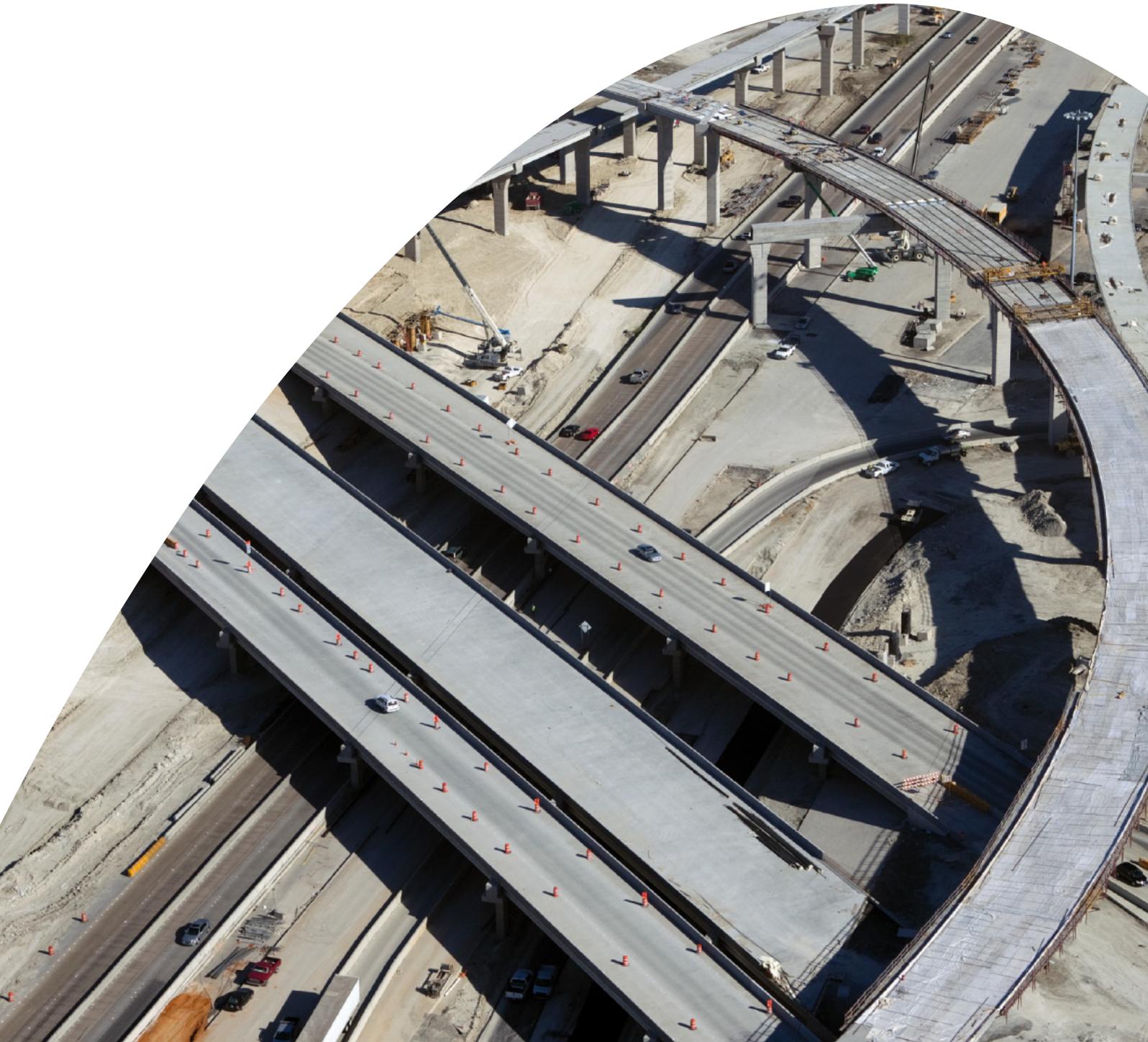




# Innovation in the Supply Chain

Theory and practice of innovation in construction

September 2016



# Acknowledgements

This report has been written by a team from Pinsent Masons, Costain and the University of Cambridge and is based upon our collective experience of working on, advising on and researching projects, together with a literature review, case studies and a number of interviews with clients and noted practitioners.



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# Foreword

We all have a responsibility to encourage and create an environment which nurtures and promotes innovation. An industry that innovates is respected, profitable, internationally competitive and undoubtedly delivers better outcomes for the customer.

The infrastructure sector is a key enabler in driving growth and allowing other industries to innovate. It is imperative therefore that the infrastructure sector succeeds and displays the characteristics necessary for successful innovation. The critical role of infrastructure is best expressed via its benefit to society, allowing communities to connect and economies to thrive. Without a high performing transport network that is integrated and connected, a constant supply of dynamic energy that is sustainable and secure and a water network that is resilient and responsive to environmental pressures, it is clear that the UK will not prosper on the global stage when competing for investment, business and talent.

It is for this reason that we must transform our infrastructure sector to become world leading in innovation, delivering world class assets and advancing research and development. This will require changes in contractual practice to drive the right commercial behaviours.

The purpose of this report is to outline what the industry has done to start on this journey and what the immediate priorities are which the industry must address to become proficient at implementing and accelerating innovation.

Contractual environments and structures can act as both an enabler and a blocker of innovation in all of its forms. Construction engineering clients and major engineering solutions providers are moving toward a contractual environment that encourages innovation in recognition that value will be created via the use of talented people and the availability of new ideas rather than the traditional price driven approach. The report presents useful recommendations that deserve an industry focus, but as separate organisations and indeed individuals, all can take something away and make a difference.

There has never been a more pressing time to innovate and I would encourage the industry to help alter perceptions through the actions we take in accelerating our journey.



**John Pelton MBE**  
September 2016

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# Introduction

The engineering and construction industry in the UK has made significant progress in embracing new forms of procurement, focusing on collaboration and seeking to create an environment where all parties' interests are aligned. This was the result of an acceptance that the industry had to evolve and develop in order to deliver the more efficient construction that the economy requires, as well as putting in place the infrastructure that will drive the UK's economy. Innovation is central to that but it seems clear that there is still much more that can be done.

There are leading examples of projects that have set the benchmark for innovation such as Crossrail, but at the same time it is necessary to address the underwhelming levels of R&D (Research & Development) and innovation more widely within the industry. There are a variety of factors which contribute to this, including the absence of a reference to innovation within contractual frameworks. Experience also shows that contract durations are increasing in length and a number of clients are moving away from some of the more traditional contracting methods, favouring more collaborative methods such as frameworks and alliances. This is especially the case for the mega-projects that are currently providing the continuity to sustain the industry. It is also the case that main contractors are evolving their business models where in some situations specialist sub-contractors and suppliers have a significant role in achieving innovations in the final product.

It is anticipated that collaborative contract structures will gain momentum within the industry as supply chains rationalise to increase productivity and many firms, clients and contractors alike, will regard innovation as unduly costly and risky. Procurement processes and standard form contracts need to address these concerns.

Our research investigation has therefore sought to identify how innovation is currently dealt with by the industry, especially within the current legal and contractual frameworks. The aim was to test how the industry would respond to a move towards a more collaborative contracting environment to deliver better outcomes and whether, and to what extent, this can be a driver to innovation. The research was carried out through a mix of workshops, interviews and a questionnaire, involving industry practitioners throughout the supply chain from clients and their advisers to contractors and small technology businesses involved in the industry as well as academics. We have then built on the findings of the empirical research to put forward a number of proposals and recommendations which in our view would assist in promoting innovation throughout asset creation, from delivery to decommissioning, both by creating an environment that encourages innovation and through specific contractual provisions.

This report brings together expertise from Costain, Pinsent Masons LLP and the University of Cambridge. We believe that this has provided us with an opportunity to combine different perspectives and prepare a report that will address a variety of audiences, from academics to industry practitioners. We hope that this approach is of benefit and we recognise that while some of the findings will be regarded as self-evident to some readers, others who are less familiar with the construction industry would benefit from such an approach. Regardless of your starting point we hope you will become a better innovator, to grow and develop a business that will continue to provide sustainable solutions to your customers. Indeed, it is hoped that this report will prove to be of interest beyond the construction industry and demonstrate we are an industry that is transforming.

Overall, this report is intended to assist anyone within the industry who is looking to unlock the innovation within supply chains. There are no complete definitive answers, but the research undertaken and the recommendations made should provide a useful starting point for further development of routes to encouraging innovation.

We would like to express our thanks to all those who have taken time to assist us with this project. They are too many to be named but their contribution was invaluable. This study would not have been possible without the investment from Innovate UK and the Engineering and Physical Sciences Research Council investment. The views expressed in the report are however our own views.

# Executive Summary

This research project has set out to investigate the extent to which the need for innovation is recognised and encouraged by the industry in general and in current contractual frameworks. Based on that research we have set out various proposals which we hope will be useful and lead to further discussions. A summary of our findings and proposals is set out below.

To start with, it is clear that the industry recognises the need for innovation. This is evident from the use of early contractor involvement at the Bank Station Upgrade project and the Innovation 18 platform created at Crossrail. In addition, there is an increasing use of collaborative contracts which seek to align interests by using target cost mechanisms and encouraging value engineering, so that all parties benefit from innovation and resulting savings.

It is also the case that more can and should be done. The empirical research, based on interviews, workshops and questionnaires, has shown that the supply chain still sees a value in clear contracts that create certainty and is wary of looser arrangements where there is less clarity on how the risks and costs of innovation, as well as the gains, are to be shared. At the same time, parties also seek flexibility and while that may be seen as going against certainty, that is what innovation requires. In addition, there is still a lack of trust and a suspicion that collaboration is being used to reduce costs as opposed to the wider potential benefits collaboration can generate.

On that basis, we propose that steps be taken at two levels. To start with, there can be further recognition and encouragement of innovation within the construction industry. This can be done by implementing the following measures:

- **Industry Innovation Platform**, to allow clients to find ways to work together and develop innovation programmes that allow the industry to collaborate and drive long term innovation and investment that benefits outcomes across the industry.
- **Innovation Maturity Framework**, creating a performance assessment framework for innovation to assess capability and skills within organisations from clients to supply chain partners. Understanding maturity for innovation implementation would allow for a large uplift in innovation capability across the industry.
- **Social Benefit Recognition**, highlighting the social benefit that the construction industry provides and creating a tool which provides a social benefit calculation and generates a fixed score.
- **Aligning Research with Major Projects**, so that major projects in the early phases of project development have specific research programmes to assist the advancement of key challenge areas that will advance the industry and deliver an improved solution.
- **Strong Leadership**, showing a willingness to share cost and risk in addition to engaging in and encouraging early innovation, so that clients can act as the catalyst for bringing the changes which are required to enable not just innovation but open innovation.
- **Innovation Champions**, ensuring all innovation is captured, delivered via the appropriate channels to those with authority for implementation and also facilitating communication across the business. Assisting with the development of strong proposals and connecting people both internal and external of the business, to accelerate innovation to market.
- **Training**, every person has the ability to innovate however not all possess the management and commercial qualities which are required when an innovation begins to grow and succeed. It is imperative that innovators are given the training and support which they require to ensure that promising opportunities are not wasted.
- **Broadening Job Descriptions**, innovation is the responsibility of all. While dedicated innovation managers and innovation champions are encouraged it is for all employees to engage in fostering a culture of innovation and bringing that innovation to market.

In addition to the above, contracts should include additional provisions that will encourage innovation and confirm the client's commitment to innovation, while delivering the commercial certainty that is needed to create confidence.

We propose that such clauses allow for flexibility and that parties are encouraged to recognise the costs and risks of innovation, which are to be shared, as well as the gains. Alternatively, a non binding protocol may also be used to set out the underlying principles to govern innovation, but it would still be necessary to provide certainty as to how innovation is implemented within the contractual structure.

# Background to Industry past and present practice

*'There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new order of things... whenever his enemies have the ability to attack the innovation they do so with the passion of partisans, while the others defend him sluggishly, so that the innovator and his party alike are vulnerable.'*

**Niccolò Machiavelli, The Prince (1513)**

The research project grew out of a frustration which surrounds the difficulty involved in introducing innovation within a construction project, a problem we still experience in practice today. National infrastructure projects are becoming ever larger and the number of mega-projects is undoubtedly increasing, from Heathrow Terminal 5 and the London Olympics, to Crossrail and on to High Speed Two, Crossrail Two, Thames Tideway Tunnels and Hinkley Point C, projects are increasing in size, scope and duration.

Over the past decade, the UK has transformed the way mega-projects are delivered, moving away from a world of fixed-price contracts, risk transfer, lowest-cost tendering and adversarial relationships. While this is encouraging, it is hoped that mega-projects can act as a catalyst for greater change in this regard as these projects offer huge potential for innovation.

Much of the ubiquitous infrastructure which surrounds us today was constructed in the Victorian era. Projects such as Crossrail, Thames Tideway and HS2 will meet the UK national infrastructure needs, not just for ourselves but future generations too. It makes sense therefore to integrate research and development with these great mega-projects. As we know well from our Victorian infrastructure, it is difficult to retrospectively fit new technologies whereas an environment in which research and development is aligned with mega-projects in the infrastructure pipeline would see a situation where assets are built to a standard which is at the peak of technological ability.

Undoubtedly there will always be technological evolution and it is not possible to envisage all future developments. However, much can be done to improve the current ad-hoc methodology which sees a disconnect between these mega-projects and the research and development which could benefit these projects. Too often have we heard the words 'what a brilliant idea, if only we'd have known about it earlier in the process.'

Among other things, this report aims to challenge this disconnect. The industry has long recognised the benefit of planning, Early Contractor Involvement (ECI) and BIM. It is generally acknowledged that the more work which can be done upfront, the more successful the project. UK Government, one of the largest construction clients, has done much to improve visibility of the construction pipeline, the National Infrastructure Plan acting as the cornerstone of this movement toward transparency and clarity in infrastructure spending, providing confidence and allowing the industry to invest.

The UK construction industry is of vast economic importance; accounting for approximately 6.5% GDP and employing in excess of two million people<sup>1</sup>. It is therefore of paramount importance that the industry prospers and remains competitive. Globally and domestically however, the industry is lagging.

The construction industry has long been plagued by its characteristics. These include high fragmentation, low margins, adversarial relationships and mistrust. As a result of this, the industry has appeared reluctant to encourage and pursue innovation and procurement processes rarely seek to incentivise R&D and innovation. The result of this is that while numerous industries invest 5% and greater of their revenue into R&D, the figure is a mere 0.5% for the UK construction industry.<sup>2</sup>

The issue of fragmentation is far from new and was recognised as early as the Banwell Report in 1964 which stated:

*"We consider that the most urgent problem which confronts the industry is the necessity of thinking and acting as a whole. It has come to regard itself as a series of different parts, roughly consisting of specialist advisers, contractors and suppliers and operatives of various crafts and skills... these attitudes must change"*<sup>3</sup>

**Banwell Report 1964**

It is disappointing that despite pockets of supply chain consolidation and collaboration, this is largely still true today. The industry requires radical collaborative change to address this as collaborative relationships are key to innovation. As construction projects become ever larger and ever more complex, supply chains must adapt to become more efficient and overcome new challenges. For this to occur, supply chains must consolidate. The authors envisage that this consolidation and creation of strong business partnerships will see increased power in the hands of the sub-contractors and suppliers who are able to consistently innovate, while delivering safety and high quality.

There is a consensus across the industry that early supplier engagement is advantageous, and that innovation begins with engaging the supply chain. However, client behaviour at the procurement stage needs to encourage and when necessary reward the early formulation of ideas which are capable of winning bids.

<sup>1</sup> House of Lords Library; Construction Industry: statistics and policy; October 06, 2015

<sup>2</sup> OECD R&D expenditure in industry database

<sup>3</sup> Banwell Report 'The Placing and Management of Contracts for Building and Civil Engineering Work' 1964

# Innovation under current forms of contract

## Traditional procurement models

Innovation in one form or another has always existed and it is therefore worth considering how it is dealt with under traditional forms of procurement. In broad terms, contracts were, and still are, usually procured as a lump sum fixed fee contract with some sectors preferring the use of measurements contracts or cost reimbursable contracts.

Under a common fixed price lump sum contract, the contractor receives in full the benefit of any savings which reduce its cost as against the contract price. The contractor is therefore motivated to innovate to the extent that such innovation will reduce its costs, but there is no reason to explore innovation that may assist the employer e.g. by providing long term benefits. For the same reason, the employer has no interest in innovation by the contractor which simply reduces the construction costs and indeed he may be wary of such innovation and may seek to prevent it from happening if there is any risk involved. If the contractor wishes to propose an innovation which results in a cost increase or a risk, but provides a long term benefit, that will normally be the subject of separate negotiations as the contractor will seek an instruction treating it as a change and identifying the cost and time consequences. In other words, there is no incentive for the contractor and employer to cooperate in identifying innovation.

In addition, fixed price lump sum contracts may be less suitable for the delivery of innovation, if they are based on a well developed design, which has been completed and forms the basis for the fixed price. As noted in the IChemE Lump Sum Contract Red Book 2013, 5th Edition Guidance, at p 79, this leaves little scope and margin for innovation as *“This is because when the contractor is limited by a lump sum contract he will be reluctant, or may simply not be able, to explore all the possibilities of optimisation or innovation of design”*.

Under a design & build contract the contractor usually takes over a preliminary design prepared for the employer which the contractor is to develop in order to achieve the final design. This therefore allows the contractor to undertake the design and therefore scope for innovation. In terms of the commercial position however, the payment basis is normally fixed price lump sum and the same issues discussed above come up. From an employer's perspective, under a design & build contract the contractor will be incentivised to innovate if at all for largely its own benefit, which may end up having an impact on the quality of the final build. Indeed, there is often a tension between the novated designers and the contractor, since the contractor will often seek ways to reduce the build cost while the designers will wish to maintain the original design and

will be less concerned about cost or buildability. Employers are also usually reluctant to lose control and will often provide very detailed employer's requirements or become involved in the design development process, which reduces the scope for innovation.

For civil works projects, a common form of procurement has traditionally been the measurement contract. Under measurement contracts, payment depends on the amount of work actually carried out based on agreed rates. As with lump sum contracts, the contractor may seek innovation which reduces its costs and does not affect the agreed rates, but may be reluctant to suggest innovation which reduces the work done and therefore the overall payment. In addition, the nature of such contracts, used for repetitive fixed tasks such as excavation, also means there is less scope for innovation and no real incentive for the employer to explore such opportunities.

The position is similar with cost reimbursable contracts, which are used when the scope of work is too uncertain to be defined and there is a need to start with the works. The price will usually be based on rates agreed in advance and while the contractor may wish to reduce its own costs, it will be less interested in reducing the scope of work. While the unfixed scope of such works may make such a contract suitable for exploring innovation, in practice the focus tends to be on carrying out the works and employers are keen to ensure that contractors do not take advantage of such contracts by undertaking unnecessary work. There is no common incentive to innovate and such contracts are therefore not regarded as promoting innovation.

Overall, under traditional procurement models, it will be unusual for the contractor's and employer's interests to be aligned with regard to innovation. The exception is the growing use of target cost contracts dealt with below.

## Standard forms of contract

Almost all construction work is carried out under one of the standard forms of contract created by the industry, albeit often subject to amendments. Innovation is not addressed in such forms, but they deal, in varying degrees, with the potential for introducing innovation and the commercial implications of innovation.

The NEC3 form is the common form used for large infrastructure works. There is no specific reference to innovation or value engineering within NEC3 standard forms and the contract provides payment options which largely reflect the models set out above, e.g. fixed price lump sum. Certain aspects of the NEC form of contract can promote innovation, such as the emphasis on communications, working together to reduce risks and optional clauses such as X6 – Bonus for early Completion, X12 – Partnering and X20 – Key Performance Indicators. In addition, as noted below, in 2015, NEC introduced an additional clause to be used with the NEC3 Engineering and Construction Contract, which allows the contractor to be appointed under a two-stage ECC contract, so the contractor can help develop the design and share any savings, creating an incentive for a cost-effective design.

In terms of promoting innovation through the alignment of commercial interests, this is best done under the main payment options C and D, which create a target cost mechanism. This is because the contractor and employer will share the benefits of any savings through innovation. This is however limited to savings during the life of the project so there is no incentive to innovate when the savings are realised after completion over the life of the completed project. The costs of investigating and implementing innovation are however shared, because under such contracts the contractor is paid its defined costs in full but any costs above the target are shared by the parties. Similarly, if the innovation has been unsuccessful and resulted in the need for remedial works, this would normally be a shared risk as a result of the cost target mechanism, albeit employers may seek to disallow such costs in certain circumstances.

For such mechanism to be effective, it is important to set the target at a realistic level so that there is a genuine opportunity to achieve savings and to ensure that the employer shares any gains on an equal basis. A target cost contract will not achieve a genuine alignment of interests if the target has been set at a very low level as a result of pressure to reduce costs. Similarly, if any gains are not shared on an equal basis, as sometimes happens, the contractor will be less motivated to introduce innovation.

Internationally, the most common forms of contract used are the suite of contracts published by the International Federation of Consulting Engineers (commonly known as FIDIC, based on the acronym for its French name *Fédération Internationale Des Ingénieurs-Conseils*). There are different versions of the FIDIC form of contract, including a measurement version (the Red Book) and a plant design and build version (the Yellow Book). Like other standard forms, it is common for employers to amend the form to reflect specific requirements, local law issues and a different allocation of risk.

Under the FIDIC Red Book form, there is a value engineering provision which allows the contractor to submit written approvals to accelerate completion, reduce the cost to the employer of executing, maintaining or operating the works or improve the efficiency or value to the employer of the completed works, or otherwise be of benefit to the employer. This is therefore defined in wide terms and includes any benefit for the employer. Where there is such a proposal then that is approved through the variation procedure and if the approved proposal includes a change in the design of the Permanent Works, then the contractor takes risk of design of that part.

Under the Red Book version, the contractor is incentivised to make such proposals because a fee is payable where the change results in a reduction in the contract value. The fee is fixed in the standard form at 50% of the difference between the reduction in contract value resulting in the change and the reduction in the value to the employer of the varied works taking account of any reductions in quality, anticipated life or operational efficiencies. If the reduction in contract value is lower than the reduction in the value to the employer of the varied works, the contractor is not entitled to the fee.

This provision therefore acts as an incentive on the contractor to innovate, but it is very much focused on reducing the costs of the works as the basis for the incentive, albeit the scope for proposals under this provision is drafted in wider terms.

The Institution of Chemical Engineers (IChemE) also publishes a suite of contracts which is used in the UK and internationally, mainly for process plants. The IChemE lump sum form enables the contractor to propose a variation through the Contractor Variation procedure. Whilst the contractor can propose a variation under this procedure, the onus is on the contractor to convince the project manager of the viability of the proposed variation and its benefits to the project, since the project manager's decision to reject a variation is not open to review unless it concerns the rectification of a defect or a hazard.

If the contractor makes an initial proposal, which the project manager is willing for the contractor to develop, the contractor is entitled to the cost of developing the proposal. If a variation is accepted, it is processed and paid out through the valuation of variations procedure.

Under the IChemE Target Cost Contract (Burgundy Book) the process for variations proposed by the contractor is similar to that under the IChemE Red Book. However, the key difference is that the Cost incurred in carrying out the variation shall form part of the Actual Cost which in the Target Cost Contract is then subject to the pain-gain share, in a similar manner to the way the NEC target cost contract operates.

The Infrastructure Conditions of Contract (published by the Association for Consultancy and Engineering and the Civil Engineering Contractors Association) also include a target cost version that, like the NEC and IChemE versions, creates a mechanism where parties share savings and are therefore incentivised to cooperate in finding innovative solutions. In addition, the target cost contract (unlike other versions of the Infrastructure Conditions of Contract) includes a value engineering clause which requires the contractor to liaise with the Engineer to identify, explore and propose value engineering initiatives that may provide overall cost savings in carrying out the works. Such cost savings do not result in the target being adjusted, which means the parties share the savings.

The guidance notes to the ICC target cost version point out that this is meant as an incentive to stimulate the tabling of cost saving opportunities. Helpfully, the notes point out that it is essential that proper processes are established to log and assess proposals in a structured and timely manner, recording the benefits, direct or indirect costs, impact of design changes on the overall project and the total effect of every opportunity. While the guidance notes are not part of the contract, they highlight the need to have a full understanding of any proposals in the wider context of the project as opposed to focusing on just the immediate cost savings.

PPC 2000, a standard form of contract for project partnering, published by the Association of Consultant Architects, also includes a target cost mechanism. In addition, it sets out express objectives, which include under clause 4.1 (iii) *“innovation, improved efficiency, cost-effectiveness, lean production and improved Sustainability”*. This identifies innovation as an objective but there is no further mechanism which deals with how innovation proposals are made and whether there are specific implications on payment.

Where a standard form of contract does not contain any provisions relating to value engineering or when parties use bespoke forms of contract, it is common to see bespoke provisions which create value engineering proposals. A typical example for an NEC contract reads as follows:

*“The contractor may propose to the project manager that the works information provided by the employer should be changed so as to result in a reduction to the forecast defined cost and/or result in a saving in the time required to provide the works.*

*In such an event the contractor submits details of the proposals to the project manager. The project manager shall provide details of any employer costs as a result of the proposal.*

*If the project manager accepts the proposal, he issues an instruction changing the works information.”*

Such clauses can encourage innovation but their aim is to reduce costs, as opposed to encouraging innovation in its wider sense. There are also bespoke clauses which seek to recognise the value of a contractor’s input into the employer’s design. Such clauses will require a contractor to provide a design coordinator who will be involved in the employer’s development of the design, so that the contractor can comment on the design using its knowledge and experience with the aim of improving the buildability of the works.

### **Early Contractor Involvement**

The potential for innovation is of course greater at the early stages, before the design and the commercial terms are fixed. It is therefore important to look at opportunities at an early stage as part of the overall procurement process and, where possible, involve the supply chain as early as possible too. That is the background to the use of Early Contractor Involvement as part of the procurement process.

Under such a procurement method, the contractor would normally be appointed under a contract to produce a design for the works, providing the contractor with the opportunity to use its skill to ensure that the design is buildable and efficient. The contractor will then be invited to submit a bid for the construction phase of the works, but as he will be familiar with the works, such a bid is more likely to reflect the true cost of the works and have less of a need to include allowances for unlikely risks. Alternatively, the employer can seek proposals from contractors as part of the tender process.

The benefits of Early Contractor Involvement were investigated in “Project Procurement and Delivery Guidance Using Two Stage Open Book and Supply Chain Collaboration” published by King’s College London, Centre for Construction Law and Dispute Resolution in 2014. This was a study of the outcomes of UK Government Trial Projects seeking to determine whether the procurement and delivery models known as Two Stage Open Book and Supply Chain collaboration generate cost savings and other improved value. The guidance seeks to assist parties who want to engage in open book two stage procurement based on collaboration, having concluded that this can have a significant, positive impact on project costs and other outcomes if led by a client committed to creating an integrated team and if supported by clear contractual processes for the early conditional appointment of main contractors and their supply chain. The Bank station case study is set out below.

In 2015, NEC introduced an additional clause to be used with the NEC3 Engineering and Construction Contract, which allows the contractor to be appointed under a two-stage ECC contract before details of what is to be constructed have been fully developed and priced. The aim is to allow the contractor to take part in the design development and construction planning stage of a project, to improve team working, innovation and planning. The clause provides a choice between the employer engaging the contractor to assist the employer’s consultant in designing the project or appointing the contractor to carry out the design with assistance from the employer’s consultant. Using either approach, the contractor can also be incentivised to provide a cost-effective design by sharing in the resulting savings.

### **Alliancing and collaborative contracts**

In 1994 Sir Michael Latham called on the industry to improve its conduct and to work more collaboratively (Sir Michael Latham, “Constructing the Team”, July 1994) and the same points were made in subsequent reports such as Rethinking Construction (Sir John Egan, “Rethinking Construction”, 1998) and Never Waste a Good Crisis (Andrew Wolstenholme, “Never Waste a Good Crisis”, Constructing Excellence 2009) and more efforts have been made by the government in recent years to implement such approaches.

In addition, the Government’s Procurement/Lean Client Task Group has set out its preference for collaborative contracts by identifying NEC, PPC2000 and the JCT’s Constructing Excellence as the basis for trials seeking to achieve better delivery (“Final Report to Government” by the Procurement/Lean Client Task Group, July 2012). This is reflected in the growing focus on and use of alliancing contracts for major projects.

Network Rail has been a public advocate of alliancing contracts and other major projects such as the Thames Tideway Tunnel are exploring the use of alliancing contracts. The Highways Maintenance Efficiency Programme has created The Local Highway

Authorities Collaborative Alliance Toolkit, a suite of documents based on collaboration, including an NEC based form of contract. The Government's Infrastructure Routemap proposed the use of alliancing contracts based on NEC ("Infrastructure Procurement routemap: a guide to improving delivery capability", HM Treasury and Infrastructure UK, January 2013).

In 2014, the Infrastructure Client Group, a collaboration between government, industry and academia produced "Improving Infrastructure Delivery: Alliancing Best Practice in Infrastructure Delivery", highlighting areas in which alliancing can potentially add value and identifying what makes a successful alliance, seeking to support any projects which are looking to use alliancing models. This was followed in 2015 by the publication of the "The Alliancing Code of Practice for Infrastructure Alliancing" providing further support to alliancing projects, focusing on four key themes identified for successful alliancing (Behaviour, Integration, Leadership, and Commercial) as well as an excel-based self-assessment tool, to identify areas that need improvement when conducting an Alliance, either before or during the Alliance.

In 2016, the Framework Alliancing Contract (FAC-1) was published by the Association of Consulting Architects. It is the first standard form of Framework Alliance Contract and it provides a multi-party over-arching agreement which will cover the relationships between the parties and set up processes in a way that does not exist under current construction contracts. It can be used with any form of construction contract as the underlying contract and it includes provisions for an alliance manager who will integrate the alliance, monitor performance and support joint activities and a core group to review new proposals and agree on dispute resolution. There are also provisions for a shared over-arching brief among all alliance members, with separate confidential agreements of each alliance member's prices and proposals and it enables additional alliance members to be brought in under a standard form joining agreement.

More specifically, the form provides for the parties to set out their objectives and include success measures and targets, as well as incentives. There are also provisions which deal with supply chain collaboration, which is to be used to achieve the agreed objectives and improved value. Improved Value is defined to include improved cost and/or time certainty, cost and/or time savings, improved quality, improved operation, improved staff and other resources, improved health and safety and other resources, and improved sustainability and efficiency.

For large projects, therefore, alliancing is an option that is supported by the government and is already being used, whether under bespoke forms of contract or with the new FAC-1. Alliancing arrangements represent opportunities for innovation, due to their large scale and the collaboration required of the supply chain at main contractor level and lower down the chain.

## Barriers to innovation

There appears to be a perception that there are certain legal hurdles that act as barriers to innovation, and the need to regulate IP rights or the effect of procurement regulation have been highlighted as such barriers. A closer examination shows that such perceived barriers do not in fact prevent innovation.

### Intellectual property

When innovation is successful, a question may arise as to who owns that innovation or the ideas behind it. The need for certainty and to protect intellectual property is sometimes cited as a barrier to innovation, as parties may be concerned that they will not benefit from the ideas they generate.

In order to understand whether this is a valid concern, it is necessary to review the types of intellectual property relevant to construction and how they are protected. This in the context of innovation occurring on site (or, in the case of software, in parallel to on site works) rather than considering research and development taking place at head offices, in laboratories or through academic links.

In that regard, there are several mechanisms for protecting intellectual property and the key routes relating to construction are patents and registered designs. Copyright may have a role to play when it comes to software and unregistered designs may provide some degree of protection in the event that a registered design has not been obtained. Trade marks and branding may also provide assistance after innovation has taken place, albeit indirectly. In addition, confidentiality regimes and non-disclosure agreements may also have a role in enabling protection whilst encouraging innovation.

- **Patents.** Patents provide protection over 20 years for inventions with industrial application as long as they are both new and involve an inventive step. Innovation in the field of construction would tend to qualify as industrial application and the degree of protection will focus on the novelty or inventiveness of the invention. Inventions do not, however, include business methods or computer programs, and it may therefore be harder to protect a new way of sequencing activities on site as compared with a novel method for laying screed. In general, a patent will be granted to the inventors albeit ownership can be assigned and there can be multiple owners (i.e. both the contractor and the developer could be named owners). It is also important to apply for protection if the parties consider they have come up with a new invention.

- **Designs.** A design can be registered, to protect the appearance of the whole or part of a product including its shape and ornamentation, if it is new and has individual character. It is not possible to register the features required to connect two articles to enable them to function and a purely functional design cannot be registered. In order to register a design a series of simple forms needs to be completed and filed, either at the United Kingdom Intellectual Property Office or at the European Union Intellectual Property Office. Even if a design is unregistered, it may still benefit from protection as a United Kingdom unregistered design or an unregistered Community design.
- **Copyright.** Copyright can also provide protection for plans, drawings and designs for construction projects (as well as works of architecture and models prepared for a project), if the work is original and it is the expression of the idea rather than the underlying idea itself that is protected. With technology becoming a common feature of construction, it is necessary to recognise that while it may be hard to obtain patent protection for computer programs, copyright protection can offer an alternative route to protection, as a literary work.
- **Trade marks.** Another form of protection is the use of trade marks. If an innovative party can develop a brand and intrinsically intermesh that brand with an innovation, it may be able to prevent others from using the innovation. This is not, however, a direct mechanism for protecting innovation, since a third party may be able to imitate the innovation under a different brand and avoid infringing the trade mark. Once registered, trade mark protection is indefinite, as long as the trade mark is used and the relevant renewal fees are paid. Registering a trade mark requires a simple online form to be completed.
- **Confidential information/trade secrets.** A party can also protect its ideas by imposing a duty of confidentiality. By requiring those involved in an innovative project to keep the details of the innovation secret, a party can obtain protection for the innovation even where it is not possible to obtain a patent, register a design or make use of copyright protection. Contractual obligations to maintain confidence can therefore be used to allow an innovative party to protect its ideas even if they cannot be protected under the usual routes described above.

### Protecting intellectual property rights

As demonstrated above, there are various ways in which parties can protect their innovative ideas and the value they generate. Parties should however consider these issues in advance, in order to identify whether a specific agreement needs to be put in place, for example during a tender period, or whether the standard clauses used in the standard forms actually reflect the parties' intention. In particular, an issue may arise as to whether the

employer owns the rights in innovative ideas generated by the supply chain.

Under the NEC3 form, for example, there is a statement that the employer may use and copy the contractor's design for any purpose connected with construction, use, alteration or demolition of the works unless otherwise stated in the Works Information and for other purposes as stated in the Works Information. The parties are therefore expected to consider this issue and address it in the Works Information.

Other forms of contract tend to contain more detailed provisions. Under the FIDIC form of contract (Red Book version) the contractor retains the intellectual property and other rights in his contract documents and the designs that he produces, but is deemed to give a non-terminable, transferable non exclusive royalty free license to use the Contractor's Documents. The ICC form of contract has a provision dealing with copyright, which states that copyright in the employer's documents remains with the employer and copyright in the contractor's documents remains with the contractor, but both parties can make further copies as needed for the works.

In projects which seek to promote and generate innovation, especially where an employer wishes to use innovative ideas across the project with different suppliers, it will be necessary to ensure that the contracts used make it clear who owns such rights and enable the employer to use innovative ideas generated by one supplier in works carried out by other suppliers.

### Procurement Legislation

Increasingly the public sector has played an important role in driving innovation. Yet public procurement is seen by many suppliers as a blocker, rather than a facilitator, of innovation. We have identified below how procurement can be used as a means of promoting and maximising innovation, before, during and after conducting a competitive process, identifying practical measures to encourage innovation in the supply chain and removing any perceived barriers to innovate.

### Public Procurement in the UK: the Regulatory Background

All contracting authorities in England, Wales and Northern Ireland are subject to the requirements of the Public Contracts Regulations 2015 ('PCR') when procuring works, services and supplies above the relevant thresholds set by the EU.<sup>4</sup>

In Scotland, contracting authorities are subject to the Public Contracts (Scotland) Regulations 2015 ('PCSR') when procuring above the relevant thresholds. It should be noted that, in Scotland, while the PCSR apply to contracts above the thresholds set by the

<sup>4</sup> For a central government bodies this is currently £164,176 for services and £4,104,394 for works. For other authorities, this is £164,176 for services and £4,104,394 for works.

EU, the Procurement Reform (Scotland) Act 2014 ('PRSA') apply to: (i) public services and supply contracts with a value of £50,000 or above or (ii) public works contracts with a value of £2 million or above. The PRSA introduces additional obligations for all regulated procurements. For example, it is worth noting in the context of this note that the PRSA imposes a duty on contracting authorities, before carrying out a regulated procurement, to consider how in conducting the process it can promote innovation.<sup>5</sup>

Although there are some minor variations between the regimes in Scotland and the rest of the UK (such as those noted at section 2.2 above), the rules in both jurisdictions are largely the same.

### **Pre-procurement: Encouraging Innovation through Early Market Engagement**

A key requirement for a public procurement process geared towards innovation is sound market intelligence and preliminary market consultations are consistent with an authority's duties to ensure adequate competition and value for money, and enables dialogue with the market before the restrictions of a formal tendering procedure are in place.

The PCR make specific provision for pre-market engagement in regulation 40-41 and early market engagement is actively encouraged by the UK Government.<sup>6</sup> For example, Crown Commercial Service guidance states that central government is encouraged to make greater use of Prior Information Notices or speculative notices if they relate to a specific procurement or industry sector-specific market engagement activity, to promote early market engagement.

Innovation through early market engagement can be encouraged practically by a contracting authority through the use of a "competition of ideas" (disseminating problems or issues to the market and seeking proposals), Prior Information Notices (putting the market on alert to the authority's requirements) and holding "potential bidder conference", an open invitation to potential bidders to attend a day where they can present views on the commercial and technical aspects and risks of the procurement.

### **Pre-market Engagement: the Risks and How to Mitigate Them**

Both contracting authorities and potential bidders must also, however, be aware of the potential risks associated with pre-tender engagement. Authorities must be fully aware that they are bound at all times of the process, including any pre-tender engagement, by the principles of equal treatment, non discrimination, transparency and proportionality.<sup>7</sup> Therefore, the contracting authority must engage with the market generally (not just a particular supplier or group of suppliers) to guarantee a level playing field for all potential bidders and ensure the process is fair, open and transparent.

Early market engagement creates the potential risk of suppliers who engage with the authority having a competitive advantage by giving them access to information which others may not get. The contracting authority should therefore seek to manage this risk by keeping a record of all documents shared throughout the engagement process and by putting steps in place to ensure that the specification is not biased towards a particular bidder and by ensuring that timescales in relation to the subsequent tender process allow adequate time for those bidders who have not been involved in the engagement process to consider all information provided and formulate a bid.

A conflict of interest issue could therefore arise if a supplier has participated in both the early market engagement and the actual tender process. Although case law has concluded that the company involved in the preparatory design could not be automatically excluded from submitting a bid,<sup>8</sup> there are measures a supplier should implement to ensure they are in the best position to both demonstrate that no conflict exists and to defend its position if other bidders suggest otherwise.

These measures include separation measures to ensure those involved in the early market engagement are removed from those who will be bidding downstream. These measures should then be clearly demonstrated to the contracting authority and assurances sought that the authority does not feel there are any conflict of interest issues. A record should then be kept of any correspondence between the supplier and contracting authority on the issue of conflict of interest.

When sharing innovative ideas, potential bidders also need to be aware of the local authority's obligations under the Freedom of Information Act 2000. If a third party makes an information request to the local authority, a bidder may find its novel and commercially sensitive information disclosed to a wider audience. While this may put some bidders off from sharing such information, the risk of disclosure can be mitigated somewhat by encouraging authorities to enter into a form of a Non-Disclosure Agreement.

### **Outcome based specifications**

Following pre-tender engagement, authorities will issue a specification as part of its call for tenders. Authorities should be encouraged to frame these in such a way so as to encourage innovation from bidders. Best practice is for specifications to contain a clear articulated requirement, taking into account criteria in relation to the capabilities of providers, informed through early market engagement. Authorities should use outcome or performance based specifications as much as possible. Innovations may be less likely where specifications are too narrow or rigid. An outcome based specification should focus on the desired outputs of a service in business terms, rather than a detailed technical specification of how the service is to be provided, unless this is necessary. This allows providers scope to propose innovative

<sup>5</sup> Section 9, Procurement Reform (Scotland) Act 2014

<sup>6</sup> See Crown Commercial Service guidance, "Public procurement policy" First published 1 October 2015, updated 8 June 2016

<sup>7</sup> Directive 2004/18/EC, recital 2.

<sup>8</sup> Case C-21/03, *Fabricom SA v Belgian State* [2005] ECR I-1559

solutions.<sup>9</sup> As noted in CCS Guidance, by specifying outcomes rather than a solution, contracting authorities allow room for innovation to create new and better options. Authorities should be encouraged to strike a balance between a specification which sets out clear guidance to bidders and leaves enough scope for the proposal of alternative solutions. Innovation may further be encouraged, depending on the nature of the contract, by dividing complex projects into smaller parts, to allow bidders the opportunity to devise novel solutions in relation to specific components.

### Securing Innovation During Selection

The PCR provide for the following procurement procedures:

- The open procedure.
- The restricted procedure.
- The competitive dialogue procedure.
- The competitive procedure with negotiation.
- An innovation partnership.

For major projects, the competitive dialogue or competitive procedure with negotiation are ordinarily used. These procedures allow for some flexibility in relation to innovation, for example by providing for discussions with shortlisted bidders to allow for further development of ideas. When using these procedures, the contracting authority can plan the dialogue phase carefully to provide for innovative solutions as far as possible. The contracting authority can do this by establishing a clear code of practice for conduct of the dialogue phase, the evaluation criteria (Regulation 67 of the PCR now provides some examples of award criteria contracting authorities may apply, including “innovative characteristics”;<sup>10</sup>) and the Methodology for ensuring tenderers need to have access to the information and explanations necessary to allow them to submit substantially unconditional tenders.

### Innovation Partnerships

The PCR set out a new procurement procedure known as Innovation Partnerships. The purpose of this procedure is to establish long term partnerships which allow for both the development and subsequent purchase of new and innovative products, services or works.

Under this route, high level project proposals are submitted during the tender process and the solutions are subsequently developed post-entering into the contract(s) with the successful tenderer(s). This is in contrast to the Competitive Dialogue procedure where dialogue is required to continue until the contracting authority identifies the solution that best meets its needs.

The process can only be used in limited circumstances, where the goods, works and services that are sought are “innovative” and there is an intention to include both the development and purchase elements in the procedure, provided they correspond to agreed performance levels and maximum costs.

The PCR define “innovation” as “the implementation of new or significantly improved” products, services or processes, which would include (but is not limited to):

- production
- building and construction
- a new marketing method
- a new organisational method in business practices, workplace organisation or external relations.

This broad definition however will cover a wide range of procurements, from development of a single specialist product to, potentially, major outsourcing arrangements. The new or significantly improved products, services or processes should be implemented with the purpose of helping to “solve societal challenges” or support the Europe 2020 strategy. From a practical perspective, the contracting authority will need to have a clear audit trail demonstrating how the proposed arrangements achieve this objective and fall within the definition of “innovation”.

The Innovation Partnership procedure permits the contracting authority to appoint one or more ‘innovation partners’ who work in parallel to undertake innovative development work. The number of partners can be reduced over time. At the end of the research phase, the contracting authority will have the option to purchase the innovative supply, service or works developed as a result of the Innovation Partnership.

Competitions under the innovation partnership procedure will be governed by effectively the same rules that apply to the Competitive Procedure with Negotiation, including an OJEU notice. The documents must identify the need for the ‘innovative’ product, service or works and the process of selecting the parties who will enter into the Innovation Partnership is very similar to the Competitive Procedure with Negotiation. The key differences include that during pre-qualification/selection stage, the contracting authority must apply criteria which addresses the tenderer’s capacity in the field of research and development and of developing and implementing innovative solutions. Namely, this stage is designed to assess capacity rather than experience, so as not to rule out the involvement of start-ups.

Once identified, those tenderers will then submit research and development projects which will be evaluated in accordance with the award criteria communicated to tenderers and the procurement documents must set out the arrangements envisaged in relation to ownership and licensing of intellectual property rights.

Those selected to enter into the Innovation Partnership shall develop the innovative product, service or works and the contracting authority will purchase the results, always adhering to the performance levels and maximum costs agreed between the contracting authority and the appointed partners. The estimated value of the supplies, works or services must not be disproportionate in relation to the value of the investment required

<sup>9</sup> See Crown Commercial Service guidance, “Public Procurement Policy” First published 1 October 2015, updated 8 June 2016

<sup>10</sup> Regulation 67(3)(a) Public Contracts Regulations 2015

for their development. This requirement seeks to avoid the abuse of the procedure and limit the quantum of the award to an amount that is essential to incentivise the development.

Finally, the reference to the term 'partnerships' in this procedure does not mean a legal partnership. The term is used to indicate the partnering type approach to working together.

The Innovation Partnership procedure became available on 26 February 2015 and there has been an uptake by public bodies in relation to its use. For example, the procedure has been used in relation to procurement of data collection and collation services and road construction works. Contracting authorities should be encouraged to use the procedure where appropriate. Although the Innovation Partnership arguably offers very similar flexibilities to the competitive dialogue and competitive procedure with negotiation in relation to the procurement process, the use of a procedure with innovation as its key incentive sends a message to the market in relation to the authority's objectives in this regard.

### Encouraging Innovation after Contract Award

Post – contract award is generally the most difficult point in a procurement to encourage innovation. Nevertheless, it can be possible to "future-proof" contracts to encourage innovation, for example by way of a clear, unequivocal review clause which sets out the circumstances in which the contract can be varied.<sup>11</sup>

### Brexit

The position following Brexit has resulted in some uncertainty. The Public Contracts Regulations 2015, the Utilities Contracts Regulations 2016, and the Concessions Contracts Regulations 2016 (and their Scottish equivalent) recently implemented the new EU Procurement regime. Until repealed or reformed, this legislation will continue to regulate procurement in the UK. If the UK negotiates a free trade deal with the EU with access to the Single Market, it would need to adopt the EU procurement rules. That being the case, there would be no impact on the current UK procurement regime which already implements those EU rules.

Even if the UK exited the Single Market completely, the UK would still need to ensure a fair and transparent cross-border procurement system if it wanted (as it almost certainly would do) to maintain its membership of the WTO's Government Procurement Agreement (GPA) and thereby access for its national suppliers to other governments' procurement markets (e.g. the USA, Canada, China and Japan). Given that the UK regulations which implement the EU procurement rules comply with the GPA requirements, it would seem unlikely and arguably unnecessary for the UK to alter its domestic procurement regime.

In the short term, organisations bidding for competitions which are in the very late stages should consider whether any changes to their submitted financial or commercial proposals are required in light of changes to the economy and recent slide in the property market. With the current uncertainty impacting business priorities, contracting authorities and utilities may need to review current live projects which may in turn lead to a need to reshape projects, such as scaling back scope or duration. Those bodies need to ensure such modifications are handled in line with the current UK procurement regime. Authorities and Utilities should also be prepared to handle changes in the bidding pack as businesses weigh up their response to an exit of the EU, which might include companies dropping out of bidding for contracts or changes in consortium membership.

### Conclusion

As explained above, procurement legislation should not be seen as a barrier to innovation. There are a number of high level steps which a contracting public body could take to capture innovation through procurement. Such public bodies need to balance the requirements set out in the PCR with the need to provide for flexibility in the procurement process to facilitate innovation. Any arrangements put in place should be coupled with an extra-contractual culture that encourages and supports innovation, for example through the use of procurement strategies and policies which actively encourage this, with an appropriate risk appetite. The introduction of innovation partnerships is to be welcomed and provides further support for the growing recognition of the importance of innovation.

<sup>11</sup> Regulation 72 of the PCR provides that contracts and framework agreements may be modified without a new procurement procedure where the modifications, irrespective of their monetary value, have been provided for in the initial procurement documents in clear, precise and unequivocal review clauses.

# Defining innovation

Fairclough<sup>12</sup> stated that a narrow definition of construction research does not serve the industry. A broad definition however is likely to be complex due to the plethora of stakeholders within the industry and variety of views, a single encompassing definition may be difficult in regard to achieving agreement.

As far back as 1934, Schumpeter<sup>13</sup> recognised that innovation could consist of transforming an already invented process into a commercially viable tool. This highlights that an innovation is not necessarily a new process or product. Lee<sup>14</sup> argued that there is no single definition of innovation due to its complex and dynamic nature however he attempted to in general terms, describing innovation as the creation and adoption of new knowledge for the purposes of improvement. DTI (2007)<sup>15</sup> described innovation as the successful exploitation of new ideas and a key process to compete in an increasingly competitive global market. Also, the OECD (2005)<sup>16</sup> differentiate technological and non-technological innovation.

It can be said that an innovation definition varies upon context. DTI for example indicate that the process of innovation within services differs from that of manufacturing and so it can be sensibly concluded that the construction industry has a unique innovation process. In 2008 the UK Government released a paper titled 'Innovation Nation'<sup>17</sup> in which the changing face of innovation is referred to, suggesting that innovation itself is not static but a dynamic process which alters and evolves with time.

## Open Innovation

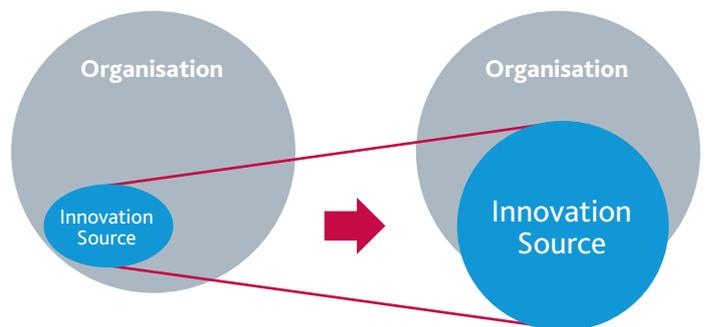
Chesbrough<sup>18</sup> suggests that open innovation (OI) is a paradigm shift that assumes organisations can and should use external ideas in addition to internal ideas, utilising both internal and external routes to market to advance their technology. Sloane<sup>19</sup> emphasised the benefits of OI, stating that engaging with external companies and organisations can reduce time to market, decrease costs, introduce new ideas and speed up processes. Collaboration does not occur in isolation and knowledge flows with the market thus there is strong argument to suggest that external organisations are acknowledged.

Sloane stated there are four distinct classifications of OI [Table 1].

**Table 1: Open Innovation Typology**

| Type                            | Description   |
|---------------------------------|---|
| <b>Suggestive/participative</b> | A company encourages anyone to submit an idea and to review and rank ideas from others.                             |
| <b>Suggestive/participative</b> | Anyone can submit suggestions for very specific challenges.   |
| <b>Suggestive/invitational</b>  | The sponsor company invites specific individuals, teams or companies to contribute ideas on very broad topic areas. |
| <b>Directed/invitational</b>    | The company invites specific individuals or partners to respond to specific challenges or requests.                 |

Sloane suggested that for open innovation to succeed, support is required from the top level of organisations as responsibility cannot simply be allocated to R&D. OI is difficult to implement for two key reasons, the first of all being that it is not enough for one company to adopt the mindset, the alteration must occur throughout a supply chain if the principles are to be implemented successfully; thus preventing a give and take scenario. The second issue is the tradition within the industry of fiercely shielding intellectual property and disregarding unconventional external ideas. OI is a collaborative production and exchange of knowledge across organisational boundaries.



(Sachidanandam, K.(2013), *Is managed innovation an oxymoron?* Management Exchange)

Sloane states that once you have identified partners to work within an innovation project you need to consider these steps:

| Area            | Step   |
|-----------------|--|
| <b>Clarity</b>  | Each party should define what it wants to get out of the relationship.                                   |
|                 | Who owns the intellectual property in the partnership must be clear.                                     |
|                 | Each side should allocate a senior person with overall responsibility for success of the partnership.    |
|                 | Key expectations, obligations and milestones should be established early.                                |
| <b>Culture</b>  | Honesty and trust is built on clear communication – especially when objectives look likely to be missed. |
| <b>Contract</b> | A good legal contract should be in place.  |

<sup>12</sup> Fairclough, J. (2002), Rethinking Construction Innovation and Research, Department of Trade and Industry, London

<sup>13</sup> Schumpeter, J.A. (1934), The Theory of Economic Development, Harvard University Press, Cambridge

<sup>14</sup> Lee, A; Wu, S; Cooper, R; Aouad, G. (2000), The Process Protocol, A Solution for the Problems of Construction, In: *Proceedings of the international conference of business ethics*, New York

<sup>15</sup> DTI (2007), Innovation in Services, Department of Trade and Industry, London

<sup>16</sup> OECD; 2005; Oslo Manual

<sup>17</sup> Department for Innovation, Universities and Skills, Innovation Nation, 2008

<sup>18</sup> Chesbrough, H. (2003), Open Innovation: The New Imperative for Creating and Profiting from Technology, Harvard Business School Press

<sup>19</sup> Sloane, P. (2011), The Brave New World of Open Innovation, Strategic Direction, Vol.27, No.5, pp3-4

# A conceptual model of supply chain innovation

The aim of this section is to develop a model of supply chain innovation using concepts drawn from the economics of collective action (Ostrom, 1990) and contracting (Williamson, 1985, 1996). This exercise can be useful in clarifying the issues at stake in the design of contracts and procurement processes.

## The basic problem

The problem is that *innovation*, by its nature, involves a departure from existing uses of materials and technology, and hence a high element of uncertainty, and an additional risk of things going wrong. High risk and uncertainty make it impossible to write a contract that will specify exactly what will be done to generate innovation, or to stipulate what the outcomes from innovation will be. Thus the contract will be necessarily incomplete.

This does not mean that the contract cannot be designed in a way which will promote innovation. The contract can allocate risks and determine rewards in ways which will promote cooperation between the parties. However, while virtually all contracts require cooperation, not all are aimed at achieving innovation. In order to promote innovation, the contract needs to go beyond establishing a framework for cooperation; it should also create incentives for *learning*, since it is only by generating new knowledge that innovation will be achieved.

## Knowledge as a common pool resource

The knowledge on which innovation depends is partly formal and technical in nature, and partly tacit and process-related. *Formal knowledge* can be embodied in intellectual property rights such as patents and trade secrets. Controlling knowledge of this kind can be critical to the ability to generate new innovations, as well as capturing supra-competitive profits ('rents) from existing ones. In principle, where IP rights are clearly specified, the parties can contract to share the use of them in ways which will generate a return.

However, *tacit knowledge* bound up with processes and relationship may in practice be just as important in triggering new innovations. This knowledge may exist at the level of understandings, or common knowledge among a group of managers or engineers on a site, and may be difficult to access. It is likely that the kind of knowledge needed to generate innovation in supply chains will be at least partly tacit in this sense.

By its nature, tacit knowledge cannot be reduced to IP rights which are fully specified. Those with tacit knowledge may be reluctant to share it if they cannot be sure that they will also share in the incomes generated from doing so, but writing a contract to ensure this will be difficult.

One way of conceptualising tacit knowledge is to see it as a *common-pool resource*, that is, an economic resource, access to which is shared among a group of actors. The sustainability of the resource is threatened by the *tragedy of the commons* (Hardin, 1968), that is, the tendency for each individual party to look only to their own interest when taking from the resource. If each party looks only to themselves there will be an incentive to withhold information which could lead to an innovative outcome. This is a version of the *collective action problem* (Ostrom, 1990).

## The collective action problem

The collective action problem can be characterised as a *social dilemma* (Poteete et al., 2010). In a social dilemma, the parties know that they can realise a common goal by cooperating. However, they cannot be sure in advance of each other's willingness to cooperate. In the prisoner's dilemma game (a type of social dilemma), it is *individually* rational for each party to 'defect' (withhold cooperation) even though *collectively* they are then worse off. The point is that it is always rational to defect if each party expects the other to do so; and vice versa. Mutual defection is then assured.

In the context of supply chain innovation, it may well be individually rational for each party to withhold from the other knowledge needed for innovation, for fear of the other capturing a disproportionate part of the gains from that innovation. The result is that neither side shares their knowledge and so the chance of innovation is lost.

A further relevant concept is that the collective action problem gets worse as the scale and complexity of contractual relations increase. *The logic of collective action suggests* that collaboration becomes more difficult as groups increase in number and size. The structure of a multi-party civil engineering project, with multiple parties arranged in vertical tiers of contractual relationships, may provide a good example of this problem.

## Solutions to the collective action problem

The risk of defection may be reduced if the parties engage in *repeated trade*, as they will then have incentives to maintain good relations for the sake of future relationships. However, the prospect of continued trading is not enough, in itself, to guarantee cooperation. Contracts with a finite end point are particularly vulnerable as the parties reach the 'end game' towards the life of the relationship. Since civil engineering contracts tend to be for a limited period and are mostly project-specific, the risk of non-cooperation is particularly high in this sector.

A fully specified *contract* might, in principle, solve certain social dilemmas. If a third party, in the form of a court, can impose an appropriate sanction against a party who commits a breach of contract, both parties' incentives may be altered in such a way as to make a 'win-win' outcome more likely. One problem with this approach is that the parties involved in an innovative project may not be able to write the perfect contract in advance; they simply won't have the information they need to describe the expected outcomes. A further problem is that even if the contract could specify every eventuality, and the sanction needed to rectify

defection in each case, it would still have to be interpreted and enforced by a court or other third party. Where the performance of the contract depends on tacit information, there is a risk that the court will interpret events differently from the parties' expectations.

*Reputation* may provide an alternative sanction to court enforcement but in a situation where knowledge is specific to a particular contractual setting or relationship, it may not be obvious to the court which party is to blame for a contract going wrong. Nor do all disputes get to see the light of day.

*Litigation* may trigger the availability of a sanction and may also help spread reputational effects, but is expensive and uncertain, so creating an additional risk for the parties.

### Types of contract

Despite these difficulties, contracts are very widely used to mitigate the risks of non-cooperation. The literature on the economics of contract suggests that different types of contract will work best in particular commercial settings.

Where the parties have complete information and a high level of confidence that their agreement will be enforced, a *classical contract* may be agreed. This is one which specifies in detail what each party must do at every stage of their relationship. It will also specify sanctions for breach of contract, for example in the form of liquidated damages clauses.

At the other extreme is a *relational contract* in which the formal agreement is deliberately left open-ended and incomplete. This is to allow the parties to adjust the contract over time, in the light of changing circumstances (Campbell and Harris, 2005). It is also to encourage them to resolve disputes between themselves, or with the help of mediation and/or arbitration, in preference to having to resort to litigation. A relational contract is sometimes said to be the most appropriate model for mega-projects involving multiple parties (Ballard and Howell, 2005).

However, relational contracts are not completely self-enforcing. They do not work in the absence of trust between the parties. *Trust* can be understood as a propensity of contracting parties to engage in cooperation for mutual gains beyond the explicit terms of their agreement. Trust may be generated by successful dealings in the past. However, it cannot be assumed to exist in the context of complex projects in which many things can go wrong and where the past will not be an infallible guide to future conduct.

One possibility is that the formal elements of a contract can be used to generate trust between the parties, and thereby induce the elements of relational contracting, including knowledge-sharing, on which innovation depends. This intertwining of the formal and informal elements of contracting is sometimes called *braiding*.

'Braiding' involves the use of a formal agreement to establish a procedure or framework for collaboration, within which parties have incentives to exchange information that would otherwise

remain private, but which, once disclosed, increase the scope for mutual gains. This then provides the framework for the informal contractual collaboration which is the immediate source of innovative product and process outcomes. The underlying idea is that the formal and informal aspects of contract can complement each other in providing a framework for the establishment of 'trust'.

Various *formal elements* can be used to foster information exchange. These include express contract terms providing for liability-sharing and risk-pooling, benchmarking, and error correction (Helper, MacDuffie and Sabel, 2000). Formal mechanisms for dispute resolution, involving an appeal to a higher body such as an industry body or a forum or panel drawn from firms involved in a particular collaborative venture, are also widely observed in this type of arrangement.

The *informal elements* of the collaboration may take the form of the adjustments which the parties make in the lights of the problem and issues they encounter over time. Collaboration can be generated in the presence of reputational costs of non-cooperation, and by the private sanctions which can be deployed against any party which chooses to withdraw its goodwill from the collaboration.

However, 'braided' contracts are not entirely informal: the formal elements of the contract help sustain a 'niche' or environment within which mutual cooperation comes to be seen as each party's best response to the likely actions of the other (Gilson et al., 2009). The function of the contract is to institutionalize a learning process through which trust is built and the risks of opportunism minimized (Jennejohn, 2008).

There is evidence to suggest that the contracts governing innovative collaborations increasingly display the properties of 'braiding'. In the US context, Gilson et al. (2009a, 2009b) and Jennejohn (2008 2010), refer to contracts of this type involving pharmaceutical collaboration and licensing agreements, the supply of precision engineering components for use in agricultural machinery, and the supply of parts used in computer manufacturing and aeronautical engineering. In the UK context, contracts governing large-scale construction and engineering projects exhibit similar features (Caldwell, Roehrich and Davies, 2009; Deakin and Koukiadaki, 2009). The NEC standard form contract could be said to have 'relational' or 'braided' features, and the concept can also be applied to contract forms which support project partnering such as PPC2000 (Trowers and Hamblins, 2005).

### Governance structures

The literature on relational contracts suggests that for them to work they may need to be embedded in a wider governance structure which seeks to create the conditions for information and risk sharing (Colledge, 2005). Examples could include the series of framework agreements which underpinned the construction of Heathrow Terminal 5 (the 'T5 Agreement') and the 'alliancing' arrangements recently agreed for the Thames Tideway project (820).

## Procurement

The way in which contracts are procured may influence the nature of the environment for innovation. As we have seen, early contractor involvement (ECI) is one of the practices which may allow for information sharing in advance of the final contract being agreed, and may help generate trust.

## Conclusions

The preliminary conclusions to be drawn from this review of the conceptual and theoretical literature on contracts are:

- (i) Innovation in complex projects depends on the sharing of knowledge between the contracting parties.
- (ii) The knowledge base of a complex project is akin to a common pool resource which gives rise to the danger of free riding.
- (iii) The logic of collective action suggests that the risks of free riding increase as projects involve more parties and additional layers of contracting.
- (iv) Contracts are only a partial solution to the collective action problem.
- (v) Relational contracting may be preferable to more traditional 'classical' contracting but the 'braiding' of formal and informal elements of contract seems more likely to work than a completely informal contracting framework.
- (vi) Standards forms such as NEC do not correspond exactly to the concept or ideal type of a 'relational' contract.
- (vii) Bespoke governance structures such as T5 and 820, and flexible procurement practices such as ECI, may have a role to play in promoting knowledge sharing in innovative projects.



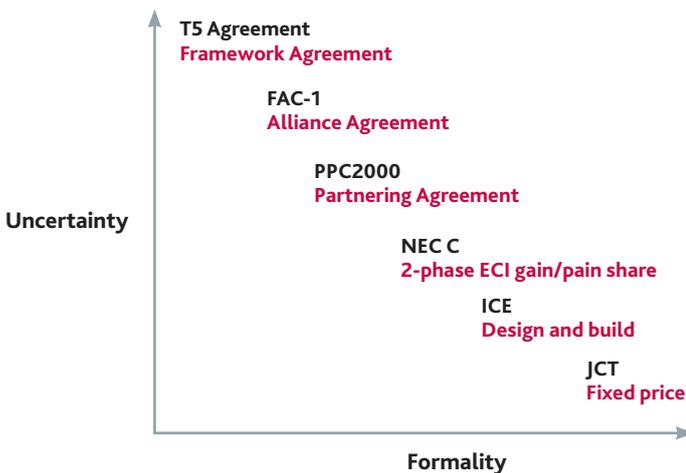
## A conceptual model for innovation in the construction supply chain

In the context of complex projects characterized by a high level of uncertainty and the presence of multiple parties operating at different tiers of the contracting process, contracts can help ensure effective project outcomes in various ways. Contract terms, when coupled with a particular approach to procurement, can be used to encourage risk identification and transfer, information sharing, gain/pain sharing, and partnering. The benefits for the parties include greater transparency on pricing at the tendering stage and collaborative behaviour (or the absence of adversarialism during performance. These benefits do not guarantee successful project outcomes but there is evidence that their presence may make it more likely that complex projects will be completed on time and on budget (see Table 2).

**Table 2. Key variables in complex projects**

| Sources of complexity | Contractual devices              | Behavioural outcomes         |
|-----------------------|----------------------------------|------------------------------|
| Uncertainty           | Risk identification and transfer | Transparent pricing          |
| Multiple parties      | Information sharing              | Collaboration in performance |
|                       | Gain/pain sharing                |                              |
|                       | Partnering                       |                              |

**Figure 1. Standard contract forms characterized by uncertainty and formality**



The relationship between contract formality and uncertainty can be represented as in Figure 1. There is not necessarily a trade-off between them. The Terminal 5 agreement represents an arrangement under which a non-binding framework agreement is used to provide an overall structure for a complex, multi-tiered project, within which many of the agreements made between different firms would have been legally binding. The T5 agreement has elements of the non-binding 'relational' contract which is consistent with the idea of 'braiding' (Gilson et al., 2011).

At the other extreme are more traditional standard forms such as the JCT and ICE, which attempt to spell out the terms of the agreement in full on the basis that the parties have complete knowledge of the contract at the time of contracting. These forms may well be an appropriate model for contracts characterized by a low level of uncertainty and will more generally be useful to parties who are familiar with them. They are still widely used in the industry which suggests that they have a continuing value. How far they can be used to support risk-sharing in complex projects, particularly those involving innovation, can be studied empirically.

If the idea of a trade-off makes sense when considering the contrast between T5 and ICE/JCT, it has less resonance when contract forms such as PCP2000 and NEC are considered. Both are examples of contracts which are relatively formal and which are intended to give rise to legal effects, but in each case the formal contract is used to generate outcomes which are consistent with a high level of trust between the parties, including risk transfer, information exchange, gain/loss sharing, and partnering. The idea that contract formality may be consistent with trust-building needs to be studied in more detail through new empirical analysis.

Information sharing in the context of innovation gives rise to a 'social dilemma' in which the individual interests of the parties are at odds with their joint or collective interests (Ostrom, 1990; Poteete et al., 2011). Thus individual firms will not have incentives to seek out innovative solutions to technical problems if they think that their investments will be appropriated by other parties 'free riding' on their work. This problem can be alleviated by the possibility of repeat trading between the parties and by reputational effects, but it may be that contracts have a role in altering incentive structures, for example via 'gain sharing' mechanisms which allow both parties to benefit from an innovative solution.

# Results and Analysis

## Empirical analysis

In this part we set out the results of our empirical analysis. This consisted of three parts:

- (i) A survey of around 120 industry practitioners conducted between March and June 2016.
- (ii) Interviews with practitioners. Ten in-depth interviews were conducted. Interviewees were selected through industry contacts.
- (iii) Four focus groups with 20 or more participants in each case were held periodically during the year-long life of the project. The participants in the focus groups were practitioners from a range of backgrounds in the civil engineering and construction industry, including engineers, lawyers and other consultants, officials of trade associations and industry bodies, and government officials. The focus groups lasted in each case for two hours and provided an opportunity for open-ended discussion of themes emerging from the research.

We report two types of results:

- (i) Quantitative results based on the survey
- (ii) Qualitative results based on the interviews, survey responses, and focus groups.

## Quantitative results

The survey was designed to obtain information on the perceptions of industry participants of current and evolving contractual practice, and of the role played by contracts in promoting trust and innovation. We wanted to test a number of hypotheses suggested by the conceptual model, existing case studies of industry practice, and the wider literature on contracting.

Respondents were invited to consider a number of statements and to express their agreement with them using a five-point scale according to which they could answer either 'strongly agree', 'agree', 'not sure', 'disagree' or 'strongly disagree' in some cases, or 'very important', 'important', 'neither important nor unimportant', 'not very important' or 'not at all important' in others.

### Expectations of contracts: formality versus flexibility

The first set of hypotheses we explored related to practitioners' expectations of contracts. Did they see contracts as devices for planning the performance of the work in detail and being strictly enforced, as would be suggested by a 'classical' approach to contracting, or did they, alternatively, see them as looser, 'relational' arrangements which should be flexibly interpreted and enforced?

Figure 1 reports results from the questions we designed to throw light on these issues. It shows that there was a high level of agreement with the idea that 'the contract should cover all

eventualities': almost 75% of respondents said that they 'strongly agreed' or 'agreed' with this statement. Nearly 70% strongly agreed or agreed with the statement that the contract should set out penalties for late performance. Over 50% were in strong agreement or agreement with the statement that contracts should be strictly enforced according to their terms, and over 90% agreed or strongly agreed with the suggestion that having a clear contract would help to resolve a dispute if things went wrong.

By contrast, there was little agreement (less than 20% agreeing or strongly agreeing) with the statement that 'it is better to have a framework agreement than a legally binding contract', and with the statement that 'the contract is not important once work begins' (less than 10% agreeing or strongly agreeing).

These answers suggest that industry practitioners placed a high value on contracts which were detailed, clear and enforceable. They do not appear to have regarded contracts as loose frameworks. They expected contracts to be referred to during the life of projects and in particular for the resolution of disputes. Thus contracts were not seen as formalities, to be filed away once work begun.

At the same time, there was strong support for the idea that contracts should be renegotiable if circumstances changed (nearly 50% agreeing or strongly agreeing) and with the suggestion that the contract should be one with which the parties were familiar with from previous dealings (just over 50% agreeing or strongly agreeing). These answers suggest that practitioners thought that contracts should be flexible enough to allow for renegotiation. They also suggest that support for the idea of contracts as mechanisms of planning and dispute resolution was tempered by a realisation that contracts needed to allow for flexibility and that experience of using a contract mattered as well as its formal terms.

### The evolution of contractual practice over time: are contracts becoming more collaborative?

As we have seen, the standard form contracts used in the construction industry have undergone a major change in recent years, with the supposedly more collaborative and clearly drafted NEC model displacing, to a large extent, the supposedly more adversarial and traditionally drafted JCT agreement. NEC replaces the ICE conditions of contract, which were previously used for civil works. JCT is not used for civil works but has always been used and is still the most used contract for buildings including residential accommodation, offices, hotels, and hospitals. With this in mind, our second set of questions was designed to find out how far industry practitioners perceived a shift towards more collaborative contracting.

Figure 2 shows that there was a high level of agreement to the effect that contracts had become collaborative over time, with over 60% agreeing or strongly agreeing). If this is evidence of a shift towards a more collaborative and clearer type of contract of the kind represented by the NEC, other responses suggest that this move has not been without costs as well as benefits. Thus the statement that 'contracts are more clearly drafted than they used to be' elicited more agreement than disagreement overall (46%

agreeing or strongly agreeing versus just under 20% disagreeing or strongly disagreeing) but over a third of respondents stated that they neither agreed nor disagreed with this suggestion. A similar pattern is found in responses to the statements that contracts are more flexible than they used to be and that they are more important to the success of projects. Thus the evidence for contracts becoming more flexible and useful to the life of projects as they also become more collaborative is, at best, equivocal.

Then there was a set of statements with which respondents on the whole registered disagreement. Over 40% of respondents disagreed or strongly disagreed with the suggestion that less time was spent reading contracts in the past, compared to 25% agreeing; nearly 40% disagreed or strongly disagreed with the claim that there were fewer contractual disputes than there used to be, in comparison to under 20% agreeing; and 50% disagreed or strongly disagreed that parties were now more aware of their contractual rights and obligations, with just over 30% agreeing or strongly agreeing.

These answers imply that the move to a more collaborative contractual model has not been without its difficulties. A significant proportion of respondents, while recognising that a shift in contractual practice had occurred to a more collaborative and more clearly drafted contractual model, were equivocal on whether this had resulted in contracts becoming more flexible or more important to the way projects were completed. A majority of respondents did not associate the move to greater collaboration with contracts becoming less detailed or with them becoming easier to read and understand. Nor did most respondents think that there were fewer contractual disputes than there had been in the past.

### **The relationship between contracts and trust**

We next asked a series of questions about the association between particular aspects of contractual practice, on the one hand, and trust in the performance of contracts, on the other. In particular, we wanted to see how far practitioners associated trust with strictness of contract performance, on the one hand, versus flexibility and give and take, on the other. We also wanted to see how far they viewed trust as enhanced by the sharing of information and risk within a contractual setting.

Figure 3 shows that there was a high level of association between trust and honouring strictly the terms of contracts (important or very important in over 60% of responses), performing on time (important or very important in over 80% of responses) and maintaining quality (important or very important in nearly 90% of cases). These answers suggest that adherence to formal contractual commitments is seen as an important way to build trust. However, there were even higher associations with features of contractual performance which stress the importance of flexibility and cooperation: over 90% of respondents rated as either important or very important to trust 'honouring informal relationships', 'engaging in dialogue at an early stage' and 'being ready to help in an emergency', and nearly 90% reported the same association between trust and 'being willing to overlook occasional faults'.

There was a positive overall association, but a weaker one, between trust and 'being prepared to give and take', 'being willing to exchange business information' and 'being willing to share business risk'. In each of these cases, only around 50% of respondents regarded the practice in question as important or very important to trust.

These responses imply that practitioners place great emphasis on informality and flexibility in promoting trust, but they value strict performance of contracts as a mechanism for establishing trust. This suggests that contract and trust may be complementary to each other.

The responses also indicate that sharing risk and information has a positive association with trust, but a weaker one than either the strict performance of contracts or informality and flexibility in contractual dealing. This can be read as suggesting that the sharing of information and risk is not a straightforward route to building trust in general, or at least not in all contractual settings.

### **The relationship between contracts and innovation**

The final part of the questionnaire was concerned with finding out how far respondents associated particular contractual practices with innovation. Figure 4 shows that there are very high levels of association of innovation with having a flexible contract, sharing the costs of innovation, sharing gains from innovation, sharing information on risks, and discussing problems as soon as they arise: in each of these cases, over 80% of respondents reported that they saw the practice in question as important or very important to innovation, with particularly strong associations reported for sharing information and discussing problems promptly. In addition, over 70% thought that sharing information on products was either very important or important to innovation.

At the same time, there was a positive association between innovation and 'having a clearly written contract with specific rights and obligations': over 50% saw this as either important or very important, compared to less than 20% which viewed it as not very or not at all important. The association between contract and innovation was about the same as that between innovation and past experience of successful dealing.

These results suggest, firstly, that flexibility in contracting is more strongly associated with innovation than it is with trust in general, and that the same is true for the sharing of information, costs and risks. They support the suggestion, therefore, that innovative projects require a particular contractual approach which places emphasis on flexibility and dialogue. At the same time, the positive association between innovation and having a clearly written contract suggests that the contract can be used as a mechanism for supporting flexibility, dialogue and risk sharing.

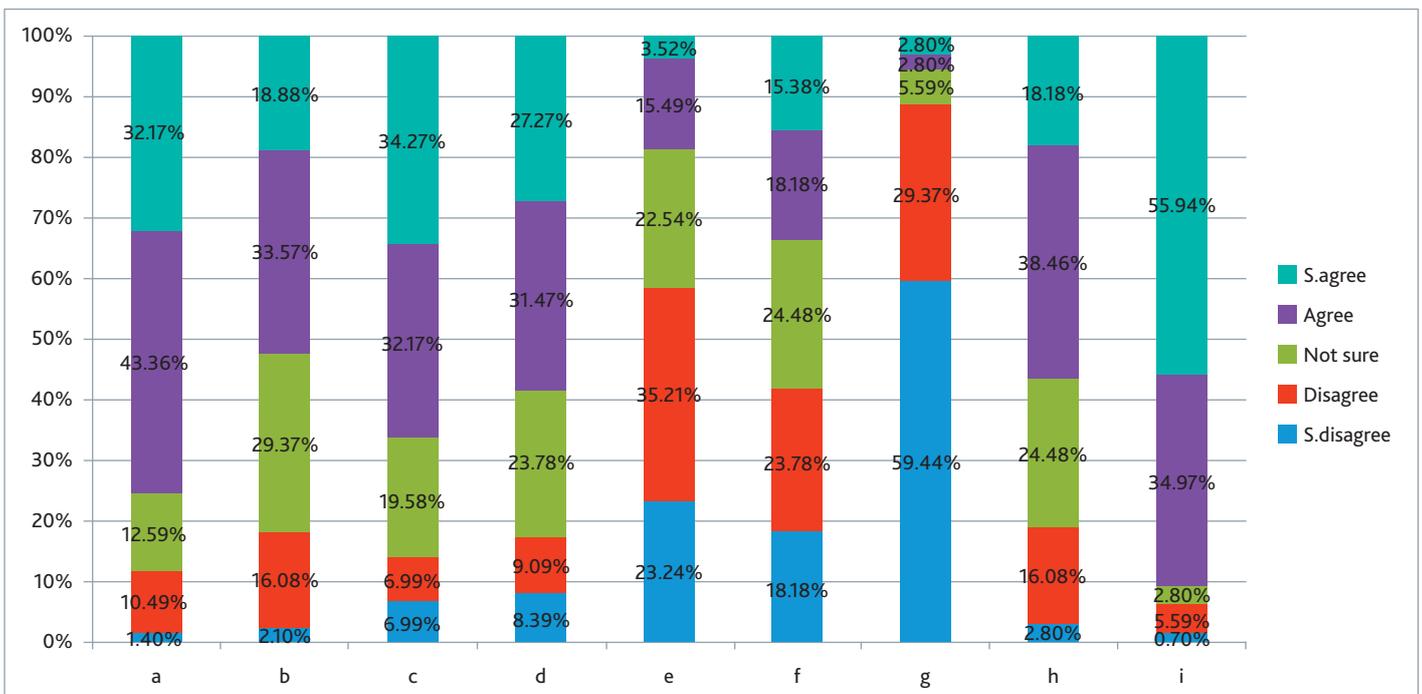
The other responses in this part of the questionnaire indicate that sharing staff and the presence of a similar business culture across firms can both assist innovation (in each case around 50% of respondents saw these factors as important or very important). By contrast there was a weak link between innovation and firms' shared membership of a business association (only just over 30% saw this as very important or important).

**Conclusions from the quantitative analysis**

- (i) A first conclusion is that industry practitioners value formal contracts as devices for shaping their relationships during the performance of projects. They understand contracts to be legally binding agreements which should be strictly enforced and do not, on the whole, view them as loose, non-binding arrangements. In particular they see a role for formal contracts in dispute resolution should problems arise in the course of a project.
- (ii) Secondly, the survey suggests that civil engineering and construction contracts have been changing: they are seen as more collaborative than they were. However, this does not mean that they have necessarily become more clearly drafted, more flexible, or more important to the performance of projects: responses on these points were mixed or equivocal. It does not appear that the shift which has taken place has made

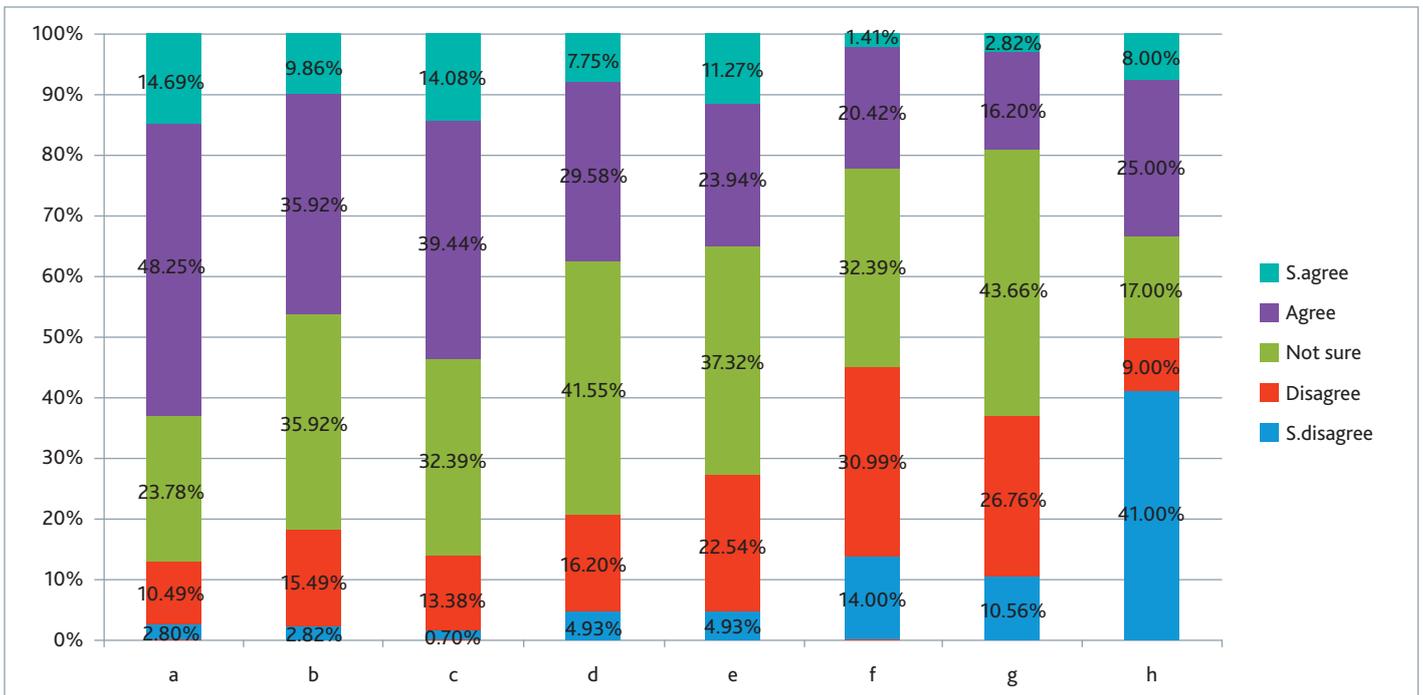
contracts easier to read or understand. Nor has it resulted in fewer contractual disputes than in the past.

- (iii) There is a strong association in the construction industry between trust, on the one hand, and flexibility in performance, as indicated by the practices of honouring informal understandings and engaging in dialogue, on the other. Respondents also associated strict performance of contracts with trust, although to a lesser degree. This suggests that in certain contexts, contract and trust can be complements.
- (i) There is a stronger association between flexibility, dialogue and the sharing of information, risks and costs, on the one hand, and innovation, on the other, than there is between these features of contractual practice and trust in general. This suggests that innovative projects more than others require a contractual framework capable of engendering close cooperation, based on dialogue and risk-sharing, between the parties.



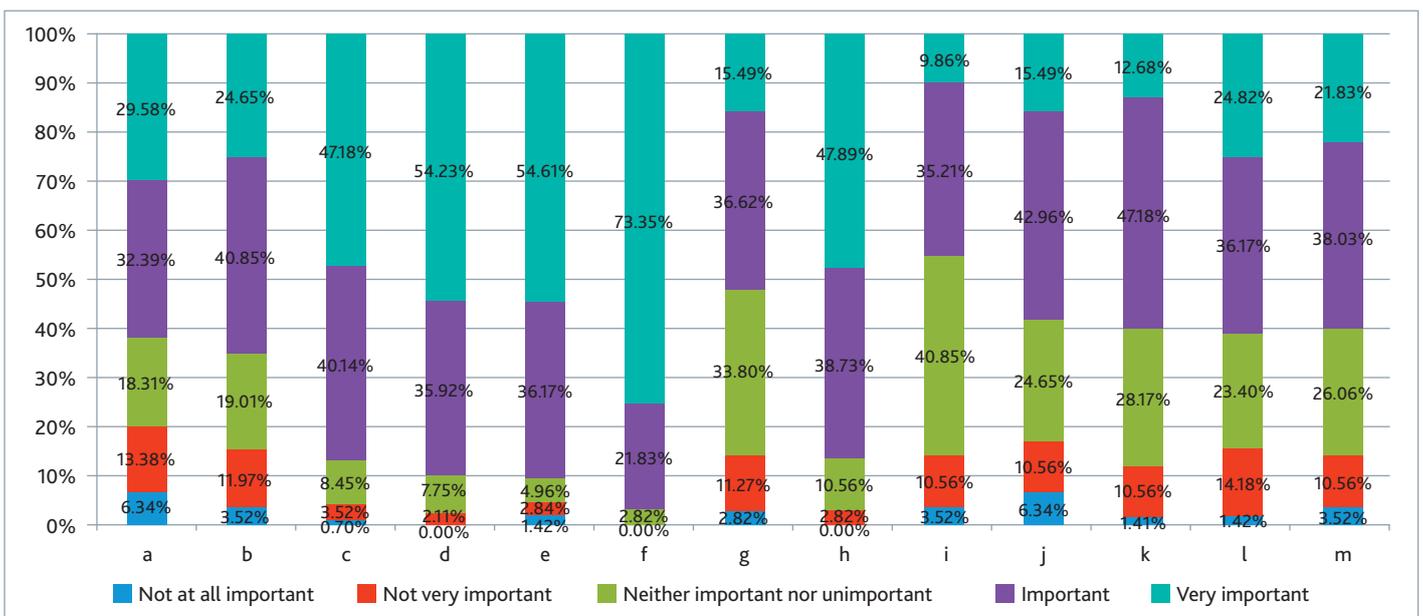
**Figure 1: Expectations of contractual practice**

Key: (a) the contract should cover all likely eventualities; (b) the contract should be familiar to the parties from previous dealings; (c) the contract should indicate penalties for late performance; (d) the contract should be renegotiable if circumstances change; (e) it is better to have a framework agreement than a legally binding contract; (f) the contract is less important than personal relationships; (g) the contract is not important once the work begins; (h) contracts should be strictly enforced according to their terms; (h) having a clear contract helps to resolve disputes if things go wrong.



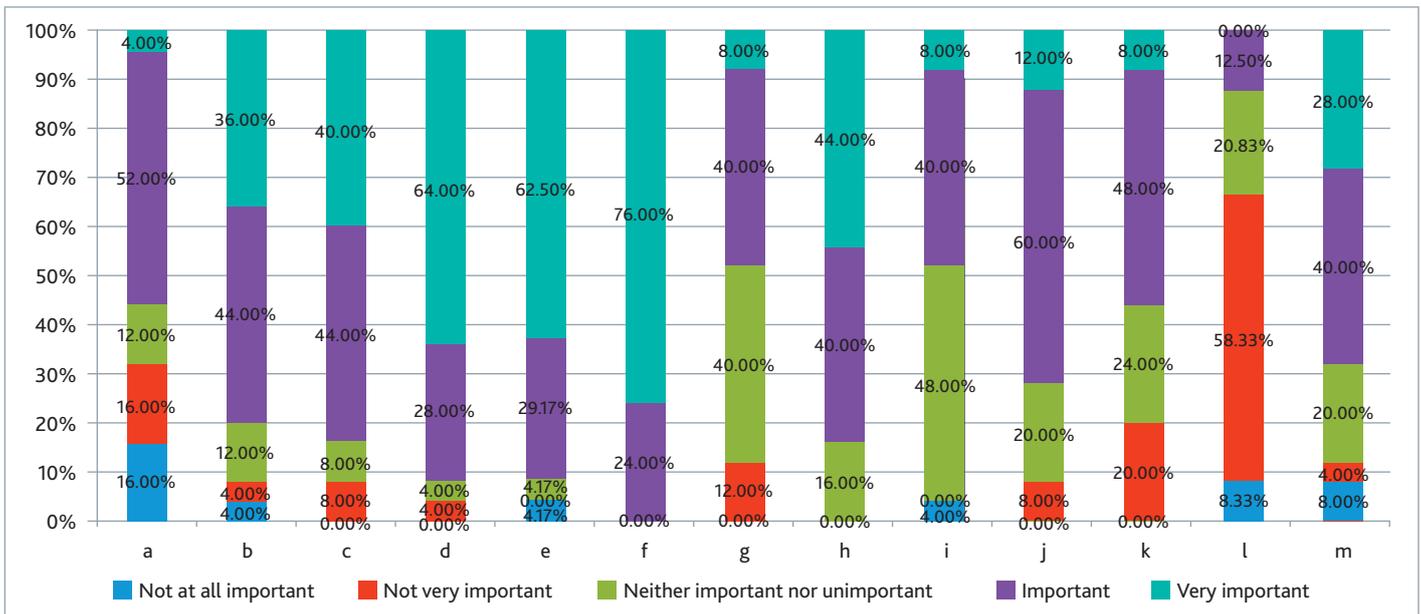
**Figure 2: Changes in contractual practice over time**

Key: (a) contracts have become more collaborative over time; (b) contracts are more clearly drafted than they used to be; (c) contracts are more detailed than they used to be; (d) contracts are more flexible than they used to be; (e) contracts are more important to the success of projects than they used to be; (f) less time is spent reading the terms of contracts than in the past; (g) there are fewer contractual disputes than there used to be; (h) parties are more aware of their contractual rights and obligations.



**Figure 3. Associations between contractual practice and trust**

Key: (a) honouring strictly the terms of the contract; (b) performing on time; (c) maintaining quality; (d) honouring informal understandings; (e) engaging in dialogue from an early stage; (f) being ready to help in an emergency; (g) being prepared to give and take; (h) being willing to overlook occasional faults; (i) being willing to exchange business information; (j) being willing to share business risk; (k) being ready to renegotiate the contract when circumstances change.



**Figure 4: Associations between contractual practice and innovation**

Key: (a) having a clearly written contract with specific rights and obligations; (b) having a flexible contract; (c) sharing costs of innovation; (d) sharing gains from innovation; (e) sharing information on risks; (f) discussing problems as soon as they arise; (g) joint ownership of intellectual property; (h) long-term relationships; (i) sharing staff; (j) sharing product information; (k) successful dealing in the past; (l) membership of the same business association; (m) similar corporate culture.

**Qualitative analysis**

In this part we report findings from our interviews, which provided us with an opportunity to discuss issues with practitioners in greater depth. We also make use of the feedback provided by respondents to an invitation in the survey instrument to provide open-ended comments on the issues it raised. 10 interviews were conducted and 14 detailed survey responses received. The interviewees and survey respondents came from a range of backgrounds in the industry and we analyse their responses by reference to their respective roles, with the focus on clients and contractors.

**Clients**

Clients stressed the importance of collaboration in complex and innovative projects but also stressed the costs and risks associated with it. Collaboration was seen as expensive and resource intensive. In part this was because close cooperation presupposed an investment of time and resources in understanding the needs of the other side. In complex projects, close collaboration would only work if clients accepted that they held a significant degree of residual risk; this also raised the set-up costs for clients.

It further followed that collaboration was not appropriate for all projects. Where projects could be procured on a standardised basis, there was no need for a collaborative approach. Practices such as integrated team-sharing and pain/gain share had a role in innovative projects but were not appropriate in every case:

*“Contracts don’t always matter and collaboration is not the blanket answer. You match markets to collaboration. Bank Station, that was complex, it required collaboration. But you can end up with ‘we must collaborate’ and then ‘partner’ becomes a dirty word. It costs to collaborate.”*

The role of the contract in promoting collaboration was not seen as straightforward. Sometimes contracts could engender a false feeling of security:

*“Contracts give people the feeling of being secure. We sell this dream to the client: here is the contract and you’re safe. There are people who think fixed price is low risk. It isn’t. We have to educate people on this.” (Client)*

*“NEC3 may be the preferred form but people use it blindly. And then things go wrong... That’s why there are all those Z clauses in NEC3. They are all about apportioning risk from the client back to the supply chain.” (Client)*

*“Sometimes contracts stop active risk management because people think, it can’t go wrong. But it’s often what the contract doesn’t say that matters.” (Client)*

There was also a perception that innovation was often an unnecessary risk for clients:

*“From a client’s point of view, innovation on a project is an additional risk – so why take it! Innovative ideas should be properly tested & evaluated before introduced into any project. A project is not a test bed, it is the sharp end of business delivery... Learn, digest, synthesis and apply i.e. no need to start from ground zero.” (Client)*

## Contractors

Contractors echoed the view that collaboration is not an easy ride and generally involved high set-up costs. There was support for the move to NEC away from more traditional contracts such as JCT and ICE, which some saw as having become too adversarial. There was recognition of the value of early contractor involvement and pain-gain sharing, but also a perception that the displacement of risk from clients on to main contractors, and then on to sub-contractors, was still common in the industry, and a feeling from some respondents that 'nothing has changed.'

Main contractors commented that risk-shifting by clients was common and also took the view that clients often regarded innovation as too much of a risk:

*"The majority of clients when an innovation is proposed will question where this has been used previously thus stifling innovation as someone will always have to be the first to employ the innovation. This is why the majority of the innovations come from the continent where presumably their clients enable the ability to trial and deploy these innovations and enable them to mature."*

*"ECI has lost its intended use over the last decade, almost becoming a way to solve some procurement burdens and secondly provide an opportunity to place greater risk on the contractor: 'why can't you own the risk, you've been there all along' is often heard." (Main contractor)*

Some contractors thought that innovation was best organised outside the framework of a formal contract:

*"The most successful value engineering on a project which I have issued post-contract is where there was a non-contractual agreement where if a sub-contractor could 'engineer out' elements of its scope of works, then this would be accepted and the sub-contractor would be paid half of the value of the omitted scope item. This gave an incentive for the sub-contractor to reduce the amount of work to be done, meaning that we (the main contractor) end up paying out less. However, if a sub-contractor is aware of this type of arrangement it could put them off value engineering pre-contract if it thinks that it could gain half of the value of an item which it could omit." (Main Contractor)*

Sub-contractors, in turn, were critical of what they saw as the tendency of main contractors to shift risk on to the supply chain:

*"The contract affects behaviour at the outset. If it is open tender under NEC3 Option A we own it, all the responsibilities and the risks, and we value all of that, we may have an escape strategy to deal with risk, but if the main contractor is risk averse they will put all the risk on us. Some of these risks are horrendous. Generally speaking the quality of the main contractor is poor. We have to manage our relationships with the main contractor."*

*"For most main contractors it is all about price and risk and putting the risk on the sub-contractor. Sometimes we will ask for information from the main contractor on how to price something and they will say, well, you work it out. Then it all becomes very brittle. They want fixed-price, lump sum, and they will devolve the risk on to us."*

Sub-contractors were also critical of open tendering procurement and similar practices which, some claimed, tended to degenerate into price wars:

*"There are many examples of tendering processes where money is wasted on failed bids. You do all this work and then you might as well throw it out of the window. The client strikes a deal with the main contractor but then tries to drive the price down further when the supply chain gets involved." (Sub-contractor)*

*"The tendering process does not help innovation. We don't get involved in open tenders. Too many tenderers, driving down the price. A closed tender built around relationships, we know who we are competing against, we know the competitors and we know there won't be a race to the bottom, that works better." (Sub-contractor)*

Contractors with experience of more innovative projects emphasised the importance of cascading pain-gain sharing mechanisms down the supply chain:

*"at the moment we are delivering a project... which involves a new procurement strategy, we have been invited to bid, we get paid a fee we are given a rate for various things, if we come in under budget we share the gain but the interesting thing is that this is not just with the main contractor, it is being cascaded down, this does help, we get a safety blanket, risk is shared across four parties, but we are incentivised even so because we gain on the upside if we do well. We could hit our budget but if one of the others failed to hit theirs, there is pain share. But the pain share is capped, e.g. 5%. So we know where we stand." (Sub-contractor)*

There was concern, conversely, that pain-gain sharing would not work if main contractors tried to squeeze profits from the supply chain:

*"Does [pain-gain share] lead to innovation? I'm not entirely convinced. It's the first time I've seen this. Typically even if the main contractor has this mechanism they put the sub-contractors on a fixed price. The main contractor will want to enhance its profitability by squeezing the supply chain. They will think, I've got a 2% margin and could get 5% but to do that I've got to squeeze the sub-contractors. Could it work with sharing innovation? Yes but it must flow down to the sub-contractors and it is about the ultimate client being prepared to go along with this approach. The ultimate client must recognise that the supply chain is where the value is. The danger is, it's a façade if the main contractor has its foot on the supply chain's throat."*

## Overseas experience

Some respondents were able to speak to the experience of contracting in overseas jurisdictions and to compare it to practice in the UK. One point of difference is that construction contracts in continental Europe tend to be shorter than their UK counterparts. There is still a reliance on traditional contract forms which have not been displaced by NEC-equivalents.

Respondents commented that contracts in France and Germany tend to be more rigid than their English-law counterparts, but that their role was different, in that there was less use of the contract once the project began, and a tendency to regard the signing of the contract as the start of the negotiation, rather than the end of it.

This suggests that continental practice is to see the contract as a framework, rather than as a road-map for the project, in part precisely because of its rigidity and relative brevity. One respondent commented that continental practitioners were surprised by how much stress is placed on the contract in Britain once the project is underway.

Respondents also commented on the importance of wider factors in driving continental contracting practice. These included the prominent role of the state in procurement in France, the persistence of the Mittelstand model of industrial structure in Germany in a way which has not direct counterpart in Britain, and the different corporate governance environment on the continent, with stock market pressure generally operating less directly on firms, and codetermination playing a more salient role.

### Conclusions from the qualitative analysis

- (i) The qualitative evidence suggests that barriers to innovation in the construction industry exist, including a continuing emphasis on adversarialism in contractual relations. This is exacerbated by price-driven procurement processes.
- (ii) There is scepticism towards innovation on the part of clients who see it as expensive and risky.
- (iii) Main contractors, conversely, regarded many clients as unwilling to share risks and willing to use formal contract terms to displace costs on to contractors.
- (iv) Pain-gain sharing arrangements are helpful for fostering innovation but they may not work if gain-sharing is not cascaded down the supply chain as opposed to being confined to first-tier contractors.



# Case Studies

In this part we present evidence in the form of case studies which are based on a combination of interview evidence and use of documentary sources.

## Crossrail

Crossrail is the largest construction project in Europe and at £14.8 billion is one of the single largest infrastructure investments undertaken in the UK. It will increase central London's rail capacity by 10 per cent. At peak construction, more than 10,000 people were working at over 40 construction sites across the capital with tens of thousands more jobs supported by the project throughout the supply chain.

Crossrail is a temporary project in the sense that the Crossrail organisation will not be responsible for running the rail infrastructure that it is tasked with creating. This can be viewed as limiting the possible returns to innovation.

Moreover, a possible barrier to innovation is that Crossrail is publicly funded. This can be seen as limiting incentives to innovate.

A further possible fetter on innovation is that the structure of Crossrail is highly complex. The project involved 16 tier one contractors and approaching 100 tier 2 firms.

However, Crossrail's managers have consistently held the view that the financing and structure of the project offer an opportunity to deliver innovations which have the potential to benefit the eventual users of the infrastructure as well as firms in the construction industry and the wider public. As the Crossrail CEO Andrew Wolstenholme has said:

*"In delivering London's new east to west railway, we hope to raise the bar in the construction industry, now and for future projects. To achieve that we need to think differently about how we share ideas and implement them."*

Crossrail's strategy for delivering innovation turned what could have been a weakness – the decentralised and multi-tiered structure of the project – into a strength, as the diversity of organisations involved was used to generate knowledge around innovation.

Crossrail's innovation programme began in 2012 when a strategic projects team was given responsibility for innovation, universities were involved in advising the organisation (Imperial College and University College, London), and an innovation strategy published. A Crossrail Innovation Forum (CIF) was established and a pilot programme begun. After the conclusion of the pilot programme in 2013, an online platform, Innovate 18, was launched with the aim of collecting information on new ideas and innovations across the organisation. At the same time the key supply chain companies

were invited to contribute £25,000 each into a matched-funding innovation fund to support the operation of the platform.

The result was that all major contractors joined Innovate 18, creating a pool of £750,000. By requiring skin in the game, Crossrail ensured mutual interest in engaging with innovation.

The Innovate 18 platform was overseen by the CIF and managed on a day to day basis by the Crossrail Innovation Working Group (CIWG). By these means, Crossrail created a bespoke governance structure which allowed for the pooling of knowledge and expertise across the group, taking advantage of the diverse range of skills and experience across the project as a whole which was previously confined to individual companies.

Between 2013 and 2015 five waves of investment were organised under the auspices of Innovate 18, with the CIF and CIWG overseeing the selection of projects for funding. The results of innovative projects were disseminated through academic publications and events organised with the help of the Digital Catapult.

Innovate 18 sent a message to the supply chain that it was not only acceptable to generate new ideas but actively encouraged. By these means, Crossrail's supply chain was encouraged to share intellectual property and release ideas. After it was launched in the summer of 2013, Innovate 18 received an immediate boost from new university graduates joining Crossrail, and within weeks ideas began to flow into the Innovate 18 portal. Much of the early innovation focused on safety. Over time, significant innovations soon began to be submitted in a wide variety of other areas. At its peak, more than 1,000 people from every corner of Crossrail were utilising Innovate 18 and sharing ideas.

In 2016, as the project neared completion, steps were taken to migrate the innovation programme into an industry-wide approach. A close-out paper is due to be published later this year and a Learning Legacy framework established so that the experience of the innovation programme can be captured for the benefit of future projects.

Contracts played a role in creating the conditions for Crossrail's innovation programme to succeed. Contracts were procured on the basis of the NEC3 agreement with provision for a 50% gain/pain share arrangement. In the words of one of Crossrail's senior managers, Innovate 18 platform was in effect organised under the 'umbrella' of NEC3.

In interviews and meetings with us, Crossrail's senior managers have pointed to features of the innovation programme which help to account for its success. It is important, they have suggested, to find ways to commit partners to innovation. This means taking specific steps to support information and risk sharing. Undue focus on IP rights can deter the knowledge sharing needed to make innovation work:

*"The problem is protectionism. An idea is shared which could have been subject to IP through normal patenting but that can be innovation-destroying. If you share an idea it can be used more flexibly."* (Crossrail executive)

At the same time, managers with responsibility for innovation must be constantly aware of the pressures on parties to behave in a narrowly commercial or self-interested way:

*“Collective behaviours are all about sharing and collaboration and it becomes too slow if you move towards competition.”* (Crossrail executive)

Contract form is important:

*“Cost-plus contracts with lump sum payments don’t work. They can generate innovation within the company but there is no sharing.”* (Crossrail executive)

At the same time, the contract is ‘an enabler not a driver’, and ‘the contract and behaviours must work together’.

Crossrail’s experience suggests clients need to be proactive in developing business and commercial models that encourage supply chain participation. Contracts which share the benefits of innovation among the parties are one aspect of this. Bespoke governance structures can play an important role in creating the equivalent of ‘common pool resources’ for sharing knowledge and information. Crossrail’s innovation programme also illustrates the benefits of taking steps to ensure that innovation does not conclude when projects come to an end.

## BaseStone

BaseStone is an example of a company that has experienced and overcome contractual barriers to innovation.

BaseStone operates as a Software as a Service (SaaS) platform. SaaS is now a well-known contractual standard in industries such as entertainment and finance but is less known in construction. SaaS is a software delivery model that gives on-demand access to licensed software on a subscription basis. Everyday and professional examples include Google Docs, Office 365, and Salesforce, where a service is delivered, and the software is centrally hosted – not sold to or owned by any client.

BaseStone is a collaboration tool for construction professionals that offers a central platform for the digital delivery of the project, offering multiple use cases across the construction site, including design review and digital redlining. BaseStone’s technology encountered a problem however at a contractual level when they were presented with a contract designed for a traditional technology software provider. BaseStone’s SaaS solution did not fit into the construction industry’s categories for adopting technology and SaaS never appeared in any of the contracts that BaseStone were offered.

BaseStone were initially offered a contract which contained a propagation clause that can cause confusion in service providers, specifically with regards to IP and foreground/background rights. These contracts state that the company who is procuring their system would own the foreground rights of their software. These foreground rights involve IP that is created by the SaaS company after the signing of the contract, including any updates or new

features. Evolving software is crucial to SaaS and the delivery of world class services. Anything that a company like BaseStone have created to benefit construction companies would then be in the hands of an organisation that cannot possibly continue that process, killing the concept of innovation. Traditional software vendors charge for any new feature and/or update (customers are made to purchase the software again). SaaS is about selling a service and access to software, not the software itself. If that software does not meet client needs, it can evolve very quickly or the client can stop paying for it, which is great for innovation. When BaseStone builds a feature after a contract has been signed, it has the freedom to deploy this feature across its user base, in different companies and their supply chains. Innovation is defined by this agility and creativity, which ceases if IP is owned.

This becomes particularly problematic when SaaS SMEs are trying to collaborate with large industries like construction which operate on outdated contractual models. These contracts give the impression that sharing information is bad, when in reality information flows are crucial to true digitisation. Fortunately, some of the biggest players in the industry are BaseStone’s clients, and they understand their need for agile technology. BaseStone have been able to work with enlightened individuals and organisations, making it possible for them to work around these constraints via the standard contract formats and have developed strong relationships as a result. People are seeing the importance of SaaS and the benefits that BaseStone’s technology is bringing to the industry. Part of the problem with technology adoption certainly resides with the contract.

## Transport for London – Bank Station

With the objective of procuring better value whilst delivering projects, Innovative Contractor Engagement (ICE) was conceived by Transport for London (TfL) to ensure that the good ideas the market had in response to project requirements could be brought forward and developed with the client as soon as possible for maximum benefit.

ICE was pioneered on a major upgrade project at Bank Station. In the case of London Underground (LU), a key lesson learnt from the award of design and build contracts for Bond Street (2010) and Victoria (2010) was that supply chain innovation had to be identified early on in the procurement process in order to maximise the benefits that the innovation could bring to the project in addition to Innovative Contractor Engagement which was borne from the same procurement learning.

ICE was designed to incentivise early innovation from the supply chain. It consists of two strands; first, commercial protection of competitive advantage from bidder’s innovation; and second, competing performance delivery against outputs (not pricing of a common outline design).



The original core principles of ICE are as follows:

- Pre-qualification based on contractors' ability to deliver and specifically their ability to innovate;
- A post qualification period of 'Ideas Development' against a Requirements Schedule;
- The protection of contractors' intellectual capital for innovation;
- Establishment of a non-disclosure agreement between the parties;
- Establishment of fees to be paid to the contractor for this development;
- Redrafting of the Requirements Statement to allow for constraint removal where conflicts are established;
- Issue of the ITT against this modified Requirements Statement;
- Commercial evaluation against Requirements Statement; and
- Contract against Requirements Statement NEC Option C (essentially therefore culminating in an orthodox contractual arrangement).

The team also recognised that developing an untried procurement approach would require the development of new management processes and procedures not in the corporate management system. Doing this on a major project such as Bank presented a significant delivery risk to the project and brought considerable reputational risk to LU. Thus it would have to develop specific processes and procedures for managing these risks. The management of reputational risk can have a significant influence on the pioneering of an innovative approach which by its very nature has no precedence.

# Proposals for reinforcing and promoting innovation

The following proposals are built on a foundation of cultural change, behavioural adjustment and an alteration in mindset.

## Professional image & innovation campaign

The industry must become more professional and the engineering profession heightened in its relative standing. Engineers have a desire to push science and engineering and aspire to advance the profession. We must equip our professionals with the resources and tools required to reach their full potential and illustrate the knowledge and excellence within the industry. Mega-projects such as the Olympics and Crossrail have contributed to making the industry more attractive and this momentum needs to be built upon by accelerating innovation to market, utilising the latest tools, products and processes in addition to improving the link between the industry and research. An industry supported and connected campaign led by the professional institutions to raise awareness around innovation would be beneficial and could be used to attract new entrants.

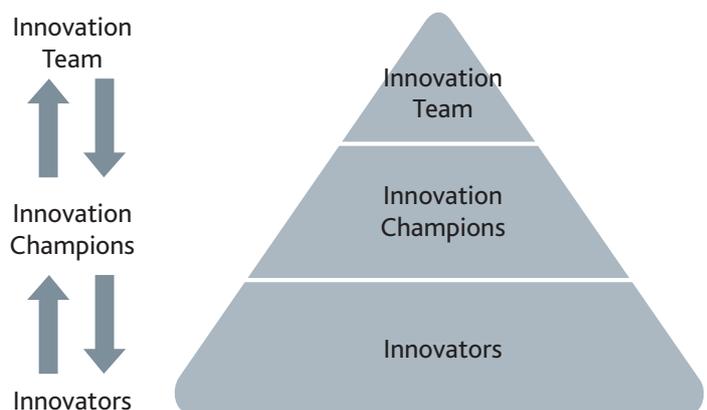
## Client leadership

In showing a willingness to share cost and risk in addition to engaging in and encouraging early innovation, clients can act as the catalyst for bringing the changes which are required to enable not just innovation but open innovation. Clients, particularly large infrastructure clients, are in a strong position to change behaviour and must aid in driving the required changes as highlighted within this report. If you are seeking to encourage innovation on major projects, experience has identified that it is important to integrate any programme and investment into the core delivery programme to ensure it is embed as part of the approach and not seen as a side function. Innovation should be part of any programme and should be considered in the overall mix of key mechanisms to deliver the programme. A measure that captures contribution by different teams should be identified that allows experts in their field to evaluate and drive innovation into the day-to-day operation and report benefits.

Behavioural assessments have been a good start however offer only a snapshot of behaviour at any given time. Without the correct business models and structure in place, poor behaviours can be inadvertently promoted. An example of a structure unintentionally promoting negative behaviour could be a client requirement to competitively tender packages of work, overlooking the opportunity for a contractor to bring forward innovation from its well-developed supply chain at the bid stage, a process which requires trust and commitment.

## Innovation managers and innovation champions

Innovation champions and innovation managers play a crucial role in ensuring that innovation is channelled to the correct places within an organisation, in addition to ensuring relationships are maintained with the appropriate external partners and that ideas are gathered from across the organisation and appropriately managed.



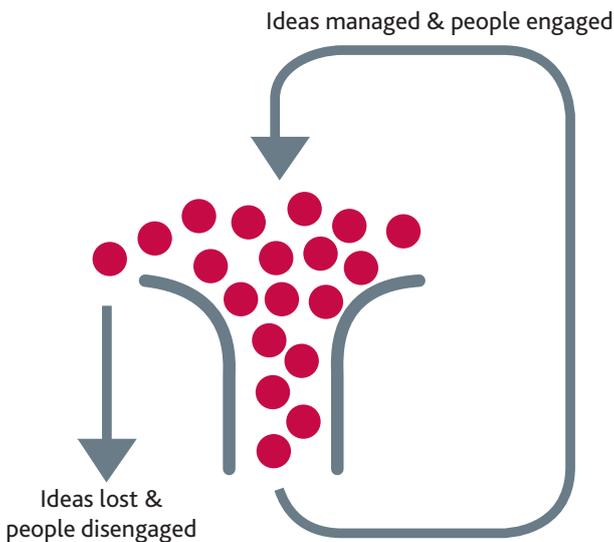
In terms of roles within the industry, the position of innovation manager is relatively new and indeed the introduction of innovation teams are newer still and almost exclusively exist within mega-projects. The introduction of an innovation manager on each project above a certain size, the appropriate level to be determined by the organisation, would surely be a move in the right direction at a time when business models are evolving to reward the benefits this role can bring.

On major projects the leadership of the client's innovation team and project managers can either hinder or inspire the wider delivery team. These managers should have the facilities and correct processes to encourage and support innovation adoption. Once a suitable innovation has been identified as an innovation that can be standardised and scaled across a number of contracts and seen as a best practice that will deliver benefit to the contract, the powers of instruction to accelerate innovation into a live operation should benefit the end outcome.

<sup>20</sup> Harvard Business Review; Don't offer employees big rewards for innovation; Oliver Baumann & Nils Stieglitz; 2014

When considering this type of approach it is important to allow the correct resource and budget. Without the people with the correct skills to facilitate the process the desired intent might not be achieved and the return on innovation not maintained. The budget is also important and has two parts, the first is the investment required to procure and trial the innovation and the second for the client project manager to allow additional costs to assist the facilitation of the innovation in the live environment. When implementing innovation you need to consider access equipment and the addition resource required for the trials should be factored into the budget.

Regarding incentivisation, it should be recognised that while large incentives may bring a deluge of ideas, that is not necessarily a good thing as this can become too difficult to manage, with organisations lacking the resource to respond to each employee or act on each idea. This risks a situation where employees become disengaged as they do not receive an adequate response to their idea. Smaller incentives are cheaper and offer a more manageable flow of ideas. While employees respond positively to incentives, they become discouraged by low odds of securing a reward or by being overlooked.



### Highlighting whole life benefit against short term cost

Major projects are often created with the investment from a capital budget. Within this capital budget an allowance should be made for innovation that will assist innovation that will benefit the life of the asset. Making this provision will assist the relationship with the maintainer to find innovations that will improve the operational performance of the asset.

### Supply chain management

Supply chain management is absolutely essential to developing and implementing innovation within the industry. From large suppliers to SMEs, these businesses are well placed to develop innovation. Contractors currently offer little incentive for sub-contractors and suppliers to bring forward innovation. Indeed, sub-contractors and suppliers assisting a contractor at work winning stage generally have no guarantee of being awarded a contract as the contractor may go on to select another party to carry out the works. As a consequence, there is no incentive to provide innovation at the crucial early involvement stage.

Human resource and the culture of your team is critical to innovation delivery. You will have selected the best team to work and deliver the project and they will expect the best working environment and conditions. The human resource business processes, training and incentive mechanisms should be adapted to ensure that innovation is recognised by formal review processes.



# Proposals for contracts

The previous section has described the extra contractual steps that can be taken in order to create an environment that encourages innovation and creates opportunities for innovation to be proposed and implemented. That can take place as part of a non-binding framework, especially on mega-projects such as Crossrail. The empirical research has however shown that people still consider it important to have a formal contract in place rather than a loose non-binding agreement and that compliance with such a contract plays an important role in creating trust. At the same time, it was recognised that it is beneficial for contracts to have some flexibility and that this is particularly important for innovation, where people recognise the sharing of information, as well as sharing the costs and benefits, plays an important role.

This suggests that there will be a benefit in having an express contractual provision dealing with innovation. That will be coupled with an extra-contractual culture that encourages and supports innovation. In such an environment, the contract can encourage and enable innovation by creating a mechanism that identifies the opportunity for innovation, clarifies its position within the contractual framework and helps address any barriers.

There is a range of views as to how such contractual mechanisms should work, and whether they should be the subject of comprehensive detailed drafting or whether a minimal approach is better, relying on the parties reaching agreement. As noted above, some existing contractual structures, such as target cost contracts and value engineering clauses, help to align parties' interest and can be said to be effective ways of encouraging innovation.

In our view, there is a benefit in addressing innovation in the contract, even where the contractual framework already encourages parties to collaborate and improve their performance. This is because of the importance of identifying innovation as a separate objective and raising awareness and the recognition in the research that innovation is different from other contractual obligations. This also ensures that the employer sends a clear message by elevating innovation under the contract, showing that it is a joint objective and allowing the contractor the confidence and incentive to put forward proposals. It is therefore necessary to consider how such provisions should be drafted.

## The approach to innovation clauses

The clear message from the research has been that people are more familiar with contract provisions than they used to be and are more likely to read the contract. Much of that appears to be driven by the use of contract forms such as NEC3, which put the emphasis on clear drafting in plain English as opposed to the lengthy formal drafting that is found in more traditional contracts (and tends to discourage familiarity with the contract).

This confirms that any clauses drafted should aim to be clear and concise. The issue however is the extent to which it is possible to

provide for all possible eventualities within the contract or whether it is possible to rely on collaboration and future agreement. It is also necessary to recognise that innovation entails some risk and that investigating the potential for innovation may impact the works and result in additional costs and delay. Such clauses can be used as part of any agreements for early contractor involvement and as part of the construction contracts.

The research has shown that while people have a preference for a formal contract that provides for all eventualities, there is also a desire for flexibility and this is especially the case for innovation, where people recognise that the contract should allow for communications, sharing of risks and benefits and flexibility.

At one extreme, it may be possible to have a brief provision that simply states that a party that wishes to propose an innovation shall provide details to the other party and they shall meet to agree whether and how such a proposal will be adopted. This is sufficient to identify innovation and provide a trigger for proposals, but it then relies on the parties engaging in a genuine attempt to agree issue such as payment, risk allocation and ownership of any IP rights. This provides a great degree of flexibility but gives rise to the risk that parties may be distracted or discouraged by having to negotiate the terms. A sample of such clause can be found below.

*Either party may put forward an innovation proposal which may reduce the costs or duration of the works and/or have benefits with regard to the performance of the works and/or the operational life of the Project. Such proposal shall be submitted in writing with full particulars and the parties shall meet to discuss whether and on what basis such a proposal may be implemented.*

An alternative is a detailed provision, which sets out in advance a process for proposing innovation and identifies how such a proposal will be dealt with in terms of sharing the costs of innovation and the impact on the works. The benefit of such an approach is that it resolves in advance incidental issues and allows the parties to focus on the innovation itself as opposed to the commercial implications. By way of example, parties can agree that the costs of any innovation will be shared equally as will be any savings, but that the party proposing the innovation will take the risk of delay caused by implementing the innovation. A sample of such clause can be found below.

*1. "Innovation Proposal" shall mean a proposal that identifies a change to the Works or a method that is likely to result in a reduction to the cost or duration of the works or an improvement in the quality of the works, manifesting itself for example in an improvement to the performance of the works, including a long term improvement or cost reduction and/or an improvement in the maintenance regime for the works and/or following completion in the long-term operation of the works. The party making the Innovation Proposal shall investigate and prepare the Innovation Proposal at its own expense and risk and without disrupting its performance of its obligations under the contract and/or the progress of the works.*

**2. The Contractor shall notify the Employer of an Innovation Proposal by submitting full particulars of such proposal in writing, including:**

- 2.1 the direct and incidental, costs of implementing the Innovation Proposal**
- 2.2 the impact of the Innovation Proposal on the duration of the works**
- 2.3 any related risks of implementing the Innovation Proposal**
- 2.4 details of any independent or external assessment of the Innovation Proposal**
- 2.5 the potential benefits of the Innovation Proposal to the value of the works to the Employer.**

**3. The Parties shall meet within 14 days of the Innovation Proposal being submitted to agree whether the Innovation Proposal should be implemented and/or any changes that may be required to the Innovation Proposal before implementation. The Innovation Proposal shall be implemented in an instruction on the following basis, unless otherwise agreed by the Parties:**

- 3.1 The Parties shall share the costs of implementing the Innovation Proposal on an equal basis**
- 3.2 The Contractor shall be entitled to an extension of time to the extent that implementing the Innovation Proposal delays completion/taking-over**
- 3.3 The Contractor shall own the Intellectual Property, if any, related to any Innovation Proposal and shall grant the employer an irrevocable free perpetual license to use the Innovation Proposal, notwithstanding any other provisions of the Contract.**

Using a pre-determined approach however prevents flexibility and goes against the inherent unforeseeability of innovation. In other words, it is very difficult to predict what innovative proposals will be made and trying to predetermine a uniform approach may well be too rigid. If the contract identifies that costs and gains are shared equally, that will prevent a party who may be willing to pay a bigger share or take a greater risk, since they have a better understanding of the potential value. The empirical research also suggests that, for innovation, a flexible contractual provision would be preferable.

It is of course possible to strike a balance between the two approaches and try to agree some matters in advance while preserving flexibility and the potential for negotiation. Indeed, we expect that parties will consider what is most suitable for the particular project and the type of innovation that they wish to encourage. We suggest that in any event such a provision should refer expressly to innovation and provide a process which allows a party to present a detailed proposal to be discussed with the other party.

### **Engaging the second tier supply chain and consultants**

Innovation will often occur at the second tier level, where specialist suppliers or consultants will have the expertise to suggest innovation in their areas. This means that second tier contracts should have similar contractual provisions and these should be on the same basis as any clauses in the main contract, in order to ensure that the interests of all parties are aligned.

In practice, it is likely that discussions about innovation will take place between the employer, main contractor and specialist sub-contractor or consultant. It also follows that any agreements about implementing an innovation and any sharing of costs and benefits will have to take place under both the main contract and the sub contract. We do not anticipate that this will create a problem and while it is possible to add a contractual provision dealing with such tri-partite discussions and agreement, on balance that seems unnecessary.

### **The use of incentives**

As noted above, the main direct incentive for proposing innovation is the opportunity to share the financial benefits of any savings. It is however possible that innovation will have benefits which are not reflected in direct savings, for example whole life maintenance cost is reduced but not the construction costs. In such a case, a contractor is likely to expect to receive a share of such benefits, as well as being paid the costs of implementing the innovation. This is something that employer will need to recognise and allow for.

In addition, there are indirect benefits in proposing innovation, by developing a reputation for innovation, which will assist with winning further work opportunities, and improving the working relationship with an employer, which will increase the trust between the parties. This is part of the wider picture and some suppliers may well feel that it is in their benefit to develop a reputation for innovation even without a direct financial incentive.

Employers who wish to promote innovation and to recognise the value in proposals being made, even if they are not implemented, could consider other forms of financial incentives. The NEC3 form, for example, provides at Option X20 for key performance indicators which are used to create targets for a schedule of incentives, so that the contractor is paid when a target is achieved. It is possible to use such a mechanism to create incentives which are based on KPIs such as the cumulative amount of savings due to innovation proposals or the number of innovation proposals submitted by a contractor, coupled with the percentage of implemented proposals.

### **Innovation in the context of mega-projects and alliancing**

Another theme that has come up from the research is that complex mega-projects, especially where alliancing is used, need to be considered separately from smaller single projects. This is not surprising and it is of course the case that in a mega project the potential for innovation and resulting benefits is much greater and the employer has a much better ability to encourage innovation. The Innovate 18 project at Crossrail discussed above is a clear example.

In contrast, a local authority procuring a road may be less keen to explore innovation and would prefer to benefit from relying on established methods and avoid uncertainty. This simply reflects the fact that innovation needs to be considered in context and that while in general innovation is to be encouraged, the extent to which innovation is promoted will depend on the nature of the project.

It does also mean that mega-projects represent the best opportunity for promoting innovation and that this should be recognised as one of their benefits. The same is true for projects procured through alliancing, where a large number of contractors are involved and there is an opportunity for different parties to collaborate.

### The use of an innovation protocol or statement

Some parties will wish to encourage innovation but will be reluctant to include a specific contractual clause. Indeed, some parties may believe that innovation should be promoted but should not be regarded as a contractual activity and that people may be discouraged if it is seen as yet another contractual process.

In such cases, parties may use an Innovation Protocol/Statement, which can be included in the contract or exist outside the contract. The Protocol can serve to promote innovation and provides guidance to the parties on how best to deal with innovative proposals. We assume that in such a case parties will want to ensure that such a protocol does not create any binding legal obligations, but that needs to be made clear to avoid any uncertainty. If the parties agree to implement an innovation, that will be pursuant to any existing contractual provisions and any amendments that may be needed.

This has the advantage of complete flexibility and it does not of course prevent the parties from agreeing at a later stage how any proposals are incorporated into the contract. We would anticipate such a protocol to include statements similar to the ones set out below:

- The parties acknowledge the benefits that innovation can bring to the project and will work together collaboratively in order to identify and develop opportunities for innovation.
- The parties recognise that innovation can assist to reduce the costs and time take to complete the works, but that innovation can have wider benefits over the whole life of the project. Such benefits include better and more sustainable performance, as well as other benefits such as improving health and safety during construction.
- When either party identifies an opportunity for innovation, the parties shall meet to discuss the potential benefits of such innovation, as well as the costs of implementing innovation and any risks that may arise. The party proposing the innovation shall provide:
  - Details of the proposed innovation
  - The potential benefits in terms of costs and time, as well as any wider benefits
  - Any risks in implementing the innovation
  - Any relevant industry experience or knowledge
  - Whether the innovation will result in any intellectual property rights that will need protection.

- The parties will discuss the approach to each innovation on an individual basis but in general will seek to share the benefits of any implemented innovation as well as related costs and risks.
- The parties recognise that the potential benefits of any proposed innovation will not materialise and that innovation involves risk. The parties will share such risks equally and will not seek to blame each other.
- Unless otherwise agreed, all parties will be able to use the innovation on other projects and works.
- The parties acknowledge and agree that the statements above are not intended to be legally binding and that any innovation will be implemented in accordance with the terms of the contract and/or other terms to be agreed by the parties.

As noted above, using such non-binding principles may be seen as more acceptable to some parties. They will help to encourage an innovation mindset and provide a structure for proposing innovation. If the parties then wish to implement any innovation, they will however still need to agree the contractual basis and confirm how the costs and benefits are shared. This may not be an issue when using a target cost contract, for example, but if the parties agree that they will share any design related risks, this is likely to require a separate express agreement.

### Summary

At present, contracts do not encourage innovation directly or identify it as an objective of its own, but the two common mechanisms that will in practice encourage innovation are target cost contracts and value engineering clauses, which allow both parties to share the benefits of savings.

Such mechanisms are likely to be sufficient on projects where innovation is less important, possibly because it is not a large scale project or the scope is based on standard designs which require no development. Innovation however will be more important on large complex projects, especially where the supply chain enters into an alliancing arrangement. In such circumstances, we believe that it is of benefit to identify innovation as a contractual objective and provide a procedure for proposing innovation. This is in addition to the non-contractual measures identified above.

The form of such contractual procedure will be up to the parties and will be based on the underlying construction contract. In general, while it is possible to create a detailed prescriptive provision, it is our view that a general and relatively brief provision has the benefit of being more flexible and accessible and is less likely to be seen as a barrier.

We have also considered the use of an innovation protocol or statement which some parties may prefer to a binding contractual process. There are clear benefits to having such a document and it will help reinforce the importance of innovation, but where innovation is proposed and implemented, it will still be necessary to address with clarity how the parties will share any benefits or risks.

# Conclusions and Recommendations

The industry has been recognising the value of innovation for a number of years, as part of the drive to respond to customer needs by forming collaborative delivery models to achieve better value. This is self evident from the case studies we have set out above and there is a clear intention to continue such efforts justified by the benefits of the approach. This enlightened approach is being led by mega-projects that benefit from attracting the best talent, resource and skills. The challenge will be to see how innovation can be used to the same effect on smaller projects such as schools and hospitals. What is clear is that innovation must be led by clients and the client must cascade the intent down into the supply chain. Innovation will not happen without the right leadership at all levels in the supply chain and the innovation intent can easily be broken by the wrong behaviours. Choosing the right businesses that have a history of long term collaborative relationships and innovative delivery will be key to the next stage of the industry's evolution.

Similarly, there are contractual mechanisms that are designed to align interests and encourage innovation, by allowing parties to share savings and assist in creating a collaborative environment. The research however has shown that parts of the industry are yet to fully convert to collaborative contracting and that there is still a perception that collaboration is promoted as a way to drive cost down rather than embracing genuine cooperation as a means to enhancing value.

In that regard, the research has shown that people still value certainty of contractual frameworks. At the same time, perhaps not surprisingly, people desire flexibility to address unexpected events. This represents a contradiction for traditional construction which places a high value on certainty. Innovation, however, is very

different by its nature. It will often require investment and some risk, in order to provide potential savings. Having said that, it is also necessary to recognise that in engineering and construction, in contrast to other industries such as advanced manufacturing, a much smaller part of the project will lend itself to innovation.

We therefore suggest that promoting innovation has to take place at two levels. First, the industry has to champion innovation by public campaigns as well as more direct and specific recognition and promotion of innovation within businesses. This has to be led by clients and based on joint investment when possible. Second, it is necessary to recognise the desire for contractual certainty as to how the costs and risks of innovation will be addressed, as well as the sharing of the benefits. Having such a contractual mechanism in place will send a clear message from the top of the supply chain that innovation is valued as a shared investment and for businesses that decide that this approach fits with their business model, they will be able to decide how they can invest to deliver better outcomes to the customer.

As the industry matures it is achieving a greater understanding of the importance of innovation and clients of the industry are recognising how to encourage innovation in the supply chain to achieve better solutions. We expect to see greater alignment in supply chains which will move from mega project to the next mega project seamlessly, taking innovation and research between projects. The continuity of continued investment in the sector and the complementary commercial legal environment will provide a justification for business to invest in research and innovation to maintain competitive advantage. Through this market transformation innovation might bring new ways that could change the way the industry operates in the future. This change could bring productivity benefits and through that legacy we would see innovation transfer to small projects.

These conclusions have led to the specific proposals set out below. The table outlines learning we have discovered in the research and from this learning we have identified in each case a recommendation with an appropriate change agent who has the remit to implement the recommendation.



| Learning   | Recommendation   | Identified Change Agent  |
|--|--|--|
| <p><b>Apprentice Mechanism</b></p> <p>Apprenticeships are an appropriate mechanism to assist and train people into skilled roles addressing skills shortages. Many clients insist on a ratio mechanism (spend to number of apprentices) to determine the number of apprentices to be employed on the contract.</p>   | <p><b>PhD Mechanism</b></p> <p>We should encourage investment in skills development at PhD level, to enable us to address some the pressing challenges faced by the infrastructure sector. These would be formal PhD mechanisms that allow industry and academia to train high calibre future industry leaders. As an industry we should be using our contracts and spend to drive a behaviour of business investing in PhD training and development programmes to develop a pipeline of innovation and talent that will advance the performance of the industry in a similar approach to apprenticeships.</p>   | <p><b>Government Minister and/or Infrastructure Client Group</b></p>                               |
| <p><b>Crossrail Early Research Engagement</b></p> <p>Crossrail and the Cambridge University Centre for Smart Infrastructure and Construction worked together in the early outline design stages as part of a research programme to embed fibre optic into the drawings of major infrastructure assets across the Crossrail programme to form a monitoring mechanism that will now allow a greater understanding of how the civil assets are performing by taking measurement from the fibre optics integrated into the structure. At Paddington Station, fibre optic was integrated into the design of the station box wall, allowing the Costain Skanska JV to price and deliver the innovation as part of the construction programme. This is a good example of how future research and teams can be paid to deliver innovation in a live environment.</p> | <p><b>Research in the early stage of infrastructure development</b></p> <p>Major projects in the early phases of project development should have specific research programmes to assist the advancement of key challenge areas that will develop the industry and deliver an improved solution. Research Councils and major infrastructure programmes should look at how combining investment will deliver better results during the operational delivery of the contract.</p>   | <p><b>Research Councils and/or HM Treasury</b></p>   |
| <p><b>Crossrail Innovation 18 Programme</b></p> <p>Crossrail's innovation programme has changed the industry perception of innovation and shown how client leadership can engage a supply chain to innovate and share learning across companies.</p>   | <p><b>Industry Innovation Investment Platform (I3P)</b></p> <p>Clients must find ways to work together and develop innovation programmes across their operation that allows the industry to collaborate and drive innovation that benefits customer's' outcomes. A structured collaborative innovation programme would provide a link between large and small companies to work with industry clients and accelerate innovation to market.</p> <p>Thames Tideway Tunnel project has adapted Crossrail's Innovate 18 model and the database and software is evolving and being shared with other national infrastructure clients. The result of this is I3P, a platform which will bring the supply chain together to tackle the industries most pressing challenges. Completing capital programmes more efficiently across the entire life cycle not only adds value but also builds public confidence. Clients should be incentivised to work together and support their supply chains to innovate. I3P and the long term collaborative ethos it embodies is fully supported by the report's authors.</p> | <p><b>Knowledge Transfer Networks</b></p> <p><b>Institution CEOs</b></p> <p><b>Innovate UK</b></p> |

| Learning   | Recommendation  | Identified Change Agent  |
|--|---|--|
| <p><b>Contract Conditions</b></p> <p>Current contract forms do not expressly encourage or deal with innovation. In addition, there is a reluctance to innovate when there is no certainty on which party bears the costs and risks of innovation.</p>  | <p><b>Contractual Clause</b></p> <p>Clear contractual provisions will help underline the importance of innovation while giving contractors and their supply chain the confidence that there will be a genuine sharing of risks and costs, as well as benefits.</p>  | <p><b>Clients and publishers of standard contract forms</b></p>                          |
| <p><b>Lack of Structure &amp; Capability</b></p> <p>The industry suffers from a large variation in capability which is accentuated in the context of innovation management and where competence is patchy.</p>   | <p><b>Innovation Audit</b></p> <p>Driving forward a performance assessment framework for innovation to assess capability and skills within organisations from clients to supply chain partners, to understand maturity for innovation implementation would allow for a large uplift in innovation capability across the industry.</p>   | <p><b>Constructing Excellence</b></p>  |
| <p><b>Divide between Research &amp; Mega-projects</b></p> <p>Mega-projects can act as a catalyst for best practice but are neglected from a research and development perspective, resulting in infrastructure which could be greater developed in terms of social benefit and technological advancement.</p> | <p><b>Review &amp; Call for Evidence</b></p> <p>A review on 'Future Integrated Industrial Research' requirements for major infrastructure projects and an industry call for evidence to understand how public research investment can enable innovation that will deliver better infrastructure. Explore future delivery models and structures of governance that would best enable integration of invest activity.</p>   | <p><b>House of Lords Committee</b></p>   |
| <p><b>Disconnect between Infrastructure &amp; Social Benefit</b></p> <p>The lack of knowledge around the social benefit that the engineering and construction industry provides results in a lack of appreciation for what we believe to be an industry with a broad social reach.</p>                       | <p><b>Social Benefit Measurement Tool</b></p> <p>Industry practitioners should unite to develop a tool which provides a social benefit calculation and generates a fixed score. A wide range of variables would be assessed and the final score would have a weighting within a client's bid assessment. Variables would include, for example, the number of apprentices and PhD students, local economic benefit and employment in addition to contribution to research funding and engagement of universities.</p> <p>This would be of benefit to all infrastructure customers and particularly government departments which suffer from additional pressures to demonstrate value for money.</p> | <p><b>Independent research project funded by the Research Council or Innovate UK</b></p> |

| Learning   | Recommendation   | Identified Change Agent  |
|--|--|--|
| <p><b>Lack of clients introducing innovative business and procurement models</b></p> <p>Examples such as Crossrail and TfL where the fundamentals of project delivery are updated and improved are extremely rare in practice.</p> | <p><b>R&amp;D Contractual Model</b></p> <p>Target cost contracts could be used so that both parties agree that a percentage of any gain achieved is set aside as an innovation fund to be administered in consensus by the parties.</p> <p>The authors make no recommendations of how the fund should be spent. It could be fed into a long-standing R&amp;D relationship, be used to undertake some research or product development of particular interest, be spent quite quickly as a contribution to a 'good cause', feed into the aforementioned ISP platform or perhaps be donated to the ICE R&amp;D fund.</p> <p>Further research should also be conducted, developing new procurement models which enhance the opportunity for innovation, in addition to investigating the merits of such new business models.</p> | <p><b>Clients and the supply chain, supported by industry bodies</b></p> |



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# Notes

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