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EPCM Contracts in the Public Sector

Project delivery through engineering, procurement and construction management

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Contents

1	EPCM Contracts in the Public Sector	1
Appendix A	Key issues for the appointment of an EPCM contractor	15
Appendix B	KPIs	22
Appendix C	Comparative delivery models	27

1 EPCM Contracts in the Public Sector

Project delivery through engineering, procurement and construction management

Introduction

In January 2016 PwC released its paper *EPCM Contracts: Project delivery through engineering, procurement and construction management*, with a focus on this procurement model in the private sector.[1] The purpose of this paper is to demonstrate the relevance of Engineering, Procurement and Construction Management (EPCM) as a procurement model option for the public sector.[2]

There has been a significant shift in contracting strategy within the construction market in recent years, particularly regarding traditional risk allocation. In many countries enjoying favourable economic conditions, it is no longer unusual to see Contractors refusing to bid for the usual fixed price and time contracts. This change is partly driven by Contractors becoming more sophisticated in their risk analysis, but also largely due to:

- the current surge in demand in the global construction and engineering sectors
- the significant size, complexity and profile of so-called "mega projects"
- a shortage of Contractors with the experience and resources needed to deliver such mega projects
- a shortage of experienced labour and quality materials and resultant fluctuations in associated costs

Increasingly, Owners and Contractors are looking for alternatives to the traditional fixed price and time project delivery methods. While the traditional delivery methods remain (such as design and build; Engineering, Procurement and Construction (EPC); and construct only), the risk allocation and payment arrangements vary significantly.

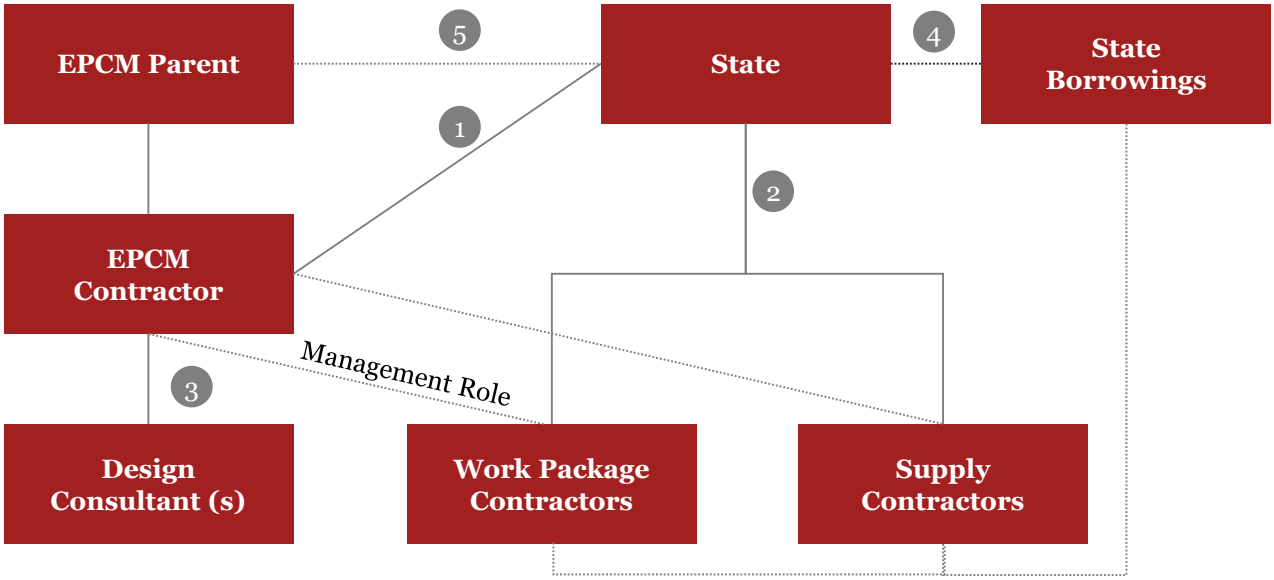
This paper provides a brief review of the traditional fixed time and cost arrangements and, in the Engineering, Procurement and Construction Management context:

- provides an overview of the EPCM model's features
- examines each phase of the EPCM delivery method
- discusses other issues, including bankability and Key Performance Indicator (KPI) arrangements
- considers suitability of the EPCM model on public infrastructure project, particularly mega projects
- compares and contrasts the EPCM model with other project delivery models current utilised on public infrastructure projects

[1] Damian McNair, EPCM Contracts: Project delivery through engineering, procurement and construction management, PwC 2016

[2] References to Owner in this paper are used interchangeably with the State.

EPCM Contracting Structure



Legend:

1. EPCM Contract
2. Work Package and Supply Contract
3. Design Consultants Agreement (ab initio or novated from State)
4. Finance Documents
5. EPCM Parent Company Guarantee

Overview of EPCM arrangements

The concept of delivering projects by way of an EPCM Contract is not new. It has wavered in popularity for a number of decades and has, for some time, been used extensively throughout the oil, gas, petrochemical and resources industries. Interestingly, we have recently seen its application on the NBN II rollout with an EPCM arrangement between Telstra and NBN Co.

In the current market, a number of sophisticated Owners are not prepared to pay large risk premiums and profits to Contractors under traditional fixed time and cost contracts. Add to this, the current "boom" in the number of projects to be delivered across the globe, increased pressure to fast-track delivery, in some cases limitations on Owners' resources and the rising prices of materials and labour, and we are witnessing a redefining of the way projects are being delivered. EPCM Contracting is just one of a number of alternative models becoming more widespread.

Delivering an EPCM project means different things to many participants. The form and structure of an EPCM Contract will vary depending on a variety of factors such as the:

- particular industry and project
- sophistication and expertise of the project parties
- owner's requirements as to level of involvement
- owner's internal project delivery resources/and skill set
- history and level of trust between the Owner and the Contractor
- level of integration between the project parties' respective teams
- level of risk on the project (i.e. technical and commercial/financial)

In its simplest form, an EPCM Contract is a consultancy agreement for the provision of professional or technical services. At one end of the spectrum, an EPCM could be considered to be a pure consultancy-type arrangement and, at the other end, an integrated EPCM Contract could look more akin to an integrated alliance style contract.

The EPCM Contractor is typically responsible for:

- basic and detailed design and engineering
- establishing, implementing and managing tendering processes for procurement of all equipment and materials and awarding and managing works package contracts
- overall project management and administration of work package contracts, including during warranty periods

Traditionally, the Owner enters into the construction and procurement agreements for the project. However, depending on the project structure, the Owner and the industry, the EPCM Contractor may enter into contracts directly with Contractors and suppliers, as agent for the Owner, (with the EPCM Contractor assuming no or limited liability under such contracts). Where this is the case, there are generally clear procedures and limitations on the EPCM Contractor's ability to execute such contracts.

EPCM Contractors usually do not take full responsibility for:

- delivery of the project by certain key milestone dates
- care and custody of the works (with certain exceptions for arranging security and management of safety etc.)
- the project being delivered in accordance with the project budget

The EPCM Contractor is usually heavily incentivised to bring the project to commercial operation on time and under budget, but is not required to indemnify the Owner for failing to do so.

Depending on the scope of services to be provided by the EPCM Contractor, potential liabilities may relate to wilful default, fraudulent behaviour and, after some form of negligence or recklessness, in respect of matters such as:

- performance of the design and engineering
- preparation of the project budget and project schedule
- management of procurement, including a failure to implement an objective and competitive tender process
- management, administration and supervision of the work packages
- coordination of the design and construction works between works package contractors

Ordinarily, the maximum liability of the EPCM Contractor is much lower than is usually the case under fixed time and cost arrangements. It is often limited to the re-performance of defective services and capped out at between 5-20% of the total EPCM remuneration (or, more recently, to the value of the profit and sometimes the overhead component as well). There are generally a number of carve-outs from such a limitation, including for losses resulting from fraud or wilful misconduct. Obviously, these arrangements depend on a number of factors and vary widely from project to project.

Appendix A to this paper contains a table summary of some key issues for the appointment of an EPCM Contractor to be considered by Owners when preparing the EPCM Contract.

Typical phases of an EPCM Arrangement

Design and engineering

It is not unusual to have the engineering arrangements split into a number of components. The EPCM Contractor's engagement may start as early as the feasibility stage of the project. That is, it may be engaged to analyse high level technical aspects and prepare a report on the likely timing and cost, proposed procurement arrangements for long-lead items, local project considerations and other aspects of the proposed project (usually on a straight cost-plus basis).

Following the feasibility study, the Contractor may be appointed to undertake the Front End Engineering and Design (FEED) for the project. Broadly, the FEED phase covers the basic engineering and design for the project and also the development of preliminary project schedules, budgets and work packages. This process allows the Owner to go to the market with sufficient scope definition to ensure that it receives bids which are competitive and realistic – ideally on a lump sum basis although this may only be for the procurement of long-lead critical path items (e.g. key equipment or foundation work/site and access preparation). As with the feasibility stage, this component usually proceeds on a cost-plus basis.

Following the FEED stage, the EPCM Contractor will work the basic engineering and design into the complete detailed engineering package. In some cases, through the KPI regime the EPCM Contractor may be responsible for ensuring that the engineering and design will meet the relevant performance parameters for the project. To this end, it must coordinate these works with the other parties involved to ensure that the engineering and design complies with the overall project specification and other specific requirements.

The EPCM Contract may also be structured in such a way to permit the Owner, in its absolute discretion, to instruct the EPCM Contractor to proceed to the next stage. For example, at the conclusion of the feasibility stage, the Owner can elect to dismiss the EPCM Contractor and engage another Contractor to undertake the FEED services regardless of whether the Contractor has properly performed the services. Also, the contract may be structured in such a way to have the EPCM Contractor roll into a lump sum EPC after conclusion of the FEED services and therefore taking the turnkey risk on the entire project. This process can provide the Owner with greater flexibility but will obviously depend on the needs and other constraints of each particular project.

Procurement

In addition to undertaking the design and engineering for the project, the EPCM Contractor is usually required to procure, on behalf of the Owner, all of the materials, equipment and construction works necessary for the proper completion of the project. To this end, the EPCM Contractor is required to establish a system or follow procedures for implementing such procurement arrangements. This may be a significant task if the project is broken down into many components and involves the EPCM Contractor preparing a suite of standard form procurement and construction contracts for the project (most EPCM Contractors will have these already), establishing a tender process suitable for the project and works to be approved by the Owner, responding to tender clarification issues, negotiating the commercial terms of all construction works packages and supply contracts and finalising each of the agreements for execution by the Owner or approved by the Owner for execution by the EPCM Contractor as agent for the Owner.

Construction management

Upon commencement of the works, the EPCM Contractor assumes the role of the Owner's "engineer" or "representative" under the various work package and supply contracts. It manages and supervises each of these contracts. A key role for the EPCM Contractor is coordinating each of the works packages to ensure that all of the works interface as required and that delays and variation claims are minimised where possible. Usually the EPCM Contract will set out the limits on the EPCM Contractor's authority. These limitations generally relate to instructing or agreeing variations, settling of claims, waiving any breach or default and certification of final payments.

Depending on the scope of the EPCM services which, in some cases, evolves as the project proceeds, the EPCM Contractor is usually required to play an active role in monitoring and reporting during the testing and commissioning phase of the works packages. Further, the EPCM Contractor is generally required to oversee the notification and rectification arrangements during the defects liability period and also to deal with any other warranty issues. In certain cases, the EPCM Contractor is required to take an active role in the management of claims or disputes from work package Contractors. Alternatively, this role may be limited to the provision of advice regarding any disputes that arise during the course of the projects.

Other issues

Financing

Government financing

Where State funded projects are financed by drawing on revenue through the State budget, the EPCM Contractor can assist an Owner (in this case the State) by providing a level of project oversight and by monitoring cost and time overruns in the absence of private sector project finance.

Financiers that lend to a project on a limited recourse basis apply rigorous due diligence and project monitoring processes to assess risk. The processes that Lenders use to identify, allocate and manage risks prior to financial close and during the construction phase include:

- obtaining due diligence (including technical, environmental and financial) as part of the credit process;
- appointing Lenders' technical consultants to review Project cost estimates and revenue projections, as well as monitoring the progress of the Project
- appointing a certifier to assess the value of the work completed and what it will cost to complete the construction of the project
- only allowing further drawdowns of the debt facilities if:
  - the forecast "cost to complete" does not exceed the SPV's available funding; and
  - Completion will occur before the Debt Sunset Date.

The EPCM Contractor assists the Owner in the absence of private sector debt by:

- being engaged as part of FEED to prepare cost, budget and schedule estimates based on experience with other mega projects, and the parallel activities being done in collaboration with the Owner's team in respect of scope definition work, development of the preliminary/full business case and design engineering development
- monitoring and reporting on anticipated costs of the Project as well as the progress of the build
- implementing cost controls (the EPCM Contractor can be incentivised to do this through the KPI/Incentives regime)
- playing an active role in monitoring and reporting during the testing and commissioning phase of the works packages
- applying its integration management expertise
- taking end to end design responsibility

Bankability and completion guarantees

As mentioned earlier, where the project is financed through limited or non-recourse project financing, Lenders will demand a great deal of outcome certainty in terms of time and cost i.e. they want a fixed price, fixed time construction contract to alleviate the risk of cost overruns and time delays resulting in additional costs. The borrower is usually the entity newly established to own the project and this usually precludes the use of EPCM Contracting even though the outcome may be cheaper and faster.

For EPCM Contracting to be bankable, the Sponsors would likely have to provide the Lenders with a completion guarantee. That is, they offer the Lenders some form of parent company guarantee until commercial operation or a commitment to cover cost overruns, delay costs and debt service obligations during a period of delay. Such a guarantee could be capped at the total amount of the debt, falling away upon commercial operation.

Depending on the Lenders, the project and the Owner/EPCM Contractor's track record for delivering similar projects, the completion guarantee may be more limited and step down prior to commercial operation or as various stages of the project are completed. Conversely, they sometimes linger beyond commercial operation to cover market pricing risk depending on the type of project and output. Project bankability requirements are further considered at Appendix A.

Incentivising the EPCM Contractor

KPI and incentive arrangements are very much project specific. As such, it is difficult to meaningfully suggest project specific KPI arrangements without first understanding the key commercial considerations driving any particular project. These are usually a combination of time, cost, quality, safety, environment and community. To a certain extent, the corporate philosophy of the EPCM Contractor is also important.

11Appendix B to this paper contains a table summary of various KPIs and related incentive arrangements that may be relevant to the appointment of an EPCM Contractor. Whilst this table is not an exhaustive list, it includes key issues which an Owner should consider in order to encourage the behaviour it requires the EPCM Contractor to display so as to achieve the Owner's objective for its project.

Given the cost-reimbursable nature of most EPCM Contracts, an alignment of interests is obviously extremely desirable from the Owner's perspective to encourage productive behaviour and positive outcomes. However market forces and an environment of rising costs and scarce technical resources impact the KPI regime that is ultimately negotiated.

At the early stages of a project, lack of project definition also complicates the setting of meaningful and precise targets against which performance can be measured and appropriate behaviour encouraged. Setting the framework and principles at an early stage, while there is a competitive environment and balanced bargaining position, is generally the best way for the Owner to lock in KPI arrangements.

As noted earlier, there has been a significant shift in the construction market over the last few years particularly regarding traditional risk allocation. This has also impacted the form of EPCM Contracts being used.

Interestingly, some Contractors are preferring to move away from, or limit the extent and impact of, KPIs. This is largely because they believe these arrangements can:

- create uncertainty (and therefore increased risk and are more difficult to achieve in a rising cost market)
- cause additional friction between the parties which does not foster a sense of cooperation or trust or help develop a long-term multi-project relationship
- waste time and resources on trying to monitor, document and agree on whether KPIs have been met (which detracts from the main objective of successfully completing the project).

Some Owners prefer an integrated approach toward administering and managing the project akin to assuming part of, and sharing, the EPCM responsibilities. Given the magnitude, complexity and duration of the "mega projects", some Contractors may be unwilling to commit a material percentage of their remuneration to an incentive regime structured on a "whole of project" basis as opposed to one that corresponds with discrete phases of work.

Many projects are almost completely "schedule" driven. Consequently, and despite both parties' best efforts, an incentive arrangement that predominantly focuses on time may inevitably create inefficiencies which result in increased cost, double handling and/or re-work which also puts pressure on costs. Any KPI arrangement adopted for a particular project must encourage the kind of behaviour the Owner wants the Contractor to display so as to achieve the project's objectives. Above all, any KPI arrangement should focus on maximising productivity and delivering timely and innovative results while striking a balance between time and budget without sacrificing quality or safety or creating inefficiencies. Obviously, this is easier said than done.

Delivery by traditional fixed time and cost arrangements

Over the past 10-15 years, project delivery methods have generally incorporated some form of fixed time and cost arrangement – whether by construct only, design and build or EPC. These delivery methods were, and remain, popular with Owners and Lenders as the fixed time and cost arrangement provides certainty and, for EPC, a single source of responsibility. Delay liquidated damages may be levied against the Contractor so as to incentivise them to complete the works on time and the circumstances where the Contractor can claim relief for increases in the cost are carefully limited. Naturally, Contractors seek to price a risk premium into their remuneration to address such risk allocation.

Where projects are delivered on a limited or non-recourse financing basis, the need for time and price certainty is magnified. While the recent forces of demand and supply in the construction industry have also impacted the risk allocation on the "turnkey" EPC Contracts used for such projects, and bank credit committees have relaxed requirements slightly (credit crunch aside), the change in risk allocation has been far more limited.

Cost definition

Where the cost-plus model is used, there needs to be a detailed assessment of what costs are in and which are not. Some EPCM models also separate the direct costs from project and head office overheads and either treat them differently or agree a lump sum or fixed percentage for some or all of the overhead or profit component. Doing so can also tie into the KPI/incentives regime. If fixed, then the Contractor's margin diminishes the longer the delivery period and/or the greater the reimbursable component becomes.

New Way Forward: EPCM in the Public Sector

This section of the paper discusses the suitability of EPCM for public sector infrastructure projects, specifically mega projects.

An infrastructure project with a contract value of more than $500m is generally considered a 'mega project', however, the broader definition offered by Dr. Aminah Fayek is 'a construction project, or aggregate of such projects, characterised by magnified cost, extreme complexity, increased risk, lofty ideals, and high visibility, in a combination that represents a significant challenge to the stakeholders, a significant impact to the community, and pushes the limits of construction experience [3]. On this basis a mega project would constitute a High Value/High Risk (**HVHR**) project for the purpose of the Victorian Department of Treasury and Finance (DTF) HVHR Guidelines.[4]

Key factors affecting delivery of mega projects by the State

There are three key factors affecting the delivery of mega projects by the State. First, mega projects are closely regulated by the prevailing public procurement framework made up of both policy and legislative requirements, including the requirement for value for money[5] as determined through some form of competitive tendering process, and accountability to the public. Given their size and risk profile, mega projects are also subject to project assurance frameworks imposed by the Gateway Process and, in Victoria, under the DTF HVHR Guidelines.[6]

Second, mega projects by their nature are complex, which means the project requires personnel with deep experience in design engineering, integration of complex work packages and leading project management skills and systems. They also need an ability to integrate and collaborate with the Owner's teams in key areas, including design and schedule.

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[3] Fayek et al, 'Assessing performance trends on industrial construction mega projects' (2006) 48(10) AACE Cost Engineering Journal 16-21.

[4] Department of Treasury and Finance, Investment Planning and Evaluation – High Value, High Risk http://www.dtf.vic.gov.au/Investment-Planning-and-Department of Treasury and Finance, Government of Victoria, Investment Planning and Evaluation - High Value, High Risk, (15 January 2018) <http://www.dtf.vic.gov.au/Investment-Planning-and-Evaluation/High-Value-High-Risk>.

[5] Department of Treasury and Finance, Government of Victoria, Achieving value for money – procurement guide <www.procurement.vic.gov.au/files/8cacaf04-5fdc-4ac8-8fec-a55200bf4655/Guide-to-value-for-money.docx>.

[6] Department of Treasury and Finance, Government of Victoria, above n 4.

Third, delivery of these projects in the Australian market has traditionally been dominated by a limited number of tier 1 domestic contractors, albeit with an increasing international ultimate ownership. Mega projects place significantly higher demands on this group which is arguably already at capacity, particularly in terms of capability. The pressures of a difficult risk profile and tight contractor margins are heightened where delivery is on a fixed time and cost basis under a single D&C contract.

The consequence of this is that mega projects essentially become too large and too risky even for a joint venture of contractors to wrap under a traditional EPC/D&C delivery model. Even within a joint venture structure, contractors are often not able to offer the same proportionate level of liability and recourse typically required in projects delivered under EPC. The lack of contractors willing to adopt this risk profile limits genuine competition in the market. This is borne out by the research by Bridge and Bianchi which demonstrates that on average the number of expressions of interest declines when a project value is over $1b[7].

It is therefore common for mega projects to be disaggregated i.e. split into smaller, more manageable packages that utilise delivery models appropriate for those packages (often EPC contractors or a few key larger contracts) with a management overlay. Bridge and Bianchi conclude that multiple contracts would be the optimal solution for a mega project that exceeds the range of $1.5b to $2b, whilst mega projects with a value of between $500m and $800m can be delivered by a single contract[8].

The Gateway Process and HVHR Guidelines comprise a series of project assurance steps aimed at improving scrutiny at key points in the project life-cycle, on the assumption that 'greater scrutiny will increase the likelihood that projects will achieve their stated benefits and be delivered successfully, on time and to budget'[9]. Following demonstration of the project concept and feasibility, the next step is to develop a full business case including the procurement strategy. Consistent with private sector procurement strategies, this is the point at which there needs to be an alignment of project objectives, project packaging options and package procurement model options. Implicit in this is the recognition that procurement options may differ for each package.

Packaging options

The inputs for the packaging options assessment include a thorough understanding of the project characteristics and the value drivers for the packaging. Care needs to be taken to avoid an excessive number of packages as this can drive interface and integration risk. Packaging options might be along physical or technical battery limits (e.g. early works), geographical limits (i.e. north/south), greenfields/brownfields, major equipment and will also be informed by an assessment of market appetite and capacity. Procurement model options are likely to include the range of fixed time and fixed cost delivery models (such as D&C and EPC) and collaborative management models (such as EPCM, managing contractor and alliancing). Taken together, the logic applied to determine the packages, the assessment of the available market (which may include tier 2 contractors), and the size of the package is likely to ensure that:

- the appropriate procurement option for the package is adopted
- a genuinely competitive bid process can be run for each package

A mega project split into multiple packages requires, however, management of the package contracts and the interfaces between them. This can be provided by the State or by an external party. EPCM is a collaborative procurement model where the management of multiple contracts in a technically complex mega project is carried out by an external professional.

The Transport Infrastructure Efficiency Strategy (**TIES**) was prepared in collaboration between the UK Department of Transport and key UK transport authorities, and was released in 2017. The purpose of TIES is to drive efficiency in the delivery of transport infrastructure and support transformation of productivity within the

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[7] Adrian Bridge and Robert Bianchi, Reforming the procurement of construction and financing of Australian infrastructure: advancing capacity, competition and investment – Final Report, (14 August 2014) Queensland University of Technology and Griffith University.

[8] Ibid

[9] Department of Treasury and Finance, Government of Victoria, HVHR Project Assurance Framework factsheet, (19 December 2017) <www.dtf.vic.gov.au/files/fb7f422b-bc34-4fc3-9f93-a6f100fbb932/HVHR-Project-Assurance-Framework-Factsheet-19Dec2017.pdf>.

construction sector.[10] One of the seven challenges it identified was promoting long term collaborative relationships with industry in order to reduce transaction costs in procurement and maximise innovation'[11]. The corresponding opportunity that it resolved upon was the choice of 'alliancing, or an approach based on collaboration, as a first resort[12].

States should consider EPCM contracting

Taking that lead, the EPCM contracting is a model that should be actively considered by Government as one of the collaborative procurement options for mega projects, including in the transport sector. This is because EPCM offers the following:

- early design engineering involvement including on a FEED basis and the opportunity for innovation
- constructability considered during the design process
- the ability during FEED to work with the Owner's engineering team in a collaborative or integrated way
- starting during the FEED, improved cost estimation[13] based on:
  - experience with large scale complex projects
  - involvement in FEED outcomes
  - early collaboration with the Owner's team
- flexibility where EPCM Contractor services are staged, to adapt procurement of the delivery phase to use of a different delivery model[14]
- improved identification and management of risk due to involvement in large scale complex projects and involvement in FEED outcomes.
- sophisticated project management systems and contract administration processes including the ability to report in line with government assurance processes and to provide a level of delivery oversight akin to the 'sense-check' provided by Lenders
- broad technical integration expertise given the level of engineering capability
- the ability for works packages and supply to be procured on a competitive fixed cost/time basis to ensure value for money
- the professional and reputational stake taken by the EPCM contractor in the project backed by professional indemnity insurance
- the ability to craft a KPI/Incentives regime to drive behaviours as well as outcomes

[10] Department of Transport, UK Government, Transport Infrastructure Efficiency Strategy, (6 December 2017), 3 <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/664432/transport-infrastructure-efficiency-strategy.pdf>..

[11] Ibid 41.

[12] Ibid 52.

[13] Marion Terrill and Lucille Danks, 'Cost overruns in transport infrastructure' (Report No 2016-13, Grattan Institute, October 2016) 25-38.

[14] Ibid.

- lessons learned from the private sector oil and gas, mining and resources and recent telecommunications mega projects.[15]

How would EPCM apply to a mega project?

How would the EPCM model apply to say a mega transport project made up of a tunnel, a rail link to the airport, and connecting road infrastructure? Each of these elements will require their own specialist design engineering, taking into account the environment, geological conditions, uneven terrain, size and length, interface points between the elements and with existing operations on existing infrastructure. This can be provided by the one EPCM Contractor on a FEED basis, working closely with the Owner's team, and bringing its construction and integration know how. The EPCM Contractor will work with the State to develop the preliminary business case and clear Gate 1 and the full business case to clear Gate 2 and seek approval for funding. The EPCM Contractor will then engage with the works and supplier market for each of the tunnel, rail link and road infrastructure, manage their respective competitive procurement processes and engage the relevant contractors and suppliers on a fixed time and cost basis. Delivery of the works for each project element and for the whole of the integrated project will be managed closely by the EPCM Contractor using its construction and integration expertise and using its management systems and processes. The EPCM will have had an early involvement (through the FEED process) setting project budget and a responsibility (underpinned by KPIs) to manage cost in accordance with budget during the delivery phase.

EPCM often closely resembles the Managing Contractor model, particularly in relation to scope and staging of services, early collaboration, risk allocation and liability, contracting structure, and alignment of incentives with value drivers/project objectives through the KPI regime. The key differences lie in the capacity and capability of the EPCM contracting market to meet the challenges of mega projects, specifically:

- the design engineering complexity;
- the interface complexity given the disparate complex elements of the project
- the project management complexity
- the need for skilled, experienced personnel

The EPCM contracting market is, for the most part, tier 1, with origins in the international engineering powerhouses such as Bechtel, Fluor, KBR, Foster Wheeler and Worley Parsons. It is a market that is global in its reach, scaled to deliver mega projects, and that can bring a considerable breadth and depth of experience in managing mega projects from a range of projects in a range of industries.

In terms of early engineering involvement, the design team working collaboratively and alignment of EPCM project objectives, the EPCM contracting model also resembles project alliancing. In other respects however, the models are very different. For example alliancing facilitates a 'no blame' environment based on unanimous decision making with participants focused on finding 'best of project' solutions and supported by pain share/gain share arrangements whereas under an EPCM contracting model the EPCM Contractor is accountable for its services and the delivery phase is characterised by fixed time and cost at the work and supply packages level.

Comparative delivery models are examined further in Appendix C

Conclusion

Current projections indicate that the international and domestic construction boom is likely to continue into the foreseeable future which will continue to impact the ability to deliver mega projects. Mega projects are also likely to increase in their complexity, with scope that may be highly uncertain. Consequently, more Owners and Contractors will seek to redefine traditional project delivery methods, including by adopting a model that makes

[15] Department of Transport, UK Government, above n 10, 4. The importance of taking into account experiences from other sectors was acknowledged by the Secretary of State for Transport, Chris Grayling.

it easier for the owner to outsource technical capabilities. In such an environment, it is likely that rigid fixed time and cost arrangements will become less common.

Government has a responsibility to deliver some of the State's most critical infrastructure projects, including mega projects, in a way which meets public expectations and the raft of public procurement and assurance requirements. In addressing these needs, government should also be encouraged to look to and learn from industries such as oil and gas, petrochemical and mining and resources and the private sector mega projects which have been successfully delivered using the EPCM contracting model.

EPCM allows for greater competitive tension by utilising smaller works package contracts suitable for tier 2 and 3 contractors and addresses challenges for mega projects being too large to wrap under traditional contracting models, even in a joint venture structure. It is also an advantageous model to consider where scope is highly uncertain e.g. projects involving subsurface conditions in tunnel excavation. Government should actively consider EPCM contracting for public sector projects given what the model offers in terms of collaboration and superior engineering, integration, project management expertise, and lessons learnt from other sectors and markets.

Appendices

Appendix A Key issues for the appointment of an EPCM contractor 15

Appendix B KPIs 22

Appendix C Comparative delivery models 27

Appendix A Key issues for the appointment of an EPCM contractor

Issue	Comment
Form	In its simplest form, an EPCM Contract is a consultancy agreement for the provision of professional and/or technical services. At one end of the spectrum, an EPCM Contract could be considered to be a pure consultancy-type arrangement and, at the other end, it could look more akin to an integrated alliance style contract where the parties " interests are aligned through the KPI incentive regime." There are many important factors arising out of a project and the current market which will influence the form of the EPCM Contract. They include: the surge in demand in the engineering/project management sector across Australia and internationally • the size, complexity and profile of the project • whether the project is to be delivered on a fast-track schedule • the requirements and approach to allocation of risk of the project Sponsor(s)/Owner's parent company(s) • the requirements of the Lenders where the project is to be financed on a limited or non- recourse basis • the requirements of other stakeholders including governments • the extent of engineering and design already undertaken by the Owner under separate contracts (if any)
Scope of services	The EPCM Contractor's scope of services typically includes: • engineering and design • procurement • construction management and administration • the provision of systems and computer software **Design and Engineering** It is not unusual to have the engineering arrangements split into a number of components. The EPCM Contractor's engagement may start as early as the feasibility stage of the project. That is, it may be engaged to analyse high level technical aspects and prepare a report on the likely timing and cost, proposed procurement arrangements for long-lead items, local project considerations and other aspects of the proposed project (usually on a straight cost- plus basis). Following the feasibility study, the Contractor may be appointed to undertake the Front-End Engineering and Design (FEED) for the project. Broadly, the FEED phase covers the basic engineering and design for the project and also the development of preliminary project schedules, budgets and work packages. This process allows the Owner to go to the market with sufficient scope definition to ensure that it receives bids which are competitive and realistic – ideally on a lump sum basis, although this may only be for the procurement of long-lead critical path items (eg key equipment or foundation work/site and access preparation). As with the feasibility stage, this component usually proceeds on a cost-plus basis. Following the FEED stage, the EPCM Contractor will work the basic engineering and design into the complete detailed engineering package. In many cases, the EPCM Contractor will ultimately be responsible for ensuring that the engineering and design will meet the relevant performance parameters for the project. To this end, it must

Issue	*Comment*
	coordinate these works with the other parties involved to ensure that the engineering and design complies with the overall project specification and other specific requirements of the Owner. As discussed below, the EPCM Contract may also be structured in such a way so as to permit the Owner, in its absolute discretion, to instruct the EPCM Contractor to proceed to the next stage. **Procurement** In addition to undertaking the design and engineering for the project, the EPCM Contractor is usually required to procure, on behalf of the Owner, all of the materials, equipment and construction works Contractors necessary for the proper completion of the project. To this end, the EPCM Contractor is required to establish a system or follow procedures for implementing such procurement arrangements. This may be a significant task if the project is broken down into many components and involves the EPCM Contractor preparing a suite of standard form procurement and construction contracts for the project (in conjunction with the Owner's legal advisors), establishing a tender process suitable for the project and works to be approved by the Owner, responding to tender clarification issues, negotiating the commercial terms of all construction work packages and supply contracts and finalising each of the agreements for execution by the Owner or approved by the Owner for execution by the EPCM Contractor. **Construction Management** Once the works have started, the EPCM Contractor assumes the role of the Owner's "engineer" or "Owner's Representative" under the various work package and supply contracts. It manages and supervises each of these contracts within pre-agreed limits of authority. A key role for the EPCM Contractor is coordinating each of the work packages to ensure that all of the works interface as required and that delays and variation claims are minimised where possible and providing oversight of site safety, industrial relations and work health and safety. Usually the EPCM Contract will set out the limits on the EPCM Contractor's authority. These limitations generally relate to instructing or agreeing variations, settling of claims, waiving any breach or default and certification of final payments. The EPCM contractor is also often responsible for: • Establishing a suitable quality assurance system, and ensuring compliance with all work, health and safety requirements • Managing stakeholder relations, where stakeholders can include lenders, other funders for example the Commonwealth Government, relevant state government departments and agencies, local government authorities, special interest groups, members of the public, landowners • Leading the Project Control Group • Taking an active role in monitoring and reporting during the testing and commissioning phase of the work • Overseeing the notification and rectification arrangements during the defects liability period and deal with any other warranty issues • Taking an active role in the management of claims and disputes from work package and supply contractors. Depending on the scope of the EPCM services which, in some cases, evolves as the project proceeds, the EPCM Contractor is usually required to play an active role in monitoring and reporting during the testing and commissioning phase of the work packages. Further, they are generally required to oversee the notification and rectification arrangements during the defects liability period and deal with any other warranty issues. In certain cases, the EPCM Contractor is required to take an active role with the Owner's legal advisors in the management of claims or disputes with work package contractors. Alternatively, this role may be limited to the provision of advice regarding any disputes that arise during the course of the project. A sophisticated level of coordination of the work and supply packages and technical integration is necessary to ensure that all of the technical, time and commercial interfaces, between the packages themselves and also between existing operations and

Issue	*Comment*
	the packages are seamless in order to manage the impact on existing operations and to avoid adverse quality, time and cost issues for the project. Experienced EPCM contractors bring very significant expertise and experience to this part of the role, with sophisticated scheduling and reporting processes and systems to assist. The more complex the project from a technical, process or interface point of view, the more critical it is for the owner to invest in this kind of systems backed expertise and experience. EPCM Contractors usually do not take responsibility for: • delivery of the project by certain key milestone dates • care and custody of the works (with certain exceptions for arranging security and management of safety etc.) • the project being delivered in accordance with the project budget. These obligations would be included in the construction contracts and supply agreements.
Cost Control	The EPCM Contractor is usually required to prepare a capital cost budget. Once approved, the EPCM becomes responsible for monitoring and managing actual cost against the approved budget, and for providing the owner with regular costs updates. Although the EPCM Contractor does not take the risk of delivering the project on budget, it generally has an obligation to use reasonable endeavours to do so, and is incentivised to manage the budget to ensure there are no project cost overruns through the KPI/incentive regime.
Remuneration	EPCM Contractors are typically remunerated on an cost-reimbursable basis, including the following components: • **Fixed Fee:** Pre-agreed fixed fee or % of the estimated cost for each phase of the project to cover margin and overheads • **Actual Personnel Costs:** Reimbursement for directly and reasonably incurred personnel costs at pre-agreed rates (fixed for the duration of the EPCM Contract where possible), with typical carve-outs for duplication of work undertaken due to defects in the services or otherwise for the EPCM Contractor's default • **Reimbursable Expenses:** Reimbursement for a discrete list of reimbursable expenses, subject to the Owner's approval prior to the expense being incurred (i.e. pre-approved work related travel) The EPCM Contractor may also be entitled to bonuses (or subject to a reduction in payment) under agreed KPI incentive regime.
Bankability	Where the project is to be financed through limited or non-recourse project financing, Lenders will demand certainty in terms of time and cost because their security is heavily reliant on achieving completion and satisfying the appropriate completion tests to be assured of sufficient and timely revenue from the operation phase. In these circumstances, to provide cost certainty for the EPCM Contract, the Owner should consider capping individual incentive arrangements (or the aggregate of all) at a certain % of the fee or the estimated target costs. The Owner should also consider incorporating a guaranteed maximum or "ceiling price" cap on the EPCM Contractor's remuneration (i.e. if the target man-hour budget is exceeded, the payments otherwise due to the EPCM Contractor could be deemed not reimbursable). This could apply to price caps for each phase of the project. Obviously this approach would require a certain level of project definition to enable the development of realistic target man-hour budgets during negotiations with the successful Contractor. However, the extent to which the Owner can impose a cap on the EPCM Contractor's remuneration will depend on market conditions at the time of going to tender. In the current market we are seeing this approach rejected by many Contractors because there are opportunities to procure work on a pure cost reimbursable basis, particularly on projects that are not subject to Lender requirements/restrictions. Also, where the borrower is an entity newly established to deliver, own and operate the project, this usually restricts the use of EPCM Contracting even though the outcome

Issue	Comment
	may be cheaper and faster (with some exceptions where there is government support or very strong owner-Lender relationships or influence). Where EPCM Contracting is used, it is not uncommon for Lenders to require the Sponsor(s) to provide them with a completion guarantee. That is, the Sponsor(s) offers the Lenders some form of parent company guarantee until practical completion/commercial operation or a commitment to cover cost overruns, delay costs and debt service obligations during a period of delay. Such a guarantee could be capped at the total amount of the debt, falling away upon practical completion/commercial operation. Depending on the Lenders, the project and the Owner/EPCM Contractor's track record for delivering similar projects, the completion guarantee may be more limited and step down prior to practical/commercial operation or as various stages of the project are completed. Conversely, they sometimes linger beyond commercial operation to cover market pricing risk depending on the type of project and output.
Novation of existing design	Where a major proportion of the engineering and design for the project has already been undertaken under separate design/consultancy packages let by the Owner (i.e. FEED during the project feasibility phase), the Owner must avoid potential gaps in liability by creating a single point of responsibility for the performance of the design of the project through the novation of the existing design to the EPCM Contractor. The Owner must allow sufficient time in the project schedule for the EPCM Contractor to verify and accept responsibility for the existing design
Optional Phases	In most instances the EPCM Contract should be structured in such a way so as to permit the Owner, in its absolute discretion, to instruct the EPCM Contractor to proceed to the next stage. For example, at the conclusion of the feasibility stage, the Owner can elect to dismiss the EPCM Contractor and engage another Contractor to undertake the FEED services regardless of whether the Contractor has properly performed the services. Similarly, where the project is to be financed through limited or non-recourse project financing, the Owner must be entitled to terminate the EPCM Contractor in its absolute discretion if the Lenders do not give finance approval or the Owners cannot raise the required capital. Terms establishing the process, consequences (including payment on termination outlined above) and risk in the services undertaken during a particular phase will need to be clearly articulated in the EPCM Contract. Also, for certain types of projects (i.e. the construction of a facility such as a power station or a process plant) the EPCM Contract may be structured in such a way so as to have the EPCM Contractor roll into a lump sum EPC after conclusion of the FEED services, therefore taking the turnkey risk on the entire project. This process can provide the Owner with a single point of responsibility for design and construction and greater flexibility but will obviously depend on the needs and other constraints of each particular project, including market considerations. For example, rolling an EPCM into a single EPC is unlikely to be suitable on major projects such as integrated mine, port and rail projects where the size, complexity and varying nature of the project components cannot be delivered in its entirety by one EPC Contractor or without significant risk premiums that increase costs to a level that impact on the overall viability of the project
Insurance	Obviously the whole of project insurance strategy is a critical issue for all projects. It will also impact on the EPCM Contract and extent of insurances to be procured and maintained by the EPCM Contractor. The insurance strategy for the whole of project is a critical matter. It will need to: • Reflect the project elements and delivery model; • Identify the range of insurances needed and what is currently available in the insurance market; • Cost the insurances and determine which party is best placed to take them out, taking into account that under an EPCM delivery model insurances will be

Issue	Comment
	fragmented, for example no one work package contractor will be taking out the 'Works' insurance in the traditional sense; • Manage the risk of insurance duplication and associated cost; and • Avoid any gaps in insurance. The EPCM Contractor is usually required to take out and maintain public liability and professional indemnity insurance. In reality the scope of the professional indemnity insurance may not underwrite all of the contractually assumed liabilities under the EPCM Contract, in particular the EPCM Contractor's indemnities This may or may not influence negotiations of EPCM Contract terms, including liability cap, depending on the EPCM Contractor's capacity to meet its liabilities. The EPCM Contractor 's liability caps are sometimes limited to the amount recoverable under insurance policies maintained by the EPCM Contractor under the contract. If this position applies, it is advisable to check the EPCM Contractor's policy operates on an 'each and every claim basis' rather than an 'in the aggregate basis'.
Liability Caps	In the current market, any sophisticated Contractor will require an overall cap on liability and exclusion of liability for consequential loss. The overall limitation could be managed in a number of ways – for example, the EPCM Contractor's exposure could be limited to: • 100% of any incentive payment or the component of the price representing the Contractor's profit and/or overhead (or part thereof) • A percentage of the contract price – ideally, this would be the higher of the "total estimated contract price" or the actual amount of payments made to the EPCM Contractor (to overcome the issue where the EPCM Contract is terminated for breach in the early stages of the project and payments made to the Contractor are insignificant in comparison to the loss suffered by the Owner) • One of the above together with any amounts recovered or recoverable under relevant insurances • The amount recoverable under the relevant insurance policies maintained by the EPCM contractor under the contract Ordinarily, the maximum liability of the EPCM Contractor is much lower than is usually the case under fixed time and cost arrangements. In the current market, and for similar services, overall caps are reported to be typically in the range of 5% – 20% of the total EPCM remuneration (or, more recently, to the value of the profit and sometimes the overhead component as well). This is in addition to proceeds available from project insurance policies. Obviously it is desirable for the Owner to set the cap at the "high water mark" to satisfy requirements of the Sponsor and Lenders in seeking to minimise gaps in liability and then by transferring liability to Contractors, suppliers and the insurers. These overall caps and exclusion of consequential loss usually do not apply to certain exempt liabilities such as the cost of re-performing defective works, infringement of IP/confidentiality obligations, third party claims, fraud, gross negligence (this is often controversial), wilful misconduct, unlawful acts and liabilities which the EPCM Contractor cannot lawfully contract out of (generally contracts are silent on this – the main one being section 18 of the Australian Consumer Law). Having said that, there may be some significant push back by EPCM Contractors on these carve-outs and even limiting consequences of breach largely to re-performance of defective work (more so in an integrated team environment and after considerable debate over what is, or is not, "defective" work). Recognising the absence of single point responsibility under the EPCM delivery model, the owner needs a coherent approach to determining the liability caps of the range of consultants, the EPCM contractor and the work package and supply contractors, to minimise any gaps in liability. Ideally this approach is based on a consideration of the liability risk profile of each consultant and contractor, but liability caps are very often

Issue	Comment
	driven by what is considered market, the relative bargaining strength of the contractor and the other means by which liability risks are to be managed, for example insurance.
Variations	Owners need to develop mechanisms for determining what amounts to a variation (i.e. a major change to the services not contemplated by the parties) and the corresponding cost consequences (i.e. adjustment to fixed fee and overhead component or payment of direct costs only). This area becomes more important in relation to the achievement of KPIs and whether the target costs and time frames are to be adjusted. Pre-award workshops are often conducted with Contractors to define the limited nature of events giving rise to a variation.
Termination Payments	In the current market, where the EPCM Contract is terminated for the Owner's convenience or default during one of the optional phases, the EPCM Contractor is likely to expect to be paid a portion of loss of profit for the balance of that phase and for its reasonable demobilisation expenses which have not been recovered through payment up to the date of termination. Where this is the case, to the extent possible, it is desirable to have pre-agreed fixed amounts. Where this is not possible, the method of calculation should be clearly defined, including what's in and what's out, particularly in respect any demobilisation entitlement (on other projects we have seen the Owner paying significant sums for staff wages and relocation as part of demobilisation payments). Where the EPCM Contract is terminated for the EPCM Contractor's default any payment should be limited to the services performed up to the date of termination and subject to the Owner's right to set off.
Contractor's Security	At the risk of stating the obvious, given the duration of the EPCM services, the likely low caps on liability and the cost of maintaining the performance security (which will ultimately be borne by the Owner), consideration should be given to the value of the security required, rather than simply allocating an arbitrary X% of the estimated contract price. Other security such as a parent company guarantee or deed of substitution may be more effective.
Project and Services Budgets	The concept of whole of project and/or EPCM services budgets could be incorporated into the EPCM Contract terms to deal with limitations on the cost of certain services or implementation contracts etc. As outlined above, any incentive or KPI arrangement incorporated could be limited where the Owner incurs cost overruns above budgeted amounts of greater than X%.
Contractor's Key Personnel	The traditional provisions regarding personnel (i.e. the EPMC Contractor cannot remove Key Personnel without the Owner's prior approval) may be too inflexible. Given the market squeeze on suitably qualified personnel and resourcing, consideration could be given to alternate arrangements regarding Key Personnel – such as payment of a liquidated amount where senior personnel leave or are taken off the project within a certain period (i.e. within 2 years – we have seen amounts up to USD$300k for the project director). Possible exceptions to such payment could include illness, incapacitation, and resignation or if the personnel are temporarily absent on annual, sick, long service or compassionate leave etc. If liquidated damages are not suitable, Key Personnel turnover could also be a consideration in any KPI incentive payments (as outlined in Table 1).
Project Control Group	Generally the Owner will establish a form of "Project Directorate" or management team (Project Control Group) comprising personnel from the Owner, Sponsor(s) and the EPCM Contractor. Terms must be included dealing with the composition, role and powers of the Project Control Group (and various other administrative matters, such as meeting protocols and reporting). These arrangements could also deal with the Owner's "reserve powers", the flexibility to add other equity participants to the Project Control Group and procedures for determining KPI performance as discussed above.

Issue	Comment
Health and Safety	The Owner must consider that it will have primary responsibility for implementing the workplace, health and safety obligations for the project. We often see the EPCM Contractor (to the extent permitted by law) assuming primary responsibility for implementing the workplace, health and safety obligations for the services and the overall project (including any and all implementation Contractors and the Owner's personnel at the site).
Disputes	Given the likely duration of the EPCM Contract, the size and complexity of the project, the range of work package and supply contracts and the extent of interfaces, it is likely that the project will need a responsive, nimble and flexible approach to the resolution of disputes. This is more likely to be achieved through: • A stepped process, which escalates from project level attempts at resolution through to arbitration or litigation and where nominated participants have delegated authority to settle the matter; • Time-frames which promote prompt resolution during the currency of the project rather than a storing of disputes until completion; • Options to hive off technical disputes to experts; • Use of mediation; • Litigation as a last resort rather than arbitration given the difficulty of joining parties to an arbitration. It is important that the dispute resolution procedure in the EPCM contract and in each work package and supply contract aligns, to the extent reasonably practicable, to avoid the owner facing multiple 'battlefronts' and to improve the likelihood of resolution of the broader issues. From an enforceability perspective, arbitration is preferred if contracting with foreign parties (i.e. to be able to rely on the New York Convention).
Reserve Powers	Terms should be added to clarify the "reserve powers" held by the Owner to manage and direct the project, including approval of systems and procedures governing the project, urgent protection of people and property, issuing bid documents, awarding implementation contracts, approving variations and extensions of time or any event likely to have a major impact on the operation or viability of the project etc.
Intellectual Property	Under an EPCM model the overall intellectual property regime needs to reflect the range of background IP being contributed and the range of project IP being developed at the work package and supply contract level, and the corresponding need for licences and rights to use and develop that IP. The EPCM contractor can play an important role in providing centralised management of the IP regime, including ensuring appropriate IP warranties and indemnities in the work package and supply contracts and that the necessary third party licences are in place.
Lender requirements	Where the project is to be financed through limited or non-recourse project financing, terms must be added to the EPCM Contract regarding the usual Lender requirements (such as step-in rights, cooperation (including providing access to Financiers' engineer), execution of a tripartite deed, the Owner's right to assign its interest in the EPCM Contract etc.)

Appendix B KPIs

Incentive Arrangement	Comment
General	Given the cost reimbursable nature of EPCM Contracts, without KPI incentive mechanisms, it is difficult, if not impossible, to instil the same sense of urgency and efficiency in the EPCM Contractor and its personnel over a long period as compared to a fixed price model. Therefore, the KPIs will be critical in incentivising the EPCM Contractor to perform in a safe, productive, efficient and timely manner in order to ensure the Owner's key commercial objectives for the project are realised – usually time, cost, quality, safety, environment and community or some combination of these. It is critical to the success of the KPI incentive regime that, when formulating the targets and methods of measuring performance, there is sufficient clarity of project scope and the Owner's requirements. Whenever possible, the Owner must allow sufficient time and resources to agree and clearly articulate quantifiable KPI targets and corresponding methods of measuring performance in the EPCM Contract. Obviously, formulating incentive arrangements is problematic where they need to be agreed through the execution phase. This approach is not recommended as the parties often fail to reach agreement, in which case the incentive regime has little or no value. The KPI incentive regime should focus on maximising productivity and timely delivery whilst striking a balance between time and budget, and without sacrificing quality or safety. We have seen very detailed and sophisticated KPI incentive regimes, particularly in an alliancing or relationship contracting context and where project deliverables are to be measured over long time frames. Conversely, some EPCM Contractors prefer to move away from (or limit the extent and impact of) KPI incentive regimes, largely because they believe these arrangements can create uncertainty (and therefore some risks in a rising cost market) and additional friction between the parties, which does not foster a sense of co-operation or trust. Where this is the case, we see Owners often opting for an integrated approach toward administering and managing the project (akin to assuming part of, and sharing, the EPCM responsibilities). In the current market we are also seeing that some EPCM Contractors are unwilling to put a material percentage of their remuneration at risk based on a KPI incentive regime. However, if the KPI incentive regime is structured with proper recognition of the current market conditions and the issues below are addressed then successful outcomes are achievable.
KPI – Cost	The cost incentive arrangements can be structured on a "whole of project basis" or a "phase by phase" basis with an underlying "whole of project" component (which directs the EPCM Contractor to also focus on the integration of the phases into the over-arching project). For the "whole of project" component there needs to be a meaningful target reimbursable cost – something that might not be available with any degree of accuracy at the time the Owner elects to go to the market. The Owner should consider whether it has sufficient detail to develop realistic target man- hour budgets. If the target man-hour budget is exceeded, certain components of the payments otherwise due to the EPCM Contractor could be deemed not reimbursable (unlikely to be acceptable in this market), or there could be some reduction in the incentive payment (likely to be more acceptable). Another alternative is to set a fixed profit and off-site overhead component as part of the EPCM Contractor's remuneration. If the project takes longer than anticipated or more man-hours are required, the profit and overhead component does not change. It diminishes as a percentage of the overall project value (unless there is a very significant/fundamental change in scope).

Incentive Arrangement	*Comment*
KPI – Schedule	The traditional schedule disincentive arrangements of liquidated damages for delays are not generally applicable in the EPCM context. This is because the EPCM Contractor does not have complete control over the delivery of the works and achieving project milestones. On projects where time is of critical importance, the "carrot" rather than the "stick" approach seems more commonly used. This can be done by agreeing fixed bonuses up front (typically where the additional revenue/cost savings to the Owner resulting from early completion can be assessed at the outset), or by including schedule KPIs as part of an overall weighted performance measurement calculation used to determine bonuses or abatements. As noted above, schedule incentive can also be dealt with indirectly, by setting a fixed profit and off-site overhead component (i.e. if the project takes longer than anticipated, the profit and overhead component diminishes as a percentage of the overall project value). Many projects are almost completely "schedule driven." Despite both parties " best efforts, any arrangement that predominantly focuses on time may inevitably create inefficiencies (resulting in increased cost, double handling and/or re-work which ultimately puts pressure on costs and impacts on quality and safety). Therefore, it is important to try, if possible, to ensure that the KPI incentive regime is not solely "schedule" driven to eliminate those inefficiencies. Obviously, too great an emphasis on schedule incentive arrangements can jeopardise or undermine other objectives of the project – i.e. cost, safety, quality, environmental performance, community relations and minimising operational expenditure.
KPI – Performance	There are many other ways in which to incentivise Contractors regarding performance. It is not unusual to see performance incentive arrangements where performance by the EPCM Contractor which: • exceeds pre-agreed fixed targets will lead to better than normal returns for the EPCM Contractor • falls short of the pre-agreed fixed targets will lead to poorer than normal returns for the EPCM Contractor. It is important to set targets that can be effectively measured to collect demonstrable performance information. This is easier said than done and requires specific project management expertise. If this is not possible, or it is difficult, there is a real prospect of dispute and the incentive arrangement will be of little value. Regular meetings of a "Project Control Group" (made up of members from both the Owner and the EPCM Contractor) where performance issues are raised and areas for improvement are identified are important (as are outcomes and objectives reached during any pre-contract workshops to set targets). It is also common to see KPI incentive mechanisms whereby the Contractor's overall bonus (or reduction in fee) is determined using weighted performance measurement across several pre-agreed targets (i.e. time, cost, safety, environment and community). The weightings and formula are agreed and recorded in the EPCM Contract from the outset. The weightings reflect the importance placed on each target in achieving the Owner's commercial and other objectives for the project (it is common to see safety with the greatest weighting). Often it is the role of a Project Control Group to analyse performance against targets and determine the inputs to the formulae used to determine the adjustment to the Contractor's fee (if any). To avoid disputes over performance it is important that the measurement of performance is based on quantifiable targets and not open to subjective interpretation. However, in circumstances where the Project Control Group is unable to reach agreement on performance, the determination is typically made by the Owner's representative or an independent expert (the latter generally considered the fairer

Incentive Arrangement	Comment
	option, while recognising that appointment of the expert will be an additional cost to the parties). Under a weighted performance mechanism, the Contractor may be entitled to a bonus, despite failing to achieve one of the KPI targets. Alternatively, the EPCM Contractor's bonus or the fee payable may be reduced where the EPCM Contractor achieves some but not all of the targets.
KPI – Safety	Generally, KPI arrangements for safety are largely based on the corporate policy of the Owner or the project Sponsor (i.e. zero deaths and/or lost time injuries (LTIs)), many of which are absolute. Other factors that may be relevant include: • compliance with safety management plans, procedures and policies (and diligence in reporting and/or ensuring other parties comply with these) • number of accidents, near misses or project-related injuries • Contractor's management and administration of accidents, near misses and project-related injuries (i.e. reporting, preparation of hazard assessments etc). It is likely that many of the safety incentive arrangements for the EPCM Contract will also take into account the performance of the other Contractors appointed by the Owner on the project. This is typically the case where the Owner wants the EPCM Contractor to drive safety KPIs and culture across the whole project. Also, it is not uncommon to see the achievement of certain safety KPIs as a mandatory requirement to the EPCM Contractor receiving any incentive bonus. In these circumstances, where the Contractor fails to achieve these KPIs, they often forfeit the entire project incentive arrangement (not just for safety) that would have otherwise been available to them. For example where there is a major personal injury suffered by a person involved with the project, which results in permanent disability or death. However, the mandatory requirement to the incentive bonus may not be appropriate in the context of a single or several LTIs, particularly where the EPCM services are to be performed over 1 to 3 years. This is because it is likely that the EPCM Contractor (or one of the Owner's other Contractors) will suffer an LTI at some stage during this period, which would render the whole incentive regime void. Obviously, the Owner should also consider the corporate policy of the Sponsor(s)/Owner's parent company(s) in setting safety KPIs for the EPCM Contract.
KPI – Quality	Quality incentive arrangements are not always afforded a great deal of attention in many KPI arrangements (generally at the expense of time and cost issues). It is important to ensure that the end product is of the specified quality to minimise impact on the long term operational expenditure and profitability of the project. Generally, it will be the EPCM Contractor's responsibility to identify and instruct the Owner's other Contractors when certain performance or quality guarantees are not being met under the various work packages. Factors that may be integral in any assessment of the EPCM Contractor's quality performance include: • instances of defective services, equipment, systems or re-work by the EPCM Contractor • failure to meet the Owner's performance and other design requirements on, and after, commissioning • failure to identify defective work, equipment or plant of other Contractors and suppliers • functionality, throughput, availability and reliability of the supply chain; compliance with quality management plans, including conduct of audits and inspections (and diligence in ensuring other parties comply with these) • failure to meet reporting obligations

Incentive Arrangement	Comment
	• failure to properly administer contracts on behalf of the Owner • poor communications or responsiveness • failure to comply with relevant project approvals, regulations and standards. Back to back obligations would also be included in the implementation phase construction contracts and supply agreements.
KPI – Environmental and Community Impacts	A project's impact on the environment and community are often of key concern to the Owner and other stakeholders. Certain KPIs can encourage the EPCM Contractor to ensure it, and the Owner's other Contractors, diligently comply with their environmental obligations and meet the project's environmental objectives. Factors we have seen that may influence any environmental and community incentives include: • quality and timing of responses to environmental and other complaints from the community and stakeholders • where relevant, management of community (including Indigenous) consultation and education • number of incidents of environmental harm and the timing and quality of the corresponding response to such incidents • compliance with environmental management plans (and diligence in ensuring other parties comply with same) • compliance with the conditions and reporting requirements under any statutory approval • establishment of effective administrative procedures to deal with notifications under any implementation phase construction contract or supply agreement.
KPI – Key Personnel	Given the current pressure in the market on retaining skilled and appropriately experienced personnel, securing and retaining quality personnel for any project will be critical. Retention of sufficient numbers and key personnel has been an issue that commonly arises (especially where the project spans many years) and often results in negative cost and time outcomes due to a lack of resources and continuity of key people. Approaches to key personnel KPIs that may be considered include a reduction in the EPCM Contractor's fee: • for high turnover rate of personnel (outside of pre-agreed parameters) • for replacement of personnel during a "project introduction phase" (based on discounted rates) • for the number of personnel removed as a result of incompetence, negligence etc. The Owner may also consider some form of direct bonus for the retention of individual key personnel over certain timeframes or the life of the project or the reimbursement of recruitment costs. Some EPCM Contracts also include payment of liquidated damages by the EPCM Contractor where senior personnel leave or are taken off the project within a certain period.
Assessment	There are many ways that KPIs can be assessed including: • through the use of a formula or other mutually agreed procedure whereby the Contractor's performance is evaluated against set criteria. This is often a detailed schedule to the EPCM Contract that sets out where the risk and reward lies • through a procedure to be agreed by the parties after the EPCM Contract is signed (although as outlined above we do not recommend that you adopt this approach)

Incentive Arrangement	Comment
	• use of a committee to agree the measurement of KPIs with a dead lock or dispute resolution mechanism. As discussed above, it is important that the assessment of performance is based on quantifiable targets and not open to subjective interpretation
Structure	The Owner should consider how KPIs are going to be structured, such as: • a percentage of the EPCM Contractor's profit • a percentage of other amounts payable under the EPCM Contract (for example, profit and overhead but not direct costs) • a bonus pool or discrete cash amount set up only for the calculation of KPIs and independent of the payment provisions under the EPCM Contract.
Timing	There are a number of alternatives regarding the timing of any incentive payment: • a one off "bullet" payment at the end of the project • payments to be made at the end of each discrete phase with an additional "whole of project" payment or fee reduction made at the end of the project • payments offered on a calendar or financial year basis (to coincide with the Owner's reporting or other project obligations) • certain incentive payments could be contingent upon the happening of a set event (i.e. timely delivery of key materials, return of performance security etc.) • a combination of the above.
Other Considera-tions	The Owner may also want to consider the following: • whether each incentive arrangement (or the aggregate or all) will be capped (for example, at a certain % of the fee or the target costs), particularly where the project is financed through limited or non-recourse project financing because Lenders will demand a great deal of outcome certainty in terms of time. This can be for both individual and overall KPIs • how often the incentive arrangements will be assessed and the relevant processes that must be followed • how often the incentive arrangements will be paid or deducted. This is particularly important as some KPIs can only be assessed after completion of the project • whether the incentive arrangements can be challenged and, if so, how this is done. For example, the parties could agree to establish a Senior Management Group made up of senior executives of the Owner and the EPCM Contractor to review and attempt to agree upon any disputed decisions in relation to incentive payments prior to litigation or arbitration. Alternatively the EPCM Contract could provide for independent determinations of such disputes • whether there is a mechanism to vary any of the incentive arrangements to account for the changing emphasis and priorities of the project and drive preferred Contractor behaviour. Such a mechanism could also be used to address incentive arrangements that are not working as anticipated or those that have become less relevant. It could also address the timing of payment, amount of payment, method of calculation, criteria, addition of other incentive arrangements etc.

Appendix C Comparative delivery models

Introduction

The public sector has a sophisticated assurance framework for the identification, development and implementation of potential projects. This is seen in the Gateway Review Process and the investment lifecycle and high value/high risk guidelines for capital investments with a total estimated investment (TEI) of $10 million or more. Once the concept and feasibility of the potential project has been established government proceeds to a detailed consideration of the business case, including procurement strategy. Specifically, this will include consideration of:

- Project objectives
- Project elements
- Value packaging drivers leading to a packaging solution
- Procurement options for those packages

Appendix C considers a range of procurement options that may be appropriate to the whole of the project or its packages.

Front End Engineering Design (FEED) & EPCM

The FEED is basic engineering which comes after the conceptual design or feasibility study. The FEED design focuses on the technical requirements as well as rough investment cost for the project. The FEED will reflect all of the Owner's specific requirements and avoid significant changes during the delivery phase. It will normally require close communication between the Owner's project team and operation team(s) and the FEED contractor to develop the preliminary project schedules, budgets and work and supply packages.

On mega projects, the FEED process may itself be broken up into separate process design packages with each of these market tested and procured separately.

The advantages of a FEED phase include that it:

- Enables risks to be identified, mitigated and/or properly allocated and priced early, in the initial stages and before finalisation of the full business case to Government, allowing for a number of initial risk uncertainties to be removed so that the parties can agree to a realistic risk adjusted price
- It is flexible enough to start at any point in the design process, prior to concept and feasibility stage or from the point of the state reference design
- Reduces the costs of tendering as only one design process is undertaken
- Costs and documentation are transparent
- Decision-making process in relation to design allows for discussion and deeper understanding of project requirements
- Early incorporation of construction and integration know how, optimising construction efficiencies and improving profitability by reducing operating costs and ensuring a more efficient delivery

The disadvantages of a FEED process are that it requires commitment from the senior management of the Owner, a willingness of the Owner's design team to work with external consultants and sufficient time and cost invested early to realise the benefits of developing design and schedule and cost estimates prior to commencing the delivery phase.

There is a range of options for procurement of the delivery phase that may be available to an Owner at the conclusion of FEED. For example:

- The FEED package is used as the basis for bidding the delivery phase contracts and as the design basis
- The FEED contractor or an alternative contractor is appointed to deliver the project on a traditional lump sum basis
- The FEED contractor or an alternative EPCM contractor is appointed to develop the basic engineering/FEED into a detailed design and then manage on the Owner's behalf the procurement and construction of the works

By utilising EPCM the Owner is able to place more emphasis on risk avoidance by choosing EPCMs with experience and access to proprietary construction management technology.

Early Contractor Involvement (ECI) & Managing Contractor

Under an ECI model, the Owner engages the Contractor early in the project to develop the design to a level where the project can be accurately priced and risk effectively allocated. At the end of the design development, the Contractor can propose an offer for the delivery stage.

Sometimes the ECI can be delivered as a dual ECI which involves a second contractor in the preliminary design process leading to consideration of more perspectives and identification of more risks, resulting in greater innovation and construction efficiencies. The involvement of a second ECI Contractor keeps prices competitive although tends to increase the duration and cost of the preliminary design process and requires additional resourcing from the Owner in running two ECI processes concurrently.

The delivery stage is usually performed under a separate contract either in the Managing Contractor style of procurement described below or design and construct or construct only.

The advantages of an ECI include:

- Early collaboration between Owner's team and ECI Contractor leading to 'best for project approach', innovation and construction efficiencies, and subsequent lower build cost
- Fewer variations and reduced risk of dispute during construction where the ECI Contractor is involved in the design process
- Quicker delivery time
- Better identification of risks during the ECI phase which leads to a more efficient allocation of risks during the delivery phase
- Scope and risk issues are resolved during the design development through collaboration between ECI contractor and the Owner

The disadvantages of an ECI process include:

- Greater resourcing requirements on the Owner's senior personnel in the early design stages and for longer periods of time
- Dual-phase delivery process can be complex as the two contracts (the collaborative ECI agreement and the hard time and money construction contract) are substantially different in nature
- Competitive advantage of the incumbent ECI Contractor during the tender process for a construct only delivery phase, requiring probity management and independent pricing review to ensure value of money

A managing contractor acts as an agent on behalf of the Owner and is paid a fee for doing so. It is often utilised in conjunction with an ECI process. ECI attempts to optimise risk management, risk allocation, price and control for the Owner by exploiting the Contractor's specialist knowledge of construction processes to the benefit of the design process. This is similar to FEED.

The Managing Contractor model can differ as to risk allocation. In some cases risk allocation tends towards fixed time and cost where the Managing Contractor warrants design, provides a guaranteed maximum price (GMP) for the works and may perform some of the construction work itself, such as procuring the development approvals and site investigations. This model is contained in the New South Wales Government Managing Contractor Contract.

In other cases the Managing Contractor provides its services on a best endeavours/good faith/take all possible steps basis, like an EPCM Contractor. This is the model contained in the Department of Defence Managing Contractor Contract (MCC-1 2003).

The benefits which might lead an Owner to use this model include:

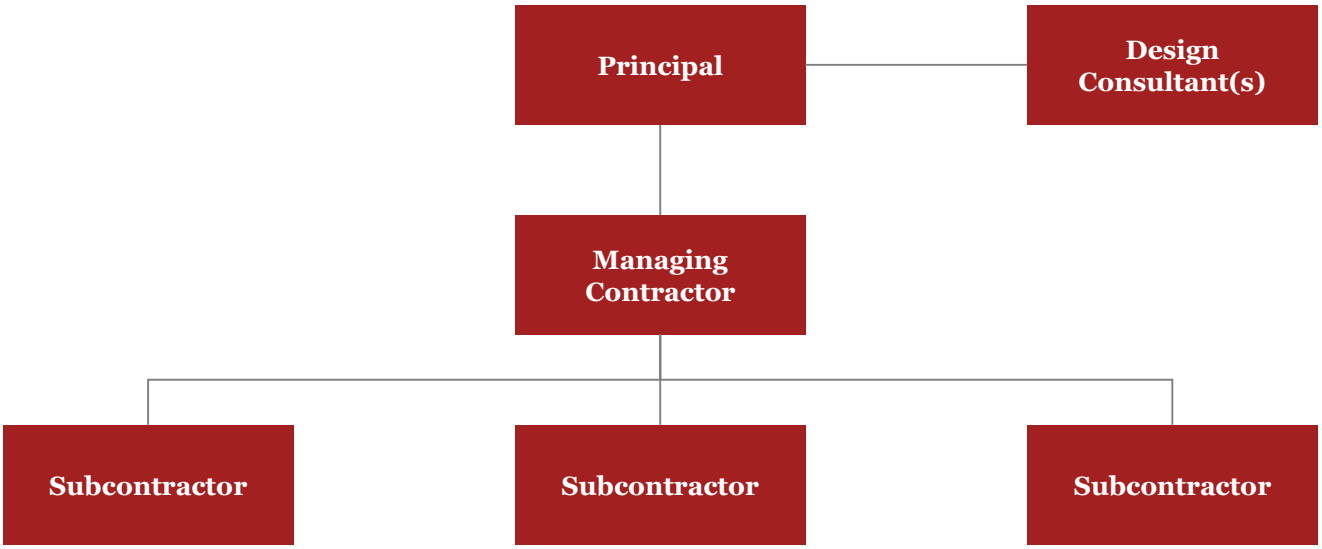
- Typically the planning and delivery stages are split which means the managing contractor has a clear incentive to use the planning stage to come up with the best project solution and maximise its chances of being awarded the delivery phase
- The KPI regime can incentive performance and behaviours
- No fixed time/price tension makes for greater flexibility in ordering variations, which is beneficial for projects where scope of work is harder to define
- It allows the Owner to retain control of the design development stage which means the Owner's current and changing requirements can be accommodated within specific designs rather than a functional specification
- Potential for shorter design and construction program as construction can commence during design development
- Overall program management to reduce the risk of delays
- The Managing Contractor provides expert advice in selecting designers/contractors as well as giving the Owner practical advice throughout the building process
- Allows for early involvement of project participants similar to an ECI process
- Cost sharing benefits can be included to incentivise the Managing Contractor to assist the Principal to meet its commercial objectives
- Reduced demand on the Owner's project management resources

Some of the disadvantages of using this model include:

- More risk to the Owner for cost, time, design and not achieving best value-for-money outcome
- Owner and the Managing Contractor share the risk of time and cost until the end of design development
- Time and cost overruns can be expensive where the design is not fully agreed and documented prior to construction commencement
- Engaging both a Managing Contractor and letting/managing multiple contracts can lead to greater costs from a contract administration perspective
- Increased risk due to the separation of responsibility for design and construction
- Overall design and fit-for-purpose risk lies with the Owner
- The difficulty in setting cost targets with limited design details means the Owner assumes total project cost risk (as there is no head contractor with a lump sum contract price for the project)

Managing Contractor is often used by governments for social infrastructure projects, for example, a Managing Contractor was appointed by the Victorian Government for the Western Women's & Children's Hospital Project. Managing Contractor is also being utilised for the early works packages on the Melbourne Metro Project.

Figure 1: Managing Contractor



Alliancing

Alliancing is a form of relationship contracting characterised by cooperation and collaboration with the Owner and one or more non-owner participations (**NOPs**) (e.g. a design, construction or operator) to share the risks and responsibilities in delivering the construction of a project. Accordingly, each participant in the alliance will share in the success or failure of the project. For this reason KPIs or a painshare/gainshare payment model is frequently included in an alliance contract.

The key features of the alliance and the alliance contract is the integrated project team and a positive culture based on 'no blame' and unanimous decision making that requires all participants to find the 'best for the project' solution. The 'no blame' culture can be eroded by the Owner when it trades one or more of its rights to sue for non-performance for a best-for project commitment from the NOPs and to the alliance governance structure in the alliance contract.

Alliances are utilised by both private and public sectors to deliver a range of infrastructure projects. For example, a project alliance agreement has been used for certain level crossing removals in Victoria. The manner in which this model is used will differ across proponents, however some of the key benefits that might lead an Owner to use an alliance is the ability for an alliance to deal effectively with the following project risks:

- Numerous complex or unpredictable risks with complex interfaces on the project
- Complex stakeholder interfaces
- Very tight timeframes to meet
- A scope which cannot clearly be defined upfront and may change during design and construction
- A need for the Owner's involvement to add value to the project (e.g. in brownfield projects this normally arises from operational risk)

As referred to in other parts of this paper, the benefits might equally be realised under an EPCM model. However the two models differ in the following ways:

- A key advantage of an EPCM is that it gives the Owner significant control over the project
- Whilst an EPCM generally operates on a cost-plus basis, the work package and supply contracts will be fixed time and money arrangements meaning there is generally no or limited incentive regime applying to the entire project

- The Owner enters into contracts with work package and supply contractors and therefore the Owner bears the risks associated with these contracts. However, the Owner also has much greater certainty in the enforceability of these contracts compared to alliances
- Alliances can face difficulties applying traditional insurance policies which is less of an issue under the EPCM model
- Lower risk profile leads to discounted margins applicable to the EPCM Contractor

The disadvantages of using an alliance include:

- Greater resourcing requirements on the Owner to participate in the alliance
- Additional cost and time of establishing the alliance makes this approach unsuitable for smaller projects
- Time-intensive requirements on management personnel from each party to be actively involved in the alliance
- Project financiers are unlikely to be comfortable with the uncapped costs
- The Owner has limited remedies for failure of project to meet performance targets due to nature of alliance and the Contractor generally only puts its profits at risk

Figure 2: Alliancing

Delivery Partner Model

The delivery partner procurement model combines elements of the managing contractor, alliancing and EPCM models. A form of relationship contracting, the delivery partner model enables an Owner to supplement its internal project management capabilities by engaging one or more delivery partners to assist the Owner with project planning, programming, design management and construction management services. It differs from EPCM, in that the delivery partner does not perform any design services. The remuneration package is akin to the remuneration package utilised for an alliance.

The delivery partner procurement model is new to the Australian market but has been utilised to deliver the Woolgoolga to Ballina Pacific Highway Upgrade and W2B project in New South Wales. It is considered a suitable delivery model for time-critical major projects[16]

[16] Hayford, O. (2017) 'Optimising infrastructure delivery with the Delivery Partner Model'

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