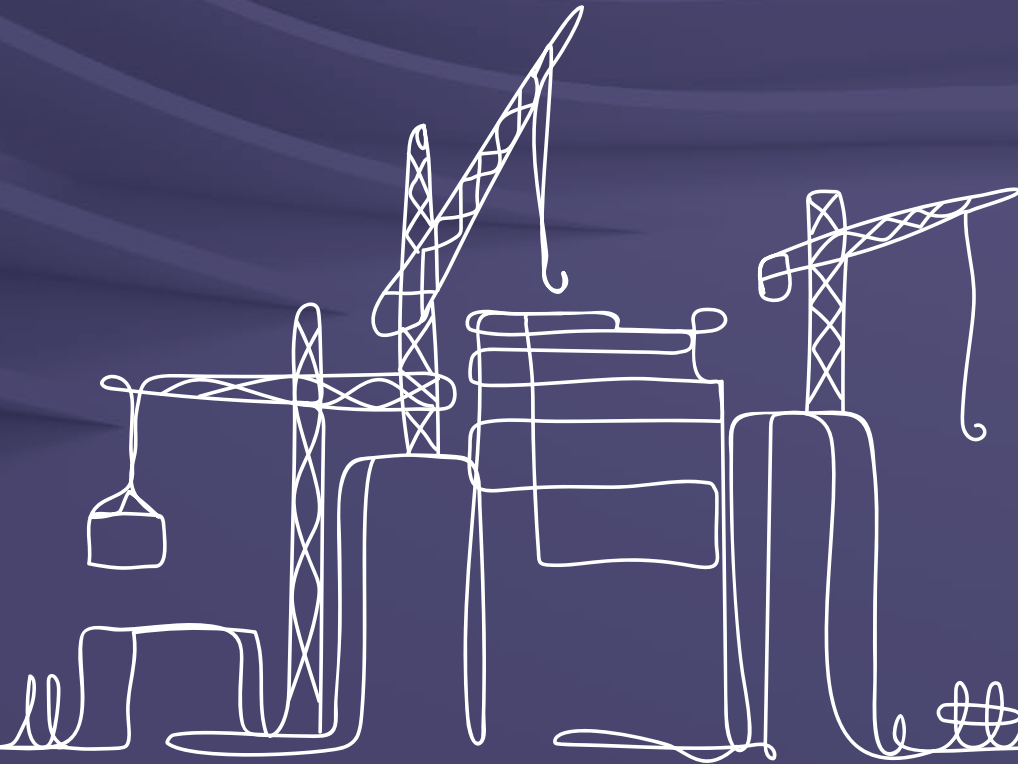


construction
productivity
taskforce

Trust and Productivity

The private sector
construction playbook

November 2022



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Foreword

Simon Gorski and Nigel Webb The Productivity Taskforce

Historically, the UK construction industry has been characterised by a lack of openness, poor productivity and a failure to invest in innovation. These issues have been well-documented across numerous reports and papers. While much progress has been made in addressing the problems, efforts towards improvement have often focused solely on the public sector.

This playbook for private sector construction projects seeks to redress that emphasis.


There is a clear consensus across the industry, be it client, consultant, or contractor, that the only way to address historic difficulties is through greater openness and transparency. *Trust and Productivity* seeks to show how. It provides a cradle to grave guide, from project concept to aftercare and all points in between, setting out how to deliver better, more smartly, more equitably and more productively. Higher productivity reduces costs, increases production, and enables the most effective use of available resources – the heart of sustainable construction.

Trust and Productivity is the result of 20 months' work across our industry. The collaborative way it has been created, by some of the UK's leading developers, contractors, professional services providers and suppliers, under the umbrella of the Construction Productivity Taskforce, has been inspirational.

Hopefully, both the spirit in which it was written and the framework it provides will help to improve the health and performance of our industry.

We are delighted that our endeavours have received widespread support, including the backing of the Construction Leadership Council and the British Property Federation. This is very much the beginning of a dialogue and we should view *Trust and Productivity* as a living document which will grow and flex as the changes it advocates come into effect. Ultimately, it will provide a roadmap towards a more productive and sustainable way forward.

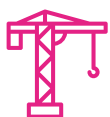
We encourage clients, contractors and all those across the design and supply chain to engage with the playbook and explore the options and ideas it contains to optimise the potential of our industry.



Simon Gorski is Chair of the Private Sector Construction Playbook Working Group and member of the Construction Productivity Taskforce. Simon is Managing Director, Construction, Europe, Lendlease.



Nigel Webb is Chair of the Construction Productivity Taskforce and Head of Developments, British Land.



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The Construction Productivity Taskforce

This playbook has been produced by the Construction Productivity Taskforce. The Taskforce brings together leading figures in the construction industry – clients, contractors, supply chain members and designers – to undertake practical interventions that improve productivity in the construction industry, which continues to fall behind other industries (see page 7).



The initial scope of work of the Construction Productivity Taskforce focuses on three mutually reinforcing areas, designed to improve performance:

1 Data and metrics

Defining a set of productivity and waste metrics which can drive performance improvement and, by facilitating clear and consistent data, drive a performance culture which enables a step-change in industry productivity.

2 Collaborative contracting

Creating this publication, *Trust and Productivity* taking cues from the government's *Construction Playbook*¹ published in December 2020 and updated in September 2022, but tailored to the private sector and prioritising increased productivity.

3 Pilot projects

Testing productivity measurement and improved ways of working across two live construction sites, to identify insights that will improve productivity, and develop a productivity framework to share with industry, titled *Measuring Construction Site Productivity: A seven-step framework for success*.



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Output and learnings from the Taskforce will be shared throughout the industry to increase the diffusion of best practice – which the Bank of England and others have identified as essential to boosting UK productivity.

The Construction Productivity Taskforce was convened by Be the Business, a charity established in 2017 by former John Lewis Chair Sir Charlie Mayfield and Sir Roger Carr, Chair of BAE Systems. Be the Business aims to boost UK productivity by sharing expertise from the highest-performing companies.

The Taskforce operates with the guiding principles of being outcomes focused, practical and pragmatic. Its priority is engaging the entire industry to adopt more effective practices. Workstreams have been established based on where progress could be made quickly, and every project is timebound, to maintain momentum.

As well as this playbook for collaborative contracting in the private sector, other key outputs to date include support for the launch of the Construction Data Trust, a framework to support collection and analysis of construction site data (see right).

Taskforce members comprise BAE Systems, British Land, Bryden Wood, Cast, GPE, Landsec, Lendlease, Mace, Morrisroe, Sir Robert McAlpine, Skanska, SOM, Turner & Townsend, Be the Business.



The Construction Data Trust

The not-for-profit Construction Data Trust (CDT) was founded in 2020 and is committed to transforming how construction projects are delivered. It enables a data-driven approach to resolving construction sector challenges, which includes productivity, health and safety, and sustainability.

The Trust manages a data platform to securely pool construction data from multiple sources in order to create a critical mass that can be analysed to create insights which would be beyond the abilities of individual organisations to achieve by themselves.

It performs three key roles:

- Legal steward of data managed by the Trust
- Data steward to establish a productivity data pool from current and completed projects
- Undertaking project work to assist in collecting and analysing data, establishing productivity benchmark metrics and consistent measurement

The Trust is a membership organisation, enabling members to collaborate on solving common problems, prioritising how and for what purpose members' data will be used to generate greatest benefit to the construction sector.

We encourage all project teams to measure productivity as a first step to improving it and to take part in the work of the Trust in collating and benchmarking data. This is expanded on further in Chapter 8.

If you are interested in becoming a member of the Trust or supporting its work, please visit:
www.datatrust.construction

About *Trust and Productivity*

Trust and Productivity is the result of many months' work by companies in the private sector who have come together under the auspices of the Construction Productivity Taskforce. They have collaborated to distil common experiences of the principles and processes that have delivered better project outcomes in terms of quality and productivity, sustainability and safety, and that have delivered projects to time and budget.

Principal authors have come from across the sector – Lendlease, British Land, Landsec, GPE, Sir Robert McAlpine, Morrisroe, Gardiner & Theobald, Alinea – to form a working group headed by Simon Gorski.



Simon Gorski is Chair of the Private Sector Construction Playbook Working Group and member of the Construction Productivity Taskforce. Simon is Managing Director, Construction, Europe, Lendlease.

Input has come from many other organisations from across the sector and we are enormously grateful for their support, including that of the Construction Leadership Council and the British Property Federation. A full list of acknowledgments can be found at the end of this playbook.

Commitments from industry

Supported by 10 drivers for success *Trust and Productivity* provides guidance that will ultimately boost productivity, quality and value and in doing so help tackle the wider societal challenge to reduce carbon emissions as well as improving the health, safety and wellbeing of the workforce.

To maintain momentum and ensure that our proposals have an immediate impact, the contributors to the playbook are committed to achieving the following by early 2023:

- **Embracing the principles it sets out across their projects** – we will continue to evolve our practices to ensure that they deliver excellent outcomes, to the highest level of safety, quality and sustainability; we will endeavour to take a collaborative approach and ensure this is pursued along the supply chain so that the playbook's principles are embedded from earliest concept to handover and aftercare in line with our recommendations
- **Spreading the word** – we will create a team of champions from each of the disciplines – client, QS, designer, contractor – to promote use of the guide through regular communications, live events and feedback sessions
- **Evolving and refining** – we will produce an interim report detailing progress so far alongside productivity benchmarking and recommending any changes or refinements to this playbook; this is a living, agile document which will develop and grow over time

Further commitments will be made as *Trust and Productivity* evolves and the knowledge base grows from the next generation of projects.

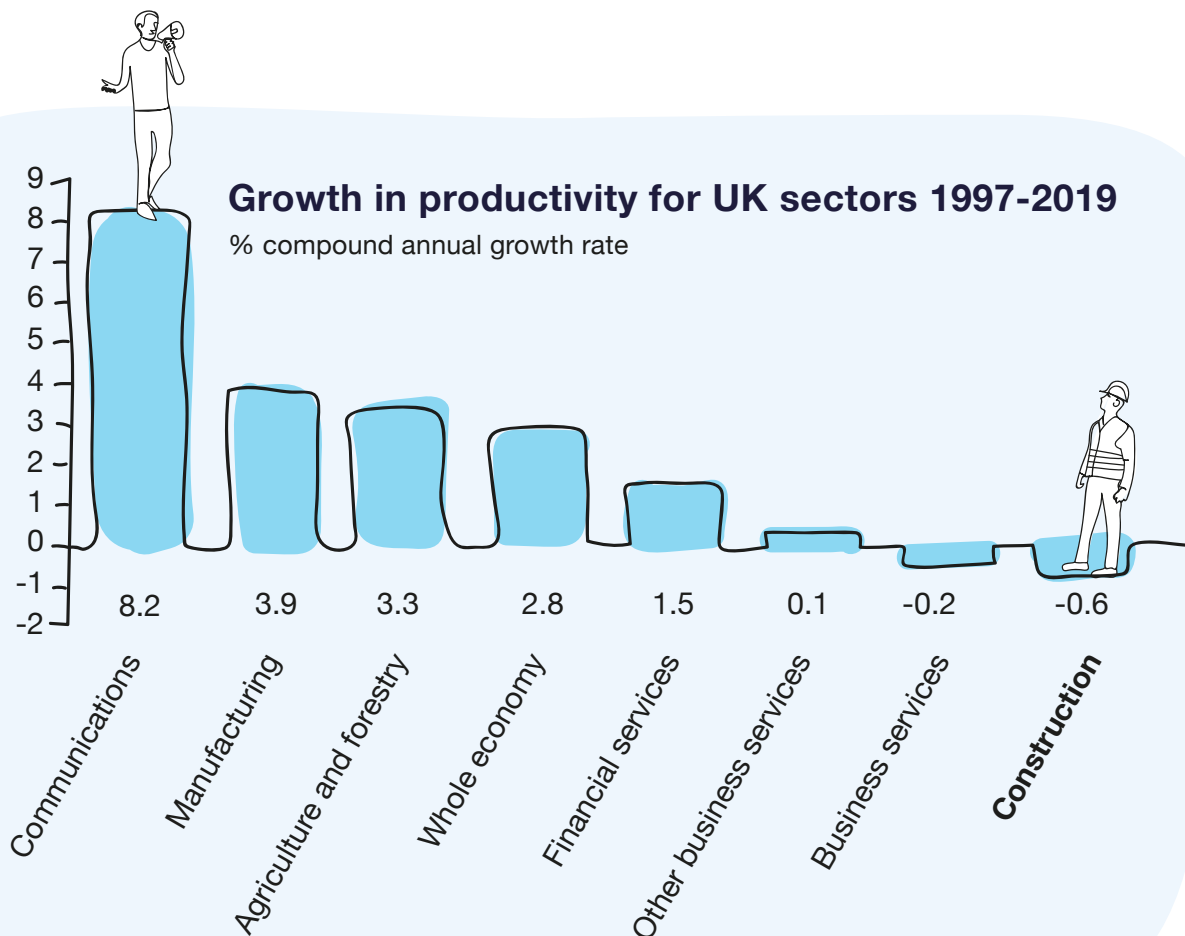
Introduction

Why do we need to change?

This playbook has been developed by the industry, for the industry, to help drive a step change in the way projects are commissioned, procured, and delivered.

The UK construction industry and supply chain is currently highly fragmented, lacks transparency and often suffers from a lack of trust. UK construction

productivity also lags behind that of other countries and other sectors of the UK economy. Since 1997 UK construction productivity growth has fallen by an average of -0.6% each year between 1997 and 2019 according to new research by Oxford Economics.² Over the same period, productivity of the whole UK economy rose by 2.8% while the productivity of manufacturing grew by 3.9%.



It now takes a larger workforce to build the same output in real terms, which makes construction more expensive than it need be and has led to a downward spiral of low margins and low investment. This, combined with high levels of fragmentation, makes innovation almost impossible. Yet increased productivity is essential if we are to cope with ever-increasing skills shortages, use resources more effectively and afford to invest in highly sustainable buildings that meet net zero commitments.

Most projects follow a traditional multi-party tender route after an extensive design process via single- or two-stage tender. However, if done incorrectly this can extend lead-in periods and establish misalignment of objectives from the outset.

Main contractors often accept low profit margins on appointment. They rely on finding buying advantage later to enhance their margin and offset the risk through the project. This encourages opaque cost management, lack of transparency with risk apportionment and non-aligned objectives.

This traditional behaviour does not encourage an optimised design or aligned procurement process. It does not necessarily drive the right behaviours or deliver the right financial outcomes at the end of project.

Trust and Productivity aims to encourage clients and their designers, construction teams and suppliers to work in a more collaborative way to help boost productivity, quality and value, and in doing so reduce carbon emissions and improve the health, safety and wellbeing of the workforce and health of the industry.



Trust and Productivity and the government's Construction Playbook

Building on the work of the public sector *Construction Playbook* first published by the government in December 2020, *Trust and Productivity* harnesses and adapts these learnings, and suggests new strategies to improve the delivery of projects across the private sector.

The many high-level aspirations of the public sector *Construction Playbook* are shared by this playbook. However, it is attuned to the wider range of organisations and projects involved in the private sector. It narrows the focus in some areas and introduces the notion that there are new measures of success, including maximising economic, environmental, and social value. It also reflects the less formal and prescriptive approach that can be adopted in the private sector as opposed to the public sector, including negotiating contracts in trust-based relationships that can develop between clients and their consultants and contractors.

This playbook cannot mandate certain behaviours and processes in the way that government is able to. Instead, it offers a suite of guiding principles distilled from best practice and collective experience from leading companies across the sector as well as those involved in the procurement, design, construction or refurbishment of buildings and infrastructure. Adopting these principles for managing projects will help to produce high quality, sustainable buildings more productively while avoiding waste, rework and potentially costly disputes.

Strong client leadership has a crucial role to play in lifting the bar. *Trust and Productivity* encourages clients and their teams to appoint suppliers on best overall value, not just lowest price. An open approach to parties' individual profit aspirations is something else the playbook encourages.

It also advocates for clients, designers, contractors and the supply chain to increase their focus on productivity to promote innovation. Alongside, it acknowledges that this will require greater training of the workforce to make the most of new technologies and more efficient working.

Measuring productivity is the first step to improving productivity and we are recommending project teams do this as routine.

Trust and Productivity is designed to support everyone involved in the construction process – from clients to contractors, from designers to construction managers, from bid writers to procurement teams, from logistics specialists to supply chain suppliers and beyond, in organisations of all sizes.

By adopting the playbook's principles, there is every chance that project leaders – irrespective of the size or complexity of project – will drive real change to the benefit of the sector as a whole.

We acknowledge that while our principles have been assimilated from the experience of working on large projects with repeat clients, we also believe there is much that one off and smaller clients and their teams can usefully apply from the playbook.

The playbook is timely. Requirements set out in the Building Safety Act will result in fundamental changes as all parts of our industry are being challenged to

raise their game. To meet this higher threshold, clients, contractors, consultants and the supply chain will need to think and behave differently.

Whether it's inflation pressures or pressure on resources both now and in the future, it is clear that the industry must embrace better ways of working to deliver the efficient and sustainable buildings our economy and society need.

Those following the guidance set out within the playbook's chapters will be adopting practices and processes that:

- Establish a collaborative team at the outset
- Encourage early supply chain engagement
- Drive standardisation and modern methods of construction
- Create mutually beneficial contracting arrangements
- Ensure a strong and capable supply chain



Using the playbook

To achieve the improved productivity outcomes outlined in the introduction, we have set out 10 drivers for success explained in the next section. These run as themes across nine chapters which follow the project sequence from concept and planning to procurement and delivery, and set out advice and practical considerations for each stage of the project. Each chapter provides case studies and practical takeaways and toolkits.

Like the cross-cutting policies set out in the government's playbook, it is a given that any project must make the safety of its workforce an absolute priority.

Equally crucially, the process must ensure that design and construction delivers buildings that are safe for occupants. And, of course, the buildings must be designed and constructed to reduce carbon emissions over their full lifetime. These are non-negotiable priorities which are expanded overleaf.

The playbook chapters

Typical engagement activities	Building the concept/Preparation and planning		
Chapter	1 Setting up the project and defining success	2 Understanding and apportioning risk	3 Benefitting from modern methods of construction
Typical engagement activities	Procurement		
Chapter	4 Defining a procurement strategy to create value	5 Bid evaluation and awarding contracts	
Typical engagement activities	Managing construction		
Chapter	6 Site accommodation for a modern workforce	7 Creating a platform for change	8 Measuring success and checking in
Typical engagement activities	Managing post-construction		
Chapter	9 Transition to handover and effective aftercare		

The non-negotiable priorities

Every project must adhere to non-negotiable priorities in the way it is designed and constructed; these underpin all of the actions and processes that teams should adopt.

Health, safety and wellbeing

Health, safety, and wellbeing must always be the highest priority on construction sites.

Regrettably, injuries, harm to health and deaths still occur on construction sites, largely as the result of poor planning and organisation giving rise to unsafe behaviours and workplaces.

However, healthy construction sites are achievable, and it is the responsibility of leaders to ensure that everything possible is done to prevent accidents and injury. In practice, strong health and safety performance shares the same drivers as high-quality products, productivity and efficiency. Getting it right first time, must include health, safety and wellbeing, sacrificing these standards to improve delivery speed is a false economy.

Health and safety should go beyond statutory requirements, and the mental health and wellbeing of the workforce must always be safeguarded. We need to provide a high-quality workplace synonymous with professional behaviours and culture, which will feed through into the quality of work. By setting clear expectations for site behaviours and culture and promoting an inclusive and diverse workforce, we can better safeguard wellbeing and mental health.

Building safety

We as an industry must constantly work to be positive contributors to improve building safety.

It is the responsibility of clients, designers and contractors to ensure compliance is consistently maintained and that competence requirements and processes set out in the new Fire Safety Act and Building Safety Act are met.

Sustainability

The construction industry in the UK is currently committed to achieving net carbon zero greenhouse gas emissions by or before 2050. This commitment includes dealing with embodied carbon.

The UKGBC's *Net Zero Whole Life Carbon Roadmap*³ illustrates that the UK built environment is currently responsible for (ie, has direct control over) 25% of total UK greenhouse gas emissions (buildings and infrastructure).

The built environment sector must mitigate all these impacts and work together to deliver projects that are sustainable throughout their construction and lifecycle.

Value to society

The construction industry should aim to maximise economic, environmental and social value on every project it delivers.

Fair and reasonable risk transfer between all parties will result in better overall value and drive economic, environmental, and social value.

The 10 drivers for success

Trust and Productivity proposes 10 drivers for success that should underpin any project. These have been derived from our collective experience of what works, plus the government's *Construction Playbook* and other studies and best practice. The drivers for success are:



Form effective partnerships



Benchmark objectives



Adopt portfolio and longer-term contracting



Allocate risk fairly and appropriately



Adopt an outcome-based approach



Pay fairly



Embed digital information flows and technologies



Assess the economic and financial standing of suppliers



Involve the supply chain early



Promote innovation and continuous improvement



Form effective partnerships

Project failure is often down to three factors: teams not collaborating effectively; team members pulling in different directions; and too much risk unfairly loaded onto one of the parties to a contract, thereby creating tension and mistrust from the start.

To avoid failure and create effective partnerships, defined goals need to be agreed at the outset. These should be embedded in a project charter, which sets out clearly the shared objectives, values and measures of success.



Adopt portfolio and longer-term contracting

Historically, there has been a perception that partnering-based approaches do not deliver value and can stifle innovation. However, when applied in a transparent way, partnering can deliver value and drive innovation. It can also provide consistency, improve quality and reduce risk.

The business resilience of the supply chain is boosted by a longer-term pipeline of future work. This also encourages investment in innovation and the workforce. In return, clients benefit from improved delivery.

The best partnership models will be structured to share between all parties the value created from higher productivity and reduced waste and incentivise positive behaviours. Clients and their teams need to assess the health and capability of the market regularly and be aware of innovative approaches as they emerge.



Adopt an outcome-based approach

An outcome-based approach requires that the client and the supply chain agree at the outset what they are trying to achieve. To be successful, the client must clearly articulate their vision for the project.

This also requires a strong relationship between the parties, mutual trust and a genuine intent to share risk and reward.

Outcome-based approaches should resolve gaps between design intent and in-use performance, and emphasise the need for improving whole-life value, performance measurement, sustainability, programme and cost certainty, and allow for innovative solutions from the supply chain.



Embed digital information flows across the whole life of the asset

Increased use of digital information processes and technologies will reduce programme time and whole-life cost, and enable buildings to be delivered more cost effectively, while reducing risk and enabling the smart use of buildings during operation.

Projects should embed digital information flows across the whole life of the asset, which can be enabled and supported by sensors, intelligent machines, mobile devices and new software applications that automate design and construction processes.

Digital information flows need be developed in line with guidance in the UK BIM Framework.⁴ This is the overarching approach to implementing building information management (BIM) in the UK, using the framework provided by ISO 19650 series. ISO 19650 is an international standard for managing information over the whole life cycle of an asset (and largely aligns with the UK's 1192 series, which it replaces).

Asset information should be handed over digitally, as set out in the UK BIM Framework, to fully reflect the client's Exchange Information Requirements (EIR) enabled by the most up to date interoperable technology, to support on-going management and use in the client's systems.

To embrace digital construction and all its benefits, projects need to engage main contractors and specialists with the project at the earliest opportunity. Significant improvements in several areas including digital construction, design for manufacture and assembly, carbon reductions and smart buildings can be derived through such early engagement.



Involve the supply chain early

Early supply chain engagement is critical to improving productivity within the construction process and the supply chain should be encouraged to explain and demonstrate additional value opportunities. This is particularly important where the input includes a design element.

Early engagement with manufacturers and specialist contractors improves the efficiency of the design and the design process through a better understanding of manufacturing capabilities, logistics constraints and on-site buildability.

It also enables a better understanding of the project drivers. These should include cost, quality, programme, sustainability and carbon reduction, and waste reduction.

Early engagement means designs can incorporate innovation and emerging technologies such as modern methods of construction (MMC), design for manufacture and assembly (DfMA), and in sourcing of materials that contribute towards positive carbon outcomes, all of which must start at the earliest possible stage. This in turn drives construction efficiency and improved productivity through standardisation.



Benchmark objectives

Benchmarking objectives is integral to an outcome-based approach. It enables those involved in a project to agree performance targets right at the start. This should produce better decision making and accountability.

By using key performance indicators (KPIs) across a range of criteria, teams can see where they are succeeding and where they are not. If the project is falling behind its benchmarks, action can be taken swiftly to get back on track. One of the aims of teams should be to measure productivity.



Allocate risk appropriately and fairly

The allocation of risk needs to be decided by evaluating the project, using experience, expertise and knowledge. The party best placed to manage the risk should take the leadership role and should also encourage collaborative thinking among all parties.

Contractual arrangements should be flexible enough to transfer the risk at the right time where applicable. This will mitigate the financial stresses associated with onerous contracts and should also include appropriate recourse or review if risk transfer is not suitable or agreeable for all parties.



Pay fairly

Payment mechanisms must be put in place right at the start and have buy-in from the supply chain. Trust and collaborative partnerships can only be established if fair payment is in place. Best practice, as set out in the Construction Act 2011 amendment, should be adhered to at the very least, and embedded in all construction contracts, with any amendments taking into consideration supply chain implications and risk allocation.

Well-known mechanisms, such as advance payments and bonds, should be reviewed and applied throughout the supply chain. But other mechanisms should be considered to incentivise parties to promote better outcomes and benefit project culture.



Assess the economic and financial standing of suppliers

Minimising the risk of failure in the supply chain is crucial for the efficient delivery of a project. The financial strength of all supply chain partners should be assessed during the selection process. Assessments should be transparent, objective and non-discriminatory.

Where required, the project should consider appropriate risk mitigation through measures such as guarantees, escrow accounts and insurance protections.



Promote innovation and continuous improvement

Innovation through using digital information processes and digital technology, adopting modern methods of construction and designing for manufacture and assembly can improve productivity, reduce waste and drive significant reductions in lifetime carbon emissions. Considering operational as well as embodied carbon emissions over the project's lifecycle, including its deconstruction, reuse and disposal at the end life, constitutes the whole-life carbon approach.

It can also lead to efficiencies in material use, as well as reduce project time and cost and improve productivity and safety. Creating a culture of innovation is best achieved through early collaboration and should be explored throughout the lifecycle of the design and construction process.

1

Setting up the project and defining success

1

Setting up the project and defining success

Establishing from the outset a well-structured, defined set of project principles and objectives which encourage trust-based relationships and a cohesive culture, provide firm foundations for project success

Why it's important

The culture and priorities adopted by the project team at the outset will drive behaviour and set a course for the project. Once this is decided, it becomes difficult, if not impossible, to change later and particularly once setbacks arise. As a result, the client has a pivotal role in establishing the correct project behaviours, tone, strategic direction and leadership, as well as ensuring this is cascaded throughout the project team.

The early stages of a project typically provide the best opportunity to benefit from key drivers for success.

The window for adopting innovative solutions on a project can quickly close. Once that window is closed, it becomes very difficult for the client or project managers to access and embed technological advances, maximise economic, environmental, and social value or simply improve on core aspects of successful delivery from logistics to risk reduction.

All these benefits can only be achieved if the project team's objectives are clearly understood and defined from the outset. It should nevertheless be recognised that the primary objectives may develop throughout the lifecycle of the project and all parties must be aware of how this impacts the overarching brief.

In a trust-based relationship everybody has a voice and team members are respected.

Developing trusting and co-operative relationships between individuals and companies will invariably benefit a project's bottom line and deliver its objectives.

A trust-based relationship is one that is open, honest and transparent, where everybody has a voice and team members are respected. Fostering a working environment based on these values can also help mental wellbeing during periods of pressure.

There are a number of key steps to take at this early stage to establish the basis for a project's success.



Statement of objectives

Depending on the project, a pre-start plan is often an essential tool for the project team to steer by and needs to be instigated by the client and may benefit if it is developed in conjunction with the supply chain.

Comprehensive in scope, it should provide structure and context to the project, giving clear direction to the team before formal commencement and help in the development of the brief as well as set out the principles and planned approaches for all the other steps referred to in this chapter. It should be referred to throughout the project, amended where necessary and communicated properly to the team.

The complexity and nature of the project will determine its structure. However, it could include:

- A project vision defining success and outlining specific metrics
- Definition of the culture or environment that should be adopted by the team
- Objectives, strategy and brief
- Site or building summary and provision of existing relevant information
- Project summary on current position and history
- Known risks or constraints
- Scheme considerations

Defining success

The vision for the project should define what success looks like. Specific metrics or goals like costs and quality should be included in a hierarchical manner and briefed by the client.

Requirements should be clearly articulated and well defined in a series of key performance indicators. Strong leadership and vision will lay the foundations for project success.

Examples of success factors include:

- The project duration and/or programme certainty
- The level of project costs and/or cost certainty
- Environment, social and governance (ESG)
- Whole-life carbon
- Health and safety
- Waste
- Construction productivity and level of pre-manufactured value (the extent of off-site construction used on a project)
- The quality or appearance of a building
- Overcoming external factors such as planning or conditions on site
- Achieving a defined lettable floor area
- Design performance or criteria
- Operational performance and satisfaction including energy efficiency and embedded technology targets

Weighted rankings should be attached to these objectives to underline their importance. These rankings will add clarity and precision when defining and delivering information requirements, providing feedback on a range of factors, chiefly performance, delivering project milestones, budget criteria, specification criteria and procurement success.

The Value Toolkit,⁵ funded by government and developed by industry, helps clients to define outcomes, informs early supply chain engagement, evaluate options, and embed social, environmental, and economic outcomes.

It is important that the success factors are continually referred to and communicated throughout the project and are explained to new team members who come on board. One approach worth considering is drawing up a project charter, with best practice examples, that all members of the team sign and commit to.

This will help embed an open and collaborative culture and build trust-based relationships, as well as providing consistency across the project by making parties aware of the supply chain hierarchy and standards such as industrial relations policies or non-poaching agreements.

Establishing and defining clear roles and responsibilities

To function successfully all members of the team, from client to design team and from contractor to supply chain members should understand their roles and responsibilities. As a result, there needs to be an early discussion regarding:

- The timeline for engagements, as not appointing members at the correct time can lead to periods of inactivity or lack of productivity, followed by unrealistic programming to make up lost time
- Scope of the appointments
- Performance targets such as the use of KPIs and benchmarking to promote improvements
- Risk, and how is it mitigated and managed including who may be best placed to own and have the authority or direct relationship to manage

Providing clear governance and empowerment

Teams should be subject to continuous assessment of their performance. This provides the opportunity to develop processes to ensure quality, drive improvement and address the accountability of the individual parties.

The approach should focus on working collaboratively and openly with clear performance measurement and well-defined KPIs. That said, there should also be dispute resolution mechanisms in place.

Clear governance and empowerment require:

- Leadership focused on the successful delivery of project vision and outcomes
- Effective controls and systems to avoid mistakes
- An emphasis on problem solving, progress and opportunities for improvement rather than blame
- Fair reward and contract mechanisms supported by prompt payment, as well as review of traditional retention mechanisms, cascaded payment terms, and consideration of a project accountant, project bank account or project insurance or mechanisms that share project risk and certainty and security of payment; this may include early initial payment to ensure partners are not funding the project, which also demonstrates early trust in the two-way relationship
- Financial incentivisation may be helpful
- Fair contract terms aligned with the culture and facilitating the key drivers for success

Consider drawing up a project charter that all members of the team sign and commit to.

Early engagement

Early engagement leads to an alignment of goals right from the outset. This way, parties work together and take collective decisions on what is in the best interests of the project, rather than for individual companies.

To obtain maximum benefit, early engagement needs to be supported by appropriate procurement and contractual arrangements. Aspects to consider include:

- Building on existing contractual arrangements and creating new partnerships; this may include framework agreements between clients, consultants or contractors which have provided value beyond a traditional lump-sum tender based relationship
- The complexity and nature of the project, and which packages best warrant early engagement; this may include packages such as the building frame, lifts, cladding and building services
- How early engagement can be used as a mechanism to help mitigate, eliminate or allocate project risk and the best stage to undertake this
- Who is best placed to input and at what stage
- Recognising the key role of supply chain members in driving innovation and identifying emerging markets and opportunity
- What is the appetite to seek innovative solutions around design, manufacture, and assembly or MMC?
- Are there external market conditions which may warrant a greater need for certainty on cost, programme, quality or ESG credentials?
- How greater integration of design and construction processes at an early stage can help drive material efficiency and construction productivity and therefore improve programme effectiveness
- Are there any particular project risks that would benefit from specialist involvement to mitigate, eliminate or apportion to?
- What is the expectation for the use of BIM within the context of the UK BIM Framework and whole-life management of digital information, and the transfer of asset information at completion?

Nurturing collaboration and a cohesive culture

Project failure is often down to teams pulling in opposite directions rather than working together. It is crucial to provide the right environment and establish from the outset a cohesive culture where the expertise of members is valued and their voices heard. Also helpful is:

- Providing a physical project environment whereby the team can co-locate and work as a business, either full or part time; co-location can act as a mechanism for the team to share knowledge and insight and learn to trust each other
- Holding project team events and informal social gatherings outside of the normal work environment, which can help develop stronger relationships
- The use of collaboration platforms such as an electronic document management system (EDMS) which make it easy for the team to communicate
- Celebrating successful teamwork, through simple weekly shoutouts for example, can be an effective way to keep up motivation
- Ensuring an approach to governance and reward that nurtures and drives this culture
- Providing a common data environment (as specified in the UK BIM Framework) whereby the team can collaboratively develop and share information they can trust.

Key takeaways for setting up a project



- Invest in team building to improve performance and create an environment that will drive collaboration, such as co-location, informal social gatherings and celebrations of good teamwork; this may also include financial incentives, which should be aligned to measurable and achievable objectives
- Seek to engage with the supply chain early on to realise value and innovate collaboratively
- Define, identify and manage risk with the right parties at the earliest opportunity

Toolkit



- Draw up a clear project vision which defines project success, instils a positive project culture, aligns goals, provides collective accountability and outlines specific metrics which should be tested as the project progresses
- Establish protocols for collaborative working including sharing relevant information while respecting business confidentiality
- Adopt the UK BIM Framework as the standard for managing information about the building



Defining success at Broadgate

Case study

At Broadgate, British Land has been developing a pipeline of projects using a 10-year framework agreement with Sir Robert McAlpine to deliver all of their large complex projects. The 10-year redevelopment of Broadgate is transforming central London's largest pedestrianised neighbourhood into a world-class, mixed-used destination through the delivery of multiple buildings.

The Broadgate Framework has given British Land the opportunity to reduce the risk that several concurrent projects pose and provide the catalyst for consistency, continuity, innovation and continuous improvement.

A framework provides an opportunity to consider the wider elements of complex projects, for example standardisation and the benefits of long-term strategic relationships with designers, principal contractors and the supply chain. It is these partnerships that provide the nucleus for success, driven by close collaboration and exemplar performance.

Since the inception of the Broadgate Framework four projects have been completed and two of the largest projects in the pipeline have now begun on site. These will run concurrently for over three years and within 30m of each other. To date across all the projects there have been no contractual disputes, no fundamental disagreements and no significant complaints from our stakeholders or tenants.

The benefits of establishing and refining a multidisciplinary team, with common goals, shared experience, and a deepening understanding of each other's skills, brings heightened productivity. This can be measured against programme savings during design, procurement, and construction, as the

co-located team are allowed to focus on the project drawing in expertise and lessons learnt from the group at the right time.

It is the consensus of all parties that the Broadgate Framework has been hugely successful. This is largely because of the initial strategy and the manner in which British Land and Sir Robert McAlpine have worked together to build a team based on an ethos of trust, honesty and collaboration that has stood the test of time and the many vagaries of construction.



2

Understanding and apportioning risk



2

Understanding and apportioning risk

The inappropriate apportioning of risk can be a major cause of project failure. This can be avoided by early engagement, by transferring risk at the right time and by not saddling suppliers with onerous liabilities

Why it's important

Ensuring risk is clearly defined and apportioned equitably at the right time will lead to more successful projects and a healthier construction industry. Onerous terms and liabilities – often far in excess of the financial capability of suppliers – regularly lead to project failure. If suppliers cease trading because of unrealistic conditions, capacity is reduced and clients and main contractors pay more for those specialist services.

Inequitable transfer of risk, either too early or at the wrong time, based on undefined scope or insufficient information, can be a considerable source of friction and leads to protracted disputes. It is not uncommon, for example, for single-stage demolition or enabling works tenders to be issued without asbestos survey reports, site investigation reports, geotechnical reports, utilities surveys and the like. This missing information will affect cost and programme risk as well as impact on design solutions for any permanent works. In some instances (particularly when opportunities in the market are scarcer) fixed-price lump-sum contracts can be executed with the above information still outstanding, meaning contractors do not have a full understanding of cost and programme risk when they start the contract.

The same information can also be absent when single-stage tenders are issued to main contractors – this is not equitable risk apportionment and transfer.

More mature developers and most tier one contractors avoid these scenarios because there is a comprehensive tender process with clear information and they have repeat relationships with the contracting market. This is the approach advocated in *Trust and Productivity*.

Other challenges that lead to poor risk allocation:

- Inability of parties to price risk accurately
- Rigid corporate policies regarding acceptable risk allocation
- Competition in procurement (or shortage of work) at certain times creating pressure to accept contracts despite a lack of expertise and capacity within the parties to properly manage the risks



Risk management agreements

A clear project risk management agreement based on agreed project goals and outcomes should be drawn up at the earliest opportunity.

The agreement should aspire to eliminate risk and where this is not possible accept the need to put adequate costs against it. The agreement should be aligned to a clear procurement strategy setting out the ownership of risk and at what stages this will be transferred, if at all. These proposals should be communicated clearly. An example of how this can be managed for enabling or demolition works with a flexible contract is set out in the case study at the end of this chapter.

Assessing the capacity of supply chain

The terms and conditions set out in contracts should be reasonable, linked to financial capacity and offer a fair and proportionate price for risk ownership.

The financial capability of suppliers to accept contract liability needs to be rigorously assessed and the technical capacity considered in relation to scope of risk.



Early engagement

As set out in Chapter 1, risks can be managed more effectively through early involvement of the project team and main suppliers. Defining a tailored procurement strategy, with suitable contractual mechanisms so risk can be allocated at the right time, is essential to all parties' understanding of their responsibilities. A mechanism for early engagement should ensure risk consideration and mitigation is a key driver in all design solutions.

Tailored contractual mechanisms that allow for the mitigation, allocation and transfer of risk, utilising stepped commitment stages within a defined and agreed contract, can provide the benefit of early engagement to sequentially work through design, risk and programme issues thereby reducing cost, risk, carbon and overall project duration. When it works, great advantage can be gained in innovation, efficiency and risk mitigation from those best placed to provide it (see case study at the end of this chapter).

There are also other means of achieving risk mitigation, including pre-construction service agreements (PCSA), where the contractor is paid a fee to help develop the early stage design and planning until the risks have been clarified or mitigated and the contract agreed.

Managing risks through the project

The following mechanisms should be put in place to manage risk throughout the project:

- Define requirements and monitor risk by agreeing how risks should be managed and what information is required against an agreed timeline; this should run in parallel with and be linked to contractual gateways to ensure allocation is fair and transparent
- Agree and then allocate or transfer the risk when all information is available
- Monitoring, measurement and resolution are the final stages of risk management; success factors should be assessed against aligned goals and an outcome-based approach for all parties; feedback on the successes and failures of the strategy should be regularly provided

Key takeaways for mitigating and apportioning risk



- Ensuring risk is clearly defined, considered and apportioned equitably at the right time will lead to a healthier construction industry
- The equitable allocation of risk should be based on robust information
- Mitigating risk starts with a project risk management agreement on agreed project goals and outcomes and then articulating this to the market and in any early engagement
- Ensure contractual arrangements and mechanisms are properly considered and are aligned to availability of the necessary information
- Risk should only be allocated to a party with the technical and financial capability to own, manage and mitigate

Toolkit



- Draw up a clear project risk management agreement based on agreed project goals at the earliest opportunity
- Rigorously assess the financial capability of suppliers to accept contract liabilities
- Define a tailored procurement strategy with suitable contractual mechanisms so risk can be allocated at the right time



Using tailored contractual arrangements to apportion risk fairly

Case study

In order to mitigate risk in contracts where there are unknowns, flexible contractual arrangements were introduced for GPE's 2 Aldermanbury Square project (2AS). 2AS is a 12-storey 320,000 sq ft (NIA) new build development in the City of London. The demolition and enabling works (by Keltbray) and the main works (by Lendlease) commenced on site in August 2022, with both the demolition and enabling works and the main contract works procured within the same tailored, contractual framework.

The principles of this process were evolved from a similar successful framework with GPE (client), Mace (main contractor) and Erith (demolition and enabling works contractor) on the Hanover project, a complex major development in London, above and around the new Crossrail Bond Street station.

This arrangement works well when coupled with an early engagement approach, where main contractors and principal supply chain members are appointed for specific and limited services while completing the Stage 3 and 4 design. This approach utilises supply chain expertise early in the process to contribute to design efficiency and co-ordination while also reducing risk and carbon and maximising opportunities for programme, off-site manufacture and innovation.

What this means, in practical terms, is that a contract is agreed at the outset, based on full terms and conditions for an entire scope of contract works. This would include clearly defined and stepped commitment stages with a clear strategy for how the design and construction considerations for the project will be worked through to minimise risk and cost for all parties, while working through the completion of design (with contractor input) based on final site survey and investigation results. The approach on 2AS includes an

agreed mechanism for working through the risk for the entire scope of works with the contractor at the point of contract execution; progression to the next stepped commitment stage is subject to successful resolution of deliverables and agreement by all the parties.



In the case of 2AS, the contract is split into a series of stepped commitment stages that sit within the overall contractual framework:

Demolition and enabling works (Keltbray)

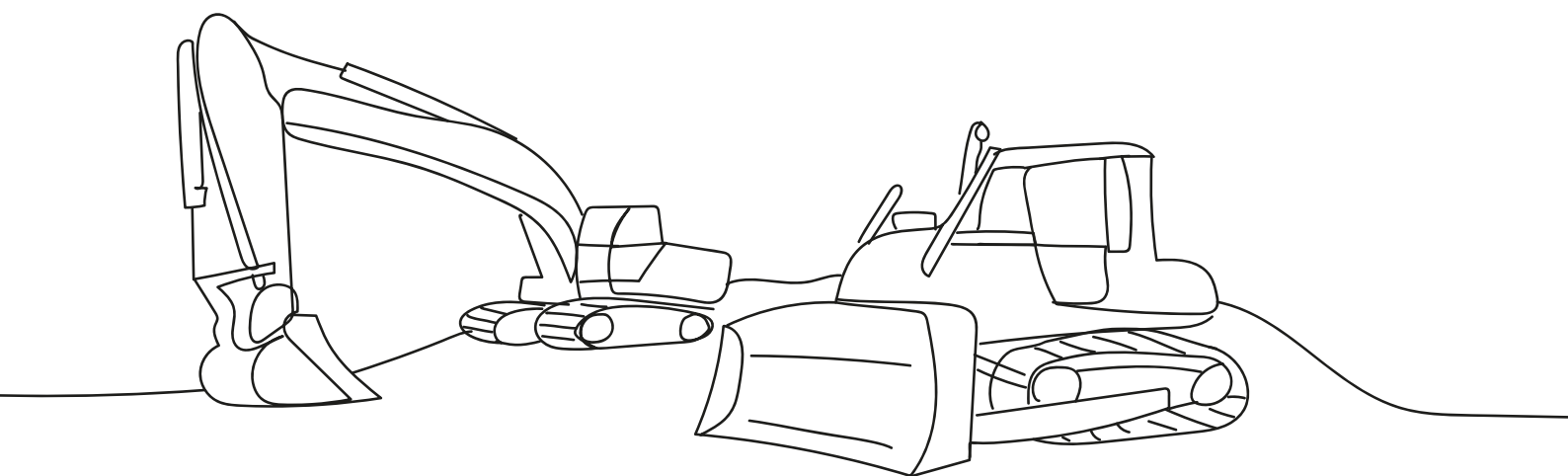
- Pre-construction period: carry out all outstanding surveys (i.e. asbestos, bore-holes, geotechnical), third-party agreements and any design work required to identify, quantify and mitigate risk and inform the final design
- Strip out works: during this period any residual unknown risk in the building can be established, fully understood and mitigated or priced and allocated
- Demolish building: during this period, detailed design can be completed incorporating the outcomes from all surveys, tests and reports as they are made available. The demolition or enabling works contractor has the ability to positively influence the permanent works design by maximising coordination and reducing construction risk, cost and carbon through liaison with the design team and main contractor.
- Excavation, piling and basement works: the construction of the basement works will be carried out based on a fully quantifiable risk position utilising the early engagement process as well as bringing supply-chain expertise to maximise design efficiency, carbon, programme and construction opportunities

The above steps flow concurrently through to the subsequent main contractor procurement process, as the sequential understanding of the scheme and site conditions are further understood. The main contractor stepped commitment stages are as follows:

Main works (Lendlease)

- Early engagement period (Stage 3 to Stage 4): positively influence overall design development and seek opportunities in efficiency, co-ordination, carbon, programme, off-site manufacture/innovation and construction methodology through earlier engagement
- Formal second stage procurement (Post Stage 4 completion): procure remaining packages based on a fully co-ordinated design seeking further supply-chain expertise
- Mobilise/Start on site: begin main works in a fully understood risk position for all parties

The above has proven effective because the basis of the contract is set at the start of the engagement process providing clarity and transparency through aligned goals. This enables earlier supply chain engagement while the design matures, with clear risk apportionment worked through and agreed as a better understanding of the scheme is gained and all relevant information becomes available, ensuring the fair transfer of risk at the right time.





3

Benefitting from modern methods of construction

3

Benefitting from modern methods of construction

Greater use of off-site manufacturing, including designing components for manufacture and assembly, can help deliver better quality, lower embodied carbon, speed construction times and reduce safety risks; but it must be planned at the outset of a project

Why it's important

Modern methods of construction (MMC) have the potential to transform the construction industry into a highly productive, resource efficient, sustainable sector of the economy. Building off site can also make construction safer and as it delivers greater precision and accuracy, buildings are safer for those who reside in them. MMC can also help with diversity of people in construction and attract new talent into the industry to alleviate a long-term skills shortage.

To become effective on a large scale, MMC will require a greater adoption of standardisation in the design and delivery of buildings across the private and public sector. Greater collaboration and knowledge sharing between clients, designers, contractors, and the wider supply chain as well as regulators, planners, funders, and insurers will help create the scale needed to accelerate the long-term investment required to make a full success of MMC.

Individual projects should maximise the use of MMC. However, it is unlikely to constitute 100% of any programme or project design when site-specific demands are taken into consideration. This chapter discusses how to strike the balance between meeting the client's individual needs and achieving greater standardisation.

Defining modern methods of construction

MMC was a concept born of the need to deliver construction projects faster, better, safer, greener and more cost effectively. The main premise is to move as much construction work as possible away from construction sites and into factories that can efficiently create parts, sub-assemblies, modules, or even whole sections of buildings which require assembly at the final location. Government has led the way by adopting a presumption in favour of off-site construction for the procurement of public sector projects. It is committed to helping create a dynamic market for innovative technologies in the UK and has challenged the private sector to do the same.



Design for manufacture and assembly

To realise the maximum benefit from modern methods of construction, it should be coupled with taking an approach to design that allows for greater standardisation – namely, design for manufacture and assembly (DfMA). This combines the manufacturing processes of design for manufacture (DFM) and design for assembly (DFA) which have underpinned the improvements in manufacturing productivity over the last 20 years.

DfMA begins the process of standardising at a component level. It works on the proviso that if you design something once but use it many times, there is a huge multiplier effect in terms of the benefits gained.

So, it is worth concentrating design effort on optimising components that will be used repeatedly, as even small improvements will amplify at scale and enable construction to access the incremental gains enjoyed by manufacturing. This standardisation of components and/or modules also reduces risk, with increased certainty and reduced tolerance on site, meaning there will be less need to adapt or re-work on site and less reliance on skilled site operatives.

By considering materials and process efficiencies at the earliest stages, DfMA hardwires high standards into the design.

By considering materials and process efficiencies at the earliest stages, DfMA hardwires high standards into the design, which then becomes part of the manufacturing brief.

Realistically, the construction sector cannot gain the aggregation of demand needed with atomised proprietary systems. It needs to collaborate and innovate together, sharing knowledge across sectors and sharing investment in research and development to collectively move the sector forward, and accelerate the adoption of a new best practice. Firms can then work together as an industry to establish the standards and frameworks to support the adoption of MMC. Once these fixed rules and performance markers have been defined, innovation will come from the marketplace.



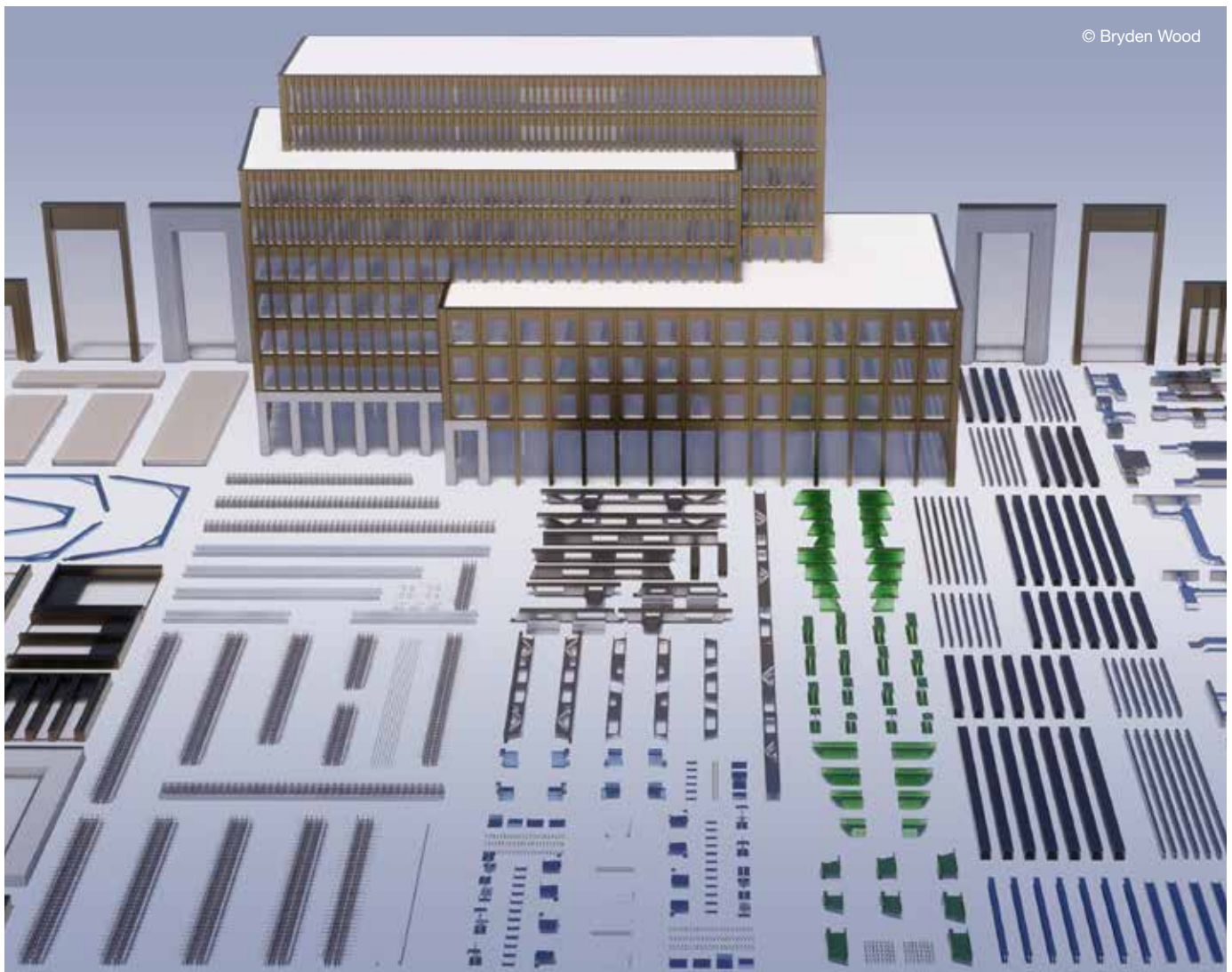
Manufactured platforms

A platform approach to DfMA (P-DfMA) is based on the adoption of digitally designed standard components that can be used repeatedly across multiple projects and types of buildings, minimising the need to design bespoke components for different built assets. Platforms identify and embody shared features of assets within and across sectors, such as structural grids, beams, columns, connectors and slabs.

A good example of where this could be applied is the office sector. The British Council for Offices (BCO) produces its *Guide to the Specification of Offices*⁶ which is widely adopted across the sector. The guide

identifies a standard 1.5m planning grid to be used as the dimensional building block of component and system design: this provides a great starting point for a platform solution to be developed.

Landsec adopted a standard 9m by 9m structural grid (a multiple of the 1.5m planning grid) to develop a P-DfMA structural system for its office development, The Forge, a Transforming Construction Demonstrator Project in the London borough of Southwark. Details of how this was used to create the UK's first P-DfMA-led office scheme can be found in the case study at the end of this chapter. *The Construction Innovation Hub Platform Rulebook*⁷ provides guidance on the development of platform-based approaches to construction.



Redefining logistics

The adoption of P-DfMA and MMC has the potential to radically accelerate the speed of on-site construction. However, capitalising on the opportunity puts pressure on every aspect of the process.

Teams will need to rethink the logistics solutions employed on construction projects to meet the new business models driven by highly systemised solutions and disruptive technologies – in much the same way as companies such as Amazon and Ocado have reinvented the delivery of goods to customers in their sectors.

Clients want to see a radical shift in the speed of construction and productivity on site. Achieving this will require time to be reduced at each stage of the process including design, procurement, manufacturing, delivery and installation. The adoption of standardised design, digitisation, early supply chain engagement, collaborative procurement, integrated programme planning and automated assembly processes are all features of MMC which will be key to meeting this ambition.

Tracking the movement of components and inventory management in real time will become essential and we are likely to see a growth in the use of consolidation centres to manage the flow of material to site and last-mile logistics. Two key elements that will be needed to speed up construction.

There are examples from around the world where on-site programme times are being substantially reduced. These include Prescient Co⁸ in the US who are able to install their digital design build DfMA system at rates of up to 20,000 sq ft per week with only 36 installers, and the Broad Group⁹ based in China who have completed a series of projects in exceptionally short time frames: in 2015 they constructed a 57-storey office building in 19 days¹⁰ and in 2021 completed a 10-storey apartment building in 28 hours and 45 minutes using a modular system.¹¹ Mace Tech have also reported reductions of up to 25% in programme time using their Jump Factory solution in the UK.¹² However, these are still the exception and the application of systemised solutions and MMC has up to now been constrained by the fragmented and one-off nature of the current construction industry.



Selecting the right balance of MMC

The process thinking driven by the adoption of DfMA also helps to select the right amount and balance of MMC for a portfolio development programme or an individual project. Although MMC use needs to be maximised, it is unlikely to constitute 100% of any programme or project design as site-specific demands will sometimes militate against its use. Clients and their teams need to solve the inherent tension between the desire for standardisation and the need to make unique spaces and places which are a direct response to the brief and context. The challenge is in finding the best balance – enhancing the design for manufacture to make it better performing and more adaptable.

Throughout the design and procurement process, many strategic objectives should be considered in deciding if MMC can be used, including:

- Client requirements
- Early design information and status
- Site constraints
- Programme requirements
- Specialist manufacturer input
- Health and safety considerations
- Sustainability and environmental implications
- Cost plan and budget
- Previous lessons learned



These objectives can then be used to identify the level of opportunity and understand the impact at a programme or project level across a range of factors including:

- Level of commonality or repetition
- Design time, including submissions and approval
- Early appointment of specialist manufacturing expertise
- Material, resource, and process efficiency
- Ability to deliver materials to site at the right time, in the right sequence with the correct information
- Number of interfaces or activities that could be removed from site
- Maturity and capability of the supply chain to deliver

This will then help to define the type of MMC solution best suited to the programme or project and the balance of MMC versus traditional/bespoke approaches. The questions to be asked are:

- Can manufactured platforms be used?
- Is a volumetric or modular approach applicable?
- Would 2D panelised solutions be more appropriate?
- Can the mechanical, electrical, and public health (MEP) services be pre-packaged, pre-manufactured and pre-assembled?
- Is the project better suited to a traditional but integrated delivery solution?
- Does this project have to be fully bespoke and therefore MMC may not be applicable?

On Landsec's Forge project in central London – the first commercial office project to use a P-DfMA solution – a platform approach was used for most of the structural design, but traditionally constructed special end bays were added to maximise site utilisation combining the platform approach with bespoke design to maximise footprint.

The productivity benefits of DfMA were also demonstrated by the Liverpool Street station platforms for Crossrail which were manufactured by Laing O'Rourke and took a seven-person team of operatives 2,492 hours to assemble on site. This compares to identical station platforms at Tottenham Court Road which were traditionally constructed on site using a 57-strong team and taking a total of 82,080 hours.

Measurement of on-site and off-site productivity is critical to the successful application of MMC and crucial to embedding a culture of continuous improvement. Early identification of the value of standardised components on any project as a part of pre-manufactured value (PMV) and setting targets to inform the brief will help to drive greater uptake of MMC and off-site manufacturing solutions.



Sustainability and lifecycle benefits of using MMC

The adoption of MMC will be critical to the delivery of sustainable net zero carbon construction. As the use of operational energy in buildings is reduced and then powered from renewable sources, the level of embodied carbon used in their initial construction and future adaptation and modification becomes the key factor in the whole life carbon impact.

With its focus on maximising material and labour resource efficiency and minimising waste, DfMA-led MMC has many sustainability advantages over traditional construction in minimising embodied carbon. These include:

- Minimising the use of materials through the use of standardised components and the adoption of efficient site assembly
- Maximising the opportunity for the recovery and reuse of components at the end of life – promoting circular economy principles
- Reducing waste using more efficient off-site manufacturing processes and improved monitoring
- Faster on-site programmes minimising on-site energy use, noise, and pollution – reducing the impacts on the local community
- Reducing vehicle movements to and from site
- Better jobs for people due to the shift to off-site manufacture – providing greater security of employment, a safer working environment, more investment in training and less travelling
- Safer working conditions on site through the greater use of preassembled components and automated construction processes

Digital, digital, digital – the creation of a digital ecosystem

MMC relies on the adoption and use of digital tools and data analytics to drive rationalisation, deliver safer, more sustainable buildings and to capture learnings for continuous improvement and quality management.

It creates and relies upon a data-rich library of robust, reusable objects, stored in an open access, central digital location, which combines the standardised requirements including:

- Standard space types, critical adjacencies and operational flows, spatial clusters for common configurations (for example, standard teaching blocks, plant facilities, apartment layouts, clinical spaces)
- Groupings of items to perform a function (for example, systems and asset types that mitigate risks like spread of smoke or fire)
- Sets of rules regarding interfaces, technical requirements, and standards (for example, building tolerances, load, thermal performance and energy efficiency technical standards, tasks, and competency). To be used effectively, and to benefit other projects, consistent rules relating to data quality, storage and interoperability need to be applied, as provided for by the UK BIM Framework.

This data can also help designers plan for re-use, net zero and wider sustainability goals at the earliest stages, considering and integrating the pertinent data in the earliest design concepts, thereby locking in the value from the start.

At later design stages, the data library will house the inventory of standard components and assemblies, for example, a door set. This data can then be embedded in configurators – digital web-based apps/software, which apply the digital data to automatically generate anything from a schedule of room types to a full, digital asset model. This reduces a process that normally takes weeks to a matter of minutes and involves a wider range of stakeholders at the earliest stages to increase buy-in and optimise the final asset design.



The standard components can be mapped against manufactured products, enabling robust and auditable change control, automating the generation of a digital record and asset information model.

Data feedback, lessons learned, and benchmarking become essential by-products of the digital infrastructure which will provide the means of retaining the experience from one project to another, thereby passing the learnings onto future generations of buildings.

It is vital that data monitoring systems are established with all stakeholders to inform improvements during construction, capture lessons learned and measure the success of each step in the MMC delivery chain.

A consistent approach to the measurement of on-site productivity and the wider sharing of data across the industry will be critical to accelerating the changes needed to drive productivity.

Recognising the benefit of collective action to promote this, the Construction Productivity Taskforce has published a guide to *Measuring Construction Site Productivity – A seven-step framework for success* and supported the establishment of The Construction Data Trust.

Key takeaways for harnessing MMC



- Modern methods of construction provide the vehicle through which to build faster, better, safer, greener, and more cost effectively
- Clients to include requirements for MMC in the project brief and set targets for pre-manufactured value for the design and project teams
- Select the most appropriate MMC options – recognising that not all will be appropriate to individual projects
- Push for the adoption of new technology in the manufacturing and assembly process; designers and specifiers should not just accept the shortcomings of what is on the market at present but instead establish standards and frameworks to support MMC
- Establish effective data monitoring systems with all stakeholders, to inform performance and productivity improvements during construction, capture lessons learned for future projects and measure the success of each step in the MMC delivery chain
- The industry needs to promote cross-sector knowledge sharing and collaboration and adopt a shared investment in research and development

Toolkit



- Define the aspiration to use DfMA and MMC at the inception of the project
- Use 3D BIM and digital design tools to develop the kit of parts components
- Adopt a collaborative procurement model which can enable early supply chain input into the design
- Develop a clear strategy for information management consistent with the UK BIM Framework
- Develop automated construction processes and integrated logistics solutions
- Encourage supply chain investment in manufacturing capability and training in the new skills needed



Modern methods of construction at The Forge

Case study

Landsec's landmark development, The Forge, is a 140,000 sq ft scheme located close to the Tate Modern at London's Bankside. It comprises two new eight-storey office buildings and a public courtyard and is the UK's first commercial development to be built to meet the UK Green Building Council's net zero carbon definition, covering construction and operation.

Landsec specifically selected The Forge to be an innovation project marking a step change in construction: delivering buildings faster, better, safer, greener and more cost effectively. To achieve this, they chose to adopt the platform approach to design for manufacture and assembly (P-DfMA) based on processes used in the manufacturing industry. The concept as applied to construction had been originally developed by Bryden Wood when working on new-build prisons for the UK Ministry of Justice.

The pioneering approach was supported by UK Research and Innovation (UKRI) and Innovate UK which awarded Landsec, Bryden Wood and Easi-Space a research and development grant in 2019 to help develop and prototype the innovative superstructure system. UKRI and Innovate UK then selected The Forge as a demonstrator project for the Transforming Construction Challenge with the aim of proving the value and potential of the P-DfMA approach. As such, interest in the project has been significant, in the office sector and beyond.

Landsec chose a construction management (CM) based approach to procurement, appointing Sir Robert McAlpine, and Mace in an innovative joint venture to fill the newly created role of Manufacturing and Assembly Manager (MAM) and engaging with specialist supply chain contractors who could bring specific expertise to help develop the P-DfMA solution.



A pre-construction service agreement (PCSA) was used to engage specialist contractors with significant design input at an early stage of the project (between RIBA Stages 3 and 4).

The project team has also worked closely with researchers from Cambridge University who have aggregated and analysed the significant amounts of data generated by the project, developing new performance metrics for reporting on the speed of construction and on-site productivity levels of the key work packages.

The Forge is scheduled to complete in early 2023. The scheme has successfully demonstrated the effectiveness of the platforms approach. It has also established a pattern for new methods of design and construction that have the potential to transform the industry.

Using these techniques has contributed to saving around 25% in embodied carbon from the initial design stage. And Landsec saved 178 tonnes in steel by using the platform approach – the equivalent of just under 13.5 London double decker buses in weight.

The Forge is one of two pilot projects which have been used to inform the framework methodology developed by the Construction Productivity Taskforce for on-site productivity measurement - *Measuring Construction Site Productivity: A seven-step framework for success*.

Data from The Forge is also being shared with the Construction Data Trust (CDT) which has been established to help transform how we deliver construction projects by pooling data to create benchmark performance measures to drive improvements in efficiency and productivity.

The Forge has provided a valuable step on the road to improving construction productivity through the use of P-DfMA and MMC. Interest from the public sector is particularly high, reflecting the government's ambition set out in its public sector playbook to use platform-led modern methods of construction solutions procured through collaborative contracting models to deliver public works.



4

Defining a procurement strategy to create value



4

Defining a procurement strategy to create value

A procurement strategy to align objectives, establish trust and attract the best suppliers

Why it's important

A procurement strategy that is based on alignment of objectives, underpinned by trust and fairness to achieve certainty of outcome, is essential. As discussed earlier, appointing suppliers solely on the basis of lowest cost is a recipe for projects going awry. Weighting bids against value for money, technical competency and quality should be the foundation for any procurement strategy. We examine this in more detail in Chapter 5.

As buildings become more complex and technical, there needs to be a more flexible approach to the procurement route to create a risk profile which is appropriate for the project. It can pay to adopt a framework approach and/or longer-term strategic alliances.

Market engagement

Engaging with the construction supply chain ahead of a formal procurement process enables clients and contractors to plan and allocate resources, and lets suppliers become familiar with the project.

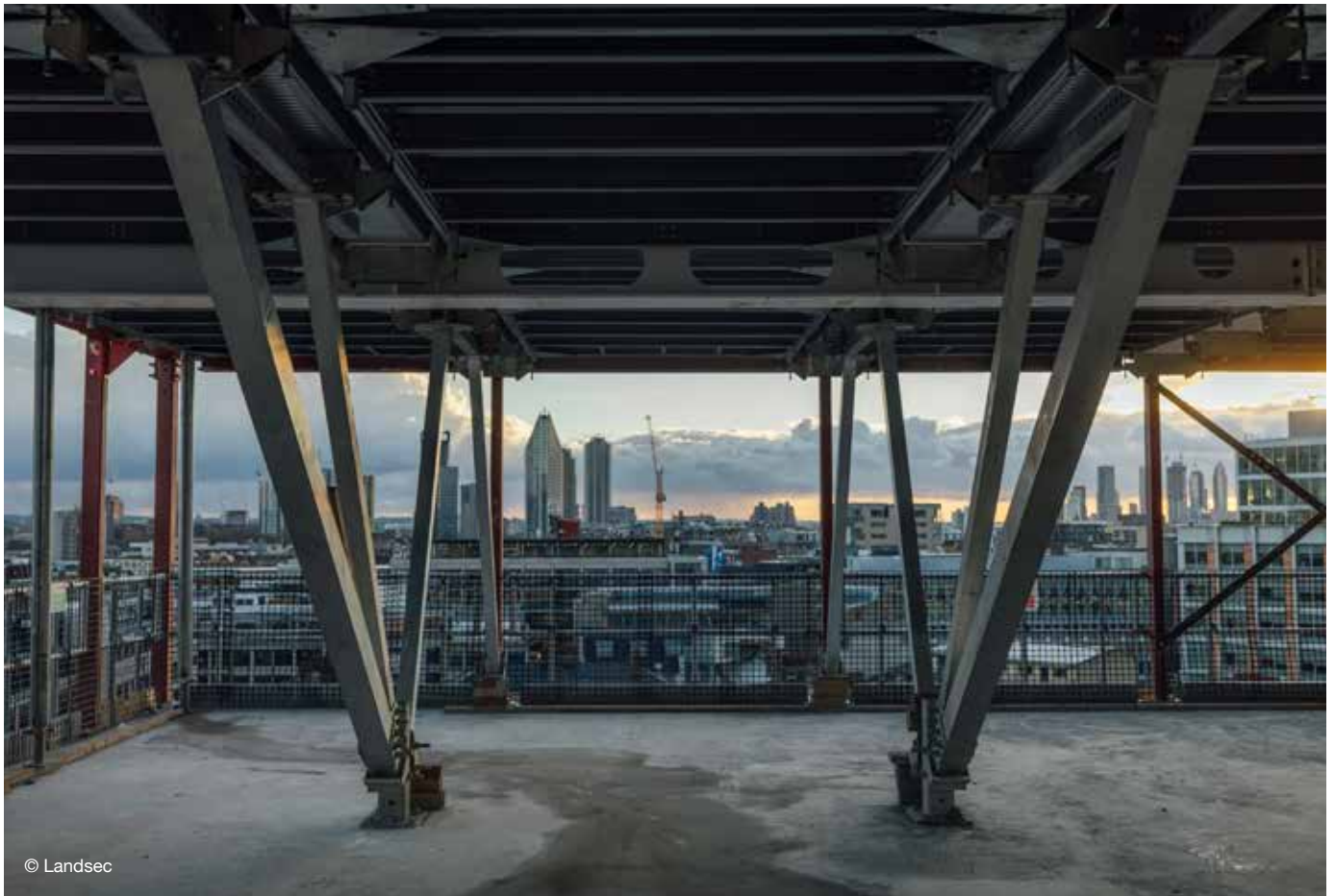
Ask the supply chain as soon as possible for advice on the mechanics of the procurement process, how the works should be taken to market, and buildability, logistics, material availability and programming. Involvement of the supply chain in this way will provide technical and specialist design input at the earliest stage of the project and encourage innovation.

In engaging with the supply chain early, we should also consider whether a competitive tender or a negotiated route is better and how the supply chain can be incentivised to achieve or beat the project goals, either through a target cost arrangement or through key performance indicators.

Clarity of objectives

Business and project objectives should be set out within a procurement statement. This should explain to all involved in the project why it is being undertaken and its overarching principles. The statement should also clearly explain how success will be measured, ie, timescales, quality aspirations, deliverables and value for money criteria. Suppliers should be told of these objectives at tender stage.





Commercial and risk management

A commercial and risk management strategy to aid procurement and contract selection needs to be drawn up. As discussed in Chapter 2, the strategy should address the current market conditions and constraints, the nature of specialist design, and to what extent design liability exists and with whom, as well as lead-in times.

Design

The procurement strategy should clearly establish who is responsible for design and at what stage. Confusion over design responsibility between designers, contractors and specialists can be a source of delay and budget overruns. A procurement strategy should include a design responsibility matrix providing clarity and this should be aligned with appointments and liabilities.

The transfer of design responsibility should be considered from the outset and made clear within a

contract, through a contractor's design portion (CDP). Having a CDP strategy will avoid redesign and provide validation for the contractor's design proposals.

Technical proficiency

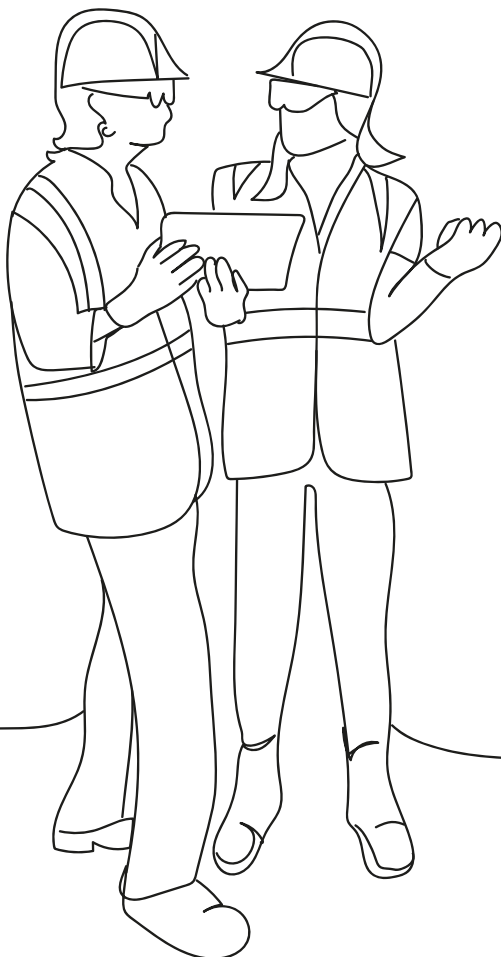
The professional and construction team should possess the necessary competence and experience for the project, as well as proficiency in the procurement and contract strategy being adopted.

Frequently, design teams are appointed at the outset of a project on the basis of a working assumption for the procurement strategy, which is consequently reflected in the consultant appointment scope of services. As the project proceeds, the procurement strategy is often refined or changed without due consideration being given to realignment of the consultant deliverables and/or, ensuring the personnel involved possess the required experience and competence to deliver.

Setting expectations for procurement

Explaining clearly how procurement will be conducted and the behaviours expected from both sides helps establish trust and attracts credible bidders. This can be done by:

- Setting out overarching protocols and procedures for procurement, these will provide a sound direction for the process – though they should be sufficiently flexible to be changed should new and useful ideas arise; guidance on these protocols should be issued to participating contractors and could include, for example, how the procurement will be evaluated and by whom, and what governance processes will be required for appointment and timescales
- Ensuring the parameters for competition are clear in advance and appropriate for the scale and nature of the project, for example, stages in the process and number of participants



Setting expectations for behaviour

The sooner the project and supply teams are told how they will be expected to conduct themselves, the better. Doing this at the start of the project will drive high-quality tenders, produce better solutions and reduce problems downstream.

To agree and set the expectations:

- The project team should state what is of value to the project to help stimulate creativity and open sharing of new ideas; areas of value are unlikely to be restricted to capital cost alone and may reflect the whole life of the project and its sustainability and social value as well as key parameters for delivery such as programme and quality
- Procurement documentation should clearly define anticipated areas of responsibility including all parts of the design, this will enable participating contractors to highlight any efficiencies of ideas to produce better value (see Chapter 5)
- Sufficient time should be given to participating suppliers to review tender documentation, raise clarifications and firm up cost
- Sufficient weight needs to be given in the competition to behaviours, cultural fit and compatibility

Explaining clearly how procurement will be conducted and the behaviours expected from both sides helps establish trust and attracts credible bidders.

Key takeaways for defining a procurement strategy to create value



- Engage with suppliers early and before the formal tender process to provide opportunity for interaction and for clients and contractors to plan and allocate resources and allow the supply chain to bring innovation into the design and secure a level of cost certainty
- Adopt fair and considered contractual terms which are equitably transferred to establish trust and attract credible bidders
- Explain clearly how procurement will be conducted and the behaviours expected from both sides, again establishing trust and interest
- Provide open and transparent information to the participating supply chain and set out governance processes and roles and responsibilities, which will prevent future problems
- Actively consider the benefits of longer-term alliances, strategic relationships or frameworks

Toolkit



- Document a clear strategy on why the project is being undertaken and define the measures of success – particularly the criteria for determining value for money
- Draw up a bid evaluation plan which includes the evaluation method, criteria and sub criteria and weighting factors to ensure a fair and consistent approach to selection
- Draw up a commercial and risk management strategy to aid procurement and contract selection



Long-term relationships bring rewards for Chiswick Park

Case study

Lendlease successfully delivered construction for the whole of the Chiswick Park office development in west London over a 19-year period to 2019. As contractor, Lendlease consistently used lessons learned from previous phases and maintained the same supply chain to create programme savings. The client was keen to see standardisation on the development of the office buildings, with a product that evolved as the site progressed. To achieve this, Lendlease delivered all buildings based on a standardised model and kit of parts.

An integrated supply chain and collaboration were critical factors, along with continuity of organisations and personnel. Lendlease developed rigorous lessons-learned processes, feeding into continuous improvement and incremental savings. This resulted in 7% cost savings across the scheme, a reduction in construction programme and an increase in rental income through improved net to gross floorplate efficiencies. Snagging was also reduced by 75% when compared with comparable buildings delivered without standardisation.

Lendlease delivered an award-winning business park that has achieved a consistently high return on investment for client Stanhope, and latterly Blackstone. Lendlease set targets and standards that required an innovative and collaborative approach to delivery, based on building long-term relationships and maximising the expertise and input of the supply chain.

This approach provided challenges for the supply chain but also offered opportunities. By delivering well and efficiently, there was the reward of repeat business to the supply chain providing certainty early in the project. The upshot was greater supply chain

engagement and innovation, focused on improving the performance of the buildings and reducing cost. Costs were reduced by: eliminating the costs incurred by repeat bidding, which were passed back to the project; economies of scale; and economies through product efficiencies and innovation (for example, services costs for the buildings decreased by 14% across the project).



5

Bid evaluation and awarding contracts



5

Bid evaluation and awarding contracts

This chapter explains how to adopt value-based procurement and ensure technical and financial capacity of suppliers is matched with the complexity of the job; it notes how supplier failure will ultimately lead to reduced capacity in the market, less value, and less innovation

Why it's important

Rigorous assessment of the supply chain and determining at what stage to set a price are other key factors in awarding contracts. They rank in importance with tailoring the procurement strategy and setting a clear strategy for the appropriate risk transfer, both of which have been discussed in earlier chapters.

Accepting a price significantly lower than anticipated without the appropriate due diligence is likely to lead to problems in project execution as the contractor may need to cut corners and bolster margins by other means.

The technical and financial capacity of suppliers must be established, and only organisations of appropriate size and experience should be invited to bid.

Financial duress and failure will ultimately lead to reduced capacity in the market, less value, and less innovation and greater cost to the project.



Assessing the capacity of supply chain

The capacity of the supply chain can be assessed on the following criteria:

- Capability – does the supplier have the proven track record and ability to manage the nature and risk profile of the project?
- Forecast annual turnover versus project value – does the supplier have the capacity as a business to take on a specific project?
- Financial performance – a detailed review of all financial information should be carried out by a qualified individual
- Current workload and liabilities – this can be a sensitive issue but is important, and something responsible developers and consultants find out before any appointment is made; it can best be achieved where frameworks are used since confidential discussions about workload and liabilities can be part of the regular reviews
- Cultural fit – does the supplier share the client's core values; this is an important factor when considering team dynamics

Value-based procurement

Accepting the lowest price and then trying to execute a fixed-price, lump-sum contract based on incomplete information and an incomplete design is a recipe for failure. Value-based procurement avoids this risky approach and instead sets the price and determines the risk transfer by designing the scope of the project using as much information as possible.

Where there is incomplete information, someone is taking a view on risk. This is not a transparent or equitable risk transfer and should be avoided. By utilising a tailored, flexible contractual arrangement, for example as set out in the case study in Chapter 2, risk is not only transferred at the right time but the contractor also can contribute to the design process and bring value and innovation into this process.

Setting the price at the right time

Where the scope of a project is defined and information is sufficiently developed, it is suitable to fix the price. Where requirements aren't clearly defined, or information is insufficient or the scope is not clearly defined, then a more flexible approach is required to achieve fixity to provide best value to all parties.

Bid evaluation

Evaluation should start with a focus on compliance and adhering to the principles set out in this playbook. These issues must be scored qualitatively and quantitatively and the balance scorecard should be weighted in favour of quality rather than cost.

Briefing the tenderers at the start of a tender process and telling them what success looks like means they possess the right information, which will make the assessment process easier.

Where pricing is significantly lower than anticipated, whether overall or in part, this should be considered carefully and challenged robustly.



Key takeaways for bid evaluation and awarding contracts



- Ensure value-based procurement is clearly defined and adopted as a project culture
- Strike an early agreement of contractual mechanisms, including using notice to proceed gateways, plus a clear scope and sufficient levels of design and risk
- Set the price at the right time and not to the detriment of developing best overall value solutions
- Ensure equitable allocation of risk at the right time, based on robust information, and strike a fair price to ensure loss mitigation does not become a factor that undermines performance and the pursuit of best value
- Encourage innovation through the bidding process and articulate this within the evaluation criteria
- Consider value against the overall project life-cycle cost, not just contract-entry cost
- Carry out thorough due diligence on the bid returns – compliance with the scope and specification, cost and time certainty, clarity of the bid offer and elimination of unacceptable exclusions and deviations
- Assemble a suitably qualified bid evaluation team with the technical competence, knowledge and experience to match the scale and complexity of the project and carry out a balanced and unbiased review of the bid

Toolkit



- Draw up a bid evaluation plan which includes the evaluation method, criteria and sub criteria and weighting factors to ensure a fair and consistent approach to selection
- Develop a balanced scorecard which is weighted in favour of quality rather than cost
- Be prepared to challenge and carefully consider any pricing which is significantly lower than anticipated
- Develop a scoring matrix that includes health, safety and wellbeing together with environmental and sustainability objectives



Clear objectives and rigorous bid analysis to award contracts

Case study

Following a robust pre-qualification process, three main contractors were invited to tender for a confidential project through a two-stage competitive tender process which focused on the golden triangle of any procurement route – time, cost and quality.

At stage one of the tender the client's critical objectives and success criteria for the project were clearly stated, and the contractors were asked to respond to these points within their bid. With this knowledge, the tenderers were able to structure specific and relevant technical responses to the challenges of the project. Bids were objectively assessed on this basis.

The project programme was of critical importance – the client was seeking the optimum programme that balanced speed of duration and certainty of delivery. To this end, as part of the bid assessment, detailed critical path analysis was undertaken on the submitted tender programmes – points of stress at key construction stages, critical path benchmarking and areas of risk were identified. The tenderers were in turn questioned, challenged and then invited to reassess their programmes. Within the tender analysis and recommendation, a detailed risk and commercial commentary was made against each programme.

This is in stark contrast to what can occur on a project, where without due diligence, a poorly advised client may select what on face value looks like the fastest (and achievable programme) for the reality to be somewhat different.

This project highlights the importance of defining and communicating key tender criteria and method of evaluation to tenderers, and also ensuring that robust analysis is undertaken with considered due diligence. Selecting the contractor at stage one tender, with the best qualitative response, provides a better platform for the selected contractor to successfully fulfil the obligations of the PCSA appointment and thus achieve a positive contract engrossment. This is precisely what happened on this occasion.



6

Site accommodation for a modern workforce



6

Site accommodation for a modern workforce

In the office or on site, a high standard of working environment is essential for achieving a healthy and injury-free workforce, as well as helping to attract new and diverse talent into the sector; this chapter looks in more detail at how projects can create the best working conditions

Why it's important

A project culture that places great store in the physical environment and nurtures the safety and wellbeing of its workforce has a far better chance of success and will help attract talented people into the industry. As construction will need 216,800 new workers by 2025 to meet demand, according to the Construction Industry Training Board, improving working conditions is a top priority.

As discussed in earlier chapters, project success is greatly enhanced by effective planning, organisation and communication. These same principles apply to setting up and maintaining the highest standards on site.

At the very outset, commitments should be made to provide high-grade facilities and a supportive workplace culture. This can help address the unique and highly challenging set of workplace constraints on construction sites. These include obvious physical characteristics such as space and access, but also a dynamic and changing workforce, with various trades, each with their own objectives and timeframes, giving rise to a fluid culture.

Going beyond the legal requirements

There are legal requirements for the workplace and specifically construction sites (see CDM 2015), with clear health and safety standards. However, while achieving legal compliance sets a baseline, it misses the role that a high-grade workplace plays in attracting and retaining the workforce and improving site culture and performance.

Excellent changing and washing facilities, ample secure storage for clothes and personal effects, a comfortable canteen serving healthy, well priced food, and well lit, clean offices and meeting rooms all make for a more inviting place to work and enable workers to use their time more effectively.

There are other features that will make for a professional and sustainable workplace, which in turn boost the reputation of the client/main contractor as a good employer. These features also support wider project goals relating to ESG, sustainability and inclusion, so for example, waste segregation, energy saving features, recycling facilities and multi-faith rooms.



Project culture

Being clear about the cultural characteristics and expected behaviours for a project from the outset and acknowledging the role this will play in delivering performance is key; these concepts have been explored in more detail in Chapters 1, 2 and 7.

Establishing trust-based relationships built around a no-blame culture and collaboration start way before activities commence on site.

At site level, this means acknowledging the quid pro quo relationship between providing high quality facilities and expecting high quality behaviours in return; and likewise, for setting the tone for diversity and inclusion, including provision of women-specific/ pregnancy-specific PPE, and appropriate facilities. Access to mental health support should also be provided.

A key aspect of maintaining a positive project culture is ongoing engagement and consultation with the workforce. This starts at site induction and continues with periodic reviews of facilities and arrangements that should be carried out in line with the changing nature of the works and the workforce, for example by using *You said – We did* boards and planned versus actual sessions.

It is vital that project successes (achieving deadlines or delivery of complex features on site and so on) as well as failures (such as near misses and accidents) are recorded and recognised. This is so that wins can be replicated, and incidents not repeated.

The installation of a digital infrastructure on sites with superfast Wi-Fi connections is required as a minimum.



Digital technology on site

Modern construction sites need to reflect the changing digital landscape and have facilities for sharing information through collaborative software. The days when site internet was solely for email are long gone. This requires the installation of a digital infrastructure on sites with superfast Wi-Fi connections throughout the office spaces as well as the canteen and welfare areas as a minimum.

Construction is rapidly adopting digital tech to support both traditional office and design tasks through BIM, but also on site, where augmented and virtual reality technology is now regularly employed. Likewise, the use of tablets for viewing drawings, digital forms, inspections and capturing hold-points should be provided for. The information flows resulting from this adoption of digital tech should follow the processes set out in the UK BIM Framework.

Promote effective planning – reduce unplanned events and incidents

Construction workplaces are dynamic, with a constant flow of activities and materials resulting in an ever-changing environment. Without careful, timely planning and coordination, these daily changes can have a detrimental effect on site conditions and behaviours, in turn giving rise to incidents and injuries.

As a result, effective planning, collaboration and coordination are essential for establishing and maintaining workplace standards. In practice this requires a disciplined approach to regularly discussing medium and long-range works.

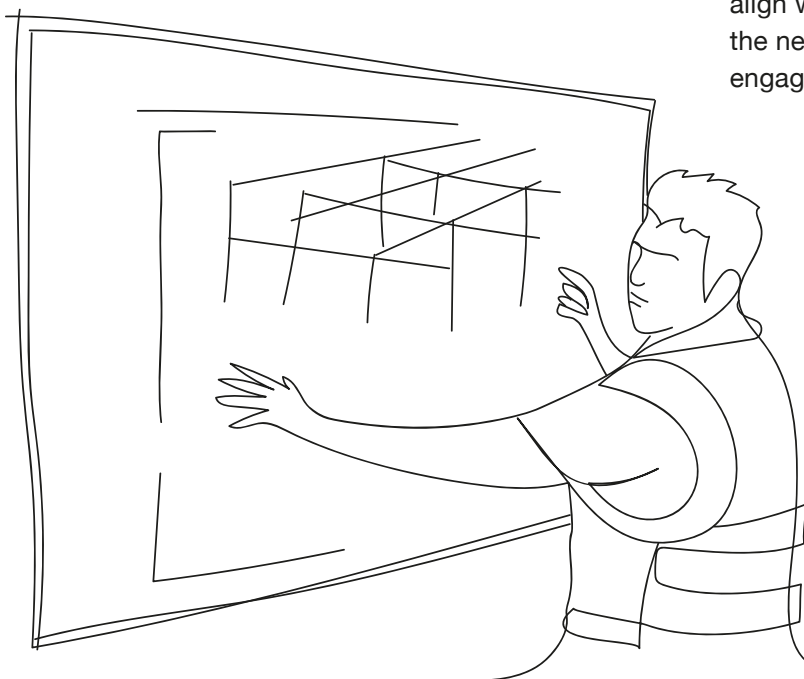
Well-managed sites monitor performance to maintain standards. They also adhere to the *Plan, Do, Check, Act* cycle promoted by the HSE, which treats health and safety management as an integral part of good management, not a stand-alone system.

Improve occupational health and wellbeing

For some time now, the industry has been firmly focused on accident prevention and safety. This has paid dividends, with accident rates falling each year. Occupational health risks must be addressed with the same energy as safety concerns.

Unhealthy site characteristics such as noise, dust, and vibration as well as poorly designed materials, logistics and access, which give rise to unnecessary manual handling, will need to be considered much earlier in the design and planning phase. Chapter 3 outlines how the introduction of new technology and off-site processes can impact on site health and safety; addressing these key occupational health issues must be a target outcome.

Mental health is a key issue for detailed consideration as construction workers have one of the highest suicide rates of any group. A study by Glasgow Caledonian University, commissioned by the Lighthouse Construction Industry Charity, found rates had climbed from 26 per 100,000 in 2015 to 29 per 100,000 in 2019. Like all workplaces, the influences on worker wellbeing are complex and interwoven with numerous external factors beyond the control of the employer. Nevertheless, it is important that construction sites align with modern professional workplaces and have the necessary processes in place to monitor and engage with worker wellbeing.



Key takeaways for workplace requirements



- Commit to providing Grade A facilities – a high quality workplace is synonymous with professional behaviours and culture, which will feed through into the quality of work
- Set clear expectations for site behaviours and culture, promote an inclusive and diverse workforce that incorporates wellbeing and mental health
- Regularly engage with the workforce and share feedback
- Share performance assessments on health and safety, quality and sustainability to identify and drive improvements in standards
- Adopt *Plan, Do, Check, Act* principles, which treat health and safety management as an integral part of good management generally, rather than as a stand-alone system
- Design workplaces in consideration of flexibility and inclusivity of the workforce

Toolkit



- Consider unhealthy site characteristics such as noise, dust and vibration as well as poorly designed materials, logistics and access much earlier in the design and planning phase
- Establish trust-based relationships built around a no-blame culture and collaboration, far in advance of activities commencing on site



Taking site accommodation to the next level at Elephant Park

Case study

Elephant Park is a major urban regeneration project by Lendlease in South London, delivering multiple new residential, retail and commercial buildings within an urban setting.

To deliver this substantial scheme, Lendlease set out to create an environment that facilitated collaboration for all and attracted the best of the industry to join them in delivering this outstanding scheme. It quickly became apparent that the most efficient and cost-effective way to create this environment was to have everyone working within the same building.

Lendlease wanted the building to reflect the quality of a permanent office and the result of this is the

four-storey Faraday building at the heart of the site that has set a new benchmark for site accommodation in the construction industry.

The welfare facilities cater for 1,200 operatives and provide office space for 400. Much thought has gone into how to create an exemplary working environment. Lendlease made a conscious decision, for example, not to display health and safety messaging within the 400-seat canteen area in order that staff can relax and not be continually conscious of the dangers of a construction site. The colours used throughout the building have been chosen to create a calmer, more collaborative work environment.



This level of detail is repeated across all floors. The first and second floors are for subcontractor and Lendlease offices respectively and are virtually identical. These floors are dominated by large open plan offices, but also include small meeting rooms and breakaway kitchen areas.

The third floor is used for larger meetings and events and opens on to a large roof terrace. PV panels work with other environmentally friendly features of the building, which include waterless urinals and toilets that use grey water for flushing.

The 158 modular units of the 5,000 sqm building took just four months to design and manufacture, and the phased handover was completed within six months.

Other notable features include:

- Lighting based on passive infrared sensors (PIR) preventing lights been left on, reducing energy consumption
- A high specification air conditioning system fitted throughout
- Openable windows to improve occupant comfort and aid cleaning
- The first UK installation of a grey water system on a modular building
- Cycle storage facilities for 100 bikes and two bike maintenance stations and showering facilities on office floors as well as operative changing rooms



7

Creating a platform for change



7

Creating a platform for change

Changes are inevitable in construction projects; but with the right environment, impact on programme timings and costs can be minimised

Why it's important

Change is inevitable on any construction contract, and as a result it is important to create an environment which facilitates open and efficient processing of change. This should be centred around a no-blame culture, which encourages and instils a no surprises approach throughout the supply chain. Anything other than this is likely to lead to wrong behaviours among the team.

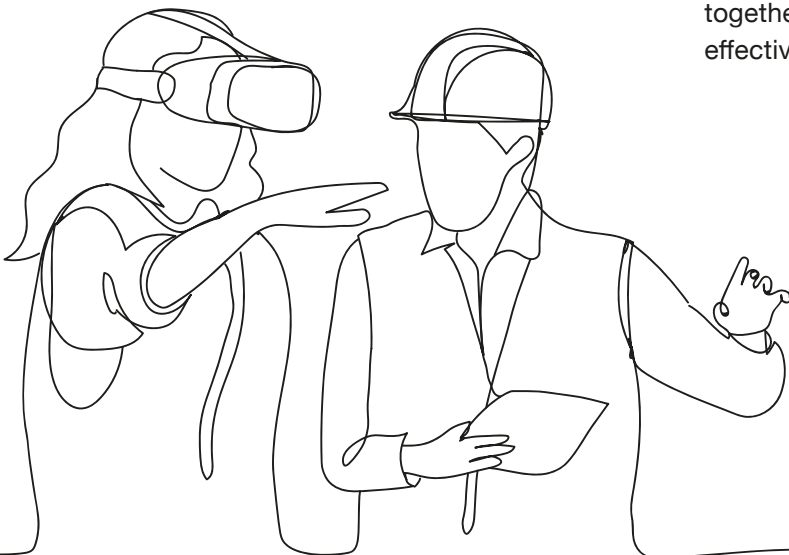
Although the principles set out apply equally to the pre-contract position, this chapter focuses primarily on the post-contract period. It is then that risk exposure is at its greatest for the contracted parties, since the parameters for the project have been set. Requirements and proposals are by now contractually bound in, supply chain partners have been engaged and the clock has started ticking on the period for completion.

Understanding the baseline

When considering change on a project, it is important to understand what the starting position looks like and therefore, what constitutes a change. Although this sounds simplistic, all too often the concept is not properly understood. The contract specifications and requirements need to be properly digested, together with the contract drafting which will outline the headline rules governing change.

Take the time, therefore, to properly understand the starting position. Review the requirements and proposals of the contract and share the salient points with your wider project team and the supply chain.

It is also of paramount importance to understand the responsibilities of all project team members, since an effective change management process is dependent upon all parties thoroughly understanding their role and responsibilities. The most effective change management processes are those where parties work together collaboratively to find the most efficient and effective solution which maximises value throughout.



Establishing the change process

As an early consideration, a project team should decide how the change process will be operated and administered. Digital technologies can establish a clear/linked workflow process, for example utilising a project platform. An effective process can operate either inside or outside of a dedicated software system, and so this is a free choice for the project parties.

Irrespective of the adopted system, the finalised process needs to have a defined workflow charting the journey of the change from point of raising, through assessment, to point of resolution. Consider including the process within a project execution plan (or rulebook). Include flow charts to articulate the process of how a change is progressed from inception to close out.

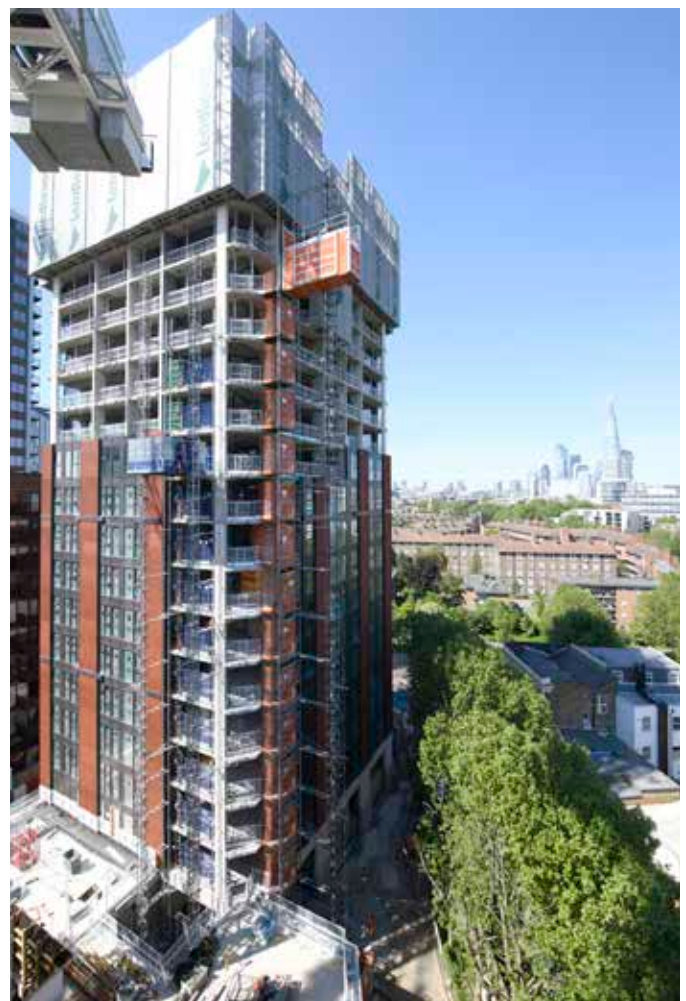
Although the fundamentals of the process are determined and recorded within the contract, the exact mechanism is not, and therefore needs to be determined. Consider, for example, the format of how a contractor should raise a change and/or who will be part of the assessment and consideration process, since it is likely that multiple people, representing different parties, will be involved in the processing and authorisation of every change item. Each person has a vital part to play, which should be properly articulated and understood.

Maintaining regular, open and honest communication among the team will maximise the efficiency of the process. Notwithstanding this, consider including an escalation process if agreements cannot be naturally reached within a suitable timeframe.

Establish the culture

Instilling a one team philosophy for change is important and should be established early in the process. All parties should be encouraged to raise potential change items as early warnings, even if they later do not manifest themselves as such. This will enable the items to be considered early, which is important to limit impact, but this will only happen if people feel part of the team and if the culture of that team is one of no blame.

The early identification of such items maximises the time available to review and consider the potential implications, thereby allowing decisions to be made proactively, rather than reactively. This level of openness, honesty and transparency will contribute to the reduction of unwanted surprises.



Every second counts

Any change process needs to be efficient, with people empowered to make informed decisions at the appropriate time, based on value added and risk impact. Changes should be assessed progressively and formalised expediently, both upstream and downstream.

This efficiency is dependent upon complete and full information being provided for each change item, so that informed and complete decisions can be made. The most effective change processes are those where the team collaborate effectively across client, main contractor and wider supply chain organisations.

We must ensure when a change item, or potential change item, is submitted that it includes as a minimum the following:

- Complete supporting information sufficient to enable a decision to be made
- Priority rating – how urgent is a decision and when is it needed
- Commercial impact
- Programme impact
- Social, environmental and carbon impact
- Value generated
- Reason for the change

This data can also help designers plan for re-use, net zero and wider sustainability goals at the earliest stages, considering and integrating the pertinent data in the earliest design concepts, thereby locking in the value from the start.



Progressive reporting

The methodical, systematic and progressive resolution and assessment of change items will enable parties to progressively develop their accounts and operate rolling final accounts. This will contribute to certainty and the elimination of surprises.

Incentivisation

Consideration should be given to operating a pain/gain share mechanism within the change process. Such mechanisms could relate to time, money or other efficiencies generated during the project.

Reflect and review

It is important that regular health checks are conducted to review and monitor the status of the overall change process. Consideration should be given to which elements are going well, and which elements need attention to enable the system to progress efficiently. Even the subtlest of refinements may provide a marginal gain.

Project teams should ask themselves what constitutes success and be prepared to adapt and refine the process to ensure that success criteria are being met as effectively as possible.

Overall, it should be noted that change management is an iterative process and can be used to inform future change items.

Key takeaways for accommodating change



- Effective change management requires proper understanding of the baseline, and what the contractual requirements for managing change are
- Engage all parties to ensure that they understand the part they have to play – open and honest relationships and communication are essential
- Change is the responsibility of all to manage, underpinned by a no blame and no surprises approach

Toolkit



- Put in place an integrated solution to fully co-ordinate, manage and document change; ensure that the process is fully understood during the procurement process and that contractor and supplier selection favours organisations that are adaptable and collaborative in their approach when dealing with change
- Ensure that a hierarchy for resolving any disputes is established together with appropriate timeframes – a successful and efficient process forms the backbone to the platform; set out the process within the project execution plan



Creating a platform for change in Piccadilly

Case study

A collaborative and effective change process was key to realising significant commercial and programme savings on the redevelopment of a former hotel in Piccadilly, central London.

The scope of works for the project included lowering the existing hotel basement. The original temporary works design for this included installing large flying shores to retain the existing basement structure during construction. Had this original design been implemented, these flying shores would have taken up a significant area within the 60m wide site. This in turn would have limited the space available for material movements and tower crane erection and had a negative impact on the efficiency of concurrent works.

The issue was recognised early and raised as an early warning through the change process. In the period that followed, the construction manager proposed an alternative, highly innovative solution, developed collaboratively with the trade contractor, structural engineer and consultants. This alternative proposal involved installing raking spider piles and a king post wall instead of flying shores. Eliminating the need for flying shores across the site meant that excavation works could proceed unhindered, and concurrent works could progress efficiently with minimal interference.

The proposed alternative methodology was processed through the change control process. Its merits were discussed with the employer, and formally instructed thereafter. The ultimate decision was value-based, as although it entailed a higher capital cost, the flexibility it afforded led to a time saving of several months, bringing significant monetary savings to the employer.



8

Measuring success and checking in



8

Measuring success and checking in

Continuous measurement and capturing of success and failure, together with feedback captured at both project and wider level, will help safeguard the delivery; increasing productivity should also start with measuring productivity

Why it's important

To maximise the success of any project, it is essential to strive continually for efficiency. The process must begin by establishing the critical success factors and how the team will check in at various stages to make sure targets are being met or whether they need to be reviewed and supplemented.

Clear success factors are to be outlined from various perspectives such as cost, programme, quality, health and safety, and sustainability and then monitored. Measuring productivity is the first step to improving it.

Measuring and reporting productivity and success

Improving productivity is the key to driving transformational change in the construction sector. Higher productivity reduces costs, increases production, and enables the most effective use of available resources which is at the heart of sustainable construction. To be able to improve, it is essential to measure and compare.

In *Measuring Construction Site Productivity - a seven step framework for success* (published in May 2022), the Construction Productivity Taskforce has drawn up a framework with a data dashboard to begin to standardise the process of measuring site construction productivity.

The Taskforce identified five high-level benchmark metrics: productivity; waste generated; pre-manufactured value; right first time; and tool time. These metrics will help the industry to establish a quantifiable baseline which can then be used to drive the transformational improvements needed in construction productivity. The publication set out how they can be measured.

These metrics were selected following a series of workshops where the aim was to identify measures that would have the following attributes:

- High relevance to productivity improvement
- Established performance measures already familiar to the industry
- Easy to measure and capture the data
- Relevant across sectors outside construction

The Taskforce has also supported the establishment of The Construction Data Trust (CDT) which provides a platform for the industry to share anonymised performance-related project data. Drawing on this data will help unlock cost-effective innovation and establish industry-wide comparison benchmarks. Projects should be encouraged to participate in CDT (see page 05 for more information).





Bringing key members of the team together to provide a forum to review progress is a straightforward way of establishing and communicating how the project is progressing and where the key success factors are.

Where productivity can be measured using project statistics and data, setting up a digital dashboard is effective in spotting whether the project is on track, for example if the successful installation of a steel frame is reliant on achieving a certain number of sections being installed each day. This can be reviewed quickly with an S-Curve on the dashboard to track the productivity of the installation. If the required number of sections being installed is not being achieved, this can be quickly identified by the forum and a mitigation plan put in place to increase productivity.

It is also important to acknowledge the routines of a project. Success needs to be broken down into measurable chunks so that everyone sees how they contribute. This enables teams to celebrate a good day as well as receive monthly feedback and will also help to drive continuous improvement.

Opportunities for continuous improvement

The CDT can be used to identify and establish areas of opportunity and improvement. It can also establish a platform to highlight and discuss possible innovation and how it can be introduced to the scheme. This may include the implementation of a new way of working or technology to track quality or data. Sufficient time should be allowed to review innovation at the right stage of the project, to ensure potential opportunities are not lost.

End of project review and feedback

At the end of the project, when it is still fresh in everyone's mind, the team should review the outcome. This should capture lessons learnt on what went well and what could have been improved, which can be fed back to the wider team. For example, the project team may have implemented a new way of working that has increased productivity: this could be implemented in future projects. It needs to be very clear to all participants that the purpose of the review is not to apportion blame but to be open about what could have been improved.

This feedback should be captured in a way that can be shared with future project teams to ensure continuous improvement is made.

Key takeaways for measuring success



- Continuous review and interrogation will drive increased productivity and efficiencies
- Lessons should be captured throughout the project lifecycle and shared to improve processes and also speed up delivery on current and subsequent projects
- Innovation should be incentivised where appropriate
- Adequate time should be allowed in the programme to enable reflection and measurement of success and failure and how to improve on them, to the overall benefit of the current and future projects

Toolkit



- Define key performance indicators at the outset and measure on and off-site performance against a range of factors including productivity, cost, time, quality, safety and sustainability
- Establish a forum for key team members to review progress and share success factors
- Set up a digital dashboard to show whether a project is on track
- Capture lessons learned at the end of a project while it is still fresh in people's minds



Steel erection progress monitoring using digital rehearsals

Case study

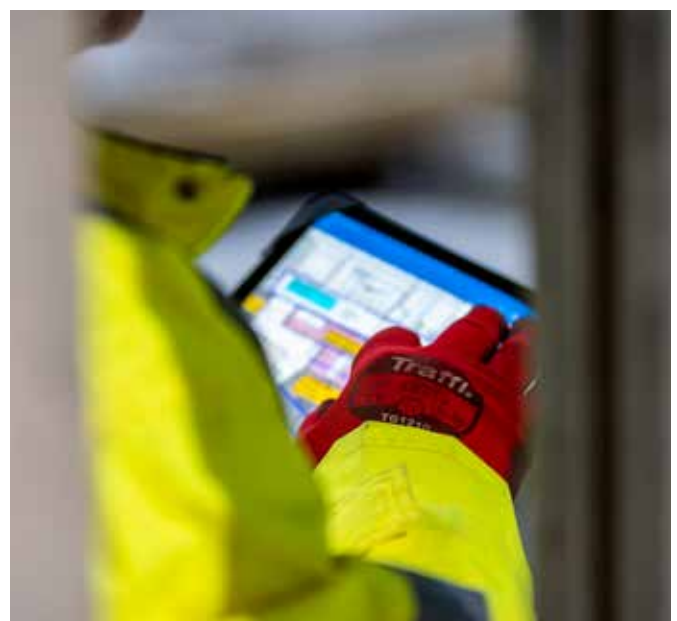
Skanska uses 4D digital rehearsal models to measure the actual productivity of steelwork installations against the planned project programme across live projects.

Each week, production data is collected, and a digital dashboard produced using Power BI software. The information is easy to understand using productivity graphs and a 3D model to review the progress, thus ensuring strong production control. It also creates an animation of planned versus actual progress making it easy to identify where adjustments to the programme can be made, thereby avoiding delays.

Key benefits include being able to calculate the installation rate against the programme, as well as visualising the methodology to monitor the progress of the works each day.

On completion of the works, the team is able to complete a digital debrief. This reviews information such as the overall productivity output, how long plant was operational and how much time was deployed. Such information is used to make improvements to future operations.

Linking the construction programme and the model allows a project to control and monitor progress from the beginning. It also enables greater collaboration between project planners, engineers and the supply chain to create a realistic and achievable installation plan.



9

Transition to handover and effective aftercare



9

Transition to handover and effective aftercare

Improving the operational efficiency and energy intensity of the building is a must; it requires the input of the operation team, a robust handover, a post-completion and aftercare strategy and sufficient training and simple-to-follow instructions for occupiers at handover

Why it's important

The wellbeing of the occupants, the efficient energy use of the building and the costs of maintenance and replacement costs all depend on three things:

- How the operation of the building is tackled in the design
- A considered and well thought out handover process
- Ongoing monitoring and optimisation of the building operation

Moving from construction to operation can often be a challenging process. Ongoing engagement with the occupiers and receiving their feedback will optimise the building's operation and can help improve the construction of future projects.

The best way to ensure the most efficient operation of the building is to involve the operational team from early in the design process through to completion; they are experts in the ongoing operation of the building.

To ensure the most-efficient operation of the built asset, it is important that the team who delivered the project continues to be involved post-completion of the building. This will reduce time, cost, operational risk and improve carbon in-use while also allowing any defects or issues that arise to be dealt with quickly.

The client should discuss with the contractor how important it is that the building should operate efficiently once completed. Be clear on roles as the building moves from construction to operation and occupation. Ask the following questions:

- Who is the lead from the construction team who will manage and respond to any defects as they arise?
- How are these defects raised and what are the agreed response times?
- Who from the project team will bring benefit to the operation of the building through continuous engagement through the initial operation and occupation of the building?
- How can the building be stress tested either before or during operation to ensure its success?



The importance of a handover strategy

A clear aftercare strategy should be agreed early in the project stages for handover and beyond to ensure alignment on building and operational requirements.

The way the building operates when its user takes possession will define the success of the project. As a result, it is important to prepare early for operation by adopting a soft landings approach, supported by whole-life management of information as defined in the UK BIM Framework.

Soft landings involve a structured process in which the building management team is brought into the design process to inform how the building should operate. This involvement is repeated through the mid to latter stages of the construction process and during commissioning to fully influence the building's operation beyond construction completion. BRSIA soft-landing guides emphasise the importance of the initial design stage in ensuring the successful operation and use of the building.

A successful handover involves educating the building's users in how to operate and maintain numerous systems and facilities and can significantly help in reducing the operational and therefore whole life carbon. In addition, the use of sensors or smart technology, combined with continual monitoring and evaluation of building performance at set intervals post completion, can also significantly reduce its energy use.



Design and occupier engagement

Designing for commissioning and operation may often be an afterthought. However, these areas need to be included within the initial aesthetic, spatial layout and building performance focus and they must start at the briefing and specification stage.

Spaces for accessing and maintaining plant and equipment are essential to ensure the final systems operate efficiently. Access hatches, access to valves and controls and well-considered riser co-ordination all play a part in the successful running of a building. Well considered and thought-through building management facilities, together with operational considerations for common parts areas such as reception, toilet cores and shower/changing facilities, are also key to get right, through engagement with the operational team.

Occupier engagement and integration

Occupiers may wish to adapt components of the building to suit their specific needs and that of their intended fit out or function. This may require occupier-led change or adaption to base build systems, floors or access. Obviously, the earlier this is concluded, the more time is given to its co-ordination and optimisation, specifically within the early design stage of the project, as it will reduce reworking and strip-out of completed works.

It is recommended that the base build team are included in the review and sign-off of occupiers' fit out systems, and that installation is witnessed to ensure compliance and successful operation. These records will need to be added to the health and safety file and be clearly identifiable in the as-built drawings. Fit out is much more likely to change on a regular basis than some of the permanent areas of the building. Keeping the details current is an obvious necessity.

The building's functionality should be clearly defined and explained to the occupier. Ensuring appropriate adoption of digital information processes will assist this. Consider a multi-mode means of communicating the functionality, which includes flythroughs, VR, videos, websites, flow charts and training meetings.

Always bear in mind that initial teething issues can detract from the joy of moving into a new workplace or facility.

Asset data and BIM

The use of an appropriate digital technology to provide a common data environment which supports development of reliable and trustworthy information models compliant with the UK BIM Framework, is crucial to be able to effectively maintain the building. Historically, the quality of as built information has often been incomplete or inaccurate. Defining at the outset the data needed at handover is important, as is assigning adequate time in the construction process for construction information to be updated. This updating should ideally be done within the BIM environment, which can then be developed as the building moves into occupation and operation.

Quality sign off, spatial coordination (digital versus actual) and programme (programme versus actual) functionalities exist within current available technology. These should be explored and employed, if deemed cost effective. Record data and evidence is extremely hard to collate once works are complete.

The data should be available to all parties involved in the project to ensure transparent collation and consistent use of the data – one source of truth.

Where the building is modified over time, amended record information needs to supplement and/or supersede the original completion information to ensure all information held is current and accurate through the building's lifecycle. Encourage the occupiers to feed into the BIM model as the building layout flexes and changes through the life of the building – this will maximise operational efficiency.

Keeping records accurate and updated, as described above, will maintain the golden thread and where appropriate and feasible, it will ensure compliance with the original building operational philosophy. Clear

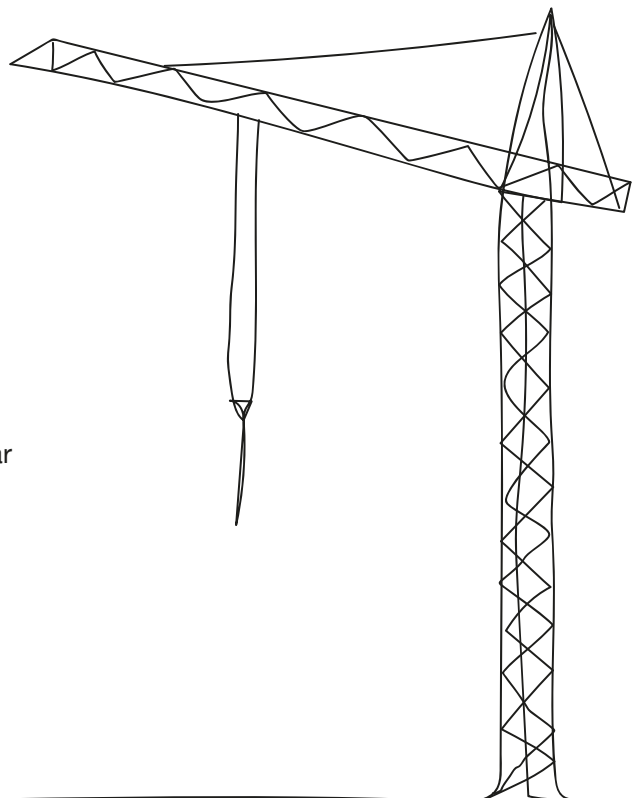
Keeping records accurate and updated will maintain the golden thread.

lines of designation between base build and fit out systems and operation must be understood on any alterations carried out.

Naming convention

Consistency in naming throughout all project stages will assist heavily in avoiding ambiguity during design and construction stages and provide a solid platform for building operations and maintenance.

The naming convention of the building may cover several interrelated topics. The use of digital or smart technology following the UK BIM Framework will help to define the drawing and specified geometric and metadata required at each stage and should clearly refer to the operation and maintenance of the building. The agreement on the floor levels, room and access naming will ensure the design information is carried through into operation without confusion, or costly rework during the later stages of construction. This should be considered within RIBA Stage 1 and developed in greater detail in the latter design stages, ensuring it is agreed and locked down prior to contract award.



Pre-handover schedule

A defined countdown to completion should be set at intervals suitable for the programme, such as 12 months, six months, three months and one month. These may include statutory and third party sign off, utilities connections, commissioning schedule and witnessing. Clear lines of instigation and action should be defined with target and actual close-out dates; this can be used at regular project progress meetings or as part of a dedicated soft landings focus meeting.

Most construction professionals are familiar with defect-free practical completion or the level of snags which are to be resolved prior to occupation. The reality is that testing and commissioning is often squeezed and defect resolution is not always as effective as intended because of a frantic dash to the finish line.

Snags should be resolved by those trades responsible prior to being able to move onto another section of work, commonly referred to as snag as you go. For those snags that remain, their resolution and close out should be documented, ideally via BIM enabled pictorial record-keeping technology, and shared among the entire project team. Quality benchmarks and mock-ups serve as useful tools to compare the final product and align obligations to standards.



At practical completion

Just as airlines do not conduct pre-flight checks while airborne, so practical completion must be satisfactorily concluded before hand over. All parties must be confident that the works have reached the relevant discharge of contractual obligations, the specified quality has been achieved and the building is in a fit state to perform its function.

The responsibility for these checks will depend on the contract used and complexity of the building. Typically, it will be a collaborative approach which involves the installation contractor, main contractor, commissioning engineer, verification engineer, operational manager and facilities management, design consultant and contract administrator/employer's agent.

Ensure that insurances are in place, that the security team is trained and that the status and operation of all mechanical, electrical and public health (MEP) systems are known and understood by the operational team.

Regular commissioning and integration of occupier systems will obviously continue after practical completion as the building use and occupation evolves. Any problems discovered must be recorded, clearly communicated and swiftly dealt with, especially when the building is in occupation.

The challenge is then to distil this feedback into tangible actions – changes to the specification or design guides for future buildings. You may wish to consider holding a lessons-learnt workshop at practical completion and then again at the end of the defects liability period – drawing together the suite of feedback gathered over the life of the building.

Learning from the operation of the completed building can be invaluable and the occupiers of that building should be engaged regularly through the lifecycle of the building. That way, lessons learnt can be fed back to the client and the project team to help with future schemes.

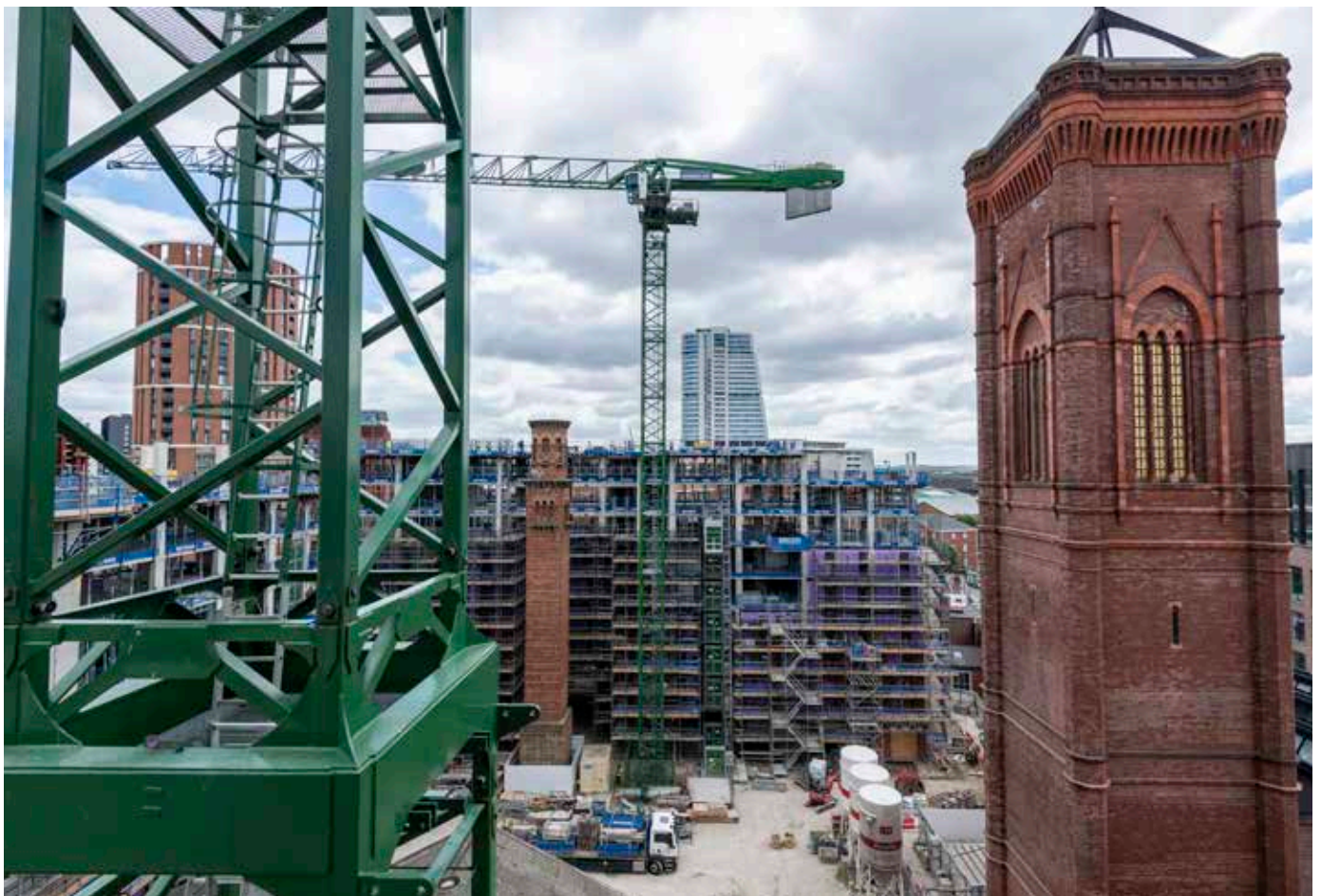
The Building Safety Act and information management

The Building Safety Act puts a legal duty on dutyholders and accountable persons to create, obtain, store and share documents and information about their buildings in scope of the Act, including when it is handed over for occupation.

Information will need to be kept digitally meaning information and data is stored electronically and can be transferred electronically. The approach being advocated by government is to follow the requirements of the International Standard ISO 19650 series and the guidance produced by the UK BIM Framework.

Certification

In consultation with the team, the client should consider using recognised accreditation schemes to provide a framework for optimisation of the building in use. Certification schemes that could be considered include Nabers UK Design for Performance, CIBSE Technical Memorandum 54 (TM54) for energy performance, and BREEAM and WELL Building accreditations for sustainability and health and wellbeing credentials.



Key takeaways for successful hand over and operation



- Early structured engagement with the end-user team is key; design, procure and build with occupation and operation in mind
- Design and standardise elements to minimise the level of aftercare required and maximise efficiency in operation, maintenance and whole life carbon
- Plan from the outset the aftercare strategy and regularly review
- Fully utilise soft landings and a robust brief to define clear lines of approval, quality expectations, sign off process
- Allow for a robust commissioning period and engage building management as early as possible in the transition
- Ensure ongoing involvement of the contractor and relevant members of the design team through the initial stages of occupation to ensure the building is operating as designed, or whether there needs to be any amendments through learning
- Ensure that the as built information is comprehensive and correct and regularly updated as the building matures

Toolkit



- A pre-handover schedule needs to be drawn up early in the concept/design stage of the building to be used as a live document throughout; ensure all third parties and consultees have been considered
- Adopt the UK BIM Framework as the standard for managing information about the building
- Utilise the golden thread of data collated and contextualise within the health and safety files; ensure there is a hierarchy to the information provided with referenceable data points
- Carry out a systematic and rigorous post-occupancy evaluation to determine the performance of the building in occupation and feedback any relevant lessons learnt into the design and construction process



The benefits of intelligent buildings and digital twin at 51 Moorgate

Case study

Skanska has developed a state-of-the-art intelligent building platform, enabling building owners to manage and monitor a wide range of building systems in real time to ensure that a building performs as designed and also helps to improve operational efficiency and carbon intensity.

The platform enables real time monitoring of several metrics including carbon dioxide levels, temperature, humidity, noise, volatile organic compounds (VOC), lighting levels, occupied time and occupancy level.

The platform, which uses a fully asset rich digital twin, has been installed in Skanska's 51 Moorgate office development in the City of London. It has enabled reductions in the building running and maintenance costs, using an array of remotely controlled digital sensors located within the building's plant and equipment.

In the first two years of deployment, the platform has delivered energy savings of 35% and building management savings of 8%, with the associated carbon reductions.

Occupiers have also benefitted as the platform has enabled the creation of a productive working environment through improved air quality, improved control of internal environmental conditions and an overall higher quality workspace.

Designed to the highest environmental and smart building standards, the building has achieved WELL Platinum and SmartScore Platinum certification.



Abbreviations

BCO	British Council for Offices
BIM	Building information modelling
CDP	Contractor's design portion
CDT	Construction Data Trust
CM	Construction management
DFA	Design for assembly
DFM	Design for manufacture
DfMA	Design for manufacture and assembly
EDMS	Electronic document management system
EIR	Exchange information requirement
ESG	Environmental, social and governance
HSE	Health and Safety Executive
MAM	Manufacturing and assembly manager
MEP	Mechanical, electrical and public health
MMC	Modern methods of construction
NIA	Net internal area
KPI	Key performance indicator
SMART	Specific, measurable, attainable, relevant, and time-bound
PCSA	Pre-construction service agreements
P-DfMA	Platform approach to DfMA
PIR	Project information requirement
PMV	Pre-manufactured value
UKRI	UK Research and Innovation
VOC	Volatile organic compounds
2AS	2 Aldermanbury Square

Endnotes and more information

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