



National BIM Report 2018



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We would like to thank the following organisations for supporting this report by circulating the survey on our behalf:



Introduction



Richard Waterhouse
CEO, NBS

This is our eighth annual NBS BIM Report. The first was in 2011, around the time that Chief Construction Advisor Paul Morrell told the industry that BIM was to be mandatory for all public sector construction projects from 2016 onwards. Over this period, our NBS survey has shown that BIM awareness and adoption have steadily grown.

How awareness and adoption are defined is, of course, a key factor. For some, it may admittedly just be 'generating and sharing information authored using 3D modelling tools', but claims of adoption have risen from just over 10% in 2011 to over 70% now in 2018.

If awareness and adoption are more tightly defined as 'UK Government Level 2' then the level of adoption is less. However, the figures are still very encouraging, with close to half of the industry following PAS 1192-2, and around two thirds of the industry using a Common Data Environment on at least some projects.

Reflecting back on the government mandate and associated strategy, the industry is split on how successful these have been. We asked participants for their views on the top-level objectives of the government strategy and found varied perceptions of success. The industry has confidence that BIM is

helping to reduce the cost of building and operating built assets, and that it also reduces the duration of projects. However, there is less confidence that BIM is helping to reduce environmental impact, or that it is helping reduce the UK construction industry trade gap. However, where there is criticism, it tends to be about the capacity to embed and enforce BIM in the industry, and not about the ambition to move the industry to BIM Level 2. Criticism is about the speed, not the direction, of travel.

Articles in this report give real examples of success, and also how the Government, industry and academia are coming together to help ensure that this mandate has a lasting legacy. The BIM Level 2 suite of standards and tools is being revised to ensure consistency. The first of these is the CIC BIM Protocol, which has been enhanced in its second edition, based on industry feedback. The Digital Built Britain team as a whole is also pushing on. The Centre for Digital Built Britain has now been created, and the UK BIM Alliance is continuing to ensure that Level 2 is embedded in industry and that this set of UK standards is being promoted across the globe.

One example of how the UK is helping to shape the global BIM world is the development of ISO 19650, Parts One and Two. This development project is an example of the UK approach being developed in partnership with the global community to ingrain a standard method of working internationally. Articles in this report show examples of how UK companies are now pushing ahead internationally and taking advantage of this position of leadership.

Looking wider than BIM, it has sadly been a year where construction has been on the front page of newspapers

for the wrong reasons. Our industry needs to find better ways of working. The move to digital will be a major factor in how we can get this right. More clarity is required over ownership of product selection and specification decisions throughout a project's timeline. Furthermore, the quality of workmanship must be documented so that it can be approved on-site. By creating a 'digital twin' of the built asset and recording decisions throughout the timeline, a transparent environment with clear ownership will be created.

NBS can and will play a part in this journey. BIM is more than the production of 3D models. Collaboration is more than reducing coordination problems on-site through clash detection at design time. The next stage of the BIM journey must focus on both the information generated from the models and the information linked to the models. For this standardised information, structures must be followed in terms of the objects in the model and linked data sources such as project specifications. NBS will continue to work with partners in the industry to help set these standards.

Whilst this report looks at the industry's current attitude to BIM, the industry will not stand still. Digital transformation will continue. Emerging technologies are continuously providing new opportunities. For example, the move from desktop to cloud computing is opening up new opportunities around collaboration, performance and transparency.

BIM Level 2 is the foundation of this digital transformation, providing data structures, responsibilities and process. Future transformative technology will build upon this foundation, helping us to create a step-change in productivity and quality within the industry.

Platforms. Bridging the gap between construction and manufacturing



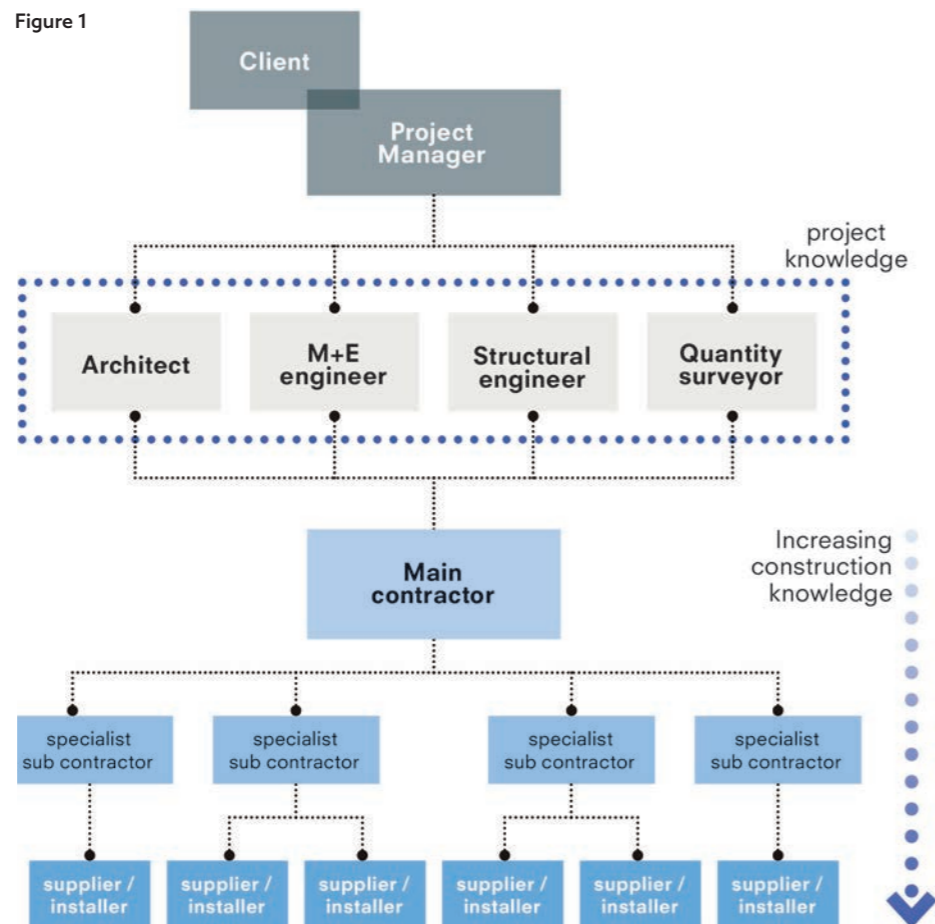
Jaimie Johnston
Director, Head of Global Systems, Bryden Wood

When the Latham Report, 'Constructing the Team', was published in 1994, Michael Latham noted that 'There is scope for improvements through greater standardisation of components and design details and more off-site prefabrication'. 24 years later, the wait for those improvements may finally be coming to an end.

The unavoidable truth is that without innovation, we don't have the resources to accomplish the huge amount of building that the UK needs. There's £600 billion of government investment in the pipeline, yet our workforce is ageing and short of the skills needed in traditional construction processes.

Some of the sobering statistics are well known. The residual value of a building is little more than half the cost of its construction. Around 30% of building materials and 40% of working hours are wasted. Yet profit margins are slim, and the unpredictability of the process poses risk for everyone from the customer onwards. The collapse of Carillion shows how real those risks are.

Figure 1



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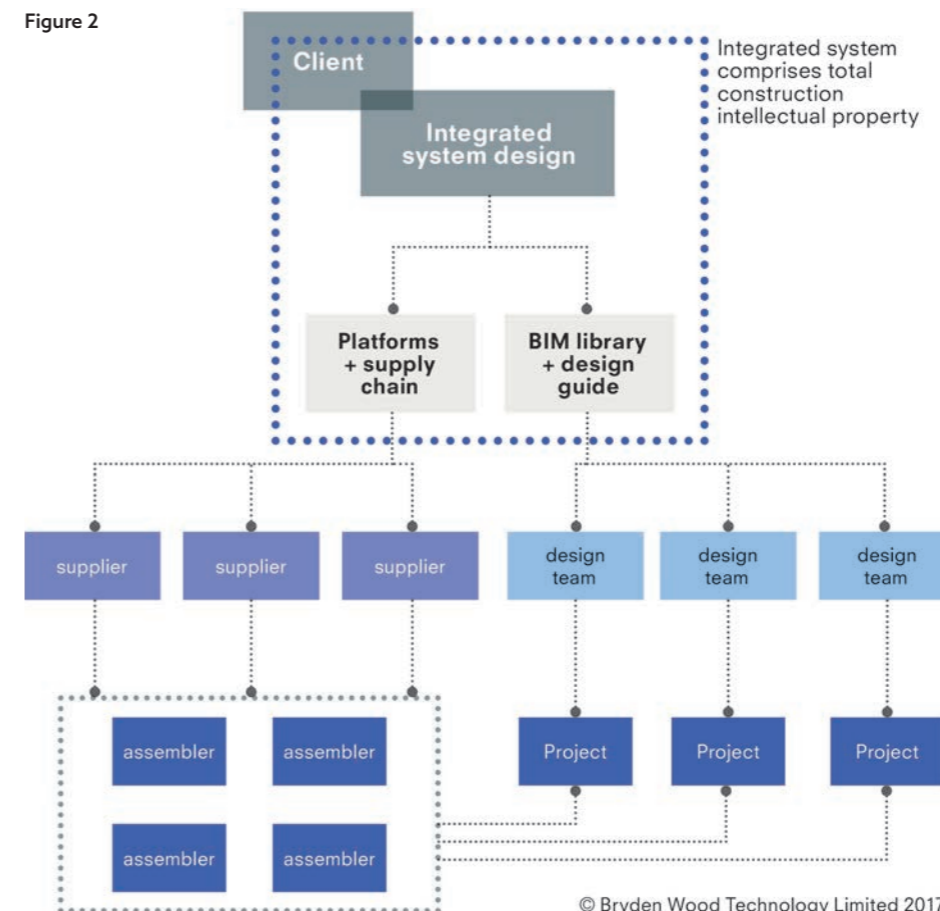
The solution is not squeezing the supply chain - that's been tried and has not worked. Nor can there be compromise on the performance of the assets, networks and systems. Much-needed efficiencies can only be achieved through a fundamental shift in process, where construction becomes much more like manufacturing, and the use of raw materials is minimised, as is their processing and handling. The components of a construction asset can be delivered to the site at the right time, in the right sequence with the

correct information. And once there, they can be assembled by fewer, more easily trained people.

This produces a new way of working (see Figure 2), where integrated solutions use standard components configured using standard processes to give bespoke assets. It contrasts with the traditional model (Figure 1). Here, there's fragmentation at every level, and clients become distanced from multiple suppliers or installers - the people who are actually delivering what they want.

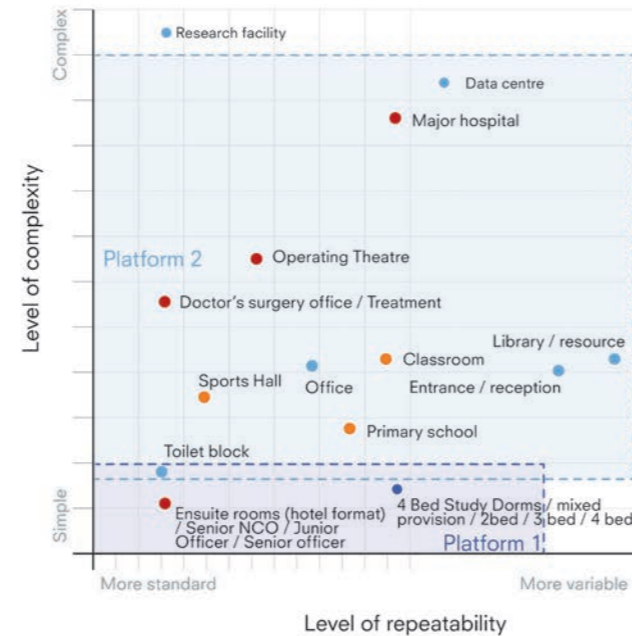
The residual value of a building is little more than half the cost of its construction. Around 30% of building materials are wasted and 40% of working hours.

Figure 2



© Bryden Wood Technology Limited 2017

Graphs - Government spaces shown mapped on three platforms.



Looked at in overview like this, the rationale for change is compelling, yet it's a difficult transition to make. Much like the switch to containerisation in transport, widespread benefit requires widespread participation, which won't happen on its own. That's why the Government is putting the weight of its construction portfolio and its purchasing power behind the drive for innovation. Five key government organisations will adopt 'a presumption in favour of offsite construction' by 2019. And in the Autumn Budget, there was support for innovation and skills in the sector.

The Autumn Statement was preceded by two books by Bryden Wood and the University of Cambridge Centre for Digital Built Britain. The first, 'Delivery Platforms for Government Assets - Creating a marketplace for manufactured spaces', set out a strategy for implementing the Government's vision on construction. It drew on work for the Ministry of Justice and the Education and Skills Funding Agency to develop an evidence-based design process and manufacture-led construction approach. A second book, 'Data Driven Infrastructure - From digital tools to manufactured components', outlined a standardised approach across a range of horizontal infrastructure projects, illustrated with initiatives by clients such as Highways England and Crossrail.

The idea of platforms was first introduced in Book 1. They are sets of components that interact in well-defined ways to allow a range of products and services to be produced. In construction, the physical dimensions of a space - particularly its clear height and span, building height, level of complexity and repeatability - will determine the platform that it can be built on. Many different kinds of space can be built on a single platform, and the entire government estate on potentially just three.

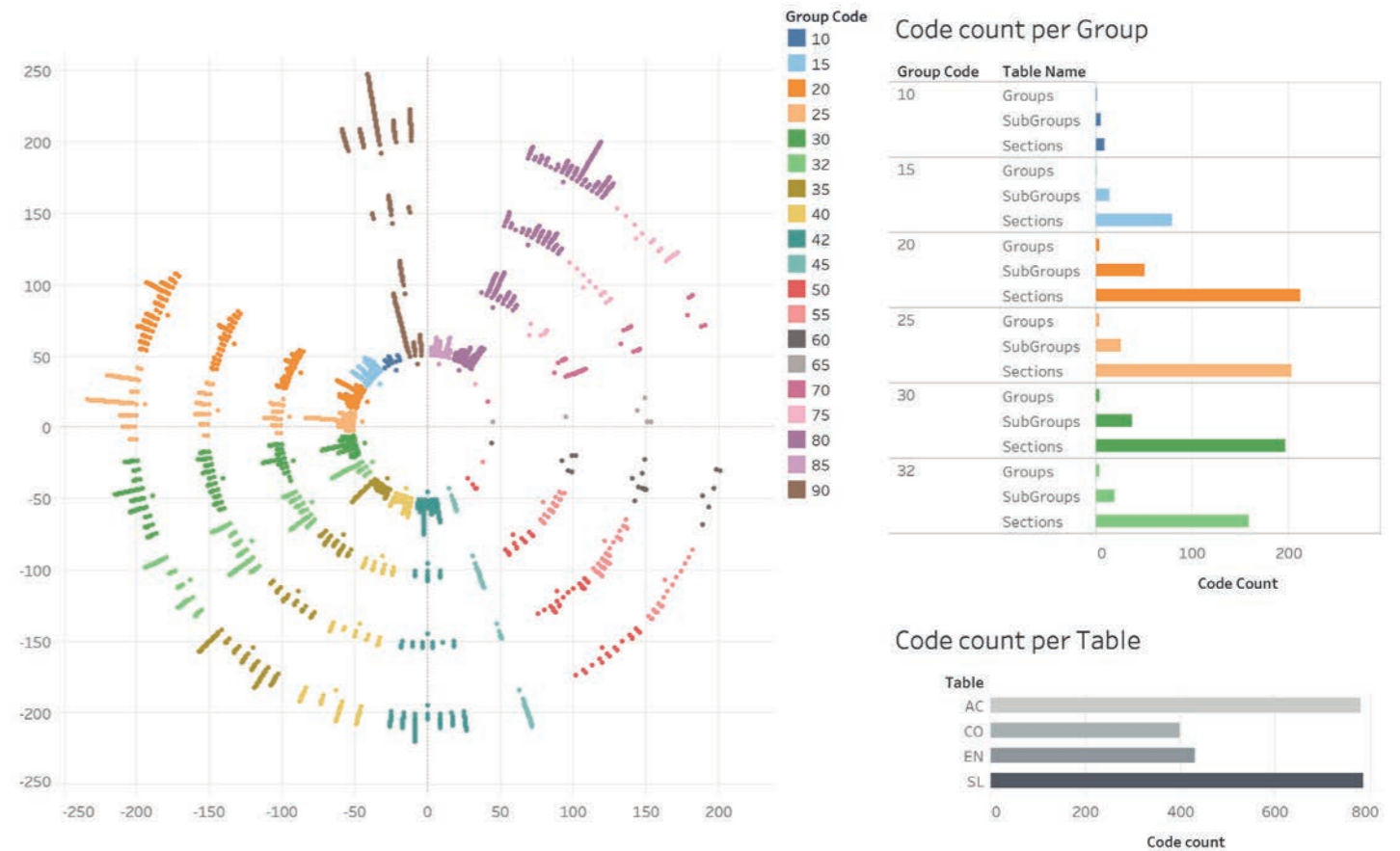
Defining the 'boundaries' of platforms requires a rigorous analytical approach. The more specific a platform is to a particular use, the more highly it can be targeted to deliver efficiency benefits. However, if a platform is too specific then it may be constrained by the size of the market that it can serve and fail due to inadequate volume. Each platform therefore requires enough application to build sustainable volume, while limiting complexity enough to deliver efficiency.

Uniclass provides the classification 'golden thread' that allows this analysis to be undertaken in a consistent way, from the highest level (complexes and entities) to the most detailed (systems and products), and also allows spaces to be analysed by use (activities). Given that the design of platforms must consider their means of manufacture and installation, the 'Construction aids' table in Uniclass crucially allows this classification to be applied to the assembly stage.

The images here show a visualization of the activities/complexes/entities/spaces tables, and the elements/systems/products tables.

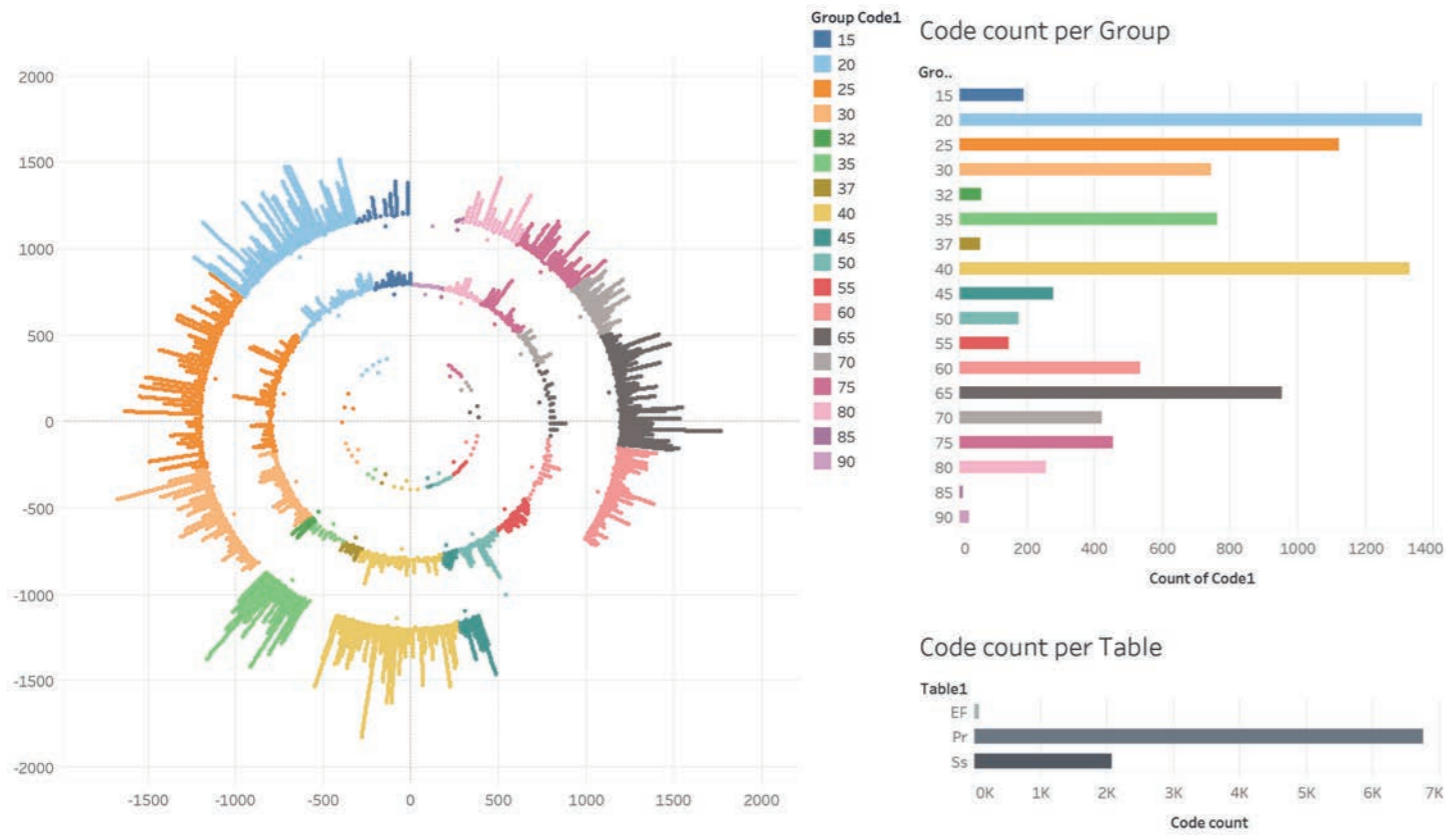
Uniclass provides the classification 'golden thread'.

Dashboard 1 - Analysing Government estate using the Uniclass 2015 tables



Five key government organisations will adopt "a presumption in favour of offsite construction" by 2019. And in the Autumn Budget there was support for innovation and skills in the sector.

Dashboard 2 - Analysing Government estate using the Uniclass 2015 tables



This level of reductionism and abstraction is analogous to the emergence of the phonetic alphabet. Early, first order alphabets, such as Egyptian hieroglyphs, needed large numbers of symbols because each had a 'one-to-one' relationship with the object that it conveyed. This made written language rather imprecise, and the communication of abstract ideas almost impossible. Later, second order alphabets used phonetic representation, vastly reducing the characters needed, yet communicating much more accurately. In the same way, a limited 'alphabet' of manufacturing processes is beginning to emerge for different construction platforms.

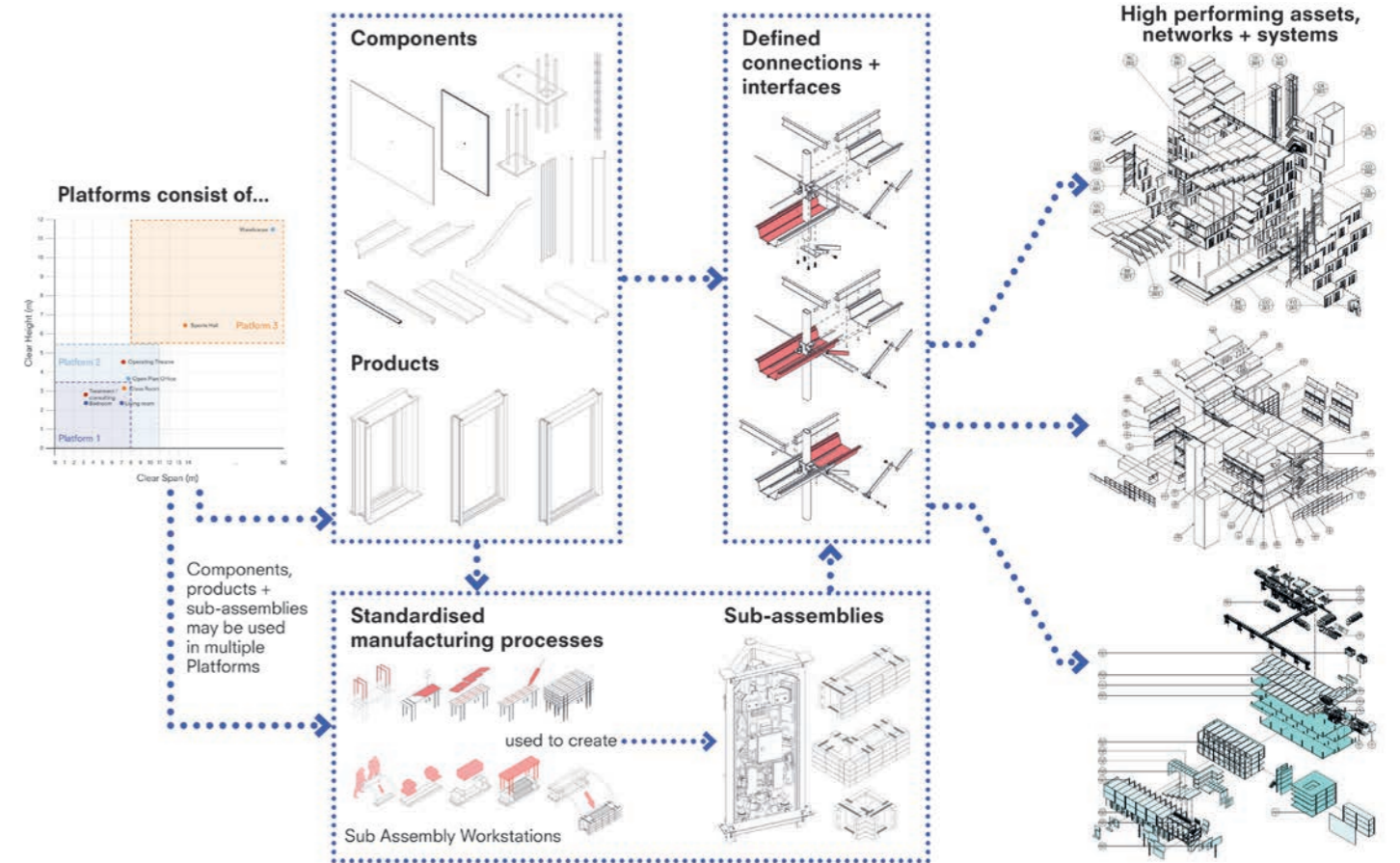
Neutral on asset type and material, they subordinate materials and components to the needs of the asset and its users.

These ideas are developed in a new, third book: 'Platforms: Bridging the gap between construction and manufacturing', which sets out the benefits to construction of the kind of platform-based approach, which is common in manufacturing and software.

For example, a car engine, working on a platform - the chassis - to produce a vehicle. Another example is an iPhone, acting as a platform for apps, such as Uber, and the services that they deliver.

In construction, pretty much all buildings relate to the human form. This means that dimensions such as ceiling heights or distance from a window fall within predictable ranges, which can be used to define a small number of platforms that can accommodate a huge range of needs, from a bedroom to a sports hall.

Platforms - Platforms work as part of an integrated, connected process.



Within those platforms, connections and interfaces can be standardised so that just a few designs meet a huge range of needs, and many components are repeatable. In projects for the Ministry of Justice, it's possible to construct almost all of the complex estate by using a combination of those three platforms.

It's easy to see why government supports this approach. It allows high-quality, effective assets to be efficiently produced at lower cost. Far fewer components are needed, and those that are can be produced in much higher volumes, creating a consistent pipeline with economies of scale, as well as more dependable and timely supply. To draw a parallel,

it was when Apple opened the iPhone platform to third party developers that use and revenue rocketed.

Bryden Wood are making all the IP generated on their public sector projects available to the Government to ensure that the platforms we are developing can be used as widely as possible. The intention is to create a network effect, lowering the barrier to entry, contributing to wider participation and generating greater efficiency for everyone. Platforms can give construction its 'Uber moment', the kind of fundamental, positive shift that we've seen in so many other industries over the last 20 years.

The books are all free to download from the Bryden Wood website: <https://www.brydenwood.co.uk/about-us/downloads/123/>

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From UK to the world – making BIM work internationally

Forest City Malaysia under construction



Peter Barker
Managing Director,
BIM Academy
(Enterprises) Ltd
and Partner, Ryder
Architecture



In 2012, during the early years of UK construction's digital journey, we organised a roundtable discussion to speculate on 'where BIM will be in five years' time'.

The group included NBS, Ryder, BIM Academy, Bond Dickinson and Mark Bew, and a wide-ranging discussion ensued, fuelled by a healthy mix of optimism and practical scepticism. The discussion was predominantly UK-centric at a time when the industry was struggling out of the mire of the global financial crisis, and before Brexit and world political instability had encroached on our lives. One closing conclusion that remained with me was that 'in 2017 we'll probably just about be doing what we think we're doing now', and I think this sums up where the UK has got to with BIM. It's now generally accepted that BIM Level 2 is part of government and often private sector procurement, and the components of this approach have entered common parlance, although they are not necessarily understood by all. But there is more

to BIM than Level 2, and our experiences working outside the UK have given us some interesting perspectives on how other regions are making it work for them.

We established the BIM Academy in 2010 during the economic downturn, as a joint venture between Northumbria University and Ryder Architecture. As an early adopter of BIM design tools, Ryder had seen the significant benefits in productivity, design quality and service which came from the intelligent use of digital technologies, and together with like-minded academics from Northumbria, we wanted to spread the word and help drive a traditionally disjointed and dysfunctional construction industry into a new era.

The BIM Academy has been fortunate to have developed into a thriving global consultancy and research organisation which has served clients in Australia, Asia, Europe and the Americas, and we have learnt that the digital built environment is a multi-layered world which does not need to be viewed through the prism of UK BIM Level 2.

Every region has its own legislative, cultural and contractual drivers, with culture perhaps being the most significant. In many regions, the vanguard of BIM adoption is often led by the design community – architects, engineers, and occasionally cost consultants – who have recognised the efficiency gains through adoption of smart tools to visualise, coordinate and analyse design. Doing so maximises their fee margins and offers an enhanced service to clients and end-users. The more enlightened construction organisations have likewise recognised the value of

productivity gains, and have invested time and resource in developing their capabilities to de-risk poor quality design and give themselves a competitive edge. These self-motivated paths to adoption have delivered value, but the real gear shift has come when central government or influential government agencies have put their foot down and prescribed the adoption of BIM as a catalyst for positive change. The drivers of that change often include construction efficiency, and whole life performance improvement and sustainability. The UK wasn't the first government to take this approach, with precedents in Singapore and Scandinavia, for example, and many others have now followed suit. However, the UK Government's top-down, bottom-up approach initiated in 2010 has proved effective, and has gradually embedded itself within UK industry consciousness; it is now perceived as business as usual, with a focus on delivering to BIM Level 2 maturity.

It's now generally accepted that BIM Level 2 is part of government and often private sector procurement, and the components of this approach have entered common parlance, although not necessarily understood by all.

bimacademy

Ryder

However, the growing potential of data analytics, Artificial Intelligence (AI), machine-learning, Internet of Things (IoT) and integration with GIS platforms means that a narrow focus on BIM Level 2 is no longer good enough for the increasingly diverse 21st century digital built environment where infrastructure, buildings, digital media and systems must all converge if we are going to create smarter cities and communities.

Our experience in markets outside the UK has given us fascinating insights into the way that BIM and the digital built environment are developing around the world.

One of our first commissions outside of the UK arose from our tender success to develop the technical specification for the BIM for FM solution at Sydney Opera House. Beginning in 2013, our support for this client continued throughout our development of the solution in a consortium with Ecodomus and the AECOM BIM team in Melbourne, and we have subsequently developed software tools to refine the management of the Opera House asset databases. This project was significant in that it represents a public sector client who manages a world heritage building, and recognised the need for a holistic BIM solution to allow them to manage their asset data and their building in a more effective way. The approach we adopted started with understanding the organisational structure of the Opera House, before analysing technical systems and resources. This resulted in a bespoke, cost-effective solution, involving a central 3D geometric representation of the building linked to multiple existing asset databases through a web-based viewer. The solution is also extendable to give future functionality, including visual analytics.



BIM Academy team member at Sydney Opera House

The project also demonstrated that an informed client, working in partnership with industry experts, can achieve positive improvements to how their assets are managed. It has been encouraging to see other large estate owners follow suit and recognise BIM as a catalyst for better coordinated and effective asset management systems, and we have been able to support other heritage building and large estate owners in the UK and Australia in adopting similar approaches.

The greatest value is often realised when an informed client has a strategic understanding of the capability of BIM tools and processes, understands the specific information requirements as relevant to their organisation, how the technology can deliver these, and how they can articulate these needs clearly to their supply chain. Many of our commissions involve guiding such clients on this journey.

Without this leadership, it is often left to individual industry practitioners to deploy BIM tactically and often ad hoc, which can dissipate the potential impact.

In 2016, Hong Kong Hospital Authority was about to embark on a \$200 billion capital programme, which included the design and construction of 16 new hospitals over the next ten years. The Authority realised that a programme of this scale and complexity could not be delivered using traditional methods, and commissioned BIM Academy to assess the business case and regional industry readiness, and determine how best to articulate and prescribe their needs to the market. What emerged was a realisation of the huge value to be gained from improved quality of visual communication of design intent with clinical staff and end-users, leading to a significant reduction in periods for design sign-off, reduced delays and contractual claims from improved coordination of MEP design,



Aerial view of M+ Museum Hong Kong under construction

and greater transparency on project phasing, programme and outturn costs. The Authority recognised the potential for future operational efficiencies through the delivery of more reliable and complete asset data through the BIM process, but recognised that these would take a little longer to realise. The point here is that these aspects of BIM, which might be regarded by some as standard and now common BIM uses, can make a huge impact when recognised and applied by a large influential client with a major development programme. The Authority also recognised that performance improvement must be measured as part of their approach.

This tactical use of BIM for specific purposes – design coordination, BIM object libraries, construction logistics planning and cost management (often perceived as the low-hanging fruit of BIM) – continues to deliver huge benefits, particularly on the large, complex projects we see in Asia.

This might be dismissed by BIM Level 2 zealots as unsophisticated, but these users are seeing greater immediate gains in productivity from this approach, rather than focusing on the output of large volumes of metadata which, let's face it, many clients will not need or make use of.

Also in Hong Kong, the BIM Academy was commissioned in 2015 by the contractor constructing the \$400 million M+ Museum of Fine Art. The commissioning client, West Kowloon Cultural District Authority, developed a very detailed BIM specification which invoked many UK originated Standards and included COBie deliverables.

It has been encouraging to see other large estate owners follow suit and recognise BIM as a catalyst for better coordinated and effective asset management systems.



BIM Academy team on M+ Museum site



BIM Academy team on site at Forest City Malaysia



The advent of International Standards such as ISO 19650 will help to unify a common approach, but the economic, commercial and cultural dynamics of each region are different.

Our most recent international commission is the development of the digital asset management model for the Forest City development in Malaysia. Led by Chinese developer Country Garden, this 25-year project will create a smart city on reclaimed land in the Straits of Johor, adjacent to Singapore. The client is seeking to develop multidisciplinary federated models enhanced with structured asset data, which can be used to improve future management and linked with estate-wide systems, potentially through GIS platforms. The client has understood the importance of alignment with internationally recognised Standards, and has recognised the value of applying protocols methodologies such as PAS 1192 and the Digital Plan of Work.

In conclusion, our experience has taught us that whilst the UK is globally respected as a pioneer in the digital built environment, and has led the way in developing Standards as part of international groups, each region and community is finding practical applications of digital tools and processes which drive value for their specific needs. The advent of International Standards such as ISO 19650 will help to unify a common approach, but the economic, commercial and cultural dynamics of each region are different. A dogmatic, one-size-fits-all approach based on one country's preferences is neither realistic nor sustainable.

NBS Construction Contracts & Law

Read the results of our fourth major survey into construction contracts and related legal issues. Some of the key takeaways from the report are:

- Disputes are not going away, and the reasons for them are varied
- More than 20 years after the Latham report, bespoke contracts are still widely used
- More than a third of all projects started in the past 12 months (from the time of the survey) do not adopt collaboration techniques
- Traditional procurement methods are still the most popular followed by Design and Build. The gap between these is narrowing though
- The majority of respondents agree that a BIM is contractually binding

Download today from

www.thenbs.com/knowledge/national-construction-contracts-and-law-report-2018



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National BIM Survey: summary of findings



Adrian Malleson
Head of Research, Analysis and Forecasting, NBS

Welcome to the eighth NBS National BIM Report. In this report, we look at the UK Government's BIM mandate and the current levels of BIM adoption, as well as people's attitudes towards BIM.

As ever, we hope that you find the findings helpful, and enjoy reading the report. We would like to thank all those who took the time to complete the survey: without them there would be no report.

Thank you also to the professional bodies and institutes who publicised the survey to their membership. Having this cross-discipline support for our survey helps make sure that the findings are relevant to the wider industry. It is in the collaborative spirit of BIM.

The UK Government and BIM

In this section, we explore the views of the industry on the success of the UK Government's BIM mandate.

The UK Government's BIM mandate has been in place since April 2016. The mandate requires that all projects funded by central government be delivered with 'fully collaborative 3D BIM'. The mandate is not legislation: it is not the law that the design and construction team use BIM.

Instead, using BIM is a contractual condition of working with the UK's largest client, central government.

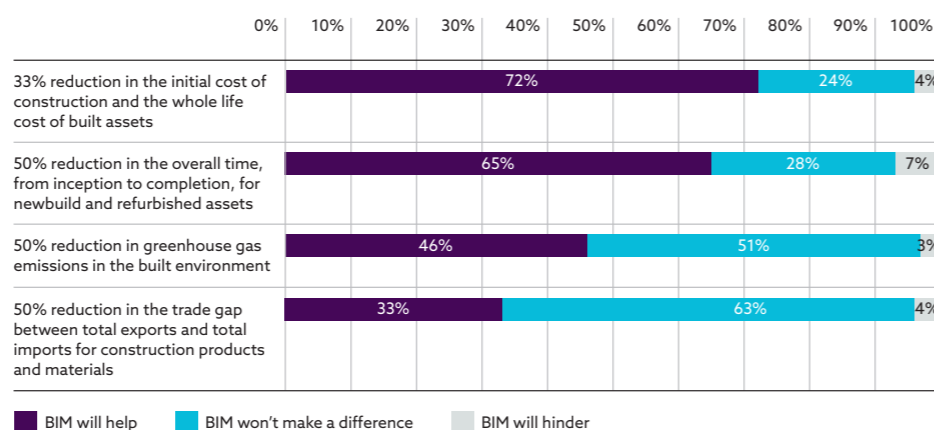
This approach ideally does **three** things.

Firstly, BIM will help the Government meet its strategic aims, specifically:

- 33% reduction in the initial cost of construction and the whole life cost of built assets;
- 50% reduction in the overall time, from inception to completion, for new build and refurbished assets;
- 50% reduction in greenhouse gas emissions in the built environment; and
- 50% reduction in the trade gap between total exports and total imports for construction products and materials.

The findings below support this, showing that a clear majority think that BIM will help reduce both construction costs and the time it takes to go from inception to completion. Fewer agree that BIM will help reduce greenhouse gas emissions or reduce our trade gap. But very few disagree with any of these points.

Please tell us the role you think BIM will have in our achieving the following...



Secondly, BIM increases the efficiency and reduces the cost of construction for central government, so the Government can build more for less.

Finally, success in government projects can be an exemplar to the private sector, leading to more rapid adoption of BIM throughout the industry.

The NBS BIM survey allows us to gauge how successful the BIM mandate has been. Four per cent told us that the mandate had been very successful, with a further 37% viewing it as 'quite successful'. Many noted how the mandate has given the industry the push towards BIM that it needed.

'The mandate focused everyone on where we should be going.'

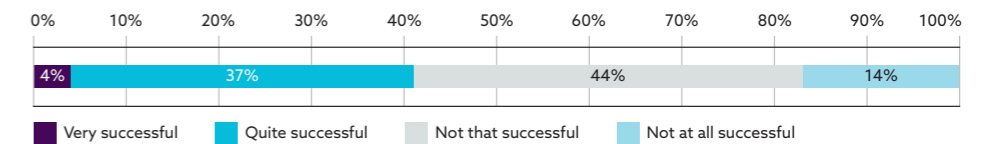
'It has brought the industry together to a common goal.'

On the other hand, 58% tell us it has either been 'not that successful' (44%) or 'not at all successful' (14%).

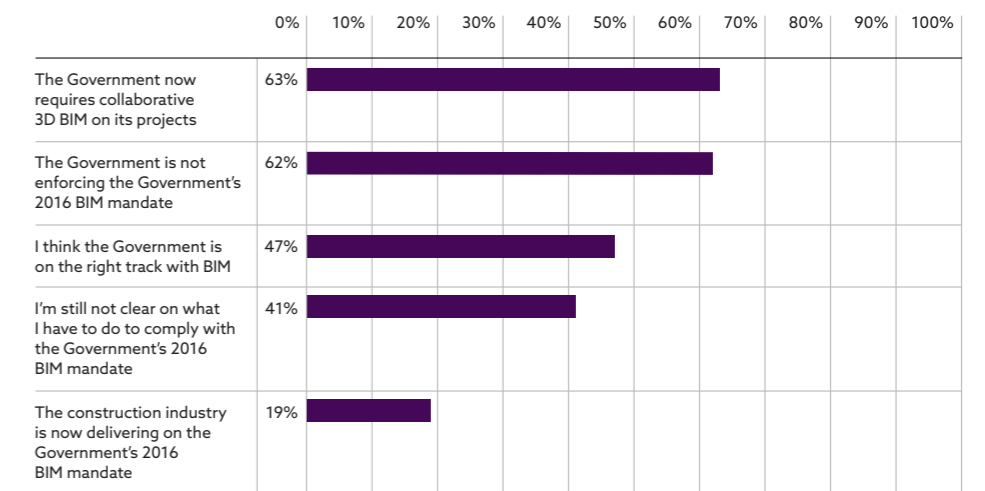
When we look at the graph on the right, we get a sense of why the government mandate is not universally viewed as successful. Whilst almost two thirds (63%) agree that the Government requires BIM on its projects, a very similar number (62%) feel that the Government is not enforcing this. For the first time, less than a majority (47%) feel that the Government is 'on the right track' with BIM. That is still a high percentage, but less than last year (51%). Just over two fifths are not clear on what they have to do to comply with the mandate.

Less than one fifth agree that 'the construction industry is now delivering on the Government's 2016 BIM mandate'.

How successful do you think UK Government's 2016 BIM Mandate has been?



Perceptions of the Government's mandate (% agreement)



Whilst almost two thirds (63%) agree that the Government requires BIM on its projects, a very similar number (62%) feel that the Government is not enforcing this.

The Government needs to go deeper and wider in its enforcement of the mandate.

Numbers alone do not always get to the heart of the issue. We also asked people to tell us why they assessed the success of the mandate as they did.

If people felt that the mandate was not successful, this was almost **always** because the Government wasn't seen to be doing enough to promote, enforce and embed BIM, and almost **never** because the aim of the mandate, to embed BIM in UK construction, was seen as a mistake.

The Government needs to go deeper and wider in its enforcement of the mandate. The following themes come from a reading of the comments that people gave, some of which are given as illustration:

1 The mandate is not being enforced

'It is rarely enforced.'

'Government is not enforcing the mandate.'

2 Clients, including the Government, are not sufficiently educated to understand the benefits of BIM.

'The Government missed the opportunity to support the client on this journey.'

'Government departments need to commit to actually understanding their own requirements and acting as an intelligent client.'

3 Local, as well as central, Government needs to mandate BIM.

'The Government should have required the use of BIM for all public projects (at regional, county, and local authority levels).'

'The BIM mandate should apply to all projects that are funded with public money including HAs & Local Gov.'

'There are reports that some Local Authorities are avoiding BIM and so it seems Government, in large part, does not have a united front on the adoption of principles of BIM.'

4 Changing the UK construction industry is difficult.

'The resistance to change was immense and in many cases it still is. The Government mandate has gone some way to improving this complacency.'

5 The Government needs to keep pushing

'The mandate was the correct initiative, but the Government have stepped back and lost momentum.'

'The Government has not done much to promote its benefits.'

The BIM mandate, then, has not been perfectly implemented, but the Government's drive for BIM is right. As the mandate has come into force, we have seen rising levels of BIM adoption; it certainly looks to have set the direction of travel correctly.

'The mandate had to come; without it, we would not be thinking of the future steps. It was not perfect but the strategy is improving, it is a non-stop process.'



BIM Usage and Awareness

'BIM is now a necessity in modern construction projects.'

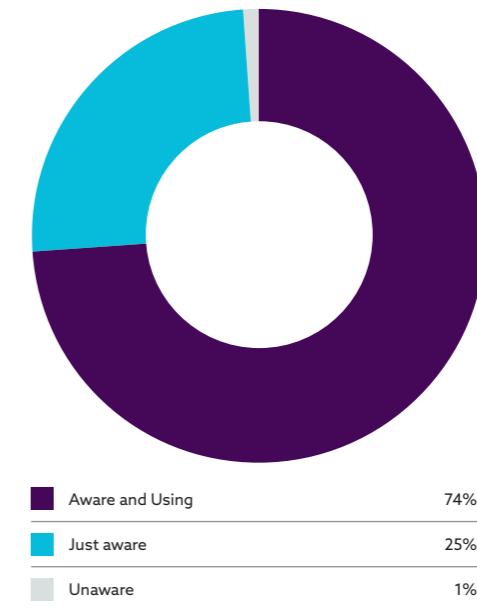
Almost three quarters of respondents are now using BIM, a 12% increase on last year. This is the highest year-on-year growth since 2014. Since 2016, the year of the mandate, a further 20% of the industry has adopted BIM.

'change takes a long time to happen.'

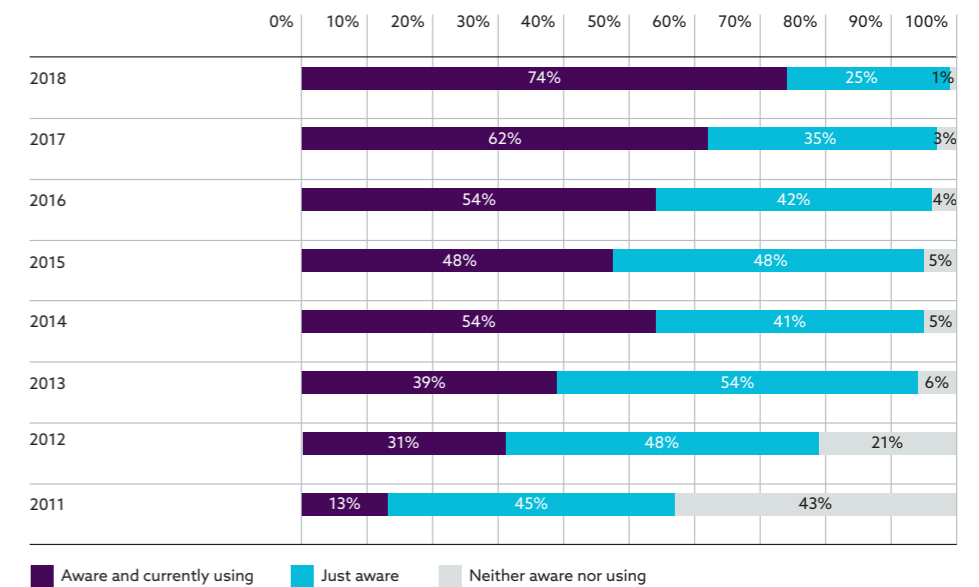
BIM is not yet universal: a quarter have yet to adopt BIM, and a negligible 1% are unaware of it. But we've come a long way over the seven years that we've been monitoring BIM. Among the design community, BIM has gone from a niche practice to the norm.

'Stakeholders are beginning to trust in the process.'

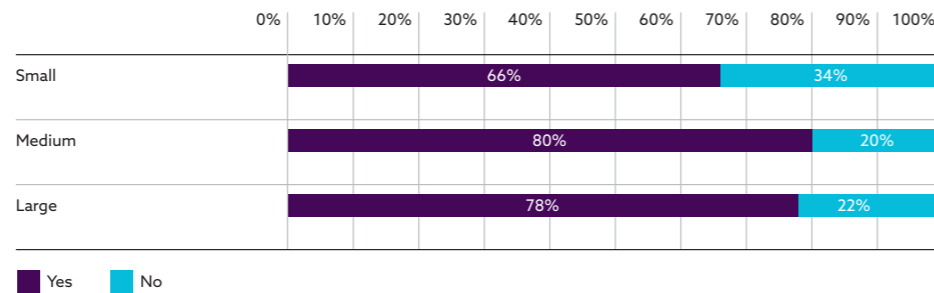
BIM Usage and Awareness



BIM adoption over time



Within your organisation, have you adopted BIM for projects you've been involved in?



Adoption and Practice size

'BIM is now an important factor for all larger organisations, which is now filtering down to smaller organisations as well.'

The thought that a practice is 'just too small' for BIM comes up from time to time, and with it the thought that BIM is really only useful for large, complex projects.

Smaller practices are less likely to have adopted BIM than others. Eighty percent of medium practices (16 to 50 staff) and 78% of large practices (51+ staff) have adopted BIM. Yet two thirds of smaller practices (with 15 or fewer staff) describe themselves as having adopted BIM. It looks like the benefits of BIM are there for practices of all sizes.

Whilst 80% of practices carrying out health or education work have adopted BIM, and 83% of those doing 'mixed use' work, practices carrying out less complex work use BIM too. Sixty seven percent of those practices carrying out 'one-off new house, extension, conversion or alteration' have adopted BIM.

It looks like BIM is not just for large practices or more complex projects.

Sixty seven percent of those practices carrying out 'one-off new house, extension, conversion or alteration' have adopted BIM.

Work to existing

The NBS National BIM Survey did not make specific reference to the challenges of repair or maintenance work, nor to the importance of historic conservation. However, a number of respondents took the time to explore this issue and highlight some of the challenges, particularly within historic conservation:

'Across the UK, there are approximately 6 million traditionally constructed buildings that were erected prior to 1919. BIM, and its application to the Heritage, needs to be considered.'

Frequency of BIM use

Last year, for the first time, we asked about the frequency of BIM use. A practice may adopt BIM, but not use it on every project. This year, we again asked those who had adopted BIM 'Approximately what percentage of projects have you used BIM for in the last 12 months?'

The graph (right) shows the response to this. As last year, 18%, nearly one in five, use BIM on every project that they work on. A quarter (fewer than last year) use BIM on between 75% and 99%, but more than 75%, of their projects. The number of those who have adopted BIM but who use it only on a minority of projects has dropped from a third (33%) to around a quarter (27%). Increasingly, once BIM is adopted, it is used for most projects.

Future Use

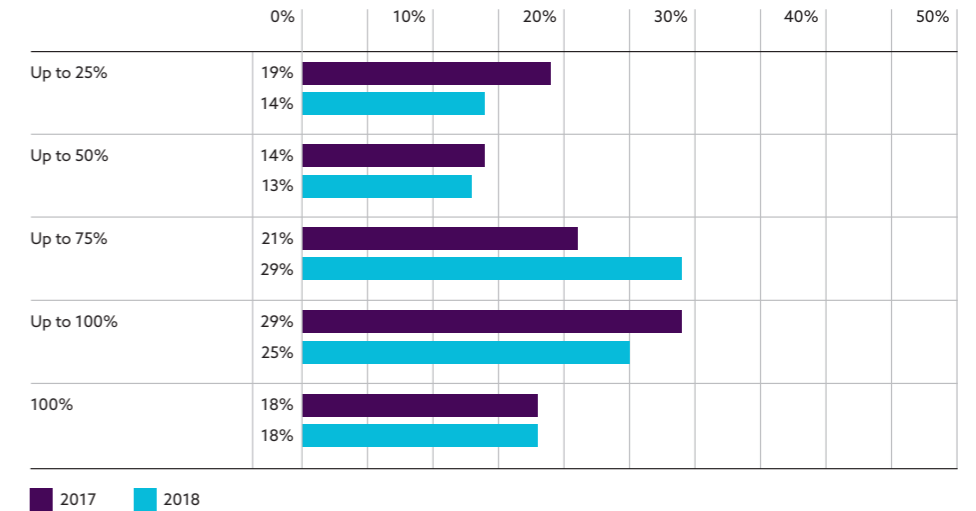
As in previous years, we ask about people's projected use of BIM: whether they will adopt or continue to use BIM in the coming years.

Having asked this question for a number of years, we can see that:

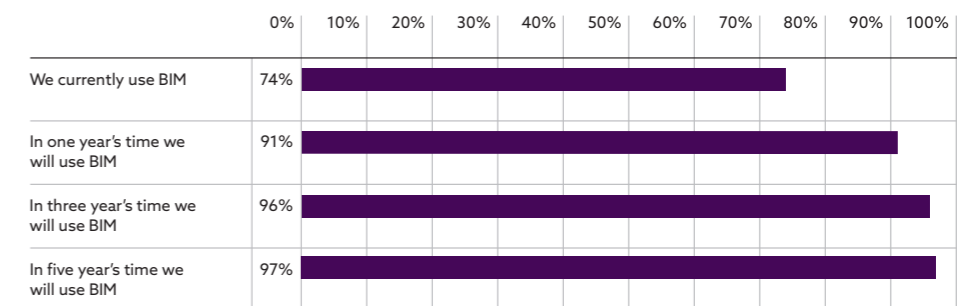
- Each year, more practices will adopt BIM.
- Nearly all practices intend to adopt BIM.
- Practices don't always adopt BIM as quickly as they intend to.
- Once a practice starts using BIM, it doesn't intend to go back.

So, whilst over 90% BIM adoption by this time next year looks unlikely, it does look achievable within three to five years. Indeed, extrapolating the growth that we've seen in BIM since 2015 suggests that we'll reach 90% within the next three to five years.

Approximately what percentage of projects have you used BIM for in the last 12 months?



How would you describe your organisation's future use of BIM?



The number of those who have adopted BIM, but who use it only on a minority of projects has dropped from a third (33%) to around a quarter (27%).

BIM maturity

As it is a way of working (rather than a piece of software), BIM requires skilled, knowledgeable, practitioners. In turn, this requires investment in training.

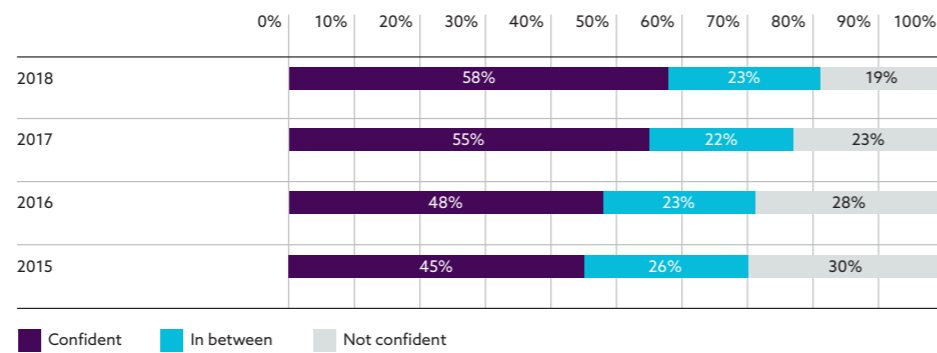
'Many practices in the industry have started to provide staff with the appropriate training.'

'Upskilling is required for all members of the project team.'

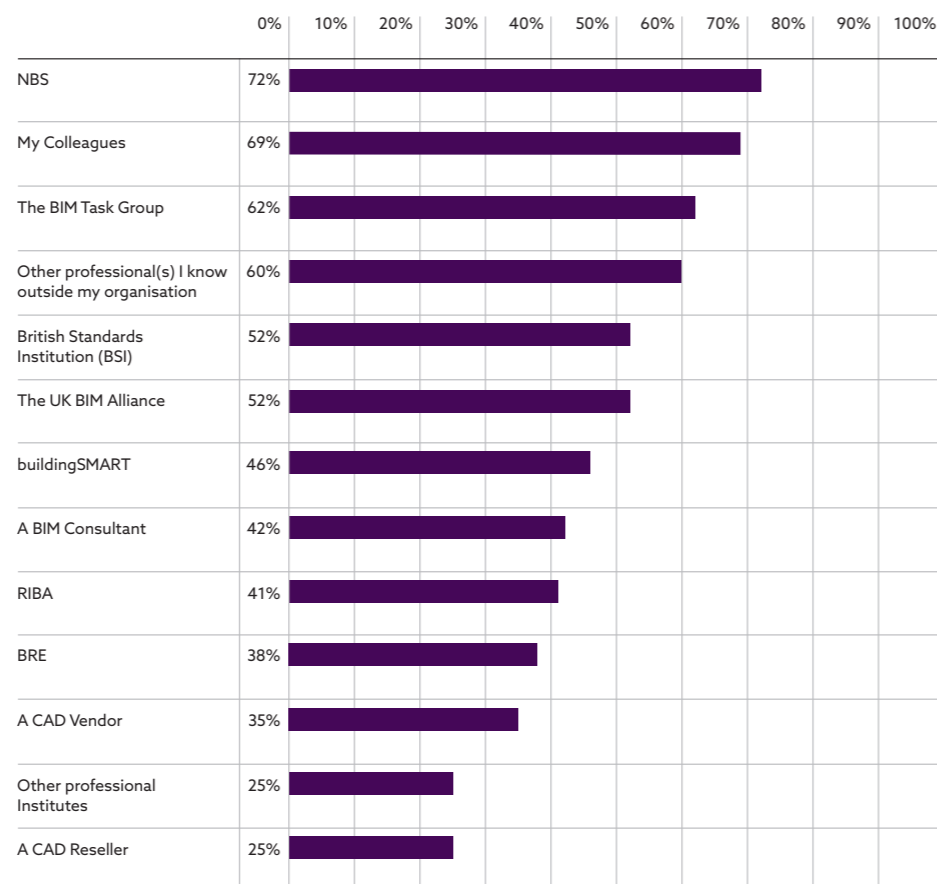
The graph below shows, year on year, the confidence levels of people's knowledge and skills in BIM. The knowledge and skills of the industry are steadily growing. Fifty eight percent are now confident (compared to 45% in 2015), and fewer than one in five (19%) are not. This is not a rapid process, but the skills and knowledge needed for the UK to make a success of BIM are coming into place.

The graph (right) shows where people turn for information about BIM. NBS is a well-used resource, as are other expert organisations. People value the help of others, whether inside their organisation or within their professional network. As we've seen before, vendors and re-sellers of software are less often turned to.

How confident are you in your knowledge and skills in BIM?



How likely are you to turn to the following sources of information about BIM



BIM Levels

BIM is not one thing. It is a gradual progression towards greater collaboration, and greater sharing of increasingly standardised project information. This gradual progression is described by the four levels of BIM. Levels 0 to 2 are clearly described, and you can read an explanation of them on theNBS.com.

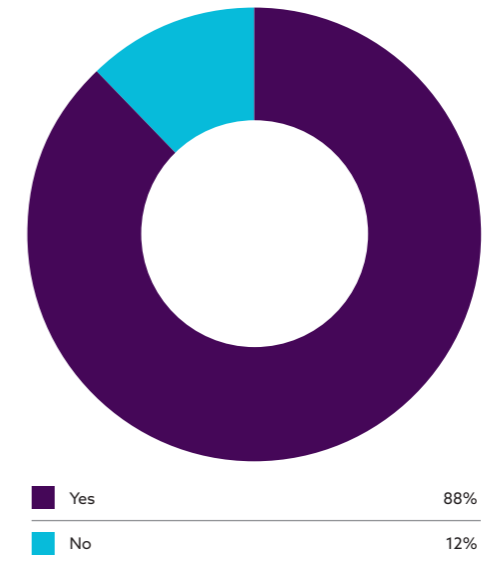
The UK Government BIM mandate requires projects to be at Level 2 BIM. Level 2 BIM means that designers design in 3D, the model itself is 'federated' (centralised, but with clear responsibility and ownership of its parts), information within it is standardised, and it must be exportable to common file formats.

Level 3 BIM is not fully described yet, but it is going to be about having more integrated, centrally held project models that everyone on the team can access and modify. It has a focus on the lifetime management of a building, not just its design.

The Government is committed to Level 3 BIM, and in the 2016 budget policy paper, we are told that:

'The government will develop the next digital standard for the construction sector - Building Information Modelling 3 - to save owners of built assets billions of pounds a year in unnecessary costs, and maintain the UK's global leadership in digital construction.'

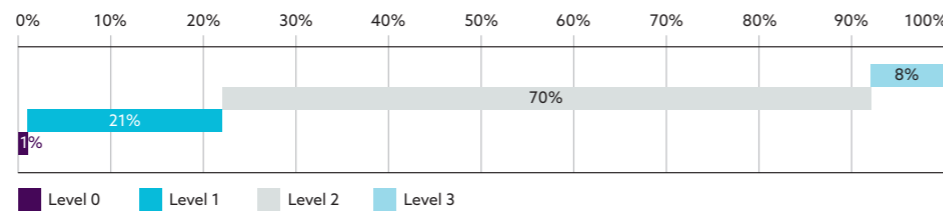
The government has described there being different levels of BIM. Are you aware of these different levels?



BIM is not one thing. It is a gradual progression towards greater collaboration, and greater sharing of increasingly standardised project information.

We asked those who were aware of the Levels of BIM which was the highest that they had reached on a project in the last year. Twenty one percent had reached Level 1, and 70% Level 2. Eight per cent told us that they had reached Level 3 BIM. As Level 3 BIM has yet to be defined, this may reflect the sophistication of BIM implementation rather than the fulfilment of a set of independent criteria.

What level would you say is the highest level of BIM your organisation has reached on a project?



This brings us to a significant point: the above are self-descriptions. Some doubt whether all those who describe themselves as having reached Level 2 BIM really have.

'I still see many projects claiming to meet BIM level 2 which simply do not.'

'A lot of companies out there claim to be delivering BIM level 2 but plainly aren't!!'

What, then, are people actually doing? The graph (right) tells us that three quarters or more are working collaboratively in a 3D environment.

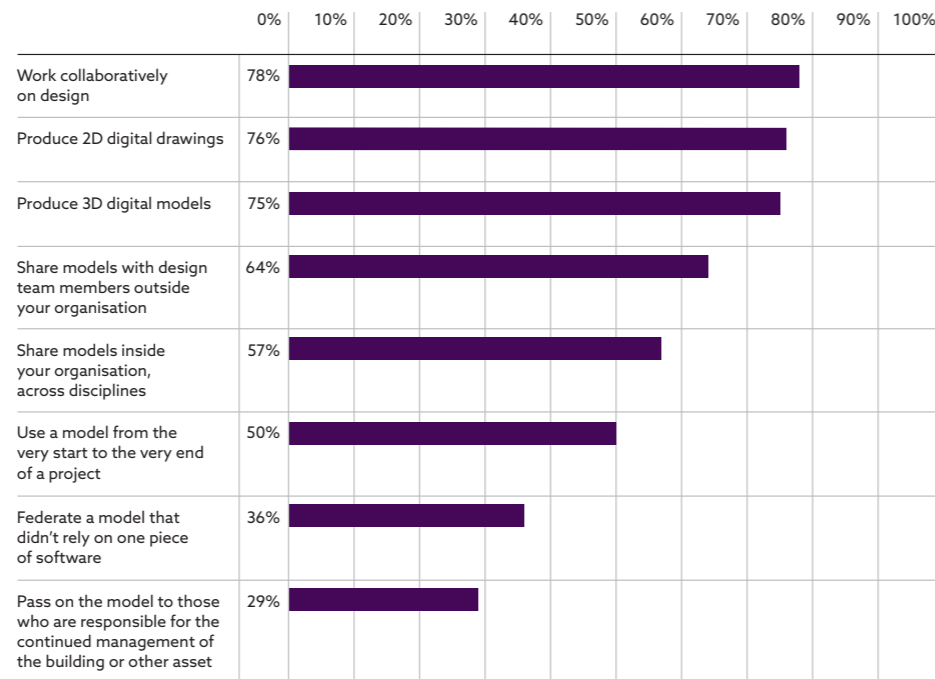
Fewer, however, are using models collaboratively: 64% share models outside their organisation, and 57% across disciplines internally. Half use a model for the entirety of a project.

'The BIM model is not being used by all relevant disciplines within our organisation.'

Only 29% 'pass on the model to those who are responsible for the continued management of the building.' This figure underlines the importance of our moving towards a vision of Level 3 BIM where buildings are intelligently maintained using BIM, and where clients are as engaged as designers in the creation and use of the model.

'No embedded FM data requirements from the client for the majority of projects we currently operate.'

Thinking about the projects you were involved in over the last 12 months, did you ever



Use of Standards

'BIM, in my opinion, only really works when everyone uses the same practices.'

BIM is collaborative. For collaboration to be effective, it needs to be governed by shared and agreed ways of working. This is where standards come in: they describe the way in which collaborative BIM practice should be done. Standards provide a shared understanding of what needs to happen, and how. Comparing practice to standards also gives us a way to differentiate between those who declare that they are 'doing BIM' but aren't, and those who truly are.

'Having standards to audit against was important, and the first steps were always going to be exploratory. It's imperative that we tie the mandate and its standards solidly in to the construction industry now.'

There is a range of freely available standards and Publicly Available Specifications (PAS documents) that provide detailed descriptions of elements of BIM, such as the collaborative production of information, or exchanging employers' information. Much work has been done to provide the standardisation that the industry needs.

That said, the industry is not yet convinced that BIM is sufficiently standardised. Seventy percent of respondents agree with the statement 'BIM is not sufficiently standardised yet'. Sixteen percent 'neither agree nor disagree'. Only 14% disagree.

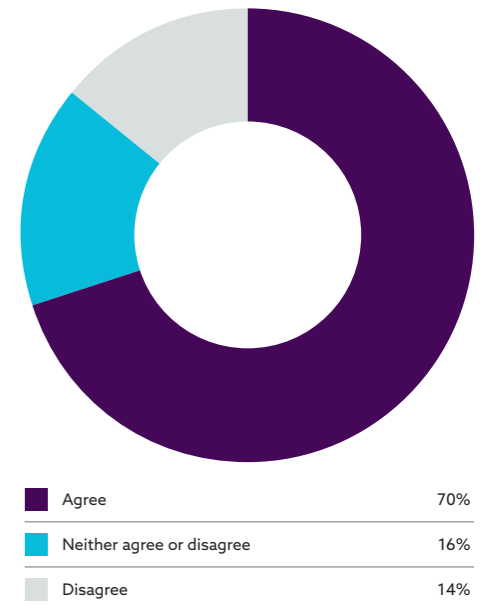
Some suggested that the number, detail and range of interpretation of standards were issues.

'There are too many different interpretations of the PAS documents and until they become a British Standard, the industry will still be heading in different directions.'

Or that the standards were not well known enough.

'The definition and basic requirements of Level 2 are not well known enough.'

BIM is not sufficiently standardised yet



Standards provide a shared understanding of what needs to be happen, and how.

The survey covered which standards people use.

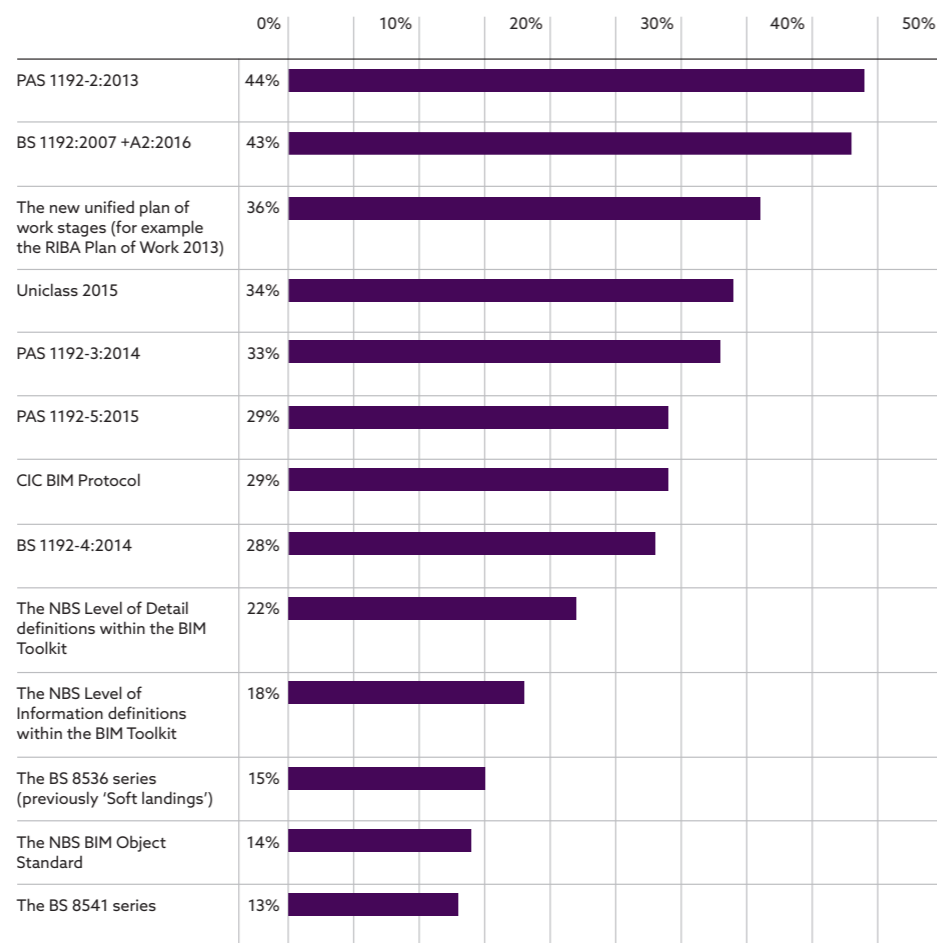
An increasing number, now 44%, use PAS 1192-2:2013 ('Specification for information management for the capital/delivery phase of construction projects using building information modelling'). Thirty three percent use PAS 1192-3:2014 ('Specification for information management for the operational phase of assets using building information modelling').

Notably, Uniclass is gaining strong traction, with over a third now using it. A similar number use the unified work stages, like the RIBA Plan of Work.

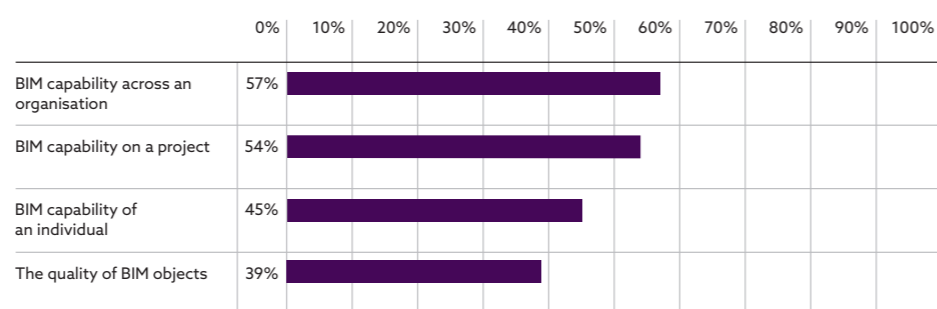
Fewer people use the range of standards than have adopted BIM. However, the use of standards, PAS documents, standardised systems of classification or descriptions of work stages is embedded and, in many cases, growing.

Adhering to standards is one way of demonstrating good BIM practice. Another is to gain certification from a third party. We asked whether such certification adds value. For many, but not all, it does, with 57% telling us that it adds to the BIM capacity of an organisation and 54% that it adds to BIM capability on a project. Fewer told us that it adds to the BIM capability of an individual (45%), or the quality of BIM objects (39%).

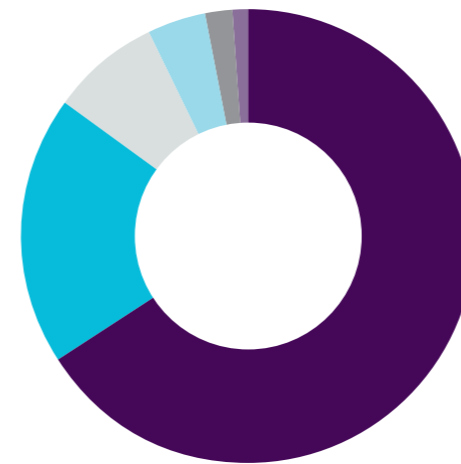
Which of the following standards/publications does your organisation use?



Third party certification adds value by assessing...



When producing drawings or models, which of the following tools do you mainly use?



BIM resources

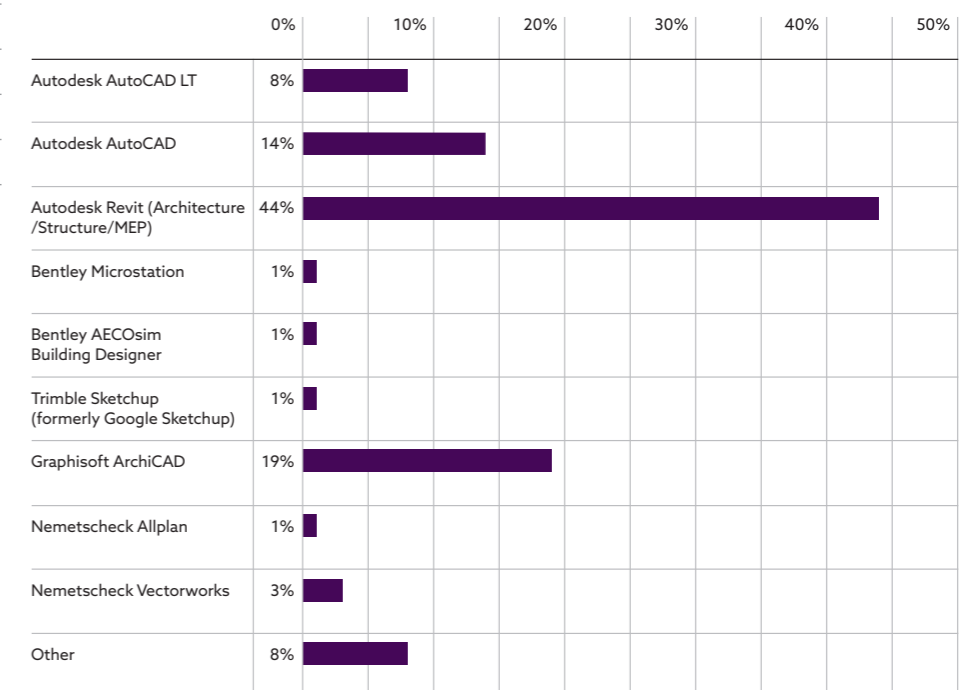
BIM is not just about buying a set of tools, templates or resources. It is about working in new, collaborative ways. But people still need tools, templates and resources to do that. This section explores some of those.

Software use

When producing drawings and models, Autodesk, with 66%, remains the most popular vendor, followed by Graphisoft.

When we break this down a little further, we can see the different packages that people use. Revit, with 44% usage, is the most popular package among the respondents, followed by ArchiCAD. In line with the adoption of BIM, people are, over time, increasingly using software packages that can be used to create models, not just drawings.

When producing drawings or models, which of the following tools do you mainly use?



Common Data Environments, COBie and IFC

If people want to collaborate, they need a shared space in which to do so. This is the Common Data Environment (CDE): a shared place where the project team can put, hold and access information about a built asset. This does not need to be onerous, but there do need to be agreed and enforced rules governing how project information is created and managed: rules about creation, access and editing, for example.

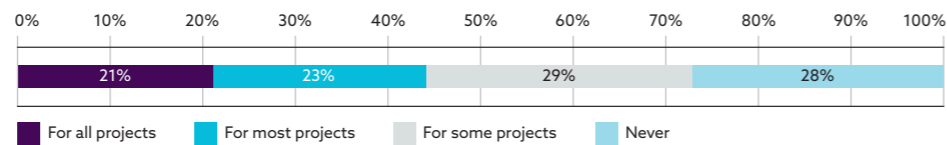
The graph (top right) shows that nearly three quarters use a CDE for at least some of their projects, 21% for all projects, 23% for most and 29% for some. As a core part of PAS 1192-2 is about sharing data within a CDE, this helps us to see how many, and how often, organisations practise collaborative BIM.

We asked people to list the CDEs they use. This question had a free text space, and people gave a range of responses. Some used more than one tool. The graph (right) shows the tools currently being used.

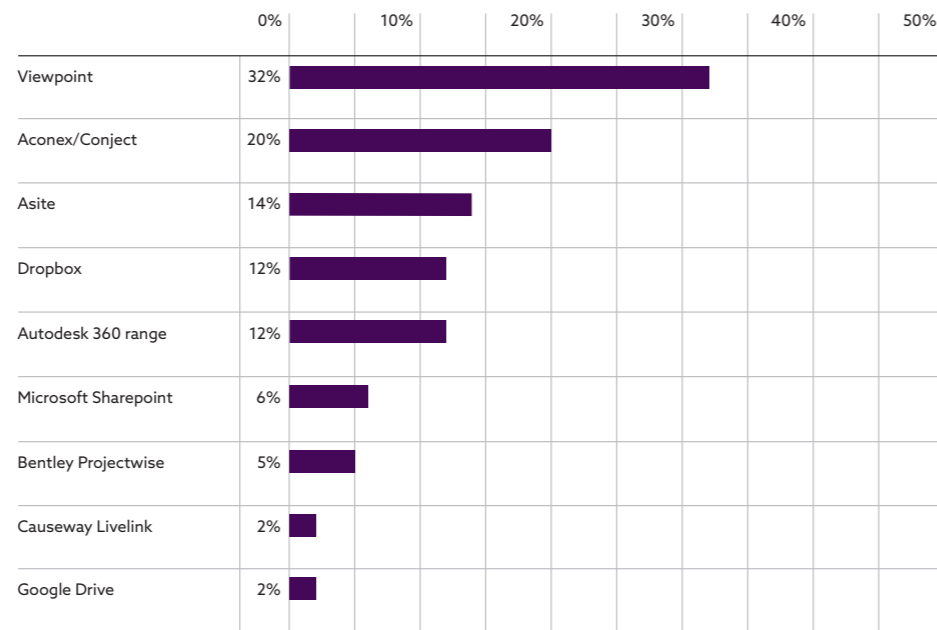
When creating a CDE, people use a range of tools. These can be industry-specific, such as Viewpoint, Asite or Aconex. For projects of a less complex nature, many tell us that they are using general tools like Dropbox or SharePoint.

The prevalence of industry-specific tools indicates that BIM cannot be understood as using one tool or another (Revit or ArchiCAD); instead, it is the coming together of a wide range of tools and processes to support collaborative information delivery.

Within the projects you are involved in, do you share information in common data environment...



Please list the Common Data Environments you use



As a core part of PAS 1192-2 is about sharing data within a CDE, this helps us to see how many, and how often, organisations practise collaborative BIM.



Coordinating the project documents and models within the project team is one thing. Another is coordinating the documents and models themselves, so that the information they contain is consistent. Central to this is making sure that the specification and the models agree.

Conflicting information can threaten the realisation of design intent, and leaves a door to dispute open.

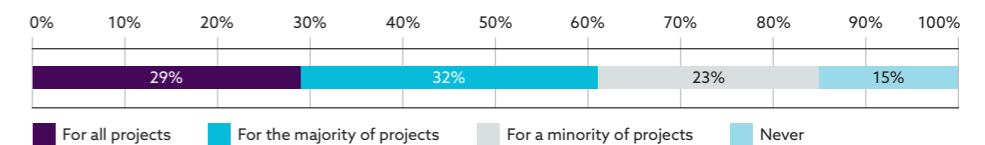
Only 15% never coordinate the specifications and the model, but less than two thirds always do. There are tools to help here: notably the NBS plug-ins for Revit or ArchiCAD. They allow direct linkage between the model and the specification.

'The statement 'it's in the model' is of little help when you're trying to transfer information.'

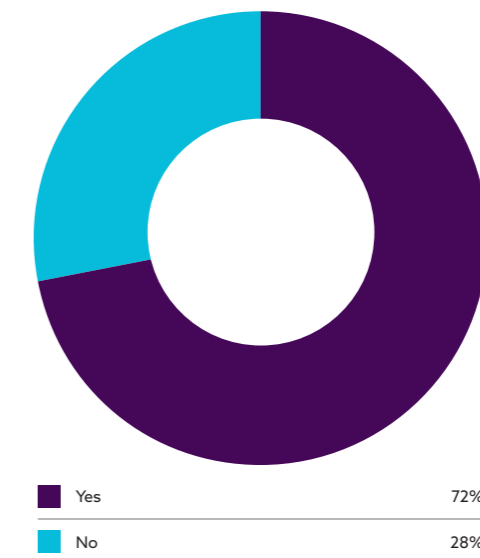
We have seen that some software packages are more popular than others. We've also seen that there are a number of packages in use. As BIM is collaborative, that collaboration cannot rest on the adoption of one proprietary piece of modelling software or another. Instead, collaboration requires an open, non-proprietary data environment. This is where IFCs (Industry Foundation Classes) come in. Seventy two per cent now use IFCs on the projects that they've been involved in.

IFCs are being adopted now, so 50% disagree that 'Information models only work on the software they were made on'. They will also become increasingly important. Sixty two per cent describe their use as essential to Level 3 BIM.

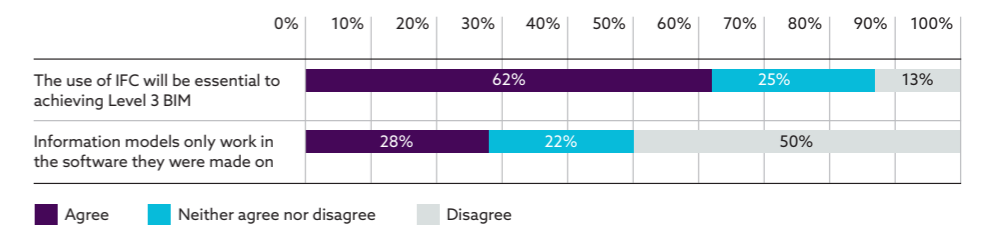
Within the projects you are involved in, do you coordinate project specifications with drawing/models



Do you use IFC on projects you've been involved with?



Agreement with statements



As BIM is collaborative, that collaboration cannot rest on the adoption of one proprietary piece of modelling software or another.

Another non-proprietary data format is COBie (Construction Operations Building Information Exchange). COBie is there so that the non-geometric data that is held within a BIM can be easily published. It is most commonly used as a spreadsheet that contains standard information about a building. When used as a spreadsheet, it can be easily shared among the design and construction team and, ultimately, with the client.

'We haven't been required to produce a COBie output, it looks too complicated to achieve and I'm not sure that it is useful.'

COBie is not universally adopted, but a significant proportion, 41%, do generate COBie output. If BIM is to deliver efficiencies throughout the life of a building and not just in the design stages, we need to see a higher adoption rate.

'Clients are starting to understand that receiving even a basic level of information can provide improved savings in FM.'

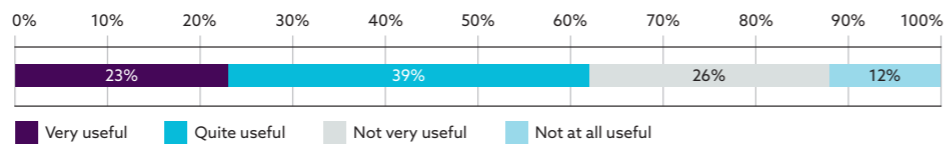
Of those who do use COBie, almost two thirds (62%) find it useful. The slow rate of adoption may be more a reflection of models not being used throughout the life of a building, instead of being restricted to the design stages. Perhaps COBie outputs would be required more often if clients requested it; this may come as we further embed BIM Level 2.

Do you generate COBie output for projects you've been involved with?



Yes	41%
No	59%

How useful did you find COBie for delivering information about the management of the facility?



If BIM is to deliver efficiencies throughout the life of a building, and not just in the design stages, we need to see a higher adoption rate.



BIM Objects

Buildings are made of things. BIMs are made of BIM objects. A BIM object may contain detailed information about the thing that it represents. This can be information about its geometry (it both contains geometric information and lets people see what the thing looks like) and about its properties (like weight, or performance).

It is very important that the information contained within a BIM object is accurate, standardised and well formed. Poor quality BIM objects make for a poor quality (and so professionally risky) model.

'manufacturers are slowly catching up with producing BIM models.'

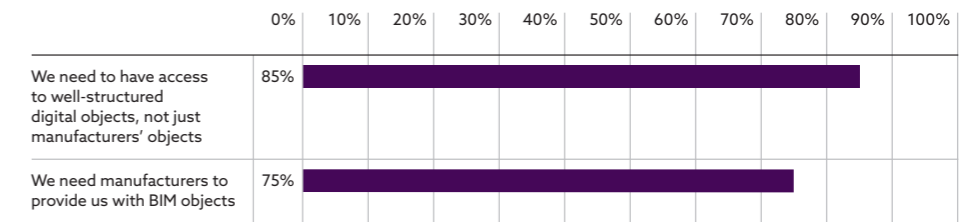
Designers need manufacturers to provide BIM objects (three quarters agree). They also need generic objects (85% agree). The NBS National BIM Library provides both of these.

As more practices and projects use BIM, the need for BIM objects increases. The most popular ways of getting BIM objects are to create them in-house then re-use (65%), and to create them as needed for a project (59%).

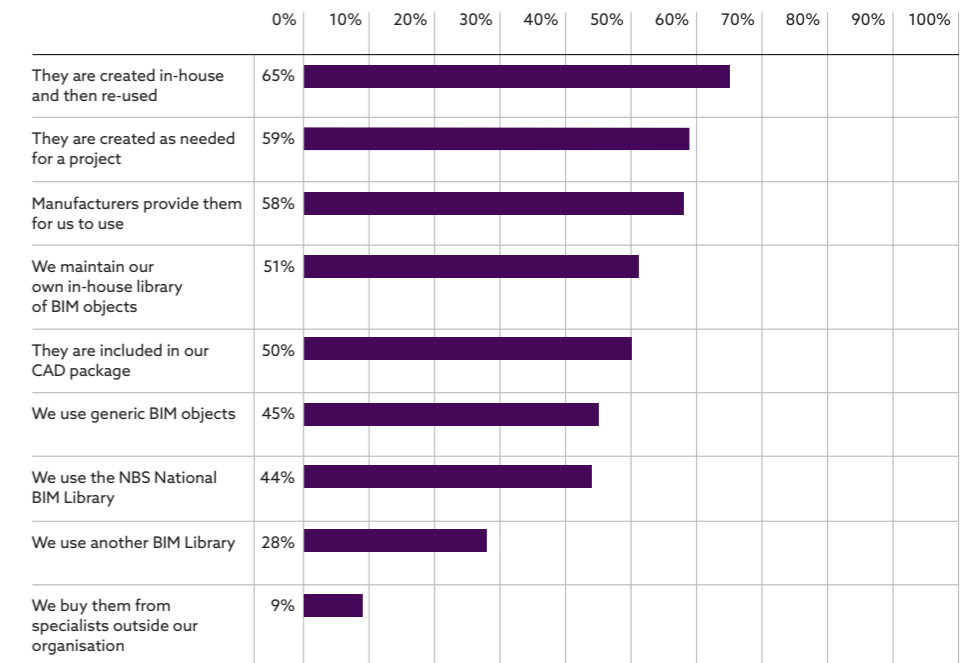
In-house creation of objects (unless they represent bespoke, project-specific items) is inefficient, because many practices will be creating the same object. Re-use is risky, as information may become out of date or inaccurate. It is better to use a free, central store of up-to-date BIM objects. This can be direct from manufacturers (58%), or from a BIM library. The NBS National BIM Library is the most used central store: 44% use it. Other libraries are less used, at 28%.

Wherever they are sourced, a majority (51%) maintain their own in-house library of BIM objects.

Agreement with Statements



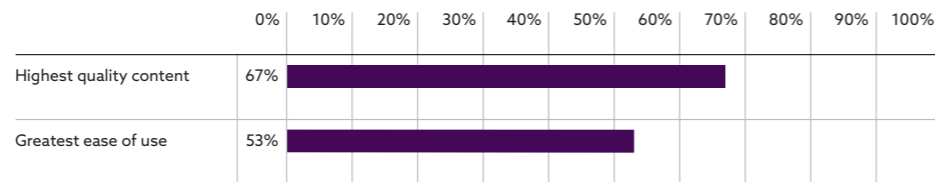
Where do you get the BIM objects your organisation uses?



Re-use is risky, as information may become out of date or inaccurate. Better is to use a free, central store of up to date BIM objects.

Participants told us that quality was essential with respect to BIM objects. When asked specifically about NBS National BIM Library, 67% agreed that it provides the highest quality content. A majority (53%) agreed that it provides the greatest ease of use.

The NBS National BIM library provides



Just as the practice of BIM needs to be standardised, so too do the objects that make up the model. This is why NBS have created the NBS BIM Object Standard. Knowing that an object conforms to the Standard provides an assurance of its quality. Over three quarters find the BIM Object Standard useful. Because all objects on the NBS National BIM Library conform to this standard, their high quality is assured.

How useful do you find the NBS BIM Object Standard



Useful	76%
Not Useful	14%

Because all objects on the NBS National BIM Library conform to this standard, their high quality is assured.



BIM Experience

Eighty two per cent agree that BIM is the future of the design process, and with over three quarters having now adopted BIM, it is a future that we're seeing realised.

But there is still work to do. People remain distrustful of what they hear about BIM (only 36% trust what they 'hear about BIM').

Only 27% think that the UK is the world leader in BIM. That said, many people commented in the free text on how well the UK is doing:

'UK is further ahead with BIM than most other countries, and the Government's action has spurred the UK forward.'

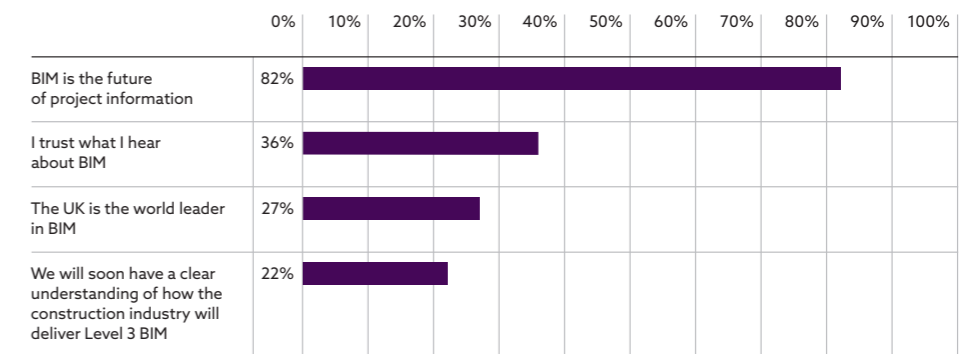
'We operate in the United States which is a long way behind the UK and NBS in particular when it comes to the coordination and use of data associated with materials and manufactured products.'

Few (22%) believe that clarity on delivering Level 3 will come soon.

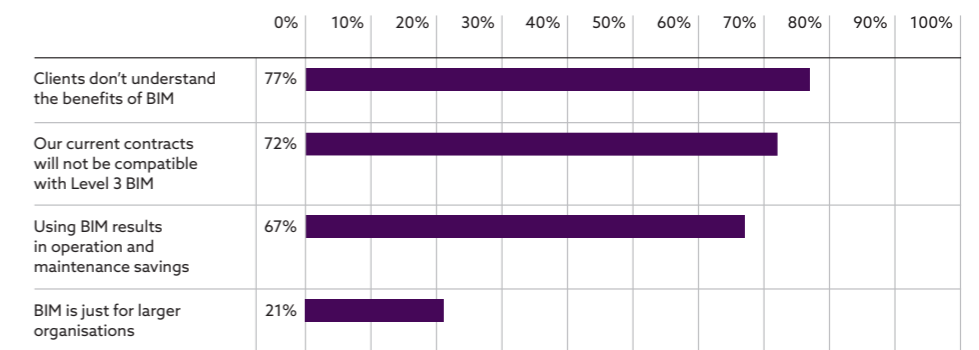
Even without Level 3 BIM, the design community already sees that using BIM can bring benefits beyond the design stages; 67% see that using BIM results in operational and maintenance savings. On the other hand, 77% agree that clients do not understand the benefits of BIM. The need for greater client education, perhaps led by all kinds of government clients, has not gone away.

'Clients need to be better trained to understand what BIM is.'

Agreement with Statements



Agreement with Statements



Only 27% think that the UK is the world leader in BIM.



As in previous years, we looked at the views of those who have adopted BIM and compared them to those who have yet to. This allows us to compare anticipation with experience. We have consistently found that BIM experience is better than BIM anticipation.

'BIM, not just the software upgrade, including process changes, takes time and commitment.'

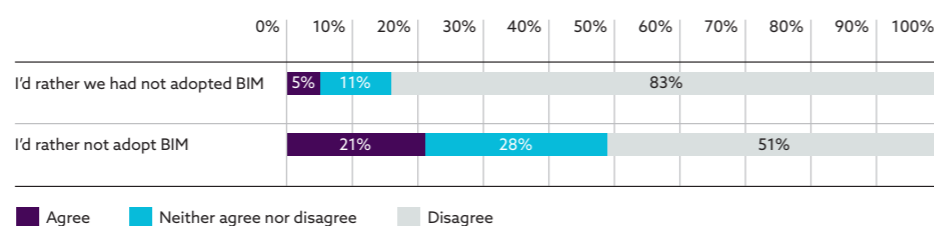
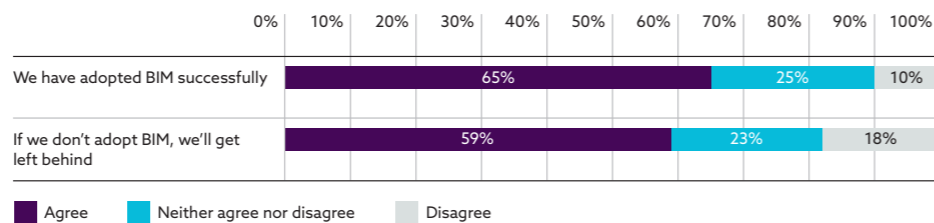
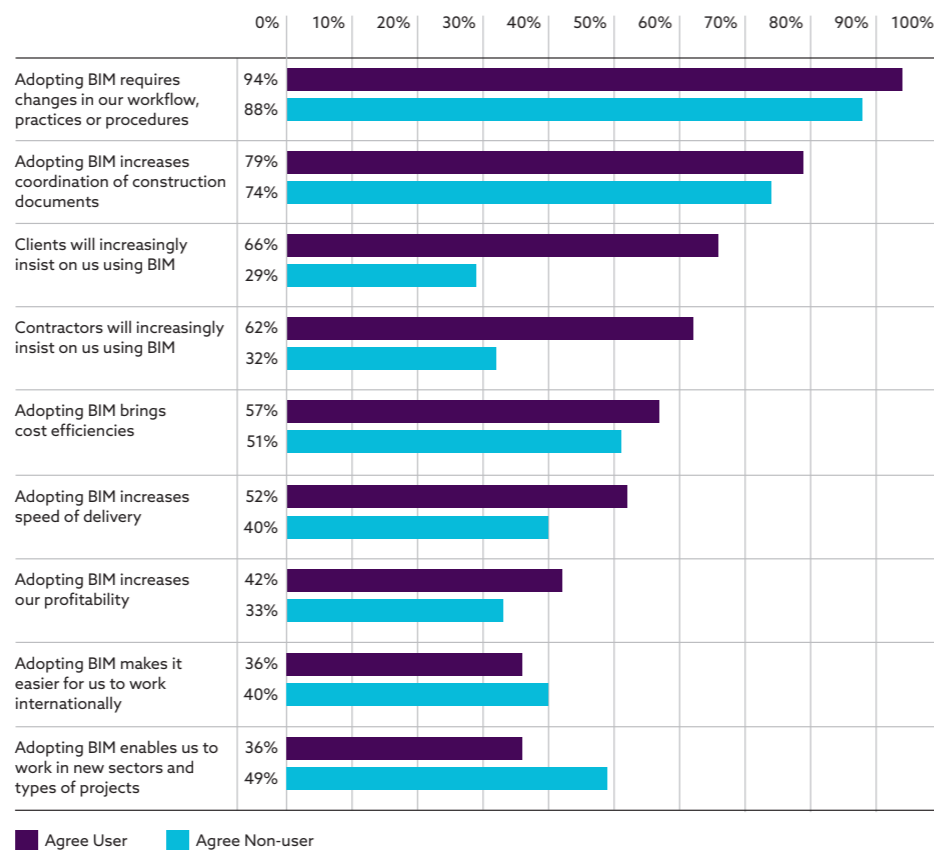
Adopting BIM is not easy. Ninety four percent of BIM users agree that it has required changes in their workflow, practices and procedures, yet only 5% wish that they hadn't adopted BIM, compared to one in five of non-users who would 'rather not'.

'we are seeing the advantages'

A majority see that BIM brings better document coordination, cost efficiencies and faster delivery. Clients and contractors will increasingly insist on BIM.

Nearly two thirds (65%) told us that they had adopted BIM successfully. Fifty nine percent of those who are yet to adopt BIM acknowledge that if they do not, they'll get left behind.

Agreement with statements



Barriers to adoption

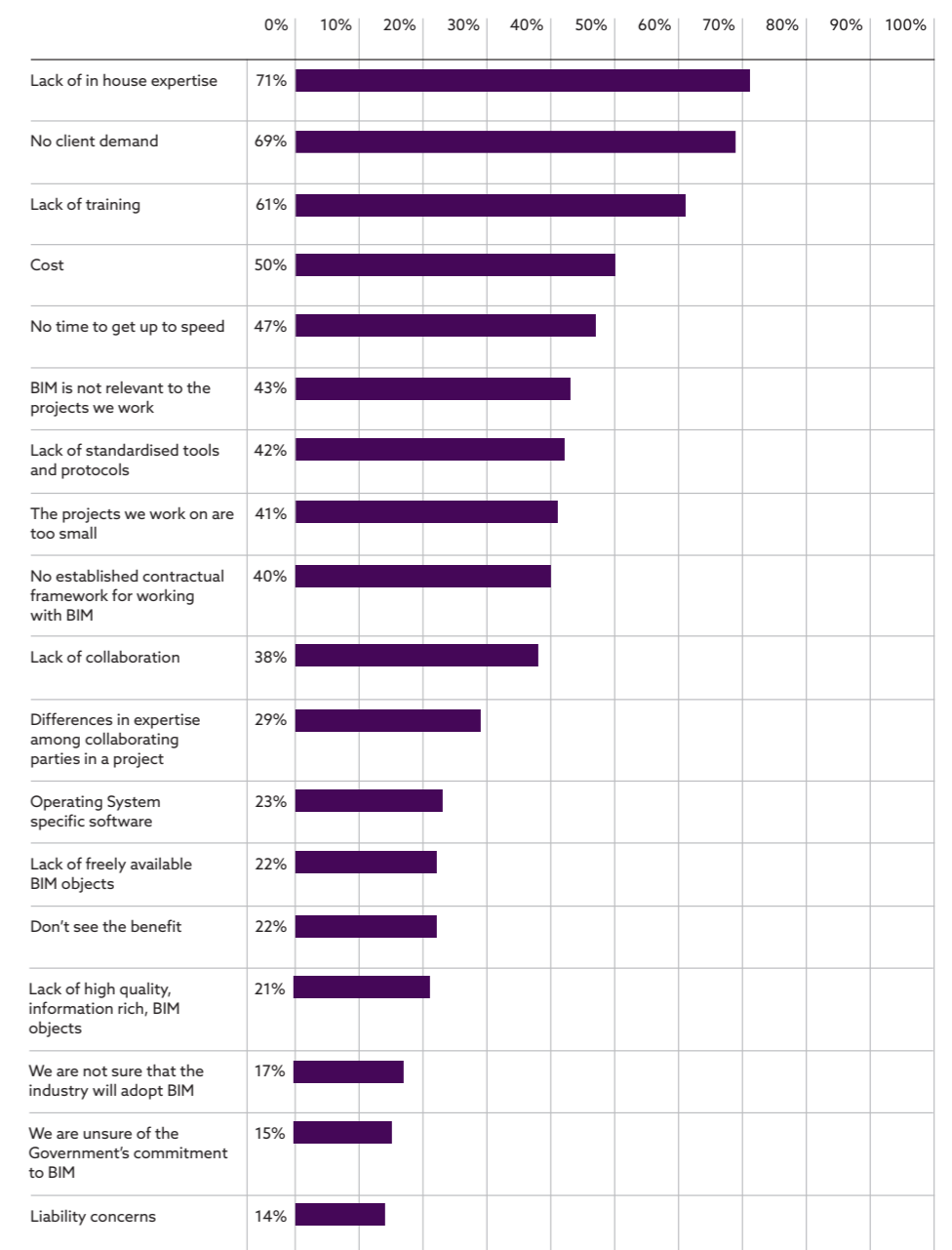
'It hasn't been requested by the client.'

We asked those who have yet to adopt BIM what the barriers to adoption are. These barriers fall into two types: internal, such as a lack of training, expertise, time or the investment cost; and external, specifically a lack of client demand and projects being too small to require BIM.

The internal barriers are barriers of investment. Responses from those who have adopted BIM suggest that it is a worthwhile investment of time and money.

It is also likely that the amount of 'non-BIM' work will steadily diminish as more clients see BIM's benefits and so require it on their projects. Client demand will accelerate as Level 2 BIM becomes further embedded and as we define and move towards Level 3. Not adopting BIM looks increasingly risky for a practice.

What are the main barriers to using BIM?



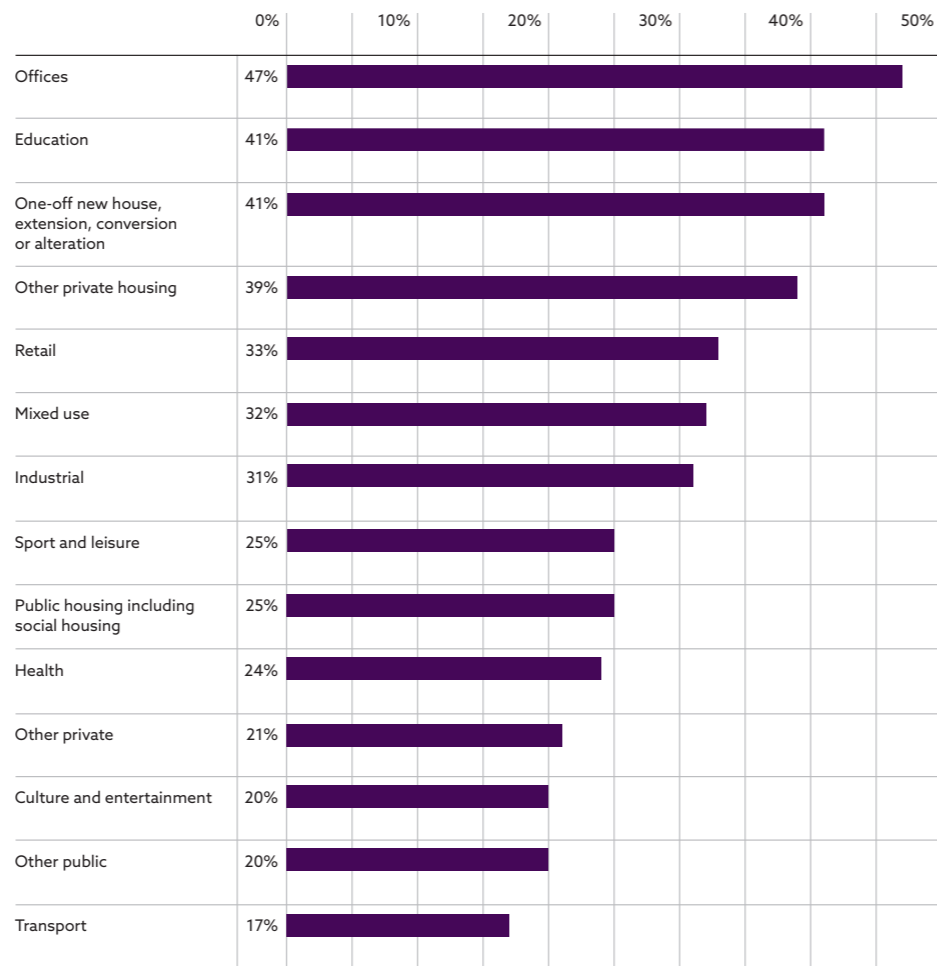
The responses we have seen from those who have adopted BIM is that it is a worthwhile investment of time and money.



Respondents

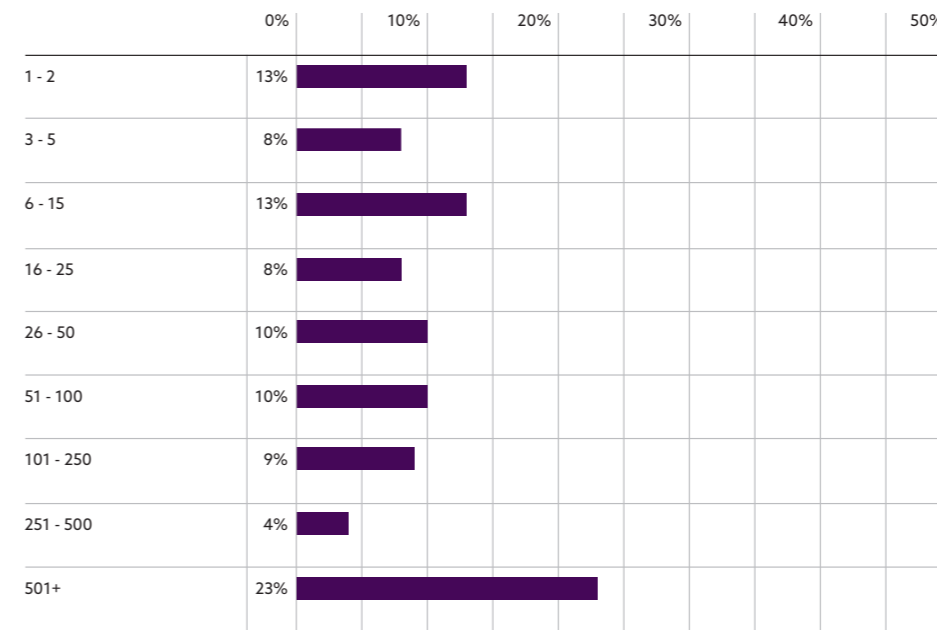
This year's findings are based on the analysis of the 808 responses to the survey. The survey was live in the first quarter of 2018. The respondents came from a range of large to small practices and organisations, carrying out a range of project types. People from a range of professions responded to the survey. The largest group were architects (31%), but other professions were represented too, including architectural technologists; BIM managers and technicians; clients; contractors; civil, structural and service engineers; surveyors; and landscape architects.

In the last twelve months, which of the following project types have you been involved in?



The respondents came from a range of practices and organisations, from large to small, and carrying out a range of project types.

Including yourself, approximately how many people are employed in your organisation?



With the Government's BIM mandate in place, and with three quarters now using BIM, it increasingly looks like BIM is not the future, but the present.

End Note

We still have a long way to go!!

Since we've been running the NBS National BIM report, we've suggested that the future is BIM. With the Government's BIM mandate in place, and with three quarters now using BIM, it increasingly looks like BIM is not the future, but the present. So, what is the 'next BIM'? What will next transform the design and construction industries? In one sense, the next BIM is BIM. Firstly, getting true Level 2 BIM used in more projects. Secondly (and this may be the next great transformation), describing, agreeing on and implementing Level 3 BIM.

'I think BIM has helped people to understand that the construction industry needs radical change.'

Of course, there are other things on the horizon too: AI, generative design, offsite manufacture, 3D printing and the Internet of Things. All these items (and others) have the potential to transform the design and construction industries. At the same time, they will all rely on the fundamentals of BIM being in place: collaborative working, 3D design and rich, standardised design information. BIM Level 2 will increasingly be seen as a foundational step for the digitisation of the industry.

CIC BIM Protocol – 2nd Edition

Andrew Croft – Beale & Co



Dale Sinclair
Director of Technical Practice, AECOM and Chair of the CIC BIM Forum

The BIM Protocol remains the only standard industry protocol for use on projects using BIM.

On 10 April 2018, the Construction Industry Council (CIC) published the much-anticipated Second Edition of the BIM Protocol. The original BIM Protocol, which Beale & Company were also responsible for drafting, was first commissioned by the CIC in 2013 as a response to the UK Government's BIM Strategy.

Following significant consultation with the construction industry, legal practitioners and standard contract publishing bodies (including the JCT and NEC), the Second Edition reflects significant progress with standards and practices in relation to BIM since 2013.

Industry Standards

The Second Edition of the BIM Protocol is very closely aligned with PAS 1192-2. For example, the Second Edition applies to all information, not just models, and the terminology is now more consistent with this standard. In addition, Appendix 1 to the Protocol is now the Responsibility Matrix (which PAS 1192-2 requires to be prepared) rather than the Model Production and Delivery Table.

As with the original Protocol, the completion of Appendices 1 and 2 (Information Particulars) of the Second Edition is key, and the Protocol includes detailed guidance on this. In addition, Appendix 2 allows the Employer's Information Requirements and the BIM Execution Plan, two key documents under PAS 1192-2, to be identified and therefore reflected in the contract.

The Second Edition also reflects other, more recent BIM standards. For example, it includes obligations to assist in relation to the Asset Information Model to reflect PAS 1192-3, and additional optional provisions in relation to security (an increasingly important issue) to reflect PAS 1192-5.



Encouraging Collaboration

The Second Edition also includes obligations in relation to the sharing and publishing of information as part of a Common Data Environment Process, and a collaborative process to resolve inconsistencies in relation to information. Collaboration is central on any BIM project, and these additional provisions should encourage further sharing of information to help identify inconsistencies at an early stage.

Flexibility and Ease of Use

The Second Edition is a much more flexible document. For example, the standard of care required of the Project Team Member and the position in relation to intellectual property are now driven by the underlying contract. This flexibility is also demonstrated by the fact that the appendices are now editable documents, so they can be easily completed.

The Second Edition still seeks to achieve the intention of creating a minimum set of consistent obligations across the project team, without overriding the agreed contractual position.

For the Protocol to have contractual effect, it must be incorporated into the contract. The Second Edition makes this even clearer: it includes suggested approaches to using the Protocol with the JCT suite, and refers to guidance on using the Protocol with NEC4 contracts, as well as a standard incorporation clause. This will also promote the effective use of the Protocol.

Clarifying the Contractual Approach to BIM

Despite recent industry progress, there is also often ambiguity over the contractual approach to BIM. It is also far too common for there to be a 'gap' between the contractual position and the approach of the project team, as indicated in the recent NBS National Construction Contracts and Law Survey, in which 57% of respondents considered BIM to be contractually binding, whereas only 33% saw specific outputs in relation to BIM being referred to in contracts. The recently published Winfield Rock Report also highlighted these concerns. If BIM is not clearly provided for in the contracts of the project team, there will be a risk that the real benefits of BIM adoption are not achieved.

Looking forward, as we see an increasingly digitised approach to construction, it is hoped that the new Protocol, which is more flexible, easier to use and reflects the industry approach to BIM, will help provide additional clarity in relation to the contractual approach to BIM.

"CIC has had a seven-year involvement with being at the leading edge of promoting best practice in BIM, which continues with the work of our BIM Forum. The Second Edition of the BIM Protocol demonstrated our ongoing commitment to the multi-professional, collaboration potential of BIM."

Graham Watts OBE
Chief Executive of CIC

"The CIC BIM Protocol is a crucial component of the UK's BIM level 2 suite of documents. We are delighted that this latest version updates the protocol in line with comments made since its inception. This is an important step forward as we move towards a collaborative digital future."

Dale Sinclair
Director of Technical Practice, AECOM and Chair of the CIC BIM Forum

"We are very glad to see the important changes made in the second edition of the CIC BIM Protocol. These include clarification as to the duty of care and timing of Project Team Member contributions, reflecting findings from our research report "Enabling BIM Through Procurement and Contracts."

Professor David Mosey
King's College London

Collaboration is central on any BIM project and these additional provisions should encourage further sharing of information and help identify inconsistencies in information at an early stage.

Welcome to a Digital Built Britain



David Philp
Global BIM/IM
Consultancy Director,
AECOM

In 2012, at the Government Construction Summit, the Ministry of Justice (MoJ) announced that it was embarking on the first early-adopter Building Information Modelling (BIM) project under the Government's Construction Strategy. This trial project highlighted the benefits of the intelligent client, clarity of information requirements, data to support decision-making and enhanced stakeholder communication in a model-based environment, resulting in reduced costs, improved predictability and enhanced SME engagement.

'The significant improvement in cost value and carbon performance can be achieved through the use of open sharable asset information.'

At this juncture, BIM Level 2 was just starting to evolve, through the creation of new standards and the stress-testing of a simple hypothesis.

As more projects came online, realising different value propositions (both quantitative and, equally importantly, qualitative), it became evident that getting the foundation of BIM Level 1 right and its related need for a common data environment (CDE), better information and design management were key. The then BIM Task Group also realised the need for the development of standards and guidance on Soft Landings, Security Mindedness and Health and Safety, all aspects that were not envisaged as part of the BIM Level 2 wrapper back in 2011.

Perhaps the most important change lever pulled was not that of technology or processes but an inner shift in mind-set and behaviours: starting with the end in mind, breaking down discipline silos and enabling collaborative working, especially between those who create and those who maintain assets. Without addressing new attitudes and including the many players involved in the built environment, the HM Government's BIM Level 2 programme would have been set for failure. In hindsight, therefore,

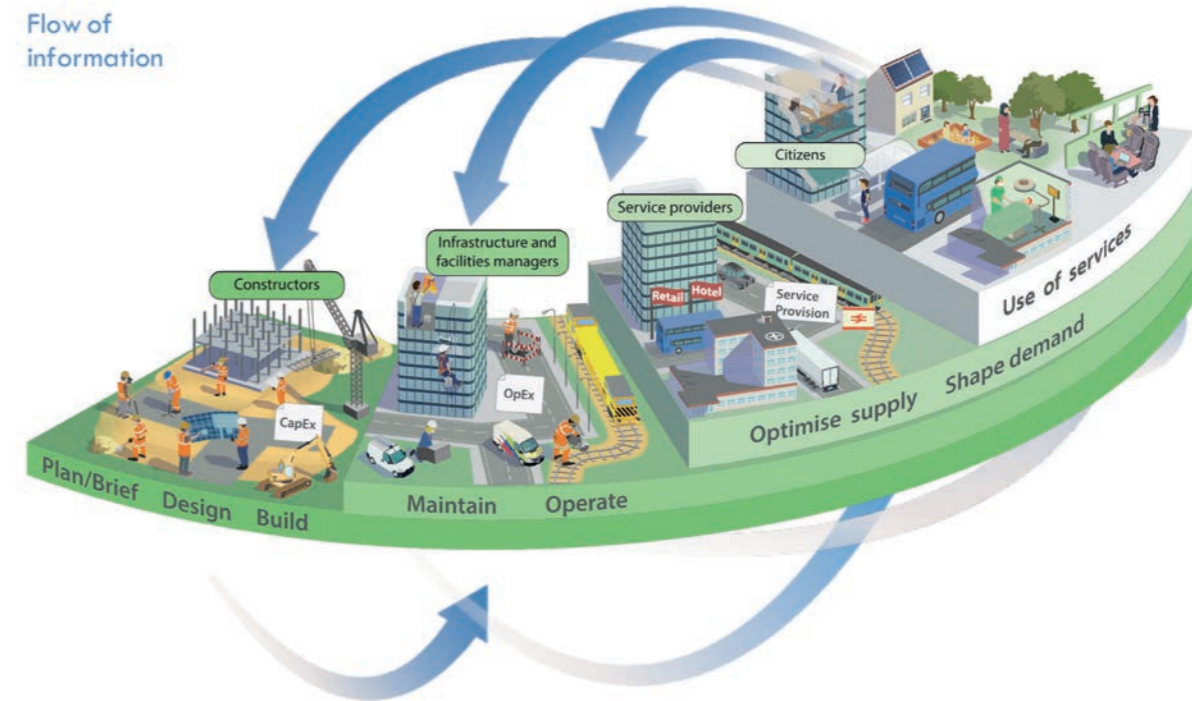
one of the biggest benefits of the UK BIM programme was the establishment of communities of practice that were kick-started in response to the BIM mandate, including the UK BIM Alliance and BIM Regions who are helping to raise awareness and build capacity in capability in the marketplace.

Since the inception of the Government Construction Strategy (GCS) in 2011, great progress has been made in BIM implementation. This progress has shaped multiple successes in the UK's joint mission to create a **Digital Built Britain (DBB)**. DBB will pave the way for a programme of digitisation of the built environment and enable: a shift into the digital economy; a boost in productivity across the built environment through investment in digital and manufacturing technologies; a focus on through-life performance; and better, more certain outcomes.

The DBB strategy published in 2015 set out a long-term vision to bring digital techniques and capabilities to the life cycle of the built environment. It will enable the more efficient building of assets and an understanding of how they are used and consumed by the users. This data's feedback loops and analysis will inform the design of better-functioning assets for the future, and thus better social outcomes.



Flow of information



Digital Built Britain: Enabling the information feed-forward and feed-back loops (Reproduced by permission of BEIS)



Home of Centre for Digital Built Britain

DBB is an important programme for the UK Government, with demographic and social changes putting new demands on our ageing infrastructure, coupled with diminishing resource to fund new infrastructure and the fact that 80% of the assets that we consume are already with us.

Government recognised the time taken to develop BIM Level 2, and if the UK is to maintain its competitive, digitally enabled position and continue to grow capability, we need to start the journey to create the next chapter in our digital journey now.

In support of and to help enable the DBB strategy, the Government announced the launch of **The Centre for Digital Built Britain (CDBB)** in late 2017: a partnership between the Department for Business, Energy & Industrial Strategy and the University of Cambridge to support this ongoing transformation of the built environment. The Centre will continue the work of the Digital Built Britain Programme and the UK BIM Task Group to support delivery of the Government's Digital Built Britain Strategy.

'The CDBB Mission: To develop and demonstrate policy and practical insights that will enable the exploitation of new and emerging technologies, data and analytics to enhance the natural and built environment, thereby driving up commercial competitive and productivity, as well as citizen quality of life and well-being.'

The strategy seeks to digitise the entire life cycle of our built assets, finding innovative ways of delivering more capacity out of our existing social infrastructure, dramatically improving the way that these assets deliver social services to improve capacity and provide better public services. So how do we retrofit these assets with the required digital capabilities to ensure that they can provide us with relevant services into the future? Doing more with what we already have, enabling a circular economy which keeps up with us reusing and recycling assets to enable citizens to make better use of their cities and infrastructure, is a key construct of DBB.



Q & A

What is the Home Nations Working Group (HNWG)?

The HNWG brings together the four UK national BIM programmes with the purpose of developing consistency of messaging, and promoting a shared understanding of the value proposition afforded by a coordinated approach to a digitised UK Built Environment.

The HNWG will provide a platform to:

- Share experiences in the implementation of BIM Level 2;
- Coordinate the sharing of BIM knowledge and collateral across programmes; and
- Manage the interface between the Centre for Digital Built Britain, and the various devolved UK Government BIM and digital built environment programmes.

The Centre is already bringing together industry, academia and government to explore how digital technologies will be used to improve the built environment and deliver value to the economy. The Centre is interdisciplinary by nature, and not just a technical programme. Alexandra Bolton, Assistant Director at the Centre for Digital Built Britain, notes that 'in order to consider the wider effects of the digital agenda on society and the economy, we need interaction with the clinical schools, with philosophers, and economists. Identifying the questions to be asked in order to establish how people want to use the built environment requires working with a multidisciplinary team, which we are starting to build - not just in Cambridge, but with other institutions too. Without this dynamic and widely-informed approach there would be danger of creating something technically perfect, but potentially unusable, or difficult to use'.

Involving partners from across industry and government, and working closely and openly with them is therefore vital. CDBB deliberately want a very open system - a network of people involved in thinking about the future of DBB. While the Centre is housed at the University of Cambridge, it is open - and running calls and competitions - to involve academics from across the UK and internationally in different programmes, projects, initiatives, networks and events.

The Centre also recognises the need to build upon a solid BIM Level 2 foundation. A key objective of CDBB is to act as the custodians of the integrity of the UK BIM and Digital Built Britain Programme across all the levels, and to be recognised both nationally and internationally as that institution. This has already resulted in the creation of a Home Nations Working Group (HNWG). The group will also help to support the UK transition towards ISO19650-1 and -2 with clear and unified messaging to industry.

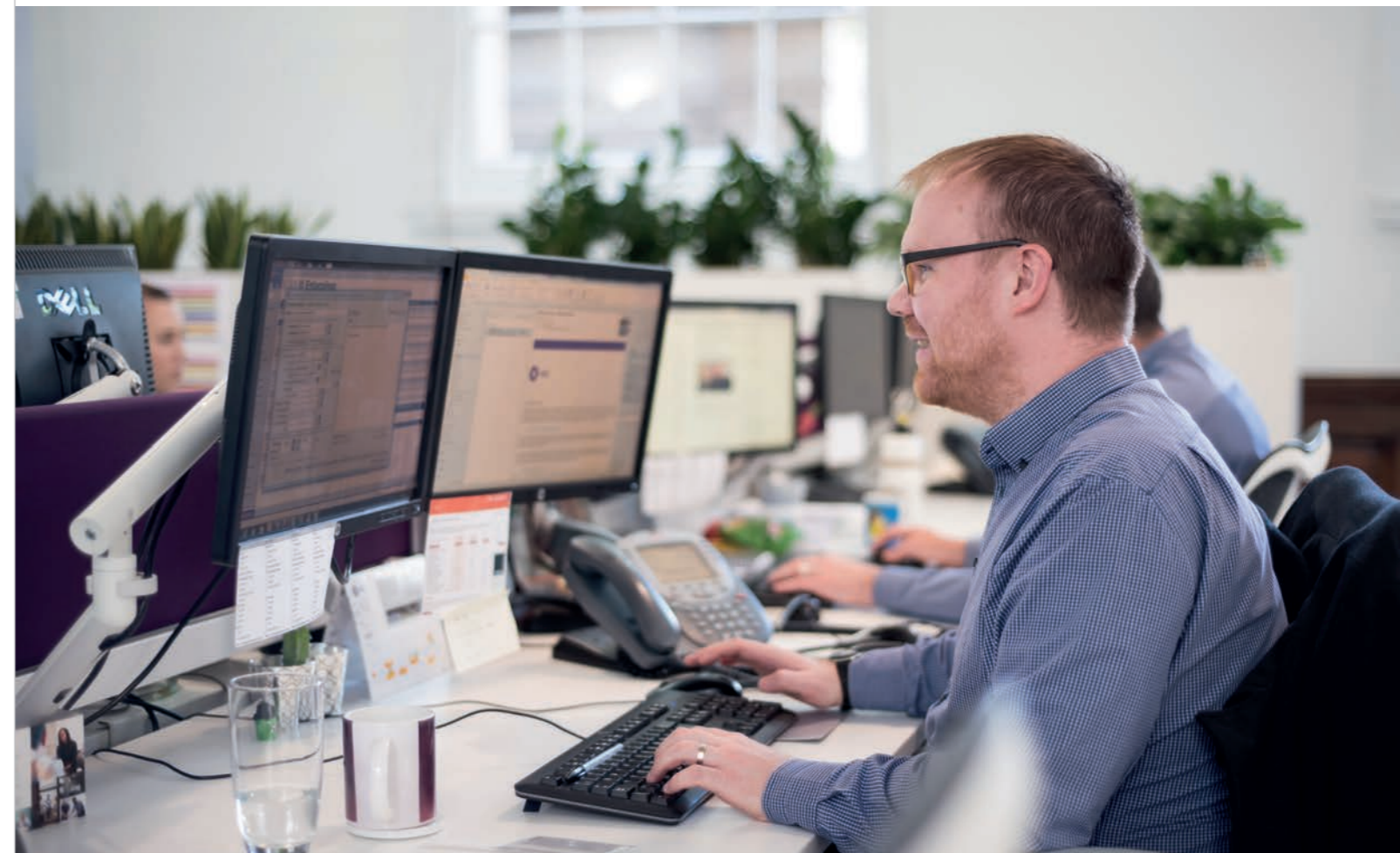
For more information about the Centre for Digital Built Britain, or to register interest in receiving regular bulletins about activities and events please see: www.cdbb.cam.ac.uk @CambridgeCDBB

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Product Identification – the missing link of BIM



Simon Powell
Director, Product Management, BSI



Adrian Malleson
Head of Research, Analysis and Forecasting, NBS

Digital Object Identifiers (DOIs)

Some projects begin with a simple question. In this case, it was 'Once we have a BIM, how are we going to know which construction products are in it?'

The answer too seemed simple – you've got descriptions of products in the BIM, so you know what you've got.

But:

- How do you know that that description is current?
- Is that product still available?
- If it isn't, what is its 'equivalent'?

Also, it seems fine to initially identify things by their attributes, but it's not the best way. Attributes can be very similar. Products can be almost the same (or 'equivalent'). If you don't know exactly which products are in a design, and exactly which products are in the subsequent completed building, there can be significant trouble ahead.

If even only a small number of the specified products have been substituted or 'value engineered' out of the final constructed building then the performance of that building could, and may often, be significantly affected.

Other industries suggest another way: it is better to have a simple identifier for products that references a 'single point of truth', maintained centrally by the true owner of that information – the manufacturer.

This led to BSI, the NBS and the CPA (Construction Products Association) coming together to work on a project, part-funded by Innovate UK, to research and develop an identifier for construction products.

We found that there are many different kinds of identifier currently in use. Most belong to a firm or system, like SKU codes: they identify products, but not publically, and not consistently.

Others make data publicly accessible, like barcodes or QR codes, but the information is not standardised or centrally held. This means that during its journey through the supply chain, any typical product will be issued with a number of identifiers by different stakeholders and systems. For anyone using those identifiers, it won't be clear which ID is the most useful, and of course there's no assurance that the data behind those identifiers will always be there in the future (e.g. if websites, or systems, change over time).

If you don't know exactly which products are in a design, and exactly which products are in the subsequent completed building, there can be significant trouble ahead.



There was one identifier that seemed to do a number of things better than others: the Digital Object Identifier (DOI). For us, DOIs have **three key** features:

- **Metadata** – all DOIs have set, standard metadata associated with them. The data is all the data that is needed to show the uniqueness of a thing, and to provide some core services. But no more than that.
- **Persistence** – DOIs are persistent both by design and culture. Once a DOI is created, people will always be able to use it to get to the core metadata. This is very useful when thinking about the supply and use of information throughout the lifespan of a building.
- **Identification** – the DOI is a fixed, standardised, machine- and human-readable identifier.

No other identifier has all these features. DOIs offer permanent and unambiguous identification of construction products. They also clearly identify the manufacturer.

DOIs also have a pedigree. In use since the 1990s, DOIs are extensively used in the publishing and film industries. There are millions of DOIs in the world, and they are used hundreds of millions of times each month. They are proven to be reliable. They are also governed by an International Standard, ISO 26324:2012.



Innovate UK



Pilot

Having established which is the right identifier, the project moved on to piloting its application.

At this point, we'd like to mention the kind assistance of the project's steering group, made up of a range of industry experts and representatives from the International DOI Foundation (consisting of those existing agencies who already issue DOIs), who gave much knowledgeable help and advice.

We implemented DOIs through a web-based application. This application allowed:

- Manufacturers to upload data about their products to create DOIs;
- Users to get metadata about a product from its DOI; and
- DOIs to take you to the relevant information on a website, when they are clicked on.

Putting together the website was, however, only the first stage. By working with industry, we were able to develop a wide set of illustrative use cases for DOIs. Or, to put it another way, once we had the website, we could see that DOIs could be readily used to solve some long-standing issues in the construction industry.

Below are some examples:

DOIs in BIM

As BIM moves into the life of a building, there is an increasing risk that data within a model may go out of date. By including a DOI in a BIM, current product information (like availability or compliance) can be directly accessed from the centrally held metadata. Indeed, where information is part of the DOI metadata, it will always be centrally available.

DOI outputs at each design stage

It's not always clear which products that formed part of the design make it into the final building. By having a list of DOIs at each relevant RIBA stage (as a minimum, stages 4 and 6, generated from a specification), changes in products can be programmatically detected, and, through the available metadata, details of substitution/value engineering given.

DOIs with other identifiers

DOIs can both embed and be embedded in other forms of identification. DOIs complement, rather than rival, other IDs. Equally the DOI's metadata can capture other IDs, so can act in future as a central ID lookup across the product supply chain.

DOIs can also be embedded within existing documents, assets or identifiers. As an example, we have successfully embedded DOIs in radio-frequency identifications (RFIDs). This means that an RFID can be attached to a product (RFIDs are now small and cheap). By using a reader, or just a mobile phone, the RFID can be read to give the persistent information about the tagged product - invaluable, for example, to a facilities manager looking to identify and replace an in situ product within their building.

DOIs and compliance

Quality and legal compliance are obviously critical for product manufacturers. The safety and performance of buildings are determined by the products that they are composed of. These attributes are key differentiators in the market for construction product manufacturers. This means that they are keen to find ways to demonstrate their compliance with schemes and standards to those using and selecting their products. The DOI metadata collected through this system allows a manufacturer to display information and evidence around compliance, including details of specific standards or schemes, plus any supporting certification. This helps the user or customer with product comparison and selection, and also helps the manufacturer differentiate their superior quality product from others.

Project Completion

At the start of the research programme, we said that 'the DOI for construction products must be a system that is of real use to the sector'. During the programme, we found not only that the technical implementation of DOIs for construction products is feasible, and that the DOIs are useful and attractive to the market, but also that more and more potentially valuable applications are being identified, as awareness increases and as we speak to more people throughout the construction supply chain.



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[theNBS.com/BIMworkflow](https://www.nbs.com/BIMworkflow)

The Winfield Rock Report – why we wrote it and what's in it



May Winfield
Senior Legal Counsel,
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Gowling WLG
(UK) LLP



After reviewing too many contracts containing vague obligations and undefined terms such as 'The project will be delivered to BIM Level 2', and encountering disputes resulting from incomplete or vague BIM documentation, we felt that it was time to do something proactive to move things forward to support the legal side of BIM.

With only one reported case remotely touching on BIM, we set out to tackle this issue head on in September 2017. The research consisted of an online survey on the use of BIM and BIM documentation, which received 158 responses.

We also interviewed 44 key industry players, consisting of a mix of clients, contractors, consultants, academics, and both in-house and private practice lawyers, to take a more detailed look at the current position.

The Winfield Rock Report was launched in association with the UK BIM Alliance at BIM Show Live on 28 February 2018. We have been humbled by the positive responses so far, with the report being described as a 'very important piece of work', 'much needed' and a 'seminal piece of work' which 'sets the benchmark'.

Reporting on the findings of both the online survey and the one-to-one interviews, the report is intended to provide a thorough and detailed review of the legal community's understanding and position on BIM; it is believed to be the first of its kind in the UK.

At the BIM Show Live launch, we took the audience through some of the findings and our suggested strategy to overcome the legal hurdle, and to assist with the wider implementation and understanding of BIM.

The report considers the position on levels, standards, standard form contracts, BIM-specific documents and the legal community generally. We summarise some of the main findings here.

Levels

The UK Government's BIM mandate that came into force in April 2016 has been widely accepted to imply or mean achieving BIM Level 2. However, each of the 44 interviewees of the Winfield Rock Report provided different definitions of 'BIM' and 'Level 2'.

With the prevalence of the seemingly magic, standalone contract term 'You will achieve BIM Level 2' (or similar) without further detail, this wide variation in understanding could give rise to a real risk of misunderstandings and unintentional disputes. Would issuing a formal definition be the solution?

Standards

The lawyers acknowledged the existence of other standards applicable to BIM; however, given the time available to research and write this report (in addition to our day jobs), we focused solely on the 1192 suite.

There were differing views about the standards. Some interviewees found them too rigidly applied, with one interviewee noting that it had become a badge of honour to know them off by heart. Conversely, others found the standards too loose or vague. However, the interviewees were in general agreement that the standards were certainly an essential starting point.

The report also briefly considers ISO 19650, which deals with BIM internationally and is expected to be issued soon.

Standard form contracts

The report reviews many of the commonly used standard form contracts used in BIM-enabled projects, although again, we were unable to analyse every available standard form contract in detail in the time and scope available.

It was discovered that interviewees again diverged in their views. Some liked the flexible approach of the JCT and NEC, whereas others felt their provisions were too 'light a touch'. This is despite the introduction of more extensive BIM provisions in the JCT 2016 and NEC4, compared to their previous iterations.

The NEC4's introduction of universal terminology in their Option X10, which is intended to cover the BIM process, drew concerns at the introduction of even more acronyms and terminology in an industry where, as a couple of interviewees put it, the 'jargon in BIM is horrific' and lawyers are 'bamboozled' by it.

We interviewed senior representatives from JCT and NEC, who provided enlightening explanations of their respective approaches to BIM, which we summarise in the report.



The report considers the position on levels, standards, standard form contracts, BIM-specific documents and the legal community generally.

BIM-specific document

The interviewees generally agreed that the Employer's Information Requirements is a fundamental document, as it sets out what the client envisages and wants from the BIM process at the outset. However, experiences of the quality and content of the EIR varied widely – with some EIRs being incomplete or no EIRs being provided at all.

There were differing and strongly held beliefs as to whether a BEP should be a contract document, partly due to its changing nature and partly due to the administrative burden of enforcing such a moving document.

Could some of the issues and concerns with both the EIR and BEP be resolved by the issue of standard form precedents for each? While no industry-wide, accepted standard precedents exist at present, it is rumoured that standard forms may be issued in the near future.

The interviewees were overall complimentary of the CIC BIM Protocol, although there were concerns about certain clauses: in particular the priority of documents clause, and elements of the copyright provisions.

Legal community

There appears to be a perception that lawyers lack a sufficient understanding of BIM, viewing it as a technical matter and thereby remaining uninvolved in the review and completion of BIM documentation. We heard stories of BIM Protocols being inserted into contracts with incomplete appendices, or an EIR referring to the CIC BIM Protocol but this document not in fact appearing in the contract documentation.

One lawyer suggested to us that these issues may be due to the legal community's perception of BIM as 'CAD on steroids'. Indeed, the authors have heard BIM being referred to as 'simply fancy CAD'.

There was, however, sympathy among the industry that there was a lack of readily available resources, such as guidance and training, for lawyers to get up to speed on BIM from a legal and contractual perspective.

The legal community was further limited by their clients' instructions: the clients may equally not be sufficiently BIM-aware, and unable to provide sufficient clarity of what they want in terms of risk allocation and the scope of the BIM process. Where this is the case, it is virtually impossible for lawyers to draft terms without clear and precise client instructions.

Conclusion

Taking into account the survey results and interviewees' opinions, as well as our own further research, we made two recommendations to progress BIM within the legal community.

The first is the establishment of a collaborative forum for lawyers and those who instruct them to meet, network and learn from each other via events and other avenues. We have set this up as BIM4Legal, and you (and your lawyers) can register interest at bim4legal@gmail.com and follow @bim4legal for updates on future events.

The next recommendation was the preparation of a non-exhaustive Legal Questions Checklist; as a guideline and starting point, for lawyers new to BIM, on the questions to ask their clients to obtain necessary information to draft and advise on BIM-enabled contracts, negotiations and other related issues. This Legal Questions Checklist can be found in the Appendices of the Winfield Rock Report.

The Winfield Rock Report can be downloaded at:
<http://www.ukbimalliance.org/resources/request-a-copy-of-the-winfield-rock-report/>

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