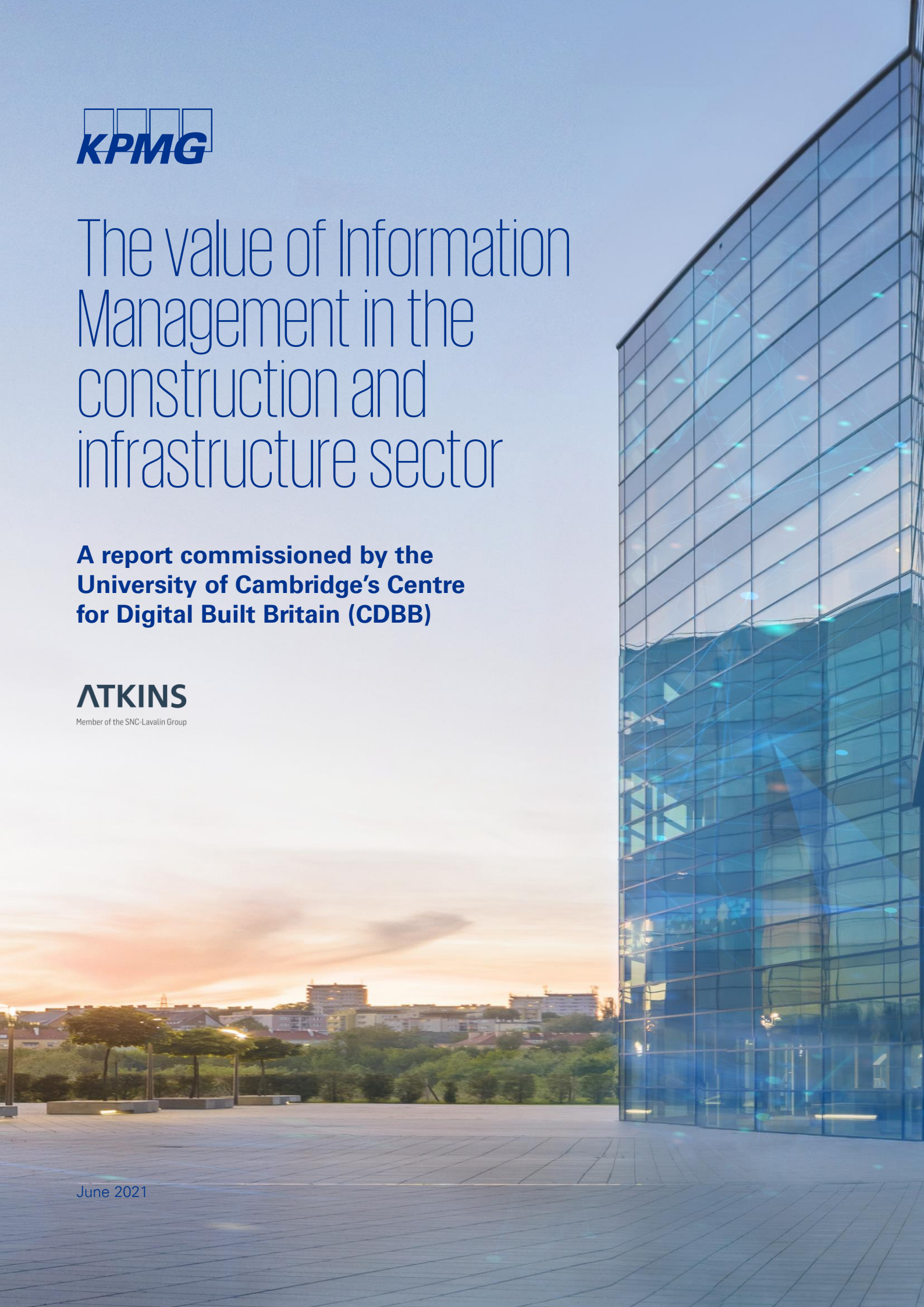
KPMG

The value of Information Management in the construction and infrastructure sector

A report commissioned by the University of Cambridge's Centre for Digital Built Britain (CDBB)

ATKINS

Member of the SNC-Lavalin Group



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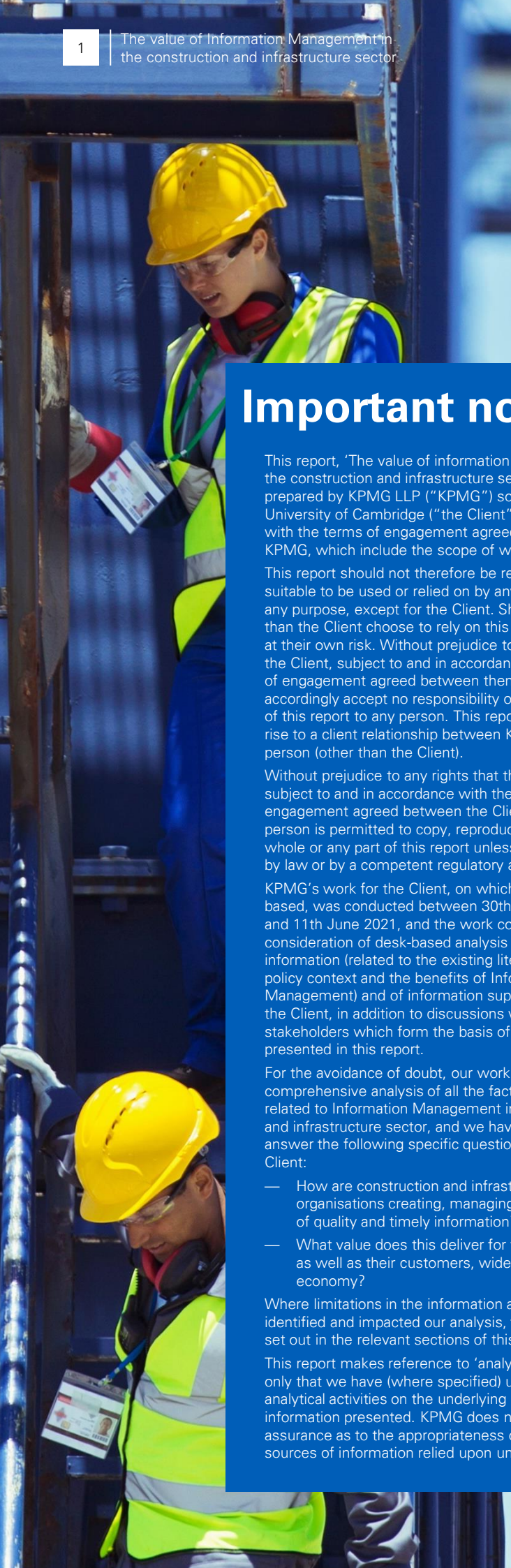

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This report, 'The value of information management in the construction and infrastructure sector' has been prepared by KPMG LLP ("KPMG") solely for the University of Cambridge ("the Client") in accordance with the terms of engagement agreed by the Client with KPMG, which include the scope of work in Appendix 5.

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KPMG's work for the Client, on which this report is based, was conducted between 30th September 2020 and 11th June 2021, and the work comprised consideration of desk-based analysis of publicly available information (related to the existing literature on the policy context and the benefits of Information Management) and of information supplied to KPMG by the Client, in addition to discussions with industry stakeholders which form the basis of the case studies presented in this report.

For the avoidance of doubt, our work is not a comprehensive analysis of all the facts and the costs related to Information Management in the construction and infrastructure sector, and we have only sought to answer the following specific questions set by the Client:

- How are construction and infrastructure organisations creating, managing and making use of quality and timely information?
- What value does this deliver for those organisations as well as their customers, wider society and the economy?

Where limitations in the information available have been identified and impacted our analysis, these have been set out in the relevant sections of this report.

This report makes reference to 'analysis'; this indicates only that we have (where specified) undertaken certain analytical activities on the underlying data to arrive at the information presented. KPMG does not provide any assurance as to the appropriateness or accuracy of sources of information relied upon unless specifically noted in this report, and KPMG does not accept any responsibility for the underlying data used in this report. Furthermore, KPMG accept no responsibility or liability for the findings or reports of other advisers even though we have referred to their findings and/or reports in our report.

The economic analysis contained in this report is for indicative purposes only. The decision as to which items should be included or excluded in the economic analysis is judgement-based. Furthermore, the items identified are necessarily limited to those that we have identified in course of the work performed by us, which is subject to the restrictions in the scope of work, as set out in the terms of our engagement. They have also been subject to the limitations on our access to, and the nature and extent of, the information which has been made available to us. Accordingly, there is no basis on which to state whether, in the economic analysis presented, the items that have been included are appropriate, or that all items that might be appropriate have been included. KPMG have indicated in our report the basis on which items have been included, excluded or adjusted. You may choose to analyse the information presented differently.

Where the analysis in this report contains illustrative forecasts, projections or estimations, these are based on assumptions provided by the Client and stakeholder organisations involved in the case study analysis, together with models operated by KPMG. KPMG does not make any guarantee that these forecasts, projections or estimations will be achieved. It is your responsibility to assess these illustrative forecasts, projections or estimations against your requirements and to make decisions regarding your operations. The forecasts, projections or estimations should not be relied upon as a single source for any decision you make, and it is your responsibility to take all relevant factors into consideration.

Furthermore, the economic modelling presented in Section 7 is done at an aggregate industry level and at a national geographic level, and thus the calculations are not representative of any particular market participant. The estimated economic impacts are intended to be illustrative and do not constitute any form of advice.

For this report the Client has not engaged KPMG to perform an assurance engagement conducted in accordance with any generally accepted assurance standards and consequently no assurance opinion is expressed.

The opinions and conclusions expressed in this report are (subject to the foregoing) those of KPMG and do not necessarily align with those of the University of Cambridge.

Executive summary

Advances in digital technologies and data are transforming the functioning of our economy and the way we live our lives. The built environment is becoming smarter, with the rise of intelligent infrastructure – enabled by the use of techniques such as machine learning and artificial intelligence – driving efficiencies, accelerating the transition to net zero and optimising the performance of the nation's built assets.

Access to information (as data) of the right quality and at the right time, in a format that is trusted by all parties, is increasingly recognised as a critical enabler of the construction sector's digital transformation, with the potential to both drive down costs in the construction and operation of built assets and drive up quality. However, there remains limited evidence on the holistic benefits of these practices.

How are construction and infrastructure organisations creating, managing and making use of quality and timely information?

What value does this deliver for those organisations as well as their customers and wider stakeholders?

This study has set out to investigate these questions and establish the value of 'Information Management' (IM) in the construction and infrastructure sector.

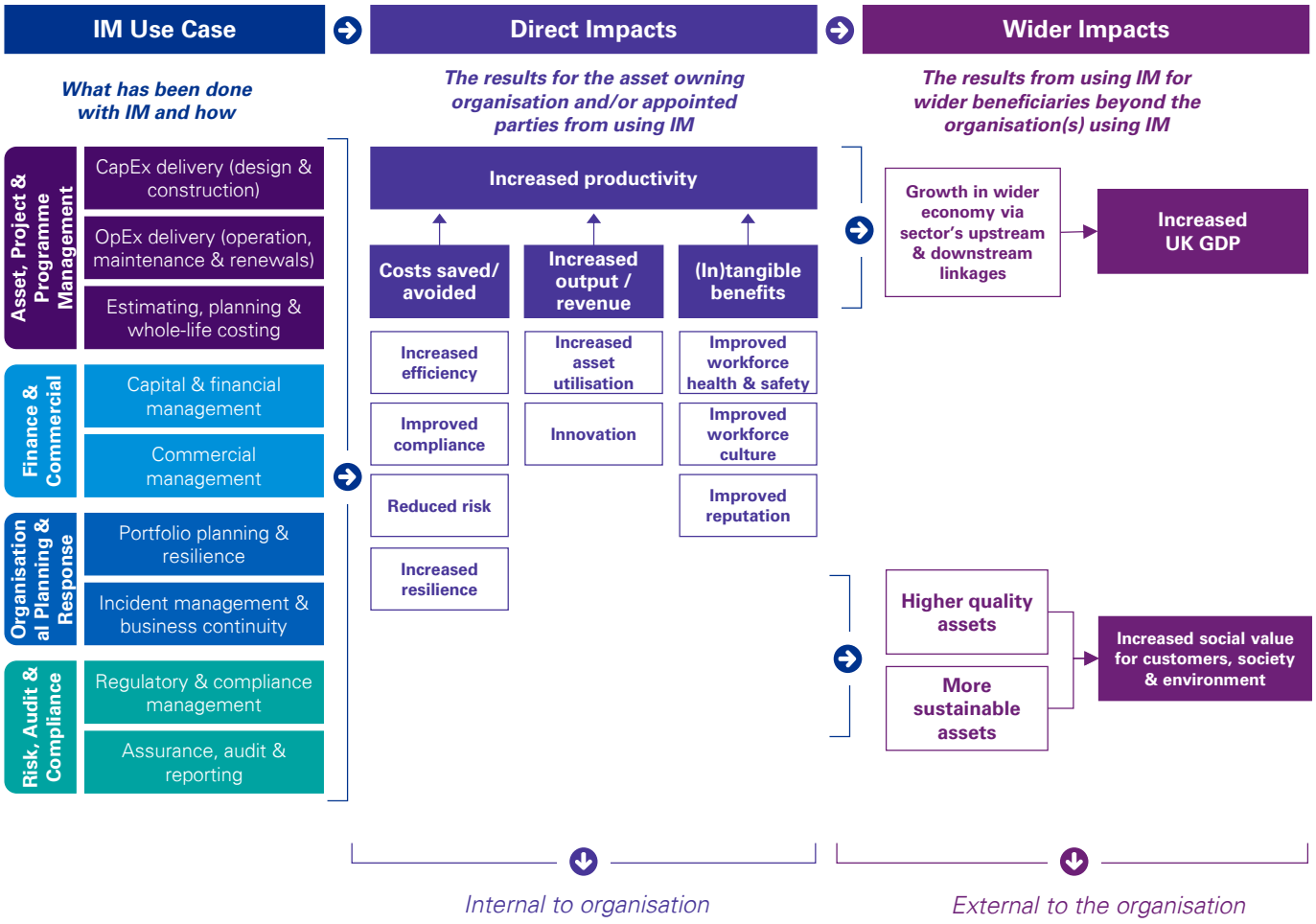
The evidence gathered through this study serves to identify the broad range of potential benefits of investing in IM, and how that investment can potentially contribute to the Government and industry's shared ambitions for the sector.

The economic case for investing in Information Management is threefold

Through this study we have undertaken a comprehensive review of existing literature on the benefits of IM and analysed real-world case studies of the use of IM at both the project- and organisation-levels to establish an 'Information Management Benefits Framework'. The Framework illustrates how the use of IM in the sector could help to unlock:

1. Direct productivity gains for organisations;
2. Increased growth across the wider UK economy as a result of those productivity gains; and
3. Social value to customers, wider society and the environment through enabling the delivery of higher quality and more sustainable built assets.

Figure 1: Information Management Benefits Framework



Source: KPMG and Atkins analysis 2021.

01 Direct productivity gains for organisations using Information Management

The construction sector faces a major (and well-documented) challenge of lagging productivity relative to other sectors of the economy, which means building and maintaining the country's built assets takes longer and costs more than it should. With the UK at the onset of a major infrastructure investment programme in the wake of COVID-19 and a bid to "**Build Back Better**" – including commitments to **Level Up the national economy** and promote a **Green Industrial Revolution** in the transition to **Net Zero** – improving the construction sector's productivity is all the more important.

The use of effective IM can play a critical role in enabling the digital economy, offsite manufacturing and improved whole life asset performance, which all have the potential to drive a step-change in the sector's productivity. The productivity gains enabled by IM can be measured through reductions in the unit cost of a project, programme or organisation's activities, and can come about as a result of:

— **Costs saved or avoided through the use of IM**, owing to its ability to increase efficiency (through savings in time, labour and materials), reduce risk contingency and compliance costs, and enhance resilience.

— **Increased revenue through the use of IM**, owing to its role in enabling better asset utilisation or the development of new, innovative products and service lines at the organisation-level.

Through our **analysis of 11 real-world case studies** we have found widespread examples of these IM-enabled productivity gains. This includes quantitative evidence which suggests **the use of IM could potentially secure between £5.10 and £6.00 of direct labour productivity gains for every £1 invested in IM, and between £6.90 and £7.40 in direct cost savings** (from reductions in delivery time, labour time and materials). We have also found evidence of **costs savings at various stages of the asset lifecycle, ranging from 1.6% to 18%[1,2], depending on the lifecycle stage.**

Notes: (1) Note that the different approaches used by stakeholders to measure or estimate the benefits of their IM investments (as well as limitations in what could be shared for commercial sensitivity reasons) makes comparisons across the case studies difficult. The cost savings quoted also relate to different stages of the asset lifecycle – e.g. cost savings in design vs. cost savings in construction vs. savings in total design and build costs. Therefore these results should be interpreted with caution, and read alongside Section 6.5.2 of this report and the detailed explanation of the benefits under each case study in the separately published Case Study Annex.

(2) These savings often come from IM's role in enabling wider digital transformation approaches and modern methods of construction, rather than the use of IM alone.

02 Increased growth across the wider UK economy

The strength of the construction sector's linkages with the rest of the economy means that, as IM is adopted by entire organisations and between organisations (as envisaged by the Government's National Digital Twin agenda), any step-change achieved in the sector's productivity could potentially drive additional, long-term growth in the wider UK economy.

These wider impacts could potentially come about through two main types of effect (as evidenced in the existing literature and through the economic modelling conducted for this study). Firstly, increased output in the construction sector means it is likely to demand more inputs from upstream suppliers, which could enable those firms to increase their production of goods and services (with knock-on benefits to other sectors linked to those firms). Secondly, competition in the construction sector means that much of the productivity gains enabled by IM could lead to lower prices for both firms and households (asset owners), with potential knock-on effects for household consumption, private investment and the output of other sectors in the economy. Under each of these two effects, the growth of other sectors could increase the demand for labour and push up wages. It could also increase the returns to private investment for capital owners (i.e. the savers and shareholders in the economy), which could in turn incentivise greater investment in capital and, thereby, growth in the UK's capital stock[3]. This latter effect is particularly relevant to the construction sector, given that around 50%[4] of the UK's annual investment in capital comes from the sector. This means that any IM-enabled productivity gains in the construction sector translate into productivity gains in the UK's capital stock, which supports additional, long-term growth in national GDP.

Using KPMG's Computable General Equilibrium (CGE)[5] Model, which adheres to the economic disciplines of HM Treasury's Green Book[6], **we have analysed these potential long term impacts on the UK economy using a series of hypothetical scenarios** which represent the different types of productivity gains that could be enabled by widespread adoption of IM across the sector. **Compared to a baseline scenario without sector-wide IM adoption, we find:**

Every £1 of direct productivity gain in the design, construction and maintenance of newly built assets enabled by IM today (2021) could potentially translate into an additional £3.70 in annual UK GDP in 2051 (expressed in real terms in 2021 prices). This suggests that the returns to the UK economy could be a multiple of any direct productivity gains in the construction sector that are enabled by IM.

A significant driver of this estimated wider impact is the role of the construction sector in supporting growth in the UK's capital stock across all sectors of the economy. We estimate that a 1% productivity improvement in the design, construction and maintenance of newly built assets in 2021 (£2.3bn) could potentially increase the UK's capital stock by some 0.25% (£32bn) in 2051. This highlights the important role of IM and other productivity-focused interventions in the construction sector in helping to address the Government's ambitions to Build Back Better, Level Up and transition to Net Zero by 2050, which require substantial levels of private investment sustained for future decades[7,8].

Estimated net increases in household consumption, employee wages and exports, with most of these gains being in sectors outside of construction. These effects are driven by the impact of a more productive construction sector on the competitiveness and economic output of other sectors.

A greater long-term increase in total additional UK GDP when IM-enabled productivity gains are realised in *both* the design/construction *and* maintenance of built assets. This underlines the importance of a continued focus on a whole life cost approach to improving productivity and advancing the emerging use cases for IM in the operation of assets.

Notes: (3) Capital stock is a measurement of physical capital within the economy at a point in time. It includes any non-financial assets that are used by firms in the production of goods and services with a lifespan of greater than a year (for example, buildings and machinery).
(4) KPMG 2021, Analysis of ONS (1997 – 2018) Input-Output Supply and Use Tables, link.
(5) KPMG's CGE model uses GEMPACK software; Horridge, Jerie, Mustakinov & Schiffmann 2018, GEMPACK manual, GEMPACK Software, ISBN 978-1-921654-34-3.
(6) CGE modelling offers a robust way to address the impacts of IM-enabled productivity gains in the construction sector on the wider economy as it addresses critical interactions between sectors and markets. CGE modelling is commonly used by HM Treasury to analyse the impact of tax and trade policies, and is also seen by HM Treasury to have an important role in analysing the macro-economic impacts of the policy choices necessary to deliver the transition to Net Zero.
(7) Climate Change Committee 2021, Sixth Carbon Budget, Chapter 5 link.
(8) HMT 2021, Build Back Better: our plan for growth, link.

03 Increased social value for customers, wider society and the environment

The availability of built assets and the way in which they are designed, constructed and operated can have significant implications for the economic wellbeing of customers (end users of assets), wider society (individuals, businesses and households) and the environment. This is recognised in national policy, with the Government highlighting infrastructure investment as being "central to meeting our net-zero objectives" by 2050 and "improving everyday life" through the Levelling Up agenda. It is also central to private sector organisations' Environmental, Social and Corporate Governance objectives, which have risen to the top of board-level agendas. These effects have an important public value, or 'social value', even if they do not have a market price that allows them to be traded in the economy.

As evidenced in the existing literature and through the case studies analysed for this study, **the use of IM has the potential to influence the quality and sustainability of the assets and services produced by the construction sector, and thus offers the opportunity to drive more social value from the country's built assets.** This social value can broadly come about in two ways:

Private benefits for customers/ end-users of assets from the direct consumption of an asset once it is operational, where the use of IM enables a higher quality asset or service. For example, IM's role in enhancing the design of assets can generate journey time savings for transport users, improved health outcomes for hospital patients, improved educational outcomes in schools, or less crowded and higher quality housing/ buildings for tenants.

Externalities in the construction and operation of built assets which represent an economic cost or benefit to society and the environment beyond any private costs/ benefits for asset users. These externalities can arise through: (i) the construction of an asset (e.g. the use of IM enabling reductions in materials waste or construction blight); (ii) the operation of an asset (e.g. the use of IM enabling reductions in noise and carbon emissions); and (iii) the permanent effects on the local area surrounding an asset once built (e.g. the use of IM enabling the delivery of a better designed asset and in turn visual amenity for surrounding land/property owners).

Through our case study analysis, we have found a breadth of examples of how IM can enable this social value in both the construction and operation of built assets. In the few cases where it has been possible to quantitively estimate these benefits, our analysis demonstrates that relatively modest investments in IM have the potential to unlock significant social value.

However, on the whole, we find organisations are not fully considering the breadth of social value that could be unlocked by investing in IM, with internal business cases primarily focused on the productivity gains that IM unlocks for the organisation. Organisations are more inclined to prioritise and thus measure social value metrics which yield enterprise value, such as those affecting their reputation or long-term customer demand/ revenue, compared to those which relate to wider environmental or societal impacts that do not have direct financial implications for the organisation (such as promoting economic inclusion).

In practice, all dimensions of social value are critical to achieving the Government and industry's shared aims for the sector. There is therefore a need for more extensive evidence and awareness of the range of use cases for IM in the context of driving social value, as well as more clarity in who holds responsibility for capturing and investing against these impacts.

Continuing to advance the sector's adoption of Information Management

Through our analysis of real-world case studies, we have seen a step change in the volume, complexity, and variety of use cases of IM across both asset owners and contractors in recent years. **Organisations are seizing IM as a key enabler to digital transformation and the economic opportunities it unlocks.** Our analysis shows how organisations are **utilising IM to enable Design for Manufacture and Assembly, further Modern Methods of Construction, and innovative new services in the market – bringing life into projects that were once simply too costly**. The clarity provided by centralised information approaches equips organisations to drive closer engagement with global supply chains, streamline the manufacturing process and improve the quality of outcomes for the end customer.

To help achieve the wider economic benefits identified in our analysis, **Government and industry should remain focused on measures which expand and accelerate the adoption of IM across the sector and thus the direct productivity gains this unlocks.** Over time, as our economic modelling highlights, market forces should mean that more investment and economic growth across the wider economy will follow.

However, **the wider economic returns we have estimated rely on the productivity gains of IM being realised by organisations of all sizes, including the sector's 'long tail' of SMEs.** Meanwhile the existing literature highlights that there are particular barriers for smaller firms adopting IM which still need to be overcome. Our analysis also highlights the value of using IM across the whole lifecycle of assets for maximising both the direct productivity gains to organisations and the potential total long-term GDP gains to the UK economy. However, as highlighted in our case study analysis, **the use cases for IM in operations are still emerging – underlining the importance of a continued focus from the sector on adopting the UK BIM Framework's latest standards across the asset lifecycle.**

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