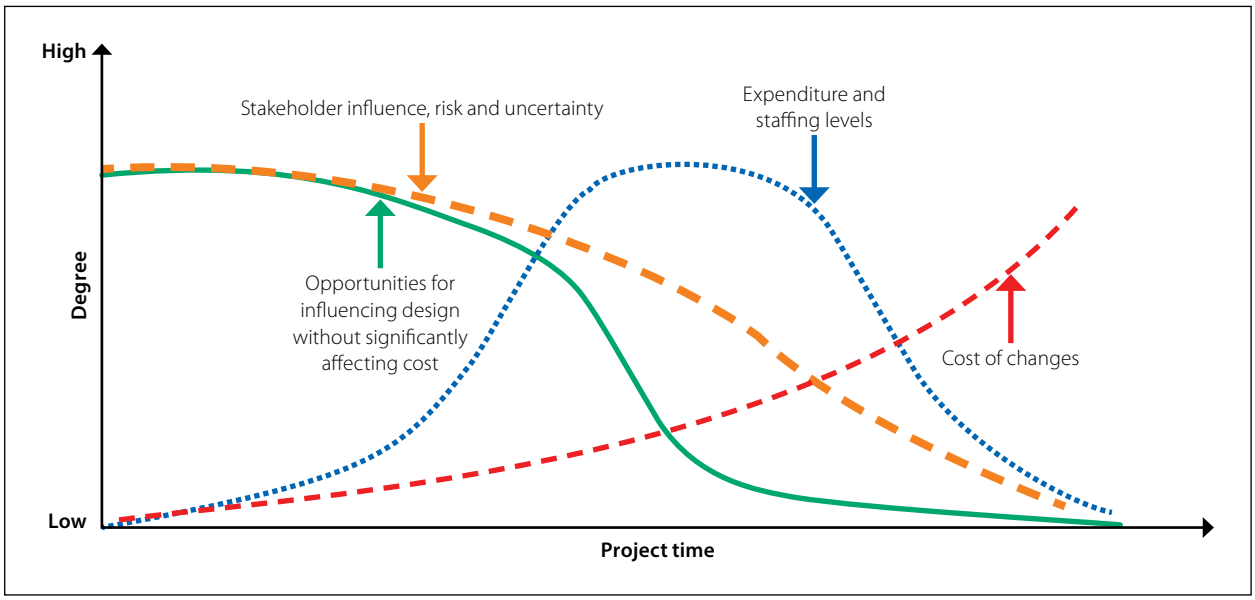


Figure 4.5 **Indicative impact of key variables on the delivery of infrastructure over time**

Stage 8 (handover) is the stage in which the record information is handed over to those that are responsible for the maintenance of the works and, if relevant, the end user takes occupation or possession of the works.

Stage 9 not only closes out the project but also provides information on the package outcomes.

As a general rule, the person designated to approve or accept a deliverable at a gate should be the person best able to make an appropriate decision based on the information presented and who has insights of the potential impact of the decision on the business case or project objectives, as relevant. Gates 0, 2, 3 and 4 are commonly signed off by executives, gates 1 by boards and similar structures who have strategic oversight within an organisation, while gates 5, 6 and 9 are signed by those with operational responsibilities. The rationale for this is apparent from Figure 4.5.

4.3 CONTROL FRAMEWORK FOR INFRASTRUCTURE PROCUREMENT

Governance activities need to be linked to the milestones in the procurement process as indicated in the control framework for infrastructure procurement indicated in Figure 4.6 and Tables 4.4 and 4.5 which are aligned with the provisions of ISO 10845-1:2010.

Projects included in the infrastructure management plan are invariably initiated during stage 0 (project initiation) and budgeted for in stage 1 (infrastructure planning), while a procurement strategy is developed during stage 2 (procurement planning) in the control framework for infrastructure delivery management (see Figure 4.3). As a result, activities 1 and 2 indicated in Figure 4.6 and Table 4.4 only take place for ad hoc procurements i.e. procurement activities which are not specifically dealt with in stages 1 and 2 of the control framework for infrastructure delivery management.

A stepwise approach to accessing of contingencies is provided in the control framework as indicated in Figure 4.7. The price at the time that the contract is awarded or an order is issued needs to be without provision for contingencies (budget covering construction work that can be required but cannot be foreseen or predicted with certainty) or price adjustment for inflation. Contingencies need to be managed above the contract level. A contract should only be awarded or an order issued if the total of the prices for the works, with allowances for contingencies and price adjustment for inflation is within the allowable amounts of the control budget.

The stepwise approach to accessing contingencies encourages the client team and the delivery team to seek alternative ways to deal with issues which lead to increases in the total of the prices for a contract or an order.

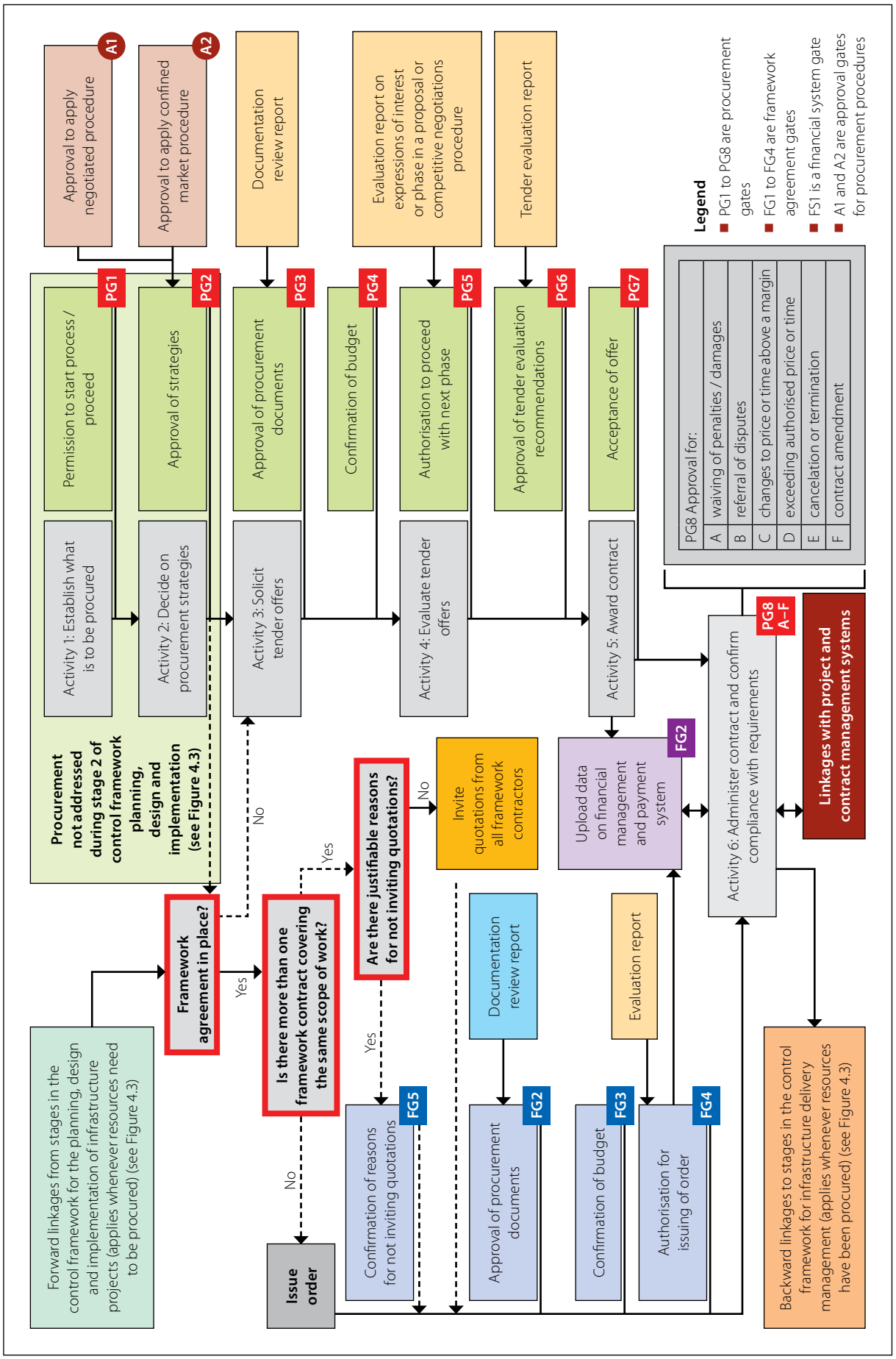


Figure 4.6 Control framework for infrastructure procurement

Table 4.4 Activities at procurement gates and associated key actions

Activity		Activity at procurement gate		Key action
1	Establish what is to be procured	PG1	Obtain permission to start with the procurement process	Make a decision to proceed / not to proceed with the procurement based on the broad scope of work and the financial estimates
2	Decide on procurement strategy	PG2	Obtain approval for procurement strategies that are to be adopted	Confirm selection of strategies so that tender offers can be solicited
3	Solicit tender offers	PG3	Obtain approval for procurement documents	Grant approval for the issuing of the procurement documents
		PG4	Confirm that budgets are in place	Confirm that finance is available for the procurement to take place
4	Evaluate tender offers	PG5	Obtain authorisation to proceed with next phase of the tender process in the qualified, proposal or competitive negotiations procedure	Review evaluation report, ratify recommendations and authorise progression to the next stage of the tender process
		PG6	Confirm recommendations contained in the tender evaluation report	Review recommendations of the evaluation committee and refer back to evaluation committee for reconsideration or make recommendation for award
5	Award contract	PG7	Award contract	Formally accept the tender offer in writing and issue the contractor with a signed copy of the contract
		GF1	Upload data in financial management and payment system	Verify data and upload contractor's particulars and data associated with the contract or order
6	Administer contracts and confirm compliance with requirements	PG8A	Obtain approval to waive penalties or low performance damages.	Approve waiver of penalties or low performance damages
		PG8B	Obtain approval to notify and refer a dispute to an adjudicator	Grant permission for the referral of a dispute to an adjudicator or for final settlement to an arbitrator or court of law
		PG8C	Obtain approval to increase the total of prices, excluding contingencies and price adjustment for inflation, or the time for completion at the award of a contract or the issuing of an order up to a specified percentage	Approve amount of time and cost overruns up to the specified threshold
		PG8D	Obtain approval to exceed the total of prices, excluding contingencies and price adjustment for inflation, or the time for completion at award of a contract or the issuing of an order by more than specified percentages	Approve amount of time and cost overruns above the specified threshold
		PG8E	Obtain approval to cancel or terminate a contract	Approve cancelation or termination of a contract
		PG8F	Obtain approval to amend a contract	Approve proposed amendment to contract

Table 4.5 Activities at procurement gates and associated key actions

Activity		Key action
FG1	Confirm justifiable reasons for selecting a framework contactor where there is more than one framework agreement covering the same scope of work	Confirm reasons submitted for not requiring competition amongst framework contractors or instruct that quotations be invited
FG2	Obtain approval for procurement documents	Grant approval for the issuing of the procurement documents
FG3	Confirm that budgets are in place	Confirm that finance is available so that the order may be issued
FG4	Authorise the issuing of the order	If applicable, review evaluation report and confirm or reject recommendations. Formally accept the offer in writing and issue the contractor with a signed copy of the order

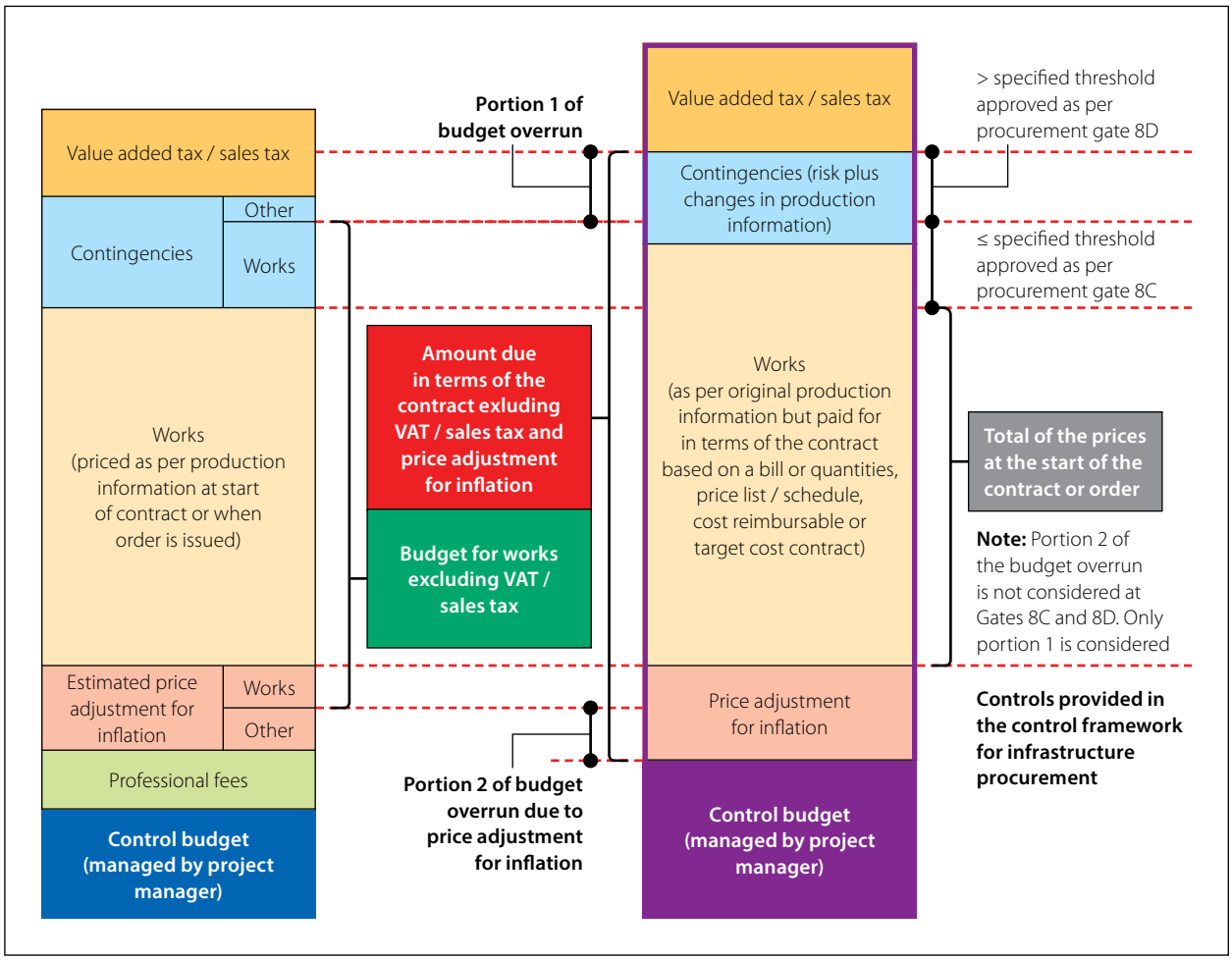


Figure 4.7 **Provisions in the control framework for controlling costs**

Accordingly, no provision for contingencies or price adjustment for inflation should be included in the contract price at the time that the contract is awarded or an order is issued. Such a price needs to be the nett contract price i.e. the value of the contract, based on the production information (information enabling either construction where the contractor is able to build directly from the information prepared or the production of manufacturing and installation information for construction) at the start of the contract or order. Budgetary items should be discouraged. Estimates of likely costs to cover identified work or services to be performed by a subcontractor appointed in terms of the contract and assumed costs based on a set of assumptions for known work can be made. These amounts can be included in the contract price and adjusted in terms of the contract when the actual costs are known or when such assumptions are found to be incorrect.

Procurement Gates PG 8C and PG 8D enable time and cost overruns to be managed and as such provide stepped access to contingencies. The principle associated with the stepped thresholds provided for at Procurement Gates 8C and 8D (see Table 4.4) is that approval to exceed these percentages needs to be granted at a more senior level with each quantum increase e.g. contract manager, then client's delivery manager and then senior line manager / executive at Procurement Gate PG 8C and the board at Procurement Gate PG 8D. The onus is on the contract manager to obtain timeous approval so that the works are not disrupted.

Data pertaining to contracts needs to be uploaded in the Financial Management System at Gate FS1. In the procurement of general goods and services, prices are typically fixed and little or no provision for price adjustment for inflation is made, there are seldom unforeseen risks and the client rarely is at risk for price increases due to pricing strategies. Changes in these prices are usually driven by extensions / expansions to the contract. As a result, the total of the prices at the award of the contract is commonly uploaded at this gate. This gate becomes the financial control for procurement.

It is, however, not advisable to follow this approach in the case of infrastructure projects as the cost controls lie elsewhere as indicated in Figure 4.7. There are often increases in the total of the prices as risks materialise, changes are implemented to enhance the quality or performance of the works or to address shortcomings and the prices are adjusted for the effects of inflation. To fix the prices encourages the inflation of the total of the prices to accommodate risks and changes to avoid the hassle of getting increases approved which in turn feeds the culture of "*if I have the money in the contract, it is ours to spend*". Accordingly, it is preferable to upload a value which equates to the total of prices at award excluding contingencies, plus an estimate for increases in the total of the prices associated with price adjustment for inflation, if provided for, and a reasonable percentage for contingencies. Procedures need to be put in place to enable the financial control value in the financial management system to be increased should approval be obtained at either Procurement Gate PG8C or Procurement Gate PG8D to do so.

There are a number of different types of controls in addition to the aforementioned gates. Stipulated monetary values set the limits for the application of the shopping, nominated and quotation procurement procedure and, in certain instances, the use of the negotiation procedure to solicit tender offers.

Approvals for the reasons for pursuing a particular procurement procedure are also necessary where the confined procedure, negotiated procedure and proposal procedure using a two envelope or a two stage system are applied to solicit tender offers (see approval Gates A1 and A2). Such approval confirms that the use of such procedures is in line with the provisions of the documented procurement system.

Approvals are also necessary for undertaking certain courses of action e.g. any departure from the documented procurement policy, processes, procedures, methods and delegations, removal of a name from a list of pre-approved contractors, etc. These matters need to be addressed in the organisation's policy for infrastructure procurement and delivery management.

As a general rule, the person designated to take a decision at a gate should be the person best able to do so, based on the information presented, in the context of the project or programme of projects. In many instances this will be the client delivery manager or a senior line manager e.g. at PG2, PG3, PG4, PG8C, FG2 and FG3. In some instances, it should be a more senior executive or governance structure e.g. at PG7, PG8D, PG8F, FG1 and FG4.

CHAPTER 5
Procurement strategy and tactics

5.1 OVERVIEW

Project outcomes in infrastructure projects are sensitive not only to the decisions made during the planning, design and execution of such projects (see Figure 4.3) but also to the manner in which resources are structured and procured to deliver infrastructure projects. There are a number of different approaches to procuring goods and services and any combination thereof, each of which can result in different outcomes. Procurement strategy is all about the choices made in determining what is to be delivered through a particular contract, the contracting arrangements, how secondary procurement objectives are to be promoted and which selection method will be employed to solicit tender offers (Watermeyer, 2012a).

Procurement strategy is formulated around procurement objectives which may relate to either the delivery of the product (primary objectives) or what can be promoted through the delivery of the product (secondary objectives) i.e. broader societal objectives. Procurement strategy is also informed by spend, organisational, market and stakeholder analyses.

A project delivery route needs to be decided upon where projects involve the provision, alteration, refurbishment or rehabilitation of infrastructure. Clients need to make decisions which include who funds the acquisition, who owns the infrastructure and which party to the contract assumes responsibility for design and interface management between contracts.

The components of a procurement strategy for a particular procurement where the client funds the acquisition includes the development of:

- a packaging strategy which focuses on the organisation of work into contracts or orders issued in terms of a framework agreement (see 3.3.5);
- a contracting strategy which focuses on the selection of a suitable form of contract including the basis for remunerating contractors, which, if relevant, is informed by decisions made when determining the project delivery route;
- a targeting strategy which identifies the procedures for promoting secondary procurement objectives; and
- a selection method which identifies the methodology by which tenderers will be solicited from the market.

The framework for the development of a procurement strategy is indicated in Figure 5.1.

Procurement tactics on the other hand typically relate to the selection of a contractor (the other party to a contract) who is most likely to deliver best value or a cost-effective solution through the performance of the contract. They also relate to the setting up of the terms and conditions of contracts to not only allocate specific risks between the parties to a contract but also to incentivise performance to achieve best results.

Clients and their agents need to understand the range of options and the tools and techniques that are available and what needs to be considered in order to make informed choices.

5.2 PROCUREMENT OBJECTIVES

Procurement objectives should be informed by the client's values and value proposition for the project (see 2.2).

Primary objectives relating to the delivery of infrastructure include (Watermeyer, 2012a):

- tangible objectives including budget (cost of the project), schedule (time for completion), quality, and performance characteristics required from the completed projects and rate of delivery (how quickly portions of the works or a series of projects can be delivered or funds can be expended);
- environmental objectives;
- health and safety objectives; and
- intangible objectives including those relating to:
  - buildability (the ease with which the designed works is constructed),
  - relationships (e.g. long term relationships to be developed over repeat projects, early contractor involvement, integration of design and construction etc),
  - client involvement in the project,
  - end user satisfaction, and
  - maintenance and operational responsibilities.

Secondary objectives typically relate to the promotion of sustainable development objectives such as:

- the alleviation and reduction of poverty through the provision of work opportunities to the vulnerable;
- local economic development;
- establishment and strengthening of indigenous building materials and methods;
- promotion of construction technologies that increase employment;

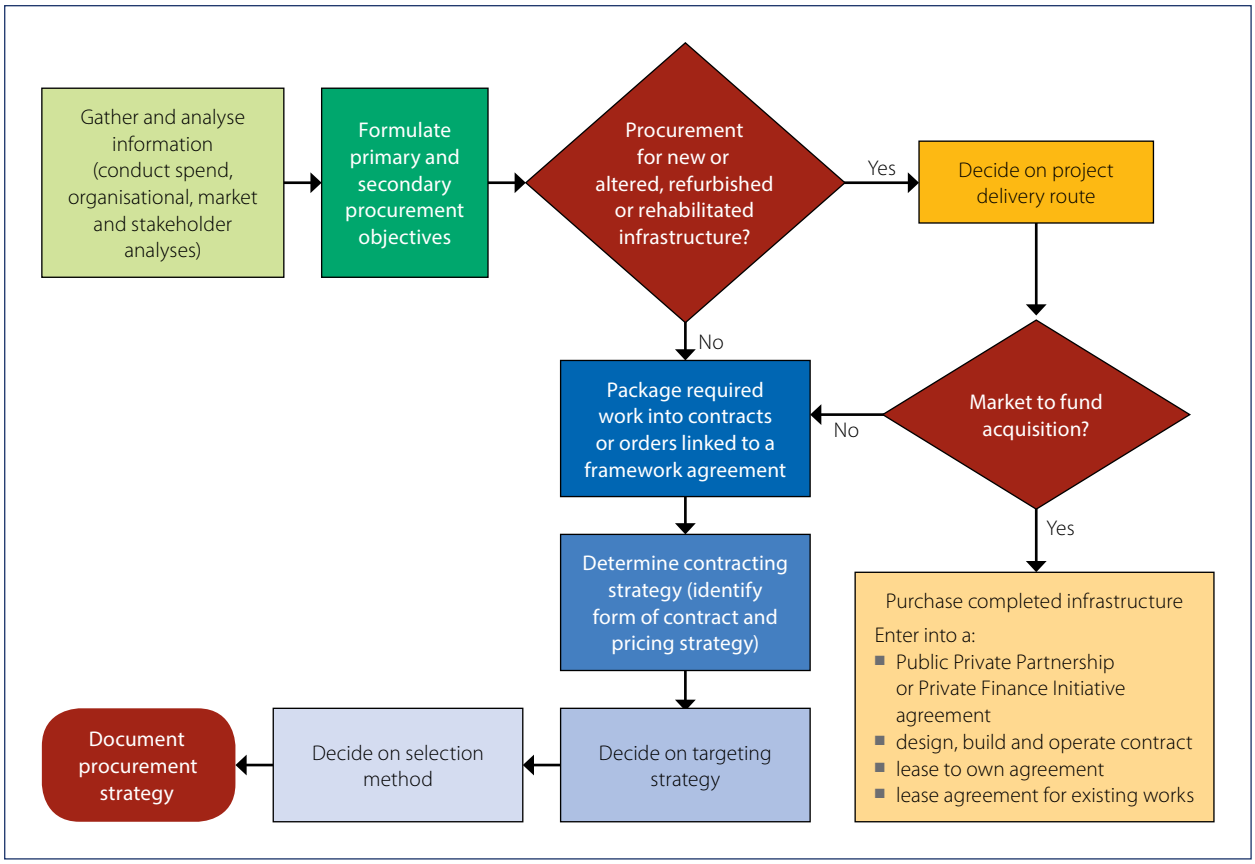


Figure 5.1 Framework for the development of a procurement strategy

- the transfer or development of skills;
- minimisation of the harmful effects of development on the local environment; and
- the promotion of increased use of environmentally sound goods, building materials and construction technologies.

Secondary procurement objectives may also relate to the redefining of business ownership patterns, the composition of the workforce, the distribution of employment opportunities and work opportunities for small and medium enterprises.

Secondary or developmental procurement objectives are additional to those associated with the immediate objective of the procurement itself. Secondary procurement policy objectives influence procurement strategies both directly and indirectly.

Primary objectives commonly relate to delivering the product while secondary procurement objectives commonly relate to the delivery process. Competing primary and secondary priorities need to be balanced. Trade-offs against priorities may be required as illustrated in Figure 5.2.

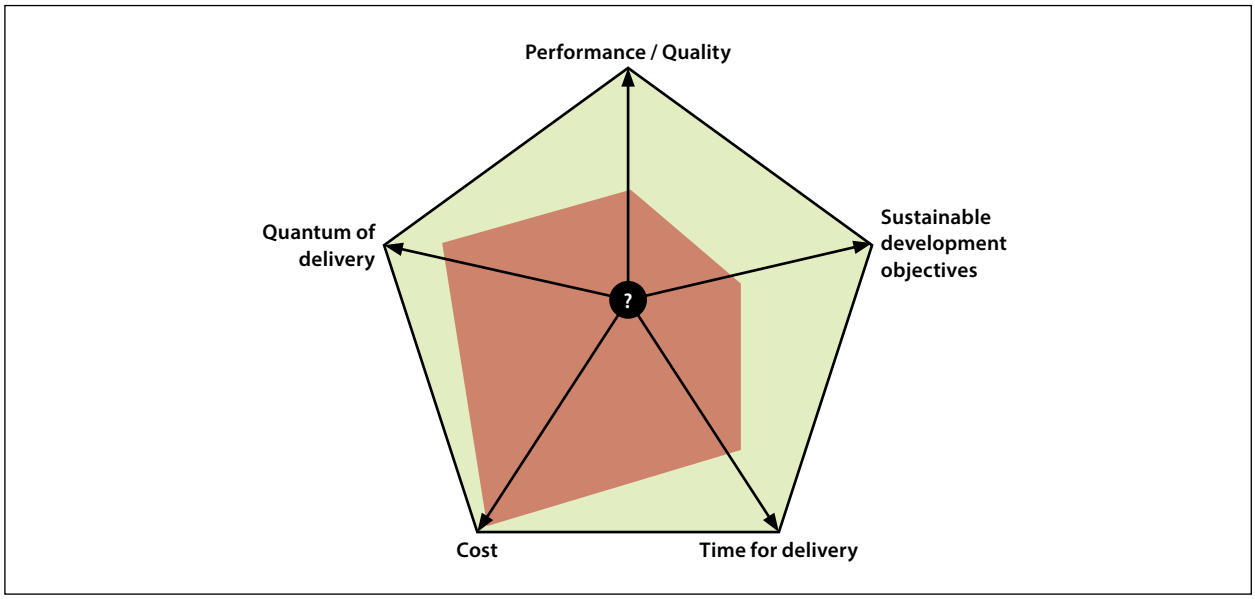


Figure 5.2 Balancing competing priorities

5.3 SPEND, ORGANISATIONAL, MARKET AND STAKEHOLDER ANALYSIS

5.3.1 General considerations

A spend, organisational, market and stakeholder analysis provides a backdrop against which all decisions are made. Accordingly, such analysis should be in sufficient detail to enable informed decisions to be made, based on identified strengths and weaknesses and the appetite for transferring or accepting risks. Such analysis should identify what internal skills, capabilities and resources are available or can be committed by the organisation to deliver the project. Use of external expertise may be required.

5.3.2 Spend analysis

A spend analysis should be based on an infrastructure management plan, which for one or more projects identifies and prioritises projects and packages against a forecasted budget and schedule, preferably over a period of at least three years. This involves, as relevant:

- the clustering of needs in terms of types of output e.g. construct an office block, refurbish a school, rehabilitate a waste water treatment plant, etc.,
- the categorising of clusters of projects in terms of commonality in relation to the attributes such as:
  - nature of work e.g. buildings or engineering works and construction, rehabilitation, refurbishment, alteration or maintenance,
  - type of service e.g. construction only, design, construct and operate, construct and maintain etc.,
  - unit value e.g. high, medium and low,
  - potential for standardisation e.g. high, medium and low,
  - one of a kind projects or repetitive projects,
  - time schedule urgency e.g. high, medium, low,
  - organisational and managerial complexity in terms of the number of managerial interfaces or hierarchical layers either within an organisation or project structure or stakeholders to be managed e.g. high, medium, low, and
  - technical complexity or level of innovation, e.g. high, medium or low,
- the identifying of spatial locations of needs per clustered category, and
- identifying needs which may occur simultaneously on the same site or within a region.

The output of the spend analysis are spatially located projects in an infrastructure management plan grouped into categories of spend with common attributes.

5.3.3 Organisational analysis

An organisational analysis involves the identification of the client's organisational capacity and capability as being limited, adequate or unlimited in respect of areas such as procurement, project management, design, construction and manufacturing.

The client's appetite needs to be tested for issues such as increasing capacity, putting new capabilities in place, assuming contractual risk, and transferring risk to other parties.

The output of the organisational analysis is a description of the client organisational characteristics and appetites.

5.3.4 Market analysis

A market analysis identifies at a macro level the available external capability and capacity as being limited, adequate or unlimited in respect of the various types of construction and professional services which may be required.

Subcontracting capabilities should also be considered and analysed.

The output of the organisational analysis are descriptions of the market characteristics.

5.3.5 Stakeholder analysis

Stakeholder expectations and interfaces should be identified as they need to be managed within the project or programme of projects by the client team.

A stakeholder analysis involves the identification and description of key project stakeholders.

5.4 PROJECT DELIVERY ROUTE

A client, where new, altered, refurbished or rehabilitated infrastructure is required, needs to answer 3 basic questions relating to (see Figure 5.3):

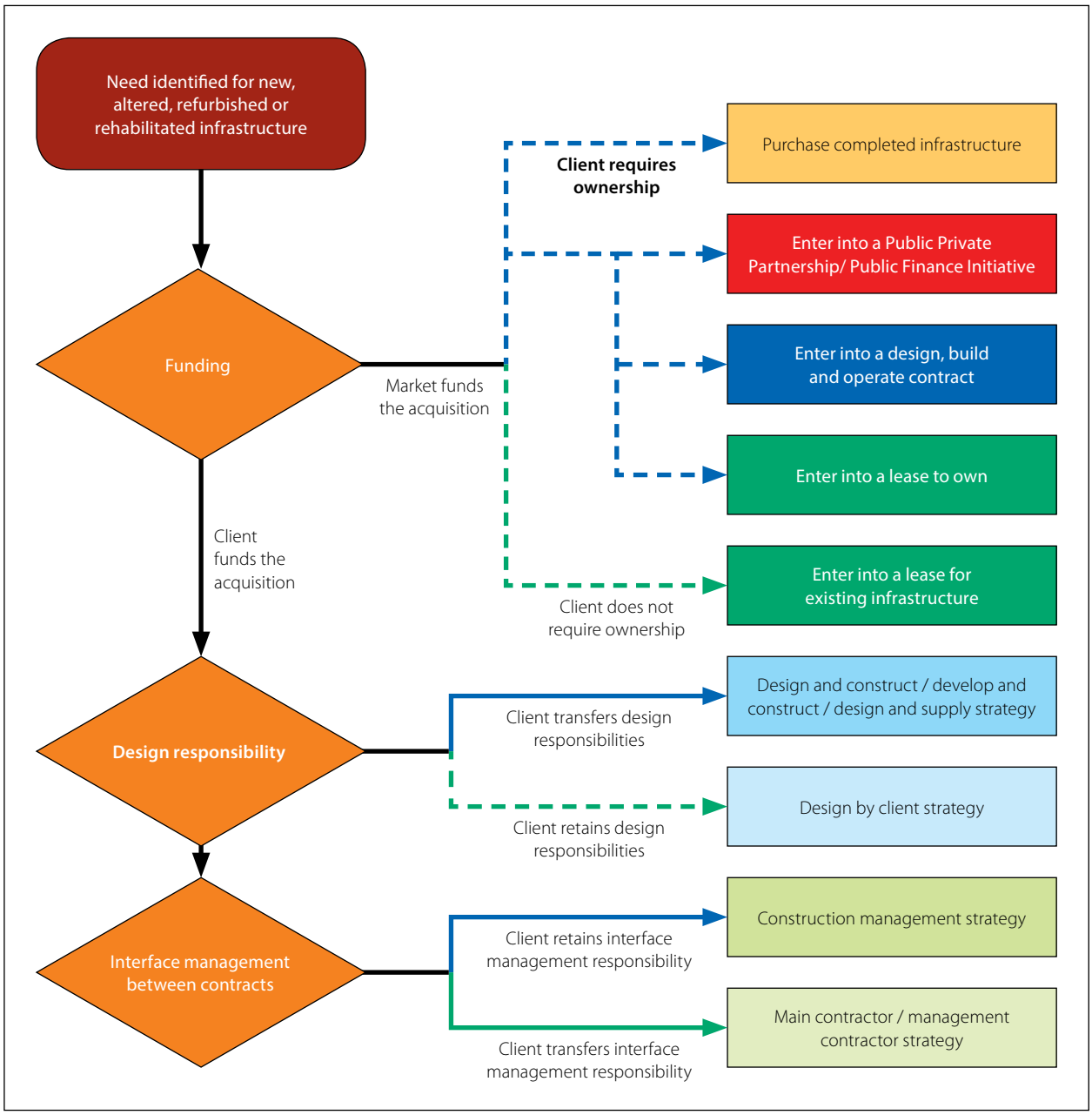


Figure 5.3: Common project delivery routes for new, altered, refurbished or rehabilitated infrastructure

- the financing or the project;
- design responsibilities; and
- responsibilities for the management of interfaces between direct contracts

in order to decide on the project delivery route which is to be followed.

This is an important decision as the choice of project delivery route determines the number of contracts that need to be procured and overseen as well as the capacity and capabilities of the client team which needs to be put in place (Laryea and Watermeyer, 2018). It also informs the procurement strategies that are adopted.

An infrastructure project may be client-financed whereby the client directly pays all contractors for the goods and services associated with the delivery of the project. Under a market-financed project, the developer typically carries the cost for providing the required infrastructure and receives payment either in the form of a lump sum, a monthly amount for the term of the contract or a percentage of the income stream following the completion of the project.

The source of funding might not be an option as it can be a matter of policy or regulation for any given client.

A client, requiring new, altered, refurbished or rehabilitated infrastructure needs in the first instance to answer the question" who funds the acquisition of such infrastructure?" If the answer is that the market funds the acquisition, the follow up question is "does the client require ownership of the infrastructure?" The options commonly available to the client where the market funds the acquisition are indicated in Table 5.1.

Public Private Partnerships (PPPs) and Public Finance Initiative (PFIs) have different meanings in different parts of the world. A PPP may be considered to be a cooperative arrangement between one or more public and private sector organisations with a multitude of different types of long term contracts with a wide range of risk allocations, funding arrangements and transparency requirements. A PFI, on the other hand, typically involves an infrastructure project being funded by private sector equity and debt funding and then being paid for by the public sector through monthly payments over the life of the project. A PPP project would not necessarily require or have such private sector funding.

Table 5.1 Options where the client requires the market to fund the acquisition

Client requirements	Options available to the client
Client requires ownership	■ Purchase completed infrastructure ■ Enter into a Public Private Partnership or a Public Finance Initiative agreement ■ Enter into a lease to own agreement
	Contract on a design, build and operate basis
Client does not require ownership	Enter into a lease for infrastructure

The client's involvement in the delivery management of a project where the market funds the project is limited. In procurements of this kind, a client may need to appoint a transaction advisor as the other party to the contract will oversee or has already overseen the delivery of the project. A client nevertheless needs to undertake a procurement process or negotiate a contract to acquire the outcomes associated with the selected project delivery route. Furthermore, clients will need to source some built environment professional capacity to ensure the quality of what they are procuring (see 2.4).

The recommendations of the Report of the Independent Inquiry into the Construction of Edinburgh Schools (2017) into the collapse of part of an external wall at a school constructed under a Public Private Partnership included the following procurement recommendations in this regard:

- *"Public sector bodies engaged in the procurement of public buildings should maintain, or have assured access to, a level of expertise and resources that allows that body to act as an 'intelligent customer' in undertaking transactions with Private Sector Construction Companies.*
- *In any construction contract let by a public body, the public body should ensure that due diligence is undertaken at an appropriate level to confirm that the requirements of that contract are actually delivered in accordance with the terms of that contract.*
- *There should always be an appropriate level of independent scrutiny in relation to all aspects of design and construction that are in effect largely or partly self-certified by those producing them.*
- *The procurement strategies adopted by public bodies should include appropriate investment in the provision of informed independent scrutiny of projects when they are being designed and constructed so that they are built right first time, rather than clients subsequently seeking to rely on their ability to seek remediation or compensation if they are not."*

Strategies and tactics appropriate to the selected project delivery route will need to be adopted to attain desired outcomes.

If the answer is that the client funds the acquisition, a decision needs to be made regarding the allocation of design and interface management responsibilities between the parties to a contract. A client can retain design

responsibility, in which case the contractor undertakes construction on the basis of production information issued by the client (design by client strategy). Alternatively, the client can assign design responsibility to the contractor in which case the contractor:

- designs the works based on a brief provided by the client and constructs it (design and construct strategy) or provides a solution to a brief and manufactures and installs the required infrastructure or component thereof (design and supply strategy); or
- completes the production information based on a scheme design provided by the client and constructs it (develop and construct strategy).

The information required to form the basis of a scope of work (see Figure 3.1) for a design and construct contract is usually a client accepted strategic brief (deliverable at the end of stages 3 (preparation and briefing)), or a concept report (deliverable at the end of stage 4 (concept and viability)) whereas a client accepted design development report (deliverable at end of stage 5 (design development)) is usually required for a develop and construct contract. In the design by client contracting strategy, the client's designers are commonly appointed at either the start of or following the completion of stage 3 (preparation and briefing).

In the design and construct and develop and construct strategy, the client nevertheless needs to have a capability in the first instance to develop the end of stage deliverables which form the basis of the scope of work for a contractor who is assigned design responsibilities and thereafter for reviewing the outputs of the contractor for general conformity with the scope of work and what has been agreed at each stage following the appointment of a contractor. A client may in order to obtain continuity in aspects of the design novate professional service providers to a contractor as a condition of contract e.g. mechanical design. (Novation is the substitution of a new contract in place of an old one or the substitution of one party for another party in a contract.)

Table 5.2 indicates the appropriate usage of the design by client, develop and construct and design and construct strategies. The client is at risk for delays in production information in the design by client strategy. The attractiveness of the develop and construct and design and construct strategy is that there is single point accountability for design and construction which overcomes fragmentation in design through integration. However, early contractor involvement (the practice of appointing a contractor before the design is complete) linked to a design by client strategy, possibly though a framework agreement (see 3.3.5), also enables construction knowledge, experience and inputs to be obtained earlier than normal to reduce costs, before the price for detailed design and construction is agreed (Laryea and Watermeyer, 2016). There are accordingly several routes to achieve design integration and minimise waste through collaboration between designers and constructors.

Table 5.2 Appropriate use of strategies involving design responsibilities

Strategy	Appropriate usage
Design by client	Where one or more of the following applies: ■ the client wishes to make significant technical inputs into the design process and design details; ■ the client requires flexibility in the development of the design; ■ reasonable certainty in cost and time is required before a commitment to proceed to construction is made; ■ independent design advice is required; or ■ the flow of outstanding production information after the formation of the contract can be tightly managed
Develop and construct	Where: ■ the client requires integrated detailed design and construction, based on the client's design development report, and single point accountability; ■ standard designs exist which need to be made site specific; or ■ the works need to be priced and commence before the production information has been completed
Design and construct	Where the client requires: ■ integrated design and construction and single point accountability; ■ that most risks lie with the contractor in return for price certainty; or ■ that the cost and completion date be agreed when a decision to proceed with the project is made

A client can retain responsibility for managing interfaces between direct contracts in which case the client is responsible for the planning and managing of all post contract activities for work packages which have dependencies due to interfaces (construction management strategy). Alternatively, a client can assign interface responsibilities to a contractor who will subcontract parts of the work (main contractor strategy) or most if not all the works to others (management contractor strategy).

A client needs to appoint professional service providers to undertake design and interface management responsibilities which it has retained, where it lacks in-house professional expertise to assume these responsibilities. Accordingly, decisions made regarding responsibilities for design and interface management determines the nature and number of professional service agreements that are entered into.

5.5 DEVELOPING A PROCUREMENT STRATEGY WHERE THE CLIENT FUNDS THE ACQUISITION

5.5.1 Introduction

A procurement strategy can be developed for a single project, a programme of projects or a portfolio of projects where the client funds the acquisition. It identifies the best way of achieving objectives and value for money for speciifc contracts, whilst taking into account risks and constraints.

Different options in a procurement strategy carry different level of risk for the client. No one option is right for every project. For each situation, there will be advantages and disadvantages in the use of any specific method. The client needs to carefully assess its particular project requirements, objectives and potential challenges and find the method that offers the best opportunity for success and achieving its value proposition (promise of value to be delivered) for the project.

The framework as set out in Figure 5.1 enables choices to be made and aligned with procurement objectives in the development of a procurement strategy. The application of the framework can rationalise the delivery of projects within a programme or portfolio of projects and minimise the contractual realtionships which are entered into. This can be used to address capacity constraints in spending public sector budgets as it can be used to reduce the number of contracts that need to be procured and managed and tap into the resources of the private sector without compromising objectives.

The application of the framework can also be applied in support of the delivery culture which the client wishes to persue in delivering the project e.g. long term collaborative relationship (see 6.2.2). The application of the framework can also be used to improve upon secondary procurement outcomes.

5.5.2 Packaging strategy

An infrastructure project needs to be broken down into one or more work packages i.e. a deliverable or project work component or a group of tasks within a work breakdown structure. The work packages can then be programmed, resourced and managed, and where necessary procured. Accordingly, a packaging strategy is the organisation of work packages into contracts or orders issued in terms of a framework agreement over the term of such an agreement.

Framework agreements (see 3.3.5) reduce the client's need to re-advertise and approach the market for work falling within the scope of the agreement over the term of the agreement and the number of relationships to be managed. They also provide client teams with programming flexibility to manage expenditure relating to the delivery of projects over time and enable collaborative relationships to develop in order to deliver better value and project outcomes, including those relating to the promotion of secondary procurement objectives. They also provide an opportunity for contractors to improve their internal management systems, develop their supply chains and improve their performance in delivering infrastructure including their attainment of secondary procurement goals, during the term of the contract, through continuity of work over a longer term than is the case in non-framework contracts (Watermeyer, 2012b and 2013a, and Department of Health, 2010).

Framework agreements are appropriate where the available budgets and the detailed scope of work is uncertain, the need for goods or services involves repetitive work of a similar nature or a quick response time is required or long term relationships (3 to 5 year) are desirable to achieve efficiencies or desired project outcomes. They also are appropriate where the client wishes to foster collaborative relationships and wishes to move away from a delivery model based on a series of isolated, highly transactional relationships.

The number of packages within a project, programme of projects or a portfolio of projects establishes the number of contractual relationships which the client team have to put in place, oversee and administer. Accordingly, the packaging strategy determines the quantum of resources that a client requires to perform client team functions.

The scope and nature of the work package also determines the resources that are required. This in turn determines the capabilities and capacities of companies that are contracted to deliver a work package. Accordingly, the packaging strategy has a significant impact on who is qualified to deliver the work package. Too big a work package can, for example, exclude small local companies or even national companies from providing the goods, services or works or necessitate that companies form joint ventures to deliver the package.

Projects should only be broken down into smaller contracts (unbundled) when there is administrative capacity to administer the increased number of contracts or orders that result from the unbundling of the project, management arrangements are in place to dealt with the management of interfaces between contracts, and the unbundling does not result in an inappropriate division of responsibilities, increased contractual risk, duplication of establishment charges and under-utilisation of resources. An alternative approach to unbundling is to require main contractors to 'unpack' their contracts into smaller contracts using targeted procurement procedures linked to key performance indicators such as those established in terms of ISO 10845-5, ISO 10845-6 or ISO 10845-7. Such procedures require contractors to procure the services of smaller businesses to perform portions of such contracts and to administer them and, in so doing, remove this burden from client. This approach can be used to secure local participation in contracts (Watermeyer, 2000 and ISO 10945-1:2010).

Work packages may be grouped together and combined or broken down into several sub-package when developing a packaging strategy. For example, work packages involving similar or different types of work may be grouped together and delivered through a single contract or order issued in terms of a framework contract e.g. construction and maintenance work or buildings and sportfields on a single site, design and construction services or architectural and engineering professional services.

The factors that inform the packaging of work packages into contracts and orders include:

- the project delivery route that is decided upon;
- interdependencies between projects and programmes;
- opportunities for long term relationships for collaboration including the need for early contractor involvement;
- avoidance of unincoporated joint ventures to perform contracts;
- discipline specific professional services or multidisciplinary professional services with single point accountability;
- the need for long lead items which can delay projects if they are not sourced early in the delivery cycle;
- organisational and managerial complexities;
- economy of scale;
- mitigating of project risk;
- risk allocations and risk appetite;
- programming (scheduling) requirements;
- attractiveness to markets;
- matching contractor skills and capabilities;
- commissioning requirements;
- delivery management considerations e.g. capability and capacity to provide the required oversight management of projects which collectively deliver strategic objectives and realise anticipated benefits;

- mangement structure to provide effective leadership to projects;
- capability or capacity of staff to procure and brief delivery teams, pay contractors, account for expenditure and manage interfaces between contracts; and
- secondary procurement policy objectives e.g. participation of target groups and local economic development / content.

The sequencing of projects of a similar nature and the spatial location of projects can inform decisions regarding framework agreements where continuity of work is a consideration.

5.5.3 Contracting strategy

The fundamental exchange between a client and a contractor is the delivery of work in accordance with stated requirements for a price. A contracting strategy is the strategy that governs the nature of the relationship which the client wishes to foster with the contractor, which in turn determines the risks and responsibilities between the parties to the contract and the methodology by which the contractor is to be paid.

Inherent risks can be transferred or accepted. In some instances, insurances can be taken out to cover risks e.g. as a hedge against adverse currency exchange rate fluctuations or to cover storm damage to the works. The focus in the distribution of risk is, however, on the payment and responsibility for the cost of the risk event should it materialise. The contractor tries to limit liability in contracts to a foreseeable figure. The client needs to bear in mind that increasing the risk borne by the contractor inevitably increases the price of the contract.

Standard forms of contract (see 3.3.6) provide fixed terms and conditions which are deemed to be agreed and are not normally subject to further negotiation or amendment following the receipt of tenders. Such forms of contract usually include the method of payment and allocate risks to the parties and how the contractor is compensated for risks for which he is not at risk should they materialise.

The selection of a standard form of contract for an infrastructure project is made by the client, particularly where competitive tenders are called for. The scope and nature of the project primarily affects the selection of type of contract as indicated in Table 5.3.

Table 5.3 The scope and nature of different types of standard contracts

Type of contract	Scope and nature of the project
Construction contract	■ Construct, alter, refurbish or rehabilitate infrastructure on a site including any level of design responsibility ■ The contractor is generally responsible for loss of or damage to the works from the time that access is granted to provide the works until the works are completed and taken over by the client
Design, build and operate contract	Design, build and operate or maintain infrastructure over a defined period of time
Professional service contract	Provide infrastructure related services with the skill and care normally used by professionals providing services similar to the required services
Service contract	Manage and provide an infrastructure related service other than a professional service or maintain infrastructure in an existing state, typically over a term, which may involve a modest amount of improvement through renewal and replacement
Supply contract	Supply local and international infrastructure related goods and provide any associated services, if any, including design

The project delivery route that is selected (see 5.3) informs the allocation of responsibilities and associated risks in construction contracts. In complex construction contracts there might be several subcontracts some of which should be selected by the client's team in order to harness the design skills of specialist trade contractors.

A pricing strategy is the strategy which is adopted to secure financial offers and to remunerate contractors in terms of the contract. There are three types of pricing strategies, namely price-based, cost-based and performance based. The range of commonly encountered options are indicated in Table 5.4.

Table 5.4 Common pricing strategy options

Pricing strategy	Description
Price-based	
Activity schedule	Contract in which the contractor breaks the scope of work down into activities, which may be required to be linked to a programme, method statements and resources, and prices each activity as a lump sum, which he is paid on completion of the activity. The total of the activity prices is the lump sum price for the contract work
Bill of quantities (construction contract only)	Contract in which a bill of quantities lists the items of work and the estimated or measured quantities and rates associated with each item to allow contractors to be paid, at regular intervals, an amount equal to the agreed rate for the work multiplied by the quantity of work actually completed (A bill of quantities is prepared in accordance with a standard system of measurement. The contractor is not a risk for increases in quantities and mistakes in compiling the bill of quantities such as omissions, departures from the rules of measurement, ambiguities and inconsistencies)
Lump sum	Contract in which a contractor is paid a lump sum to provide the works, goods or services. (Interim payments which reflect the progress made towards the completion of the works, goods or service may be made)
Price list or price schedule	Contract in which a contractor is paid the price for each lump sum item in the price list or schedule that has been completed and, where a quantity is stated in the price list or schedule, an amount calculated by multiplying the quantity which the contractor has completed by the rate (Lump sum contract where the contractor is not at risk for increases where quantities are stated)
Cost-based	
Cost reimbursable	Contract in which the contractor is paid for his allowed costs plus a fee which includes his profit, and company overheads
Cost plus	Contract in which the contractor is paid for his actual expenditure plus a percentage or other agreed sum which includes his profit and company overheads
Target cost	Cost reimbursable contract in which a target price is estimated and on completion of the works or services the difference between the target price and the actual cost is apportioned between the client and contractor on an agreed basis
Time based	Contract in which the contractor is paid for his time expended at agreed staff rates which include overheads and profit
Percentage of cost of construction (professional services only)	Contract in which the contractor is paid a fee, based on a percentage of the cost of the works or a portion thereof
Performance based	
Performance metrics	Contract in which payment is made against specific and measurable levels of operational performance as agreed

The pricing strategy determines who takes the risk for the differences between the actual prices paid in terms of the contract and those estimated when the total of the prices for the works are agreed and how changes to the scope of work are assessed and paid for. The contractor is at risk where payment is based on lump sums or activity schedules. The client is at risk where the contractor is paid on a cost plus basis. This risk is shared by both the client and the contractor for other pricing strategies as indicated in Figure 5.4.

Early contractor involvement in construction contracts, with or without design responsibilities, can be achieved through the selection of a cost-based pricing strategy. For example, a contractor can be appointed on a target contract basis whereby the contractor can be contracted on the basis of their cost parameters and a target cost can be negotiated when there is sufficient production information available to agree a target cost. Escape clauses can be inserted into design and construct contracts to enable the client to use the designs and approach the open market in the event that agreement cannot be reached regarding the target cost.

Standard forms of contract can be drafted around significantly different objectives and principles (see 3.3.6). They range from those that are designed around specific contracting strategies and don't offer flexibility in the allocation of risks to those that cover the full range of risk allocations and pricing strategies and permit flexible allocations of risk. The selected standard form of contract needs to support the selected contracting strategy. If not, bespoke contracts or modifications to the standard forms of contract need to be drafted to enable the selected contracting and pricing strategy to be implemented.

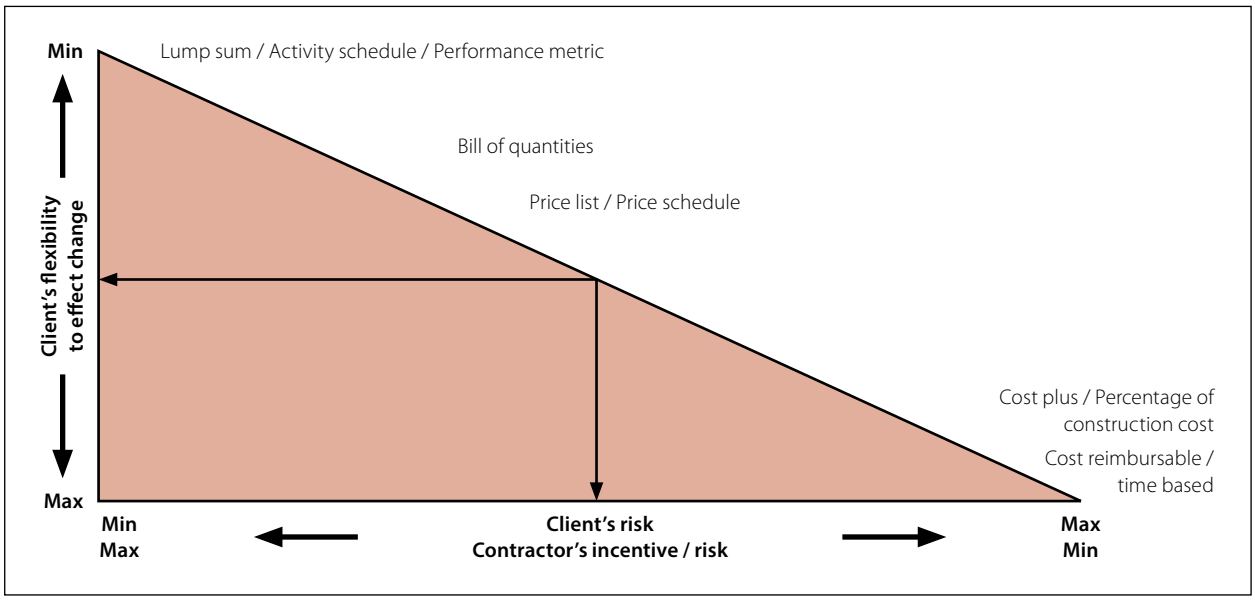


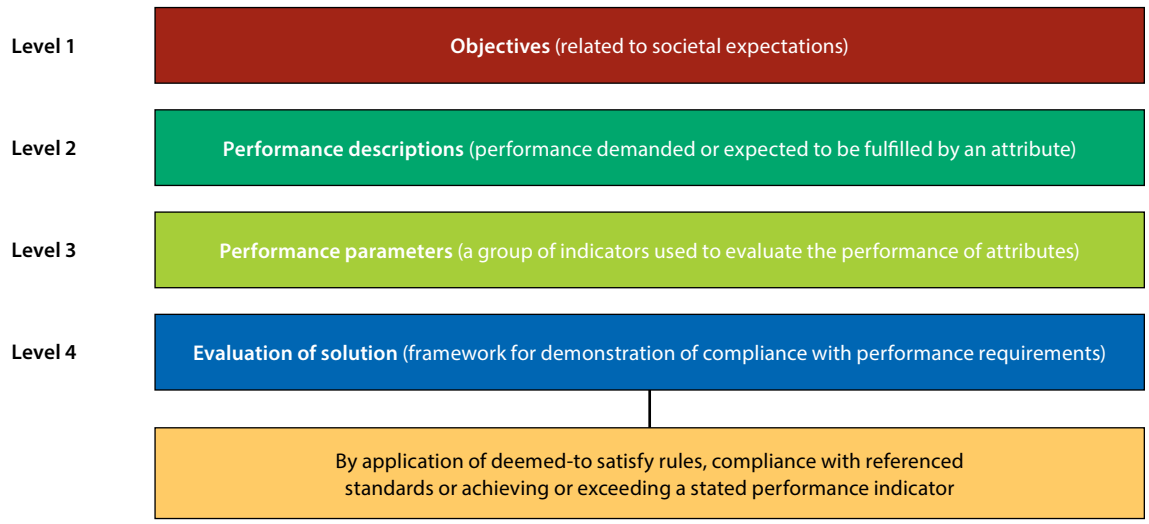
Figure 5.4 The relationship between the client's risk and flexibility to effect scope changes in different pricing strategies

5.5.4 Decide on targeting strategy

Public procurement, because of its nature and size, can have a significant impact on social and economic development. Procurement has accordingly been used internationally for several decades to, amongst other things, stimulate regional and national economic activity, protect local industries, develop competitive local suppliers, develop supply chains, address regional, gender and racial inequities and disparities, create jobs particularly for local labour, create short term work opportunities for unskilled and semiskilled workers, employ the youth and people with disabilities, transfer skills and improve working conditions (Arrowsmith,2005, Schooner, 2002, Watermeyer, 2000 and 2004 and NUPMT 2018). Private sector procurement has also embraced the promotion of social and economic development in order to mitigate community risks and in the pursuit of sustainable development objectives (Engineers Against Poverty, 2007).

Economic rent can be paid through the procurement system in the promotion of secondary objectives i.e. there is a difference between the selling price and the costs to provide the goods or services due to distortions in competition to achieve such objectives. There is accordingly a fine balance between leveraging objectives through the procurement processes and specifying deliverables. It is therefore essential that the specifying of a deliverable or the formulation of eligibility criteria (criteria which a tenderer needs to satisfy in order for their submission to be evaluated) be set as far as possible on a cost neutral basis. Legislation may, however, permit a distortion, in which case it will be permissible to distort competition or the cost effectiveness of the procurement to support political imperatives. However, it should be borne in mind that there are opportunity costs associated with paying more for the achievement of secondary objectives. Money that is used to pay for the achievement of secondary procurement objectives could have been used for other socially important functions, such as buying medicines for hospitals or for building additional classrooms in overcrowded schools. These opportunity costs need to be weighed up against the benefits of the secondary objectives.

Key performance indicators (KPIs) in the form of quantitative or qualitative measures of impacts or changes that may be beneficial which relate directly to secondary procurement objectives (desired results) need to be formulated. Such indicators need to be formulated in such a manner that they are contractually enforceable. They need as such to be described in qualitative terms and to be linked to measurable and quantifiable targets and be provided with a means of verifying and auditing claims regarding performance in relation to the target. Figure 5.5 provides a four level model for specifying KPIs relating to secondary procurement objectives, based on the provisions of ISO 19208:2016. A performance parameter in terms of this model may be regarded as a KPI (see Table 5.5).



Note: An attribute is a characteristic assessed in terms of whether it does or does not meet a given performance (performance is the impact on economic conditions, the environment, society or quality of life)

Figure 5.5 Four level model for the specifying of targets (KPIs) relating to secondary procurement objectives (after ISO 19208:2016)

Table 5.5 illustrates the structure of a performance standard relating to the participation of target groups in contracts as provided for in some of the parts of ISO 10845. The objective (Level 1) of part 4, 6, 7 and 8 of ISO 10845 focuses on different aspects of the participation of target groups in a contract. Clause 3 of each of these standards establishes qualitative (Level 2), quantitative (Level 3) requirements in relation to the objective (Level 1) and how credits towards the contract participation goal can be obtained. The remainder of the clauses establish the means for verifying and auditing the attainment of the contract participation goals (key performance indicators).

Table 5.5 Performance framework for the engagement of target groups in contracts

Aspect of performance	Participation of targeted enterprises in contracts	Participation of targeted partners in joint ventures in contracts	Participation of local enterprises and labour in contracts	Participation of targeted labour in contracts
Level 1: Objective	Provide business opportunities to specified targeted enterprises	Provide joint venture partner opportunities to specified target groups	Provide business and employment opportunities to local enterprises and targeted labour	Provide employment opportunities to specified targeted labour
Level 2: Performance descriptions	Engage targeted enterprises directly or indirectly	Enter into a joint venture agreement at a main contract level with one or more targeted partners	Engage targeted labour and targeted enterprises directly	Engage targeted labour directly
Level 3: Performance parameters	The contract participation goal (value of goods, services and works for which the contractor contracts targeted enterprises expressed as a percentage of the contract amount) is not less than … %	The contract participation goal (sum of the participation parameters in respect of each targeted partner multiplied by the contract amount of the contract, expressed as a percentage of the contract amount) is not less than … %	The contract participation goal (amount equal to the sum of the wages and allowances for which the contractor contracts to engage targeted labour and the value of goods, services and works for which the contractor contracts targeted enterprises, expressed as a percentage of the contract amount) is not less than … %	The contract participation goal (sum of the wages and allowances expressed as a percentage of the contract amount) is not less than … %
Level 4: Evaluation of solution	Apply the relevant provisions of ISO 10845-5:2011	Apply the relevant provisions of ISO 10845-6:2011	Apply the relevant provisions of ISO 10845-7:2011	Apply the relevant provisions of ISO 10845-8:2011

Table 5.6 provides examples of other key performance indicators (KPI) (performance parameters) where bespoke documents need to be drafted to enable solutions to be evaluated (NUPMT, 2018).

Table 5.6 Examples of KPIs and their definitions

KPI	Definition of KPI
Contract local direct employment goal	The percentage of the total number of equivalent person days worked by people employed by the contractor or a subcontractor within the site who are local people
Contract skills development goal	The number of hours of skills development opportunities that a contractor contracts to provide in relation to work directly related to the contract or order up to: ■ completion in the case of a professional service contract; ■ the end of the service period in the case of a service contract; ■ completion in the case of an engineering and construction works contract; and ■ the delivery date for all the work required in terms of a supply contract
Local content goal	The portion of the tendered price which is not included in the imported content

A targeting strategy is a strategy used to promote secondary procurement objectives. A targeted procurement procedure is the process used to create a demand for the services or goods of, or to secure the participation of, targeted enterprises and targeted labour in contracts in response to the objectives of a secondary procurement policy. There are a number of targeted procurement procedures which can be used to promote secondary procurement objectives as indicated in Table 5.7. ISO 10845-1:2010 provides comprehensive guidance on the application of targeted procurement procedures.

Table 5.7 Targeted procurement procedure options (after ISO 10845-1:2010)

Targeted procurement procedure	Outline of procedure
Granting of tender evaluation points	Tender-evaluation points for contract-specific goals are granted to tenderers who undertake to achieve a specified KPI in the performance of the contract
Accelerated rotations on electronic databases	Target groups are identified and accelerated at a faster rate than non-target groups on electronic data bases linked to the nominated procurement procedure
Granting of a percentage of the total number of evaluation points used to short-list tenderers following a call for expressions of interest	A point scoring system is used to shortlist respondents following a call for expressions of interest in the qualified procedure, a percentage of the total points on offer are linked to the attainment of KPIs.
Financial incentives for the attainment of key performance indicators in the performance of the contract	An incentive payment is linked to the improvement upon or attainment of a KPI in the execution of a contract
The creation of contractual obligations to engage target groups in the performance of the contract by establishing requirements for the tendering of subcontracts in terms of a specified procedure or establishing obligations to attain contract participation goals in accordance with the relevant provisions of ISO 10845.	■ Contractors can be required, as a contractual obligation, to subcontract a percentage of the work to targeted enterprises or contract goods or services from targeted enterprises. They may also be required to enter into joint ventures with targeted enterprises or engage targeted labour in the performance of a contract. This can most readily be achieved by requiring contractors to archive a minimum contract-participation goal in accordance with the requirements of ISO 10845-5:2011, ISO 10845-6:2011, ISO 10845-7:2011 or ISO 10845-8:2011 ■ Alternatively, contractors may be required to subcontract specific portions of a contract to targeted enterprises

5.5.5 Decide on selection method

The range of commonly encountered selection methods are indicated in Table 5.8. ISO 10845-1:2010 provides information on their appropriate usage.

Table 5.8 Selection procedure options (after ISO 10845-1:2010)

Procedure	Description	
Negotiation procedure		A tender offer is solicited from a single tenderer
Competitive selection procedure (Any procurement procedure in which the contract is normally awarded to the contractor who submits the lowest financial offer or obtains the highest number of tender evaluation points)	Nominated procedure	Tenderers that satisfy prescribed criteria are entered into an electronic database. Tenderers are invited to submit tender offers based on search criteria and, if relevant, their position on the database. Tenderers are repositioned on the database upon appointment or upon submission of a tender offer
	Open procedure	Tenderers may submit tender offers in response to an advertisement by the client to do so
	Qualified procedure	A call for expressions of interest is advertised and thereafter only those tenderers who have expressed interest, satisfy objective criteria and who are selected to submit tender offers, are invited to do so
	Quotation procedure	Tender offers are solicited from not less than three tenderers in any manner the client chooses, subject to the procedures being fair, equitable, transparent, competitive and cost-effective
	Proposal procedure using the two-envelope system	Tenderers submit technical and financial proposals in two envelopes. The financial proposal is only opened should the technical proposal be found to attain the minimum threshold score
	Proposal procedure using the two-stage system	Non-financial proposals are called for. Tender offers are then invited from those tenderers that submit acceptable proposals based on revised procurement documents. Alternatively, a contract is negotiated with the tenderer scoring the highest number of evaluation points
	Confined market procedure	Tenders are invited from a very limited number of contractors who are able to provide goods, services or works which are not freely available in the market, or which are provided solely for the client in accordance with unique requirements
Competitive negotiation procedure (A procurement procedure which reduces the number of tenderers competing for the contract through a series of negotiations until the remaining tenderers are invited to submit final offers)	Restricted competitive negotiations	A call for expressions of interest is advertised and thereafter only those tenderers who have expressed interest, satisfy objective criteria and who are selected to submit tender offers, are invited to do so. The client evaluates the offers and determines who may enter into competitive negotiations
	Open competitive negotiations	Tenderers may submit tender offers in response to an advertisement by the client to do so. The client evaluates the offers and determines who may enter into competitive negotiations

5.5.6 Deciding upon and documenting a procurement strategy

Clients need to identify and document the advantages and disadvantages in the different options available in order to be able to make informed decisions, taking into account the stated primary and secondary procurement objectives and the outcomes of the various analyses that were undertaken.

The factors that influence decisions made in determining a procurement strategy can compete against each other. Factors may need to be weighted and scored in order to arrive at the optimum option.

The procurement strategy that is decided upon for a particualr procurement or category of procurement needs to be documented in such a manner that the logic behind the choices that are made at each step can be communicated to and reviewed by others. It aslo should summarise the decisions made in respect of the component strategies in respect of each contract or group of contracts as indicated in Table 5.9.

Table 5.9 Headings and illustrative content of a documented strategy for a particular contract

Aspect of strategy	Comments
Project delivery route*	design strategy: design by client / develop and construct / design and construct / design and supply+ interface management strategy: construction management / management contractor / general contractor+
Packaging strategy	framework / non-framework+
Contracting strategy	contract type: construction / design, build and operate / professional service/ service / supply+ standard form of contract: bespoke / [name form of contract e.g.Fidic Redbook}+
	pricing strategy: price-based (activity schedule / bill of quantities / lump sum /percentage of cost of construction / price list / price schedule) / cost-based (cost plus / target cost / time based)/ performance-based+
Targeting strategy	granting of tender evaluation points / accelerated rotations / evaluation points in expressions of interest / financial incentives / creation of contractual obligations+#
Selection method	negotiation procedure / competitive selection procedure (nomintaed / open. qualified / quotation / proposal using a two envelope system / proposal using a two stage system / confined market procedure) / competitive negotiations (restricted / open) +
* delete row if the project delivery route has no impact on the documented procurement strategy + delete options which do not apply # describe so that readers understand the essence of the strategy and the KPI that is promoted	

5.6 TACTICS

Procurement tactics are required to successfully implement procurement strategies. Such tactics commonly relate to:

- the publicity to attract the right level of interest from the market; and
- the setting up of procurement documents to solicit tender offers and to enter into contracts.

Clients should alert markets through open and transparent processes to the opportunities presented by a project well in advance of the project, particularly where the projects are large and complex. Market engagements may take many forms, including supplier conferences and newsletters. Communications with potential tenderers (including key subcontractors) should commence well before the embarking on procurement processes. Clients should in such communications provide a clear understanding of what their core business activities and strategies are to enable contractors, who carry out their own research, to match their tenders to client requirements (BS 8534:2011).

Advertisements should be placed in a medium that enables a wide spectrum of suitably qualified and eligible tenderers (target market) to access the opportunities that are presented (ISO 10845-1:2010). Advertisements should enable prospective tenderers to make informed decisions regarding the attractiveness of the tender opportunity (ISO 10845-2:2011).

Tactics are applied in the formulation of submission data, tender data, contract data, the pricing data and the scope of work associated with a contract in order to secure a suitable contractor to deliver the required goods and services of an acceptable quality at a reasonable outturn cost (cost post execution of the contract), while being mindful of life cycle costs.

Procurement processes for works can be loosely described as either being "traditional pre-planned" or "collaborative". "Traditional pre-planned" approaches commonly involve detailed designs and specifications being prepared to allow procurement to proceed on the basis of the lowest price with or without an adjustment for a preference, once the scope of work has been developed and is capable of being measured and priced. This method works well for simple well-defined projects where the process of offer and acceptance is straight forward. In such approaches, the range of tactics which may be employed is low.

"Traditional pre-planned" procurement often seeks to "off load" considerable risks on the supply chain through standard prescriptive terms. This transfer of risk is priced by contractors and incorporated into their tender

sums. A "collaborative approach" (see 6.2.2) allows the parties to negotiate both value-and-cost efficient solutions in relation to these risks. Risks can be identified more readily within an integrated team working together on an infrastructure project, and risk can be discussed more openly with a greater emphasis on mitigation. Clients may wish to retain certain risks to benefit from lower tendered sums. Collaborative contracts require a number of tactical decisions to be made to enable the contract to not only allocate specific risks but also to incentivise performance to achieve best results.

Teamwork can overcome problems or difficulties which are encountered. Teamwork applies just as much to the internal relationships between the members of the client's in-house staff as well as to the working relationships between members of the client team and those of the delivery team. Standard forms of contract can be drafted around significantly different objectives and principles (see 3.3.6). Some forms of contract are drafted on a relational contracting basis, based on the belief that collaboration and teamwork across the whole supply chain optimises the likely project outcomes. The choice of a standard form of contract is accordingly a tactical decision. The choice also needs to be informed by the organisational culture.

The tactical variables included in the standard conditions for calling for expressions of interest and the standard conditions of tender contained in ISO 10845-4 and ISO 10845-3, respectively, are indicated in Table 5.10 Tactics should be directed towards the selection of a contractor who is most likely to deliver best value through the performance of the contract, life cycle costs of what is offered, the availability of spares, operation and maintenance requirements etc.

Table 5.10 Examples of tactical variables provided in ISO 10845-3 and ISO 10845-4

Standard conditions	Example of tactical variables	Commentary
Conditions for the calling for expressions of interest (ISO 10845-4:2011)	Eligibility criteria	Eligibility criteria can be used to introduce minimum qualification or pre-qualification criteria to screen out unsuitable respondents prior to the evaluation of submissions
	Clarification meetings	Clarification meetings can be used to interact with and to communicate specific requirements, innovations etc. associated with a procurement to respondents
	Procedure for the evaluation of submissions	Respondents can be evaluated in terms of their capability and capacity to perform the contract on a compliance – non-compliance basis or in terms of a scoring system, with or without minimum qualifying thresholds (The scoring system can be used to limit the number of respondents invited to submit tender offers and in so doing make the tender process more manageable and attractive to prospective tenderers)
Conditions of tender (ISO 10845-3:2011)	Eligibility criteria	Eligibility criteria can be used to introduce minimum qualification or pre-qualification criteria to screen out unsuitable tenderers prior to the evaluation of submissions
	Compensation of tenderers for preparing aspect of the tender	Incentives for quality submissions can for example be made in design competitions through the awarding of cash prizes
	Clarification meetings	Clarification meetings can be used to interact with and to communicate specific requirements, innovations etc. associated with a procurement to respondents
	Alternative tender offers	Main tender offers are not required to be submitted together with alternative tenders. This can be used to encourage innovation in certain circumstances
	Tender submission	Tenderers may be permitted to offer parts or the whole of the goods and services that are solicited. This can be used to make the contract more attractive to smaller or specialist contractors who may not be able to provide the full range of goods and services that is required
	Procedure for the evaluation of responsive tenders	■ Tender offers can be evaluated in terms of three variables, namely financial offer, preference and quality. A point scoring system is followed where more than one variable is evaluated. Such a system can include weightings to weight the relative importance of the evaluation criteria and sub-criteria ■ Minimum quality thresholds can be set to ensure that tenderers who are evaluated satisfy a minimum acceptable quality threshold and therefore compete on a level playing field

The Common Law of Business Balance, which is widely attributed to John Ruskin (1819-1900), states that "*There is hardly anything in the world that someone cannot make a little worse and sell a little cheaper, and the people who consider price alone are that person's lawful prey. It's unwise to pay too much, but it's worse to pay too little. When you pay too much, you lose a little money — that is all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing it was bought to do. The common law of business balance prohibits paying a little and getting a lot — it can't be done. If you deal with the lowest bidder, it is well to add something for the risk you run, and if you do that you will have enough to pay for something better.*"

This Common Law of Business Balance is increasing being recognised in the evaluation and awarding of contracts, for example:

- The Constructing Excellence publication, The business case for lowest price tendering? (2011) gives a health warning – namely "*the use of lowest price tendering may seriously damage your financial health and reputation and may have undesirable and unexpected side effects. Please consider the consequences;*"
- BS 8534:2011 in explaining a definition of value for money states that "*this means that awarding contracts on the basis of lowest price tendered for construction works might not provide the best value for money. Long-term value over the life of the asset is a much more reliable indicator. It is the relationship between long-term costs and the benefit achieved that represents value for money;*"
- The overview to the World Bank's New Procurement Framework and Regulations for Projects After July 1, 2016 states that "*Value for Money has been introduced as a core procurement principle in all procurements financed by the World Bank. This means a shift in focus from the lowest evaluated compliant bid to bids that provide the best overall value for money, taking into account quality, cost, and other factors as needed;*"
- The Infrastructure Client Group (2017) argue that lowest cost does not always represent value for money as the process of designing infrastructure, obtaining tenders, administering contracts and dealing with claims all incur transaction costs, management costs and overheads down the supply chain; and
- Module 1 of the Procurement in the UN System of Organisations Fundamentals of Procurement (Lesson 1: Guiding principles, 2018) lists best value for money as one of the four guiding principles for procurement i.e. "*selecting offers which present the optimum combination of factors such as quality, life-cycle costs and other parameters which can include social, environmental or other strategic objectives which meet the end-user needs. Best value does not necessarily mean the lowest initial price option, but rather represents the best return on the investment, taking into consideration the evaluation criteria in the specified solicitation documents.*"

BS 8534:2011 suggests that "*mechanisms specific to each contract should be developed to evaluate the quality and price (whole-life cost) components of each bid in a fair, transparent and accountable manner. Any mechanism of this type should be used to help clients come to a reasoned judgement rather than provide a prescriptive mechanistic approach for its own sake.*"

ISO 10845-1:2010 and ISO 10845-3:2011 makes provision for the evaluation of financial offer, preference and quality in the evaluation of tender offers. Quality is defined as the "*totality of features and characteristics of a product or service that bears on the ability of the product or service to satisfy stated or implied needs*". These standards make provision for four standard methods, namely Method 1 (financial offer), Method 2 (financial offer and quality), Method 3 (financial offer and preference) and Method 4 (Financial offer, quality and preference). Weightings and points are allocated to the parameters that are scored in Methods 2 to 4. The weighted scores for each of the parameters that are evaluated are added together. The tenderer with the highest score is considered to be the most competitive.

Methods 2 and 4 enables matters that form an integral part of the tender offer and which cannot directly be expressed in monetary terms and are justifiable in terms of projected procurement outcomes to be taken into account alongside the financial offer and, if applicable, preference. This enables the most economically advantageous offer to be identified. Figure 5.6 illustrates quality considerations in the setting of weightings between financial offer and quality. Quality in the evaluation of tenders as provided for in ISO 10845-1:2010

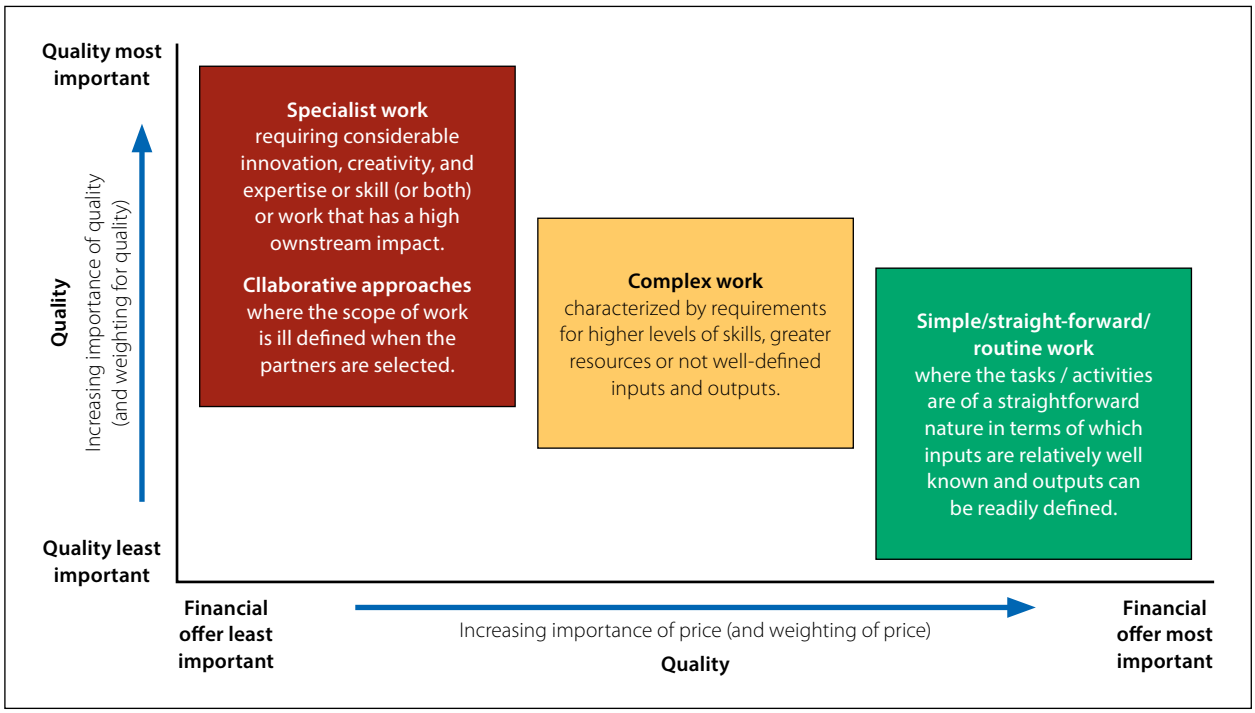


Figure 5.6: Quality considerations in the evaluation of tender offers (after ISO 10845-1:2010)

and ISO 10845-3:2011 is an important tactical tool to differentiate between tenderers, particularly where a "collaborative" approach is pursued. It enables a balance between financial offer and quality to be found in a competitive and transparent manner and seeks to achive cost effective outcomes.

Other tactical issues that may also need to be considered include:

- caps on liability and exclusion of certain types of losses, e.g. limiting professional liability;
- ownership of intellectual property;
- guarantees and appropriate bonds;
- advance payment to allow contractors to purchase, buy or mobilise items of equipment before commencing with construction;
- incentives to encourage superior performance; and
- non-collusion clauses and/or certificates of independent bids and reciprocal anti-bribery agreements.

Tender assessment schedules may be required to reduce tender offers to a comparative basis, particularly where pricing parameters are tendered which allow the price to be developed once the work is identified using a cost-based pricing strategy or to determine the cost of changes in requirements or events for which the contractor is not at risk. (A tender assessment schedule, correctly formulated, allows all tendered parameters to be assessed and taken into account in the evaluation of tenders on a comparative basis, e.g. the total of prices and the fee / profit and company overhead percentages tendered and other tendered rates are combined so that the impact on price of each of these parameters are capable of being compared on a comparative basis. This is usually in terms of a mathematical expression.)

CHAPTER 6
Improving project outcomes

6.1 VALUE FOR MONEY IN AN INFRASTRUCTURE CONTEXT

Value for money in common language usage refers to something that is well worth the money spent on. BS 8534:2011 defines value for money as the *"optimum combination of whole-life cost and quality to meet the user's requirement"*. The World Bank (2016) suggests that value for money is the *"effective, efficient, and economic use of resources"*. The UK National Audit Office (2010) and the South African National Treasury (2015) define value for money as *"the optimal use of resources to achieve intended outcomes"*. Put differently, value for money is the attainment of a most desirable or satisfactory outcome namely that the value proposition that was set for the project at the time that a decision was taken to invest in a project is as far as possible realised. It is about maximising actual outcomes and impacts and spending money well and wisely.

Underlying value for money is an explicit commitment to ensure that the best results possible are obtained from the money spent or maximum benefit is derived from the resources available. It is about striking the balance between the three "E's", namely, economy, efficiency and effectiveness, whilst being mindful of a fourth "E" – equity – as indicated in Figure 6.1 (Watermeyer, 2013b and 2015) (see Table 6.1).

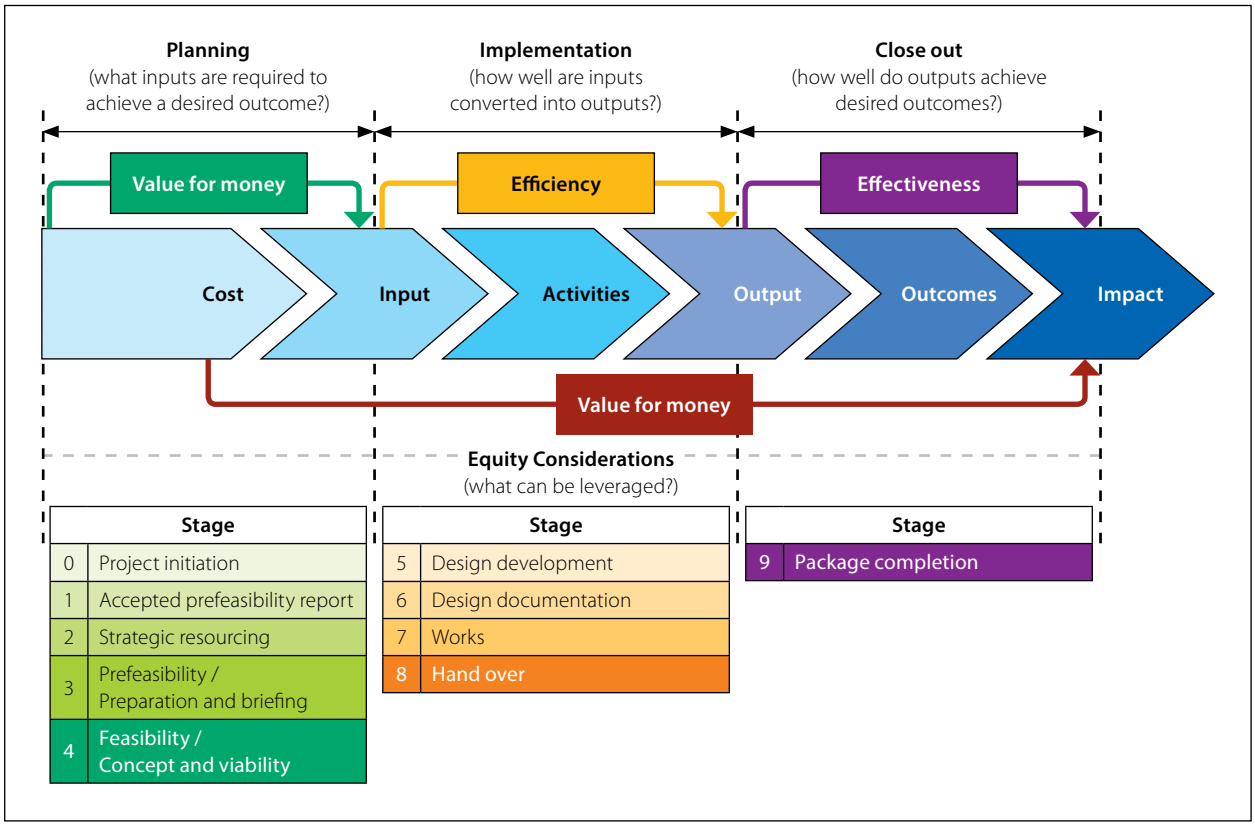


Figure 6.1 The relationship between the four "Es" in the value for money concept (after Watermeyer, 2013b)

The critical starting point in delivering value for money through infrastructure projects is, in the first instance, to align such projects with strategic objectives, priorities, budgets and plans, and thereafter, during the planning phase, to clearly define objectives and expected outcomes, as well as parameters such as the timelines, cost and levels of uncertainty i.e. the value proposition or promise of measurable benefits resulting from the project. This frames the value-for-money proposition that needs to be implemented at the point in time that a decision is taken to proceed with a project, i.e. it establishes "economy" and identifies "equity". The end point is to compare the projected outcomes against the actual outcomes, i.e. to confirm the "effectiveness" of the project in delivering value for money.

Table 6.1 Interpreting the 4 E's associated with value for money (after Watermeyer, 2013b)

Dimension	Interpretation	Underlying key questions
Economy	Economy focuses on the reduction of the cost of resources used for an activity with a regard for maintaining quality. It relates to how cost-effectively financial, human or material resources are acquired and used. It speaks to acquiring inputs of the right quality at the right price.	Can the same or equivalent inputs be obtained for less money? Would using less expensive different / alternative inputs risk effectiveness, including sustainability? Would using less expensive inputs risk greater maintenance costs over the life of the project? What are the cost inputs and the whole life costs?
Efficiency	Efficiency focuses on the increasing of an output for a given input, or minimising input for a given output, with a regard for maintaining quality. It is a measure of productivity as it relates to how resourcefully inputs are converted into outputs and subsequent outcomes. It speaks to how well inputs are converted to outputs.	Can the same results be achieved while saving on how the activities are managed? Would making savings on how the project is managed risk a reduction in effectiveness or incur other costs? Would different pathways in delivery achieve different outcomes? How much is got out in relation to what is put in?
Effectiveness	Effectiveness focuses on the successful achievement of the intended outcomes from an activity. It relates to how successfully an intervention achieves its intended outcomes and subsequent impacts are realised. It speaks to how well outputs achieve desired outcomes. Effectiveness is the extent to which planned activities are realised and planned results achieved	What outcomes have been achieved? What is the gap between what has been achieved and what was intended? Is the performance acceptable? What are the qualitative and quantitative measures of increase or decrease in outcomes or results that demonstrate that a project is effective in delivering its intended objectives?
Equity	Equity focuses on the selection of resources and targeting strategies to promote secondary objectives. It frequently relates to the potential to generate business and employment opportunities for targeted groups. It speaks to what equity can be leveraged through a project e.g. skills and local economic development.	Who benefits from the business and employment opportunities generated by economic activity? What targeting strategies are applied to promote secondary objectives? How is health and safety performance improved? What legacy does the project leave behind?

Implementation sits between "economy" and "effectiveness" in the results chain framework. It needs to be executed "efficiently" in order to minimise time delays, scope creep and unproductive costs, and to mitigate the effects of uncertainty on objectives so as to maintain the value proposition formulated at the outset of the project. This necessitates that the client team for an infrastructure project exercises due care and reasonableness during implementation. Failure to do so may result in substandard or unacceptable performance, which results in a gap between intended and achieved outcomes. This gap puts value for money for a project at risk.

Value for money considerations, based on a number of techniques including an analysis of costs and outcomes (effects) in reaching a particular goal, an analysis of costs and benefits, measuring social, environmental and economic costs and benefits and comparing impact to resources (Fleming, 2013), inform the decision to invest in a project during the planning phase. This sets the value proposition for a project. A project that achieves the client value proposition effectively, efficiently and economically is a project that achieves value for money.

The UK National Audit Office (2010) provides an analytical framework within which judgements regarding value for money can be made in a consistent manner (see Figure 6.2). In terms of this framework, what is optimal (i.e. "*the most desirable possible given expressed or implied restrictions or constraints*") is established by considering what reasonable constraints need to be taken into account in respect of planning (what is wanted), implementation (delivering or procuring well) and monitoring (being able to assess performance).

6.2 INHIBITERS AND ENABLERS ASSOCIATED WITH THE ATTAINMENT OF VALUE FOR MONEY

6.2.1 Planning phase

The value for money proposition at the time that a decision is taken to proceed with the implementation of an infrastructure project at the end of stage 4 (see Figure 6.1) is based on sets of assumptions and the available data. It is therefore important to understand the context within which the value for money proposition is established, particularly that relating to costs.

The degree of project definition as measured by the percentage of design completed at the end of stage 4 (see 4.2) lies somewhere between 10 and 40%, depending upon the nature of the infrastructure that is to be constructed. The expected range of accuracy associated with an estimate is a function of the degree of project definition as illustrated in Table 6.1.

Orr (2007) posed and answered the question "*why are initial estimates frequently too low? Quite simply, clients can become blind to the true cost of the work through haste, uncritical enthusiasm and lack of professional input. They can come up with an unrealistically low initial estimate through a combination of insufficient costs for the known scope and omission of key items. And if the initial estimate is unrealistically low, projects become burdened with the perception that 'costs have spiralled out of control'. But of course, the problem is often not real increases in cost; simply that the initial published estimate was so low it was never realistic in the first place. The unwelcome*

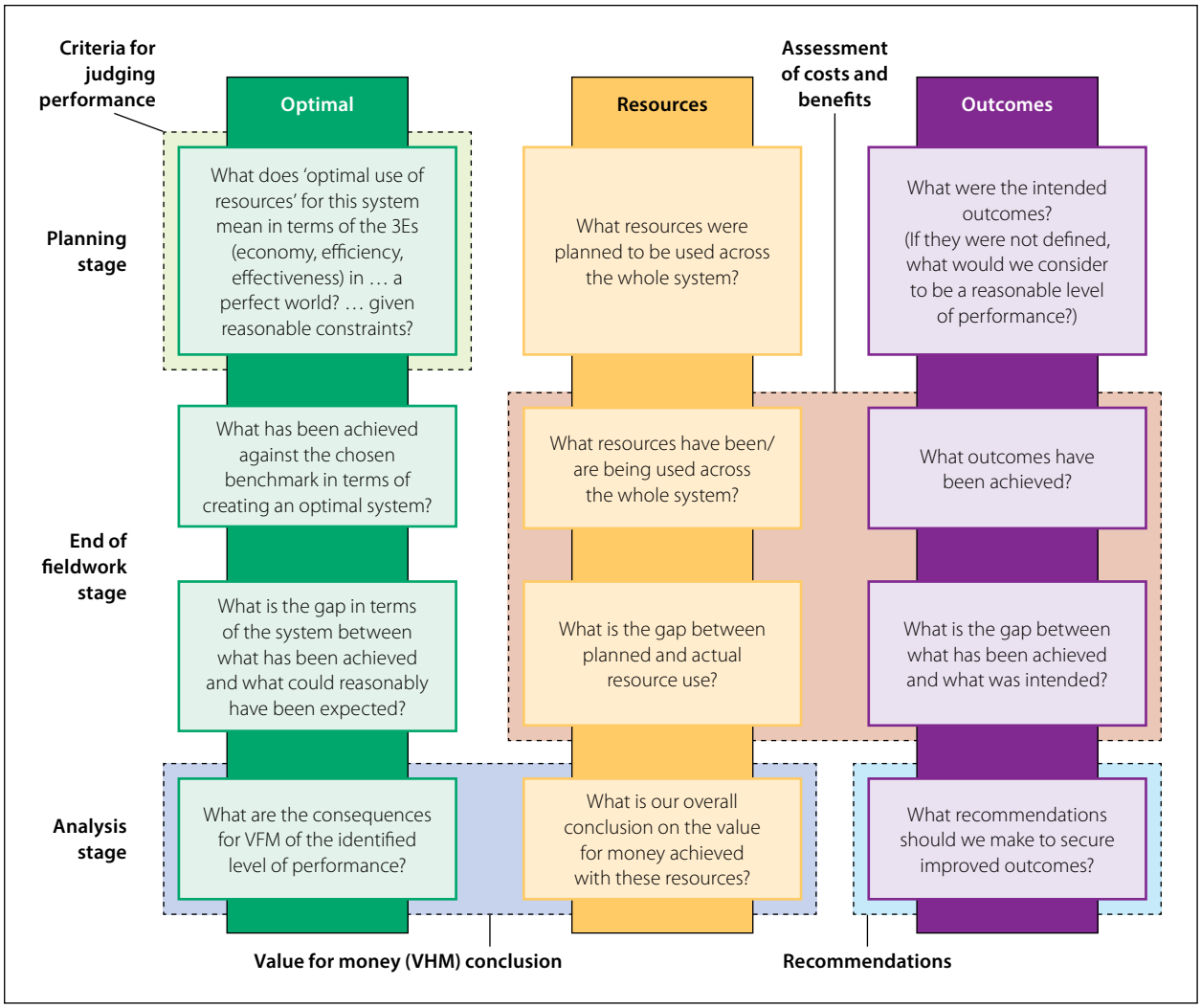


Figure 6.2 Framework of questions for assessing value for money (National Audit Office, 2010)

outcome can be very tight cost control. Changes that would add value are suppressed, and an adversarial culture runs throughout the project."

The value for money proposition upon which the "economy" of a project is made at the end of stage 4, may need to be viewed with some caution as it may be tainted by (Flyvbjerg *et al*, 2003):

- optimism bias–the human mind's cognitive bias in presenting the future in a positive light; and
- strategic misrepresentation – behaviour that deliberately underestimates costs and overestimates benefits for strategic advantage usually in response to incentives during the budget process.

The UK's HM Treasury Green Book: Appraisal and Evaluation in Central Government (2011) defines optimism bias as *"the demonstrated systematic tendency for appraisers to be over-optimistic about key project parameters, including capital costs, operating costs, works duration and benefits delivery."* This UK publication introduces an explicit adjustment procedure to redress the systematic optimism ("optimism bias") that historically has afflicted the appraisal process of projects. Optimism bias can arise in relation to capital costs, works duration, operating costs and under delivery of benefits.

Table 6.1 Generic Cost Estimate Classifications and Primary Characteristics (US Department of Energy (2011))

Estimate Class	Primary characteristic	Secondary characteristic		
	Degree of project definition (expressed as % of complete definition)	Typical purpose of estimate	Methodology	Expected accuracy range (typical variation in low and high ranges)*
Class 5	0% to 2%	Concept screening	Capacity factored parametric models judgment or analogy	–20 to –50% +30 to +100%
Class 4	1% to 15%	Study or Feasibility	Equipment factored or parametric models	–15 to –30% +20 to +50%
Class 3	10% to 40%	Budget, Authorisation, or Control	Semi-detailed unit costs with assembly level line items	–10 to –20% +10 to +30%
Class 2	30% to 70%	Control or Bid/Tender	Detailed unit costs with forced detailed take off	–5 to –15% +5 to +20%
Class 1	70% to 100%	Check Estimate or Bid/Tender	Detailed unit cost with detailed take-off	–3 to –10% +3 to +15%

* The state of process technology and the availability of applicable reference cost data affect the range markedly. The ± value represents the typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

According to this Green Book, the two main causes of optimism bias in estimates of capital costs are:

- poor definition of the scope and objectives of projects in the business case, due to poor identification of stakeholder requirements, resulting in the omission of costs during project costing; and
- poor management of projects during implementation, so that schedules are not adhered to and risks are not mitigated.

Explicit adjustments for bias are made by increasing estimates of the costs and decreasing, and delaying the receipt of, estimated benefits. Sensitivity analysis need to be used to test assumptions about operating costs and expected benefits. Adjustments are empirically based (e.g. using data from past projects or similar projects elsewhere) and adjusted for the unique characteristics of the project in hand. Table 6.2 provides adjustment percentages recommended in a supplementary Green Book guidance for generic project categories that should be used in the absence of more robust evidence.

Gateway reviews at the end of stage 4 provide an effective means for moderating the projected project outcomes and identifying gaps and shortcomings in the information upon which a decision is made to proceed

to implementation. Gateway reviews deliver a team review in which independent practitioners, from outside of the project, examine the likelihood of the successful delivery and the soundness of a project, through a series of interviews and documentation reviews. Review teams can also provide valuable additional perspectives on issues facing the project team and are able to challenge the robustness or validity of the end of stage deliverable. The gateway review process provides clients with the confidence that an appropriate level of discipline is being applied in the delivery process and the best options to meet needs are being selected. Alternatively, they can be used to review the quality of the end of stage deliverables that were developed.

Table 6.2 HM Treasury recommended adjustment ranges for optimism bias

Project type	Optimism bias (%)			
	Works duration		Capital expenditure	
	Upper	Lower	Upper	Lower
Standard building projects are those which involve the construction of buildings not requiring special design considerations	4	1	24	2
Non-standard building projects are those which involve the construction of buildings requiring special design considerations due to space constraints, complicated site characteristics, specialist innovative buildings or unusual output specifications	39	2	51	4
Standard civil engineering projects are those that involve the construction of facilities, in addition to buildings, not requiring special design considerations	20	1	44	3
Non-standard civil engineering projects are those that involve the construction of facilities, in addition to buildings, requiring special design considerations due to space constraints or unusual output specifications	25	3	66	6

Gateway reviews are based primarily on the information contained in end-of-stage deliverables, supplementary documents, if any, provided by key staff obtained during an interview process and interviews with key staff members and stakeholders. Aspects in the report produced by the team needs to be flagged as code red (aspect pose a significant risk), code amber (aspects pose minor risk) and code green (aspects have been given adequate consideration) (National Treasury, 2015).

Organisational and project governance (see 3.6) is also an important tool if correctly applied to mitigate the negative impacts of optimism bias and strategic misrepresentation, to ensure a clear definition of scope and project objectives and to ensure that stakeholders are identified and are heard as projects unfold, prior to a final decision being made to proceed.

6.2.2 Implementation phase

Implementation sits between the bookends of "economy" and "effectiveness" in the results chain framework shown in Figure 6.1, i.e. between Stages 4 and 9. Projects need to be executed "efficiently" so as to maintain the value for money proposition formulated at the outset of the project so that the expected outcomes remain as far as possible within the confines of the parameters upon which the decision to proceed with the project were based. This necessitates that:

- suitable procurement and delivery management systems be put in place;
- the necessary financial and human resources to enable the system to be effectively implemented be provided;
- procurement strategy and tactics be applied to extract value throughout the supply chain;
- the client team has not only the technical abilities but also the necessary leadership abilities, organisational culture, mindsets, attitudes and behaviours to perform its delivery management functions;
- the appointed client delivery manager creates an enabling environment within which effective delivery can take place, exercises the necessary leadership, deals with threats and interference and removes blockages to progress which are beyond the control of the delivery team;

- the client team and the delivery team function effectively and proactively to mitigate risks which fall under their sphere of control; and
- organisational and project governance is able to detect departures from what is mandated and the value proposition for the project and to take the necessary corrective action to meet objectives when it becomes clear that some of the objective might not be met.

There are a number of tools and techniques, which if adopted and embraced, can improve efficiencies within a project and therefore influence the effectiveness of a project, e.g. forms of contract, dealing with fragmentation in design, collaborative working within and between the client and delivery teams, Building Information Modelling technology and digital tools.

Forms of contract which provide open book approaches to the costing of changes, foster collaborative working relationships, provide pricing arrangements that align payments to results and reflect a more balanced sharing of performance risk are most likely to deliver value for money. The UK Society of Construction and Law's Delay and Disruption Protocol (2002 and 2017) recognises that transparency of information and methodology is central to both dispute prevention and dispute resolution. Forms of contract which contain provisions dealing with unforeseen events that can give rise to an extension of time or compensation for the additional time spent and the resources employed in a manner which is consistent with this protocol are also likely to deliver value for money (Watermeyer, 2014).

Lichtig (2006) has indicated that in order to provide higher value and less waste the fragmentation in design needs to be addressed, preferably before 25% of the design is complete. The allocation of single point design responsibilities through design and construct or develop and construct strategies or early contractor involvement linked to framework contracts can be used to address such fragmentation.

The need for organisations to work collaboratively to achieve satisfying project outcomes is increasingly being recognised, the typical characteristics of which are indicated in Table 6.3. There is a need to shift the focus from traditional contracts to behaviours, skills and governance between and within organisations. Collaboration between individuals is relatively common but transitioning this to collaboration between organisations is more complex, given the traditional contracting arrangements that have governed relationships between organisations. Collaborative working is not a solution in itself. It is a structured means of enhancing team performance and value-added returns from investment in construction and as such offers an alternative perspective to the value chain. Integration in the supply and delivery network can be optimised by focusing on the boundaries between organisations to enable each organisation to do what it does best in a complimentary business process. Developing a collaborative approach has been shown to release potential value and innovation (Institute for Collaborative Working, 2016).

Table 6.3 Key characteristics of collaboration from an organisational and relational perspective (Roberts et al, 2016)

Organisational	Relational
■ Teamship ■ Vision-driven leadership ■ Commitment ■ Early engagement with team members and supply chain ■ Effective communications ■ Mutual goals and objectives ■ Equitable risk and reward structures ■ Formal and informal networks ■ Defined accountabilities ■ Structured problem resolution ■ On-going performance management ■ Responsiveness (agility and flexibility) ■ Structured debriefing (including regular lessons learnt exercises)	■ Trust ■ Honesty and openness ■ Empathy ■ Attunement ■ The ability to confront issues without being confrontational ■ Avoiding the need to feel invulnerable (e.g. admitting to mistakes) ■ Influencing skills ■ Inspiration ■ Curiosity ■ Team coaching

Figure 6.3 **Eight stage life cycle framework for collaborative business relationships (ISO 44001)**

Collaboration between organisations may take many forms from loose tactical approaches through to longer term alliances or joint ventures. ISO 44001:2017 specifies requirements for the effective identification, development and management of collaborative business relationships within or between businesses within the eight stage life cycle framework indicated in Figure 6.3. It does not enforce a single rigid approach and recognises that every relationship has its own unique considerations whilst harnessing a range of benefits. Collaborative relationships between and within the client team and the delivery team in the delivery of a project also has the potential to significantly improve project outcomes.

The continued development and standardisation of Building Information Modelling (BIM) technology enables designers from different disciplines and phases of involvement in the design process to work together in an increasingly seamless manner. BIM facilitates collaboration amongst stakeholders from early design to operation and maintenance as all stakeholders can contribute information to and extract information from a central model. It also offers users benefits in the commissioning and operations phase.

BIM can also facilitate technologies such as combining robotics and 3D printing via parametrically designed 3D models. Digital fabrication technologies enable new aesthetic structural possibilities through intricate assembly methods. End-to end digital planning processes connecting design, structural analysis and construction processes are increasingly becoming a reality (WEF, 2016).

Digital tools can also bring about efficiencies and enable an integrated approach to be pursued by providing (AECOM, 2018):

- *"a digital thread that ensures relevant asset data is passed between phases of the project life cycle which creates a "running current" of consistent and appropriate information to all stakeholders through different stages of building and operating an asset;*
- *enhanced and automated value engineering to create a more buildable and operable asset;*

- *digital engineering techniques, including automated design tools and the growing use of artificial intelligence and machine learning that not only replace repetitive manual tasks but also use the power of machines to provide a more reliable outcome; and*
- *asset intelligence (including the capture and analysis of performance data) to drive more efficient operations and feedback into future designs."*

According BIM and digital tools have the potential to bring about efficiencies during the implementation phase of a project.

6.2.3 Procurement and delivery management practices

A procurement system is always designed around a set of system objectives. These typically relate to good governance (primary objectives) and, particularly in developing countries, to the use of procurement to promote social and national agendas (secondary or non-commercial objectives). Procurement systems (e.g. ISO 10845) such as those which are based on the system objectives outlined in 3.3 provide a platform to achieve fair competition, reduce the possibilities for abuse and improve predictability in procurement outcomes are most likely to realise value for money. This is, however, a good starting point but is not usually sufficient to achieve the desired outcomes.

There has over the last few decades, particularly within the public sector, been a change in the way organisations function as indicated in Table 6.4. Procurement and delivery management practices under the administration paradigm (see Figure 6.4) tend to degenerate into a "ticking of boxes" exercise where compliance with rules or the application of mechanistic approaches are more important that project outcomes. The management paradigm has the potential to improve project outcomes as it permits managers the discretion to explore and apply different options. The governance paradigm has the greatest potential to deliver value for money as it focuses on strategic objectives and outcomes (Phillips, 2018).

Table 6.4 Shifts in public sector paradigms (after Phillips, 2018)

Paradigm	Defining characteristics
Public administration	■ Dominance of rules to the extent that public servants don't do anything unless there is a rule allowing it. (The job of public servants is to implement the rules) ■ Highly centralised decision making ■ Management discretion discouraged ■ Incremental budgeting ■ Unresponsive, inefficient, slow and inappropriate public administration bureaucracies
Public Management	■ Decentralisation of decision making. (Give managers responsibility for decision making but make them accountable) ■ Focus on bringing lessons from private-sector into government in order to make government business like ■ Emphasis on clear accountability (Implementation distanced from policy makers, single-point accountability for accounting officers /heads of departments). ■ Emphasis on efficiency and cost management, controlling inputs and outputs, performance management and audit
Public governance	■ Pluralist- multiple inter-dependent actors contribute to the delivery of public services ■ Concerned with "relational organisation" with the focus on inter-organisational relationships and the governance of processes ■ Trust, relational capital and relational contracts as the core governance mechanisms ■ Stresses service effectiveness and outcomes (as opposed to efficiency focus)

Executives and senior managers in the management paradigm need to take responsibility and be accountable for outcomes, apply their minds to the best way of doing things, think about doing things differently to achieve better outcomes and take responsibility for finding ways of achieving more with less. Governance needs to authorise, direct, empower, provide oversight and limit the actions of management to ensure that the right purpose is pursued in the right way.

Clients may require a culture and mind set change to embrace new and emerging procurement and delivery management practices which are designed to support value for money outcomes as indicated in Table 6.5.

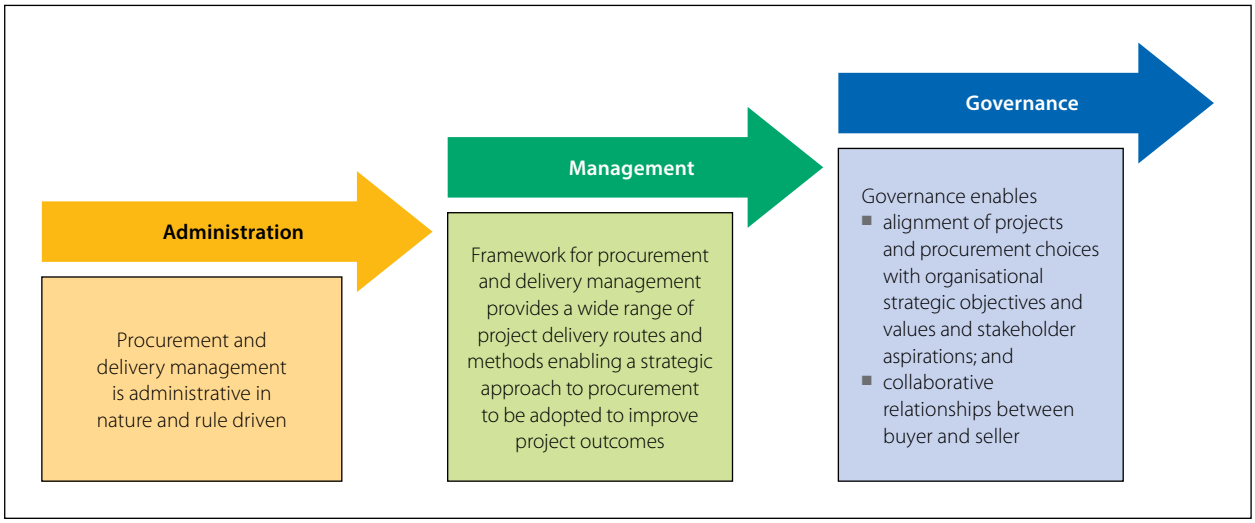


Figure 6.4 Differing procurement and delivery management paradigms

Table 6.5 Culture change which is conducive to improvements in project outcomes (after Watermeyer, 2015)

From	To
Master-servant relationship of adversity ("them and us")	Collaboration towards shared goals (integrated delivery team approach)
Fragmentation of design and construction	Integration of design and construction
Constructability and cost model determined by the design team and quantity surveyor / cost consultant only	Constructability and cost model developed with contractor's insights
Short-term *"hit-and-run"* relationships focused on one-sided gain	Long-term relationships focused on maximising efficiency and shared value
Risks are allowed to take their course	Active risk management and mitigation
Develop the project in response to a stakeholder wish list	Deliver the optimal project within the budget available
"Pay as you go" delivery culture	Discipline of continuous budget control
Pay for what is designed	Deliver infrastructure within an agreed budget
Rigid, bespoke, ill-defined and disjointed procurement system	Flexible, predictable, integrated, documented and auditable procurement system
Fragmented procurement approach whereby persons outside of the client team for a project perform critical aspects of the procurement process	Integrated procurement approach whereby the client team for a project leads performs critical procurement processes
Poorly structured procurement documents based on bespoke or local standards and forms of contract with reliance placed on local knowledge	Structured procurement documents based on international / national standards and forms of contract with minimal customisation / amendments and clear and unambiguous requirements
Meetings focused on past–what has been done, who is responsible, claims. etc.	Meetings focused on "How can we finish a project within time and budget available?"
Project management focussed on contract procedures and paper trails	Decisions converge on the achievement of the client's objectives
Standard delivery stages prescribe the contracting arrangements and are unrelated to a portfolio of projects	Delivery is managed and controlled through stages which permit the full range of contracting arrangements and commence at a portfolio level
Ill-defined end of stage deliverables and acceptance procedures	Well defined end of stage deliverables and acceptance procedures which enable informed decisions to be made
Design and construction developed in isolation from operation and asset management considerations	Design and construction aligned with operation and asset management requirements
Procurement strategy focussed on selection of form of contract as all other choices are predetermined	Selected project delivery route, packaging, contracting and targeting strategy and selection method aligned with project objectives and support the client's value proposition
One project one contract	Works packaged appropriately to achieve objectives and efficiencies
Project delivery takes place within predetermined parameters without any conscious thought to objectives	Projects deliver on documented primary and secondary (developmental) objectives in a measurable and quantifiable manner

6.2.5 Disclosure of information

The Construction Sector Transparency Initiative (CoST, 2013) is a multi-stakeholder initiative which seeks to improve value for money on projects by reducing mismanagement and corruption. It does this by increasing transparency in the delivery of construction projects by:

- putting in place an independent team to undertake data assurance and express any concerns that they may have regarding the project data; and
- ensuring that basic information associated with projects is disclosed to the public at key points throughout the project cycle.

Stakeholders can then use this knowledge as a basis for holding the responsible parties accountable. This results in improved performance which in the long term is expected to improve value for money from investments in infrastructure as indicated in Figure 6.5. CoST in essence brings key stakeholder groups together on neutral ground and assists them to form and pursue shared objectives in improving value for money in construction projects and in improving efficiency and effectiveness.

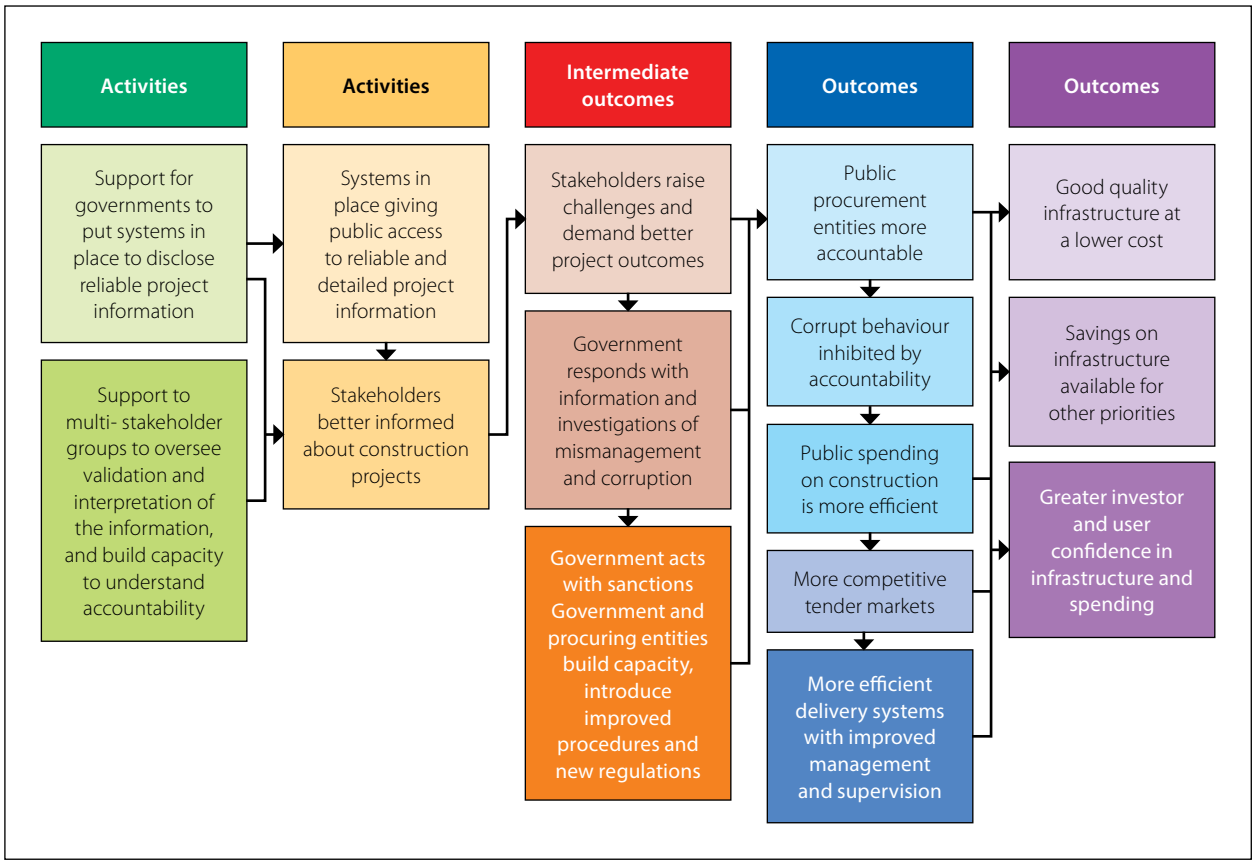


Figure 6.5 Results chain for the CoST Programme (Construction Sector Transparency Initiative, 2013)

CHAPTER 7

Designing an effective delivery management system

The potential for waste and error in infrastructure projects is high. The potential for failing to meet expectations is higher still. Accordingly, the delivery process should be properly planned and managed. Table 7.1 outlines the steps associated with a best-value procurement process associated with the delivery of new infrastructure.

Table 7.1 Fundamental actions in planning and delivering new infrastructure (ISO 10845-1:2010)

Step	Action	Observations
1	Identify needs	The catastrophic and expensive failures of procurement are almost always the lack of clarity of the expected outcome
2	Document the brief	The main cause of procurement failures are the result of inadequate briefs, ill-conceived briefs or an absence of a brief
3	Check the facts	The second most frequent cause of problems between clients and contractors are things that existed at the outset but had not been identified
4	Secure the finance	Business planning has often been ignored, leading to a lack of proper planning and consequent problems at a later stage in the process
5	Understand the construction procurement regime	Compliance with the legislative framework for procurement is essential. Non -compliance will cause delays in the procurement process as a result of a lack of clarity in processes and procedures; the lodging of complaints; and court challenges
6	Allocate risk	The higher the risk taken, the greater the financial provision should the worst happen. Consequently, the higher the risk a contractor assumes, the greater will be the tender value and hence cost borne by the client, even if the risk does not materialise
7	Identify and implement procurement strategies, methods and techniques	The particular characteristics of each procurement should be analysed so as to choose the most suitable and appropriate options Optimisation of these options will lead to obtaining the best value from the procurement process
8	Monitor impacts	Contractors will apply their own expertise to the contract. The client should employ its own experts to monitor the progress of the contractor Any dispute, unless resolved at an early stage, is likely to be costly and disruptive to the project.
9	Review the process	Procurement is a lengthy and complex process. There should always be room for improvement

Clients who embrace the fundamentals of the client functions and practices and the critical knowledge areas for effective delivery set out in Chapters 2 and 3 (see Figure 7.1), respectively, irrespective of project size or complexity are more like to attain value for money in their projects than those that do not. This is particularly true should clients in addition establish the controls and procurement strategies and tactics set out in Chapters 4 and 5, respectively, and take into account the inhibiters and enablers associated with the attainment of value for money in the design of their delivery systems outlined in Chapter 6.

Clients can improve infrastructure project outcomes should they embrace the following in the design of their delivery management systems (Watermeyer, 2013b, AECOM, 2018 and McKinsey and Company, 2017):

- adopt a strategic and tactical approach to procurement above the project level;
- establish trust-based engagement of stakeholders throughout the process to avoid suboptimal solutions and unnecessary delays;

- put in place governance systems which incorporate oversight functions to assess aspects of value for money throughout the project cycle in a systematic manner;
- embrace the "soft" issues of project delivery such as leadership, organisational culture, mindsets, attitudes and behaviours of those functioning within the client team;
- put in place rigorous project selection processes;
- differentiate between the different types of procurement which pose different challenges and require different skills sets;
- standardise delivery in a manner which enables risks to be proactively managed and responsibilities to be clearly established;
- align all objectives and rewards across the supply chain to underpin the client's value proposition for a project;
- engage in a more honest dialogue around risk with the delivery team providing greater transparency on the true nature of risk in their own programmes and the client team willing to absorb more risk;
- resist the temptation to modify standard forms of contract, unless absolutely necessary;
- build relationships of trust and understanding with suppliers, service providers and contractors;
- put in place reliable data gathering systems on which to base day-to-day oversight and long term planning;
- develop strong capabilities across the value chain of planning, delivery and operations;
- increase transparency through the disclosure of information which is subjected to internal and external scrutiny; and
- enable knowledge transfer from one project to another.

The Chair of the Infrastructure Client Group (2017) in looking to the future suggests that "*on time within budget is no longer enough. Clients need to be more demanding and focus on clearly defined outcomes and improvements in efficiencies. The supply chain needs to respond to and commit to collaboration and continuous improvement.*" This underscores a:

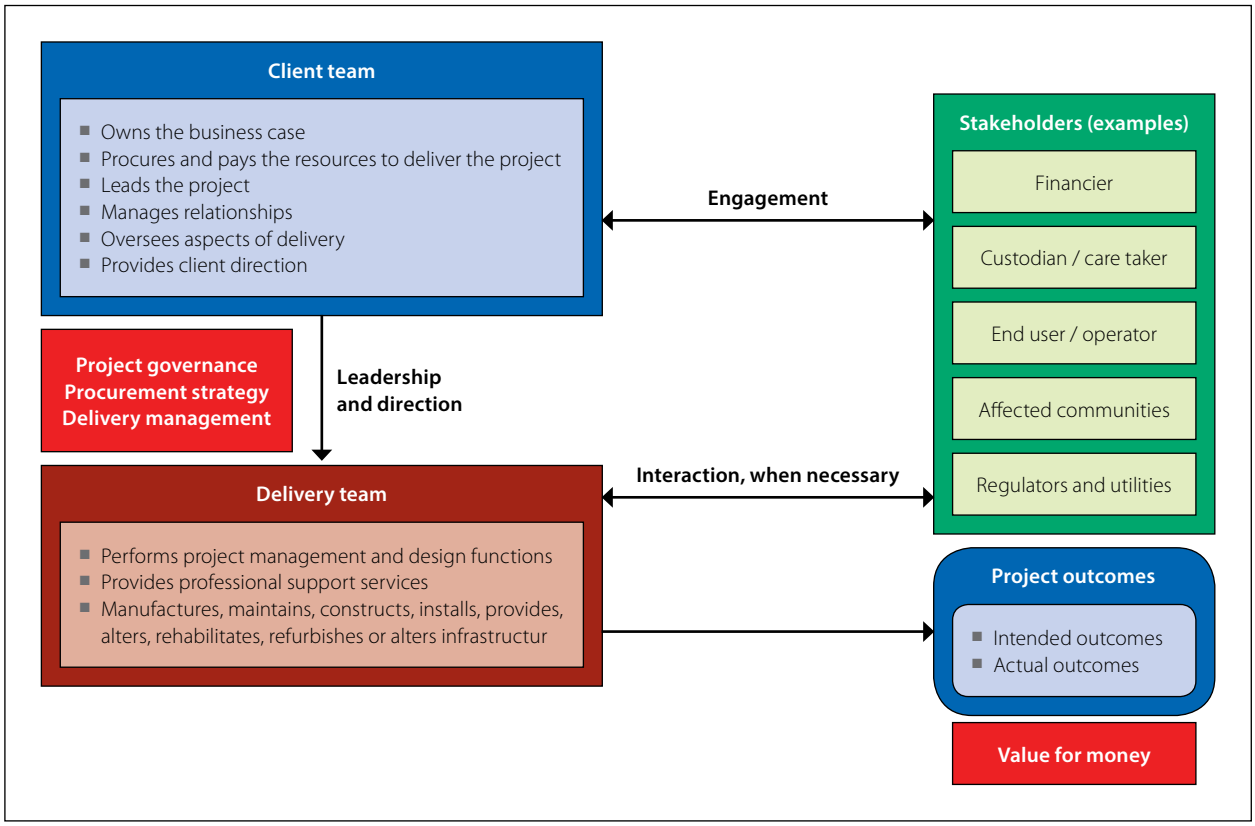


Figure 7.1 **Roles and responsibilities in the delivery of infrastructure projects**

- future shift towards outcomes and the combined efficiency of operating and capital expenditure; and
- a moving away from lowest price as the measure of value for money towards the accessing of the skills and technologies needed to build the right infrastructure and achieve the best possible outcomes.

The infrastructure Client Group (2017) envisages a "*shift away from procurement of new infrastructure as a series of individual projects each procured independently from the market. In its place it creates organisations that integrate the core functions of infrastructure owners with the capabilities of their advisors and suppliers. These organisations seek to deliver owners' outcomes through the management of shared outcomes that can evolve over time from a simple collaboration into high performing enterprise.*" The five key features of their proposed new approach are governance, organisation, integration, capable owner, and digital transformation.

Table 7.1 indicates the three stages of maturity of the Infrastructure Client Group's proposed new approach. The cornerstone of this approach, which relies on aligning the activities and behaviours and interests of the client team and the delivery team as they work together to achieve the required outcomes, is to define value in terms of outcomes. "*This new approach relies on getting the most out of all the parties involved through collaboration and integration. Collaboration works by softening the boundaries between the parties to an infrastructure programme and then integrating their capabilities, functions and activities to produce a better outcome for all. Integration does not occur naturally. Owners must take the lead in developing organisations with the culture, practices and systems appropriate to the programme being delivered.*"

Table 7.1: Five key features of the new approach and their evolution (Infrastructure Client Group, 2017)

	Simple collaboration	Integrated functions and relationship	High performing enterprise
Governance	■ Definition of value agreed by the owner ■ Long-term relationships with suppliers accepted ■ Performance targets and reporting agreed	■ Value shapes investment programme ■ Regular reports on supplier performance ■ Performance reporting integrated with production	■ Value at centre of asset management ■ Suppliers influencing investment decisions ■ Performance reporting integrated with asset management
Organisation	■ Supply chain strategy in place ■ Traditional contracts with financial incentives ■ Core team co-located with common systems	■ Key suppliers procured through frameworks ■ Cost reimbursable contracts with incentives ■ Single integrated project organisation	■ Suppliers working together in clusters ■ Suppliers' rewards depend upon performance ■ Best candidates for key roles in the integrated organisation
Integration	■ Integration defined and integrator in place ■ Integrated planning and management ■ Good practice in health, safety and well being (HSW)	■ Integrated business processes and systems ■ Production systems in place ■ HSW defines good practice for the construction industry	■ Fully integrated programme team with key suppliers contributing ■ Real-time digitally enabled production systems ■ HSW defines good practice for UK industry
Capable owner	■ Owner's champion appointed ■ Owner's functions aligned with delivery team ■ Plan in place to develop owner capabilities	■ Owners function integrated with delivery team ■ Key capabilities in place ■ Development and succession planning	■ Owner and suppliers working together to develop integrated investment strategy and next generation improvement plans
Digital transformation	■ Digital strategy in place ■ Level 2 BIM in use across the programme ■ Plan for digital delivery in place ■ Value of information recognised	■ Suppliers of digital services / technology appointed ■ Consultants' and contractors' business models adapted to the digital environment ■ Plan for adoption of Level 3 BIM ■ Information being managed as a resource across the whole "data estate"	■ Suppliers of digital services / technologies at the core of the programme team ■ Digital production platform in place ■ Asset management integrated with delivery ■ Integrated through-life approach to information in place

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There is a direct linkage between the role played by the client and infrastructure project outcomes regardless of project size, complexity and location. The root causes of project failure can frequently be attributed to the lack of governance and poor procurement and delivery management practices, all of which are under the control of the client.

This Guide describes the roles and functions of the client and identifies practices which if adopted will contribute to project value (the outcome of client decision making to achieve an optimal balance of the project benefits, risks and costs). It offers practical guidance on how a client should go about establishing a client team and the structuring of governance arrangements. The essence of the critical knowledge areas for effective delivery, namely delivery management, procurement, portfolio, programme and project management, risk and change management and governance are outlined, drawing upon the content of recently published national and international standards. A methodology for controlling workflows to regulate work in relation to its context which may from time to time change is described. The range of project delivery routes and procurement options are discussed. A generic framework within which procurement strategy and tactics can be developed is outlined. The concept of value for money is discussed as well as the enablers and inhibitors associated with improvements in project outcomes. This Guide concludes with some suggestions on what clients can do to improve project outcomes in the design of their delivery management systems.

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