BUILDING INFORMATION MODELLING (BIM) INVESTMENT GUIDANCE

NHSScotland

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Overview

Building Information Modelling (BIM) has become a key component of Scottish Government's procurement policy. The policy note sets out that all relevant procuring authorities (which includes NHSScotland) where new projects are above £2m in capital value should be assessed for BIM through the Scottish Futures Trust [SFT] BIM grading tool. For all other procuring authorities and projects below £2m, BIM is encouraged where appropriate.

http://www.gov.scot/Topics/Government/Procurement/policy/SPPNSSPANS/policy-notes/ScottishProcurementPolicyNotes2017/ScottishProcurementPolicyNote12017

In addition, BIM Level 2 implementation is a key goal for NHSScotland as structured electronic data and more collaborative working practices offer significant benefits across the project life-cycle and better organisational decision making.

This report has been prepared to assist HFS and NHSScotland's Health Boards to better understand the likely investment options and choices they may require to make, either in their mobilisation for BIM or helping making it business as usual at an enterprise level in the creation of a portfolio digital estate.

Note: Likely budget cost figures illustrated in this report are for guidance only and should always be market tested to meet the individual and unique requirements of a Board or project.

The terms BIM Level 1 and 2 maturity are used in this report and are defined below.

BIM Level 1 maturity encompasses the management of digital, indexed construction information, including that generated by 2 or 3D CAD systems within a common data environment. Disciplined design and information management policies for collaboration and a specified naming policy shall be used.

BIM Level 2 maturity encompasses the generation and management of information models comprising all named data-sets used throughout the lifecycle of a built asset.

Information models will include a series of domain and collaborative federated models. The models, consisting of both object-oriented 3D geometrical and non-graphical data, are prepared by different parties during the project life-cycle within the context of a common data environment. Using agreed information exchanges, project participants will have the means necessary to provide defined and validated outputs via digital transactions in a structured and reusable form.

Appropriate and proportionate measures will be applied to manage the security risks that affect a built asset, asset data and information.

Health Board Level Return on Investment (ROI)

Introduction

Making a business case for Building Information Modelling (BIM) firstly needs to be aligned with an organisational roadmap, usually with phased goals over a defined period. The investment may initially be geared around BIM Level 1 maturity and its Common Data Environment (CDE) and better information management requirements before then moving onto BIM Level 2 and intelligent parametric, object orientated modelling.

A return on investment (ROI) calculation needs to be undertaken to measure the gain or potentially initial loss generated on an investment relative to the amount of money invested by a Health Board in BIM implementation. The ROI should improve project-by-project as those using the tools and exploiting the data become more mature and capable both within the Board but also critically within the supply chain. Indeed, most of the quantitative capital expenditure benefits need to be unlocked with the supply chain prior to agreeing the fixed contract sum.

In addition to the project level benefits as figure 0-1 illustrates there will be benefits at Board level through better information management where at a portfolio level a single source of truth will facilitate better and a more systematic approach to capturing lessons learned and a better more holistic approach to decision making regarding operational and maintenance activities and strategic planning based upon more complete and accurate searchable portfolio information.

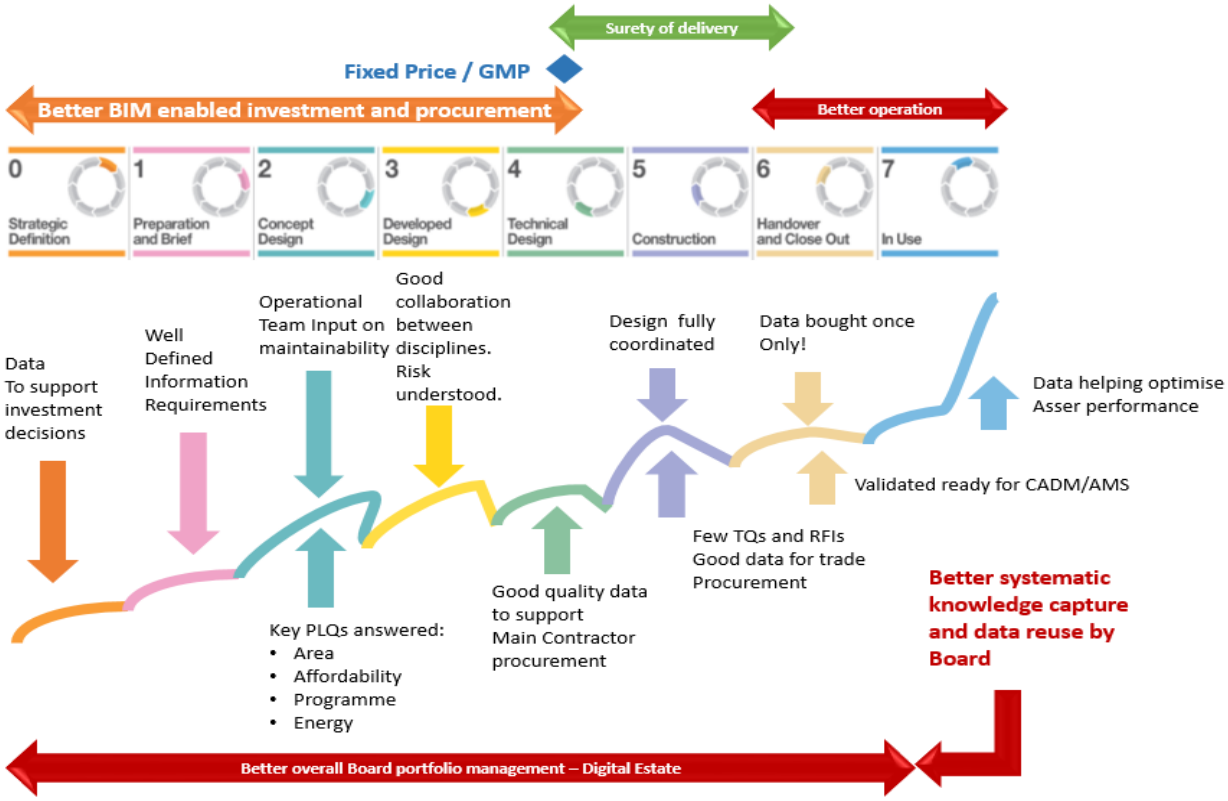

Figure 0-1 Board level benefits through portfolio level source of truth

Figure 0-2 below shows a typical organisational BIM ROI plot at an organisational level. Internal benefits will quickly be realised through the deployment of a centralised CDE and then through the savings created by BIM supporting project procurement and de-risking. The breakeven point will depend on the quantum of the initial investment however it usually takes several projects before a neutral position is achieved. After this juncture the benefits are usually now starting to be realised not just in capital stages but also in the operational stages.

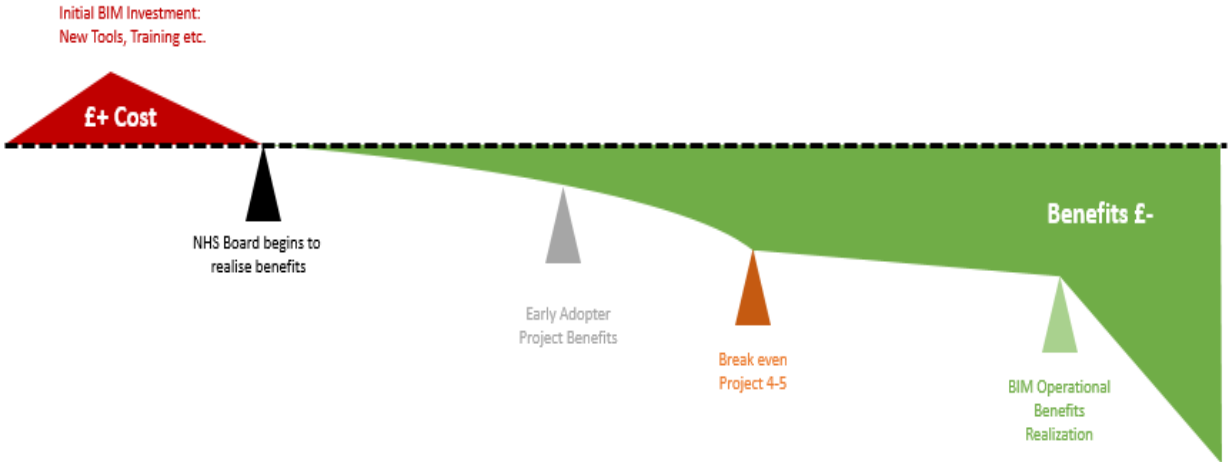

Figure 0-3 Typical organisational BIM ROI plot at an organisational level

As the board moves towards a digital estate model (a portfolio level digital model) with systematic data feedback there will be additional benefit opportunities in more data driven forward asset investment planning.

The Scottish Future Trust (SFT) have created a Return on Investment (ROI) BIM tool which estimates the benefits and the level of return that the adoption of BIM Level 2 will bring to a project. (Figure 0-4)

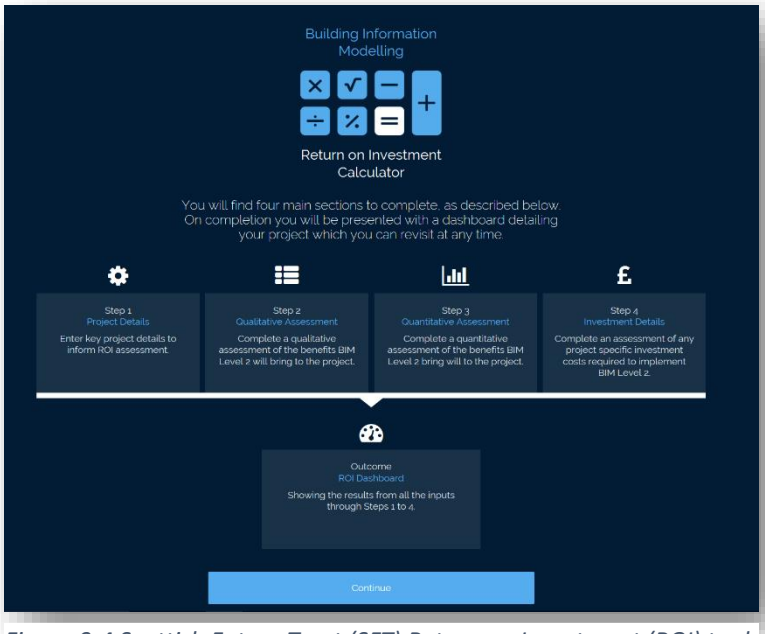

Figure 0-4 Scottish Future Trust (SFT) Return on Investment (ROI) tool

The tool supports the procurer / client assessing the benefits of adopting BIM Level 2 against a predefined list of benefits. The tool provides both a quantitative and qualitative assessment and this is reported within an easy to understand dashboard.

To note this tool is focused at a project as opposed organisation level however many of the principles of:

- qualitative assessment goals;
- quantitative assessment benefits;
- investment costs

Can be followed to help shape a Board's organisational investment model. The ROI tool can be found at: https://bimportal.scottishfuturestrust.org.uk/page/roi-calculator

1 Building your BIM ROI Model

Figure 1-1 below shows the typical areas where investment for BIM is maybe needed. At a macro level these include:

- **New processes -** aligned with collaborative, lean and highly digital workflows
- **Up-Skilling -** creating appropriate organisational capability and capacity for BIM
- **Software -** new tools and licences to support processes and goals
- **Hardware and Infrastructure -** new or upgraded technology to support software requirements and new ways of working.

We must also consider **change management as an investment**. Whilst it is often called the soft side of change, managing the people side of a change within a Board will likely be the most challenging and critical component of organisational BIM change. Getting people on board through early awareness campaigns and participating in the BIM change will make the difference. Individuals will likely have to do their jobs differently, collaborate more and it is the degree to which they change their behaviours and processes that will make or break the implementation of BIM. A structured approach to the people side of BIM is therefore important and ensuring that those who's day-to-day work will be impacted upon by BIM and the use of digital data is vitally important. A Board should therefore ensure and plan for the change management and the time needed including:

1. BIM change management strategy - where are we now – where do we want to be?
2. Managing the BIM change - the implementation plan, leading people through change
3. Reinforcing change - auditing, measuring and refining new ways of working.

Ensuring that there is a BIM leader or Board BIM Champion in place is therefore massively important to bring key stakeholders together and avoid a "them" and "us" approach to BIM. Devoting staff time to planning for change and implementing new ways of working are where it often goes wrong. Ensure that you have made allowance for time not just leadership groups but at the coal-face with those that will actually make change happen and sustaining it.

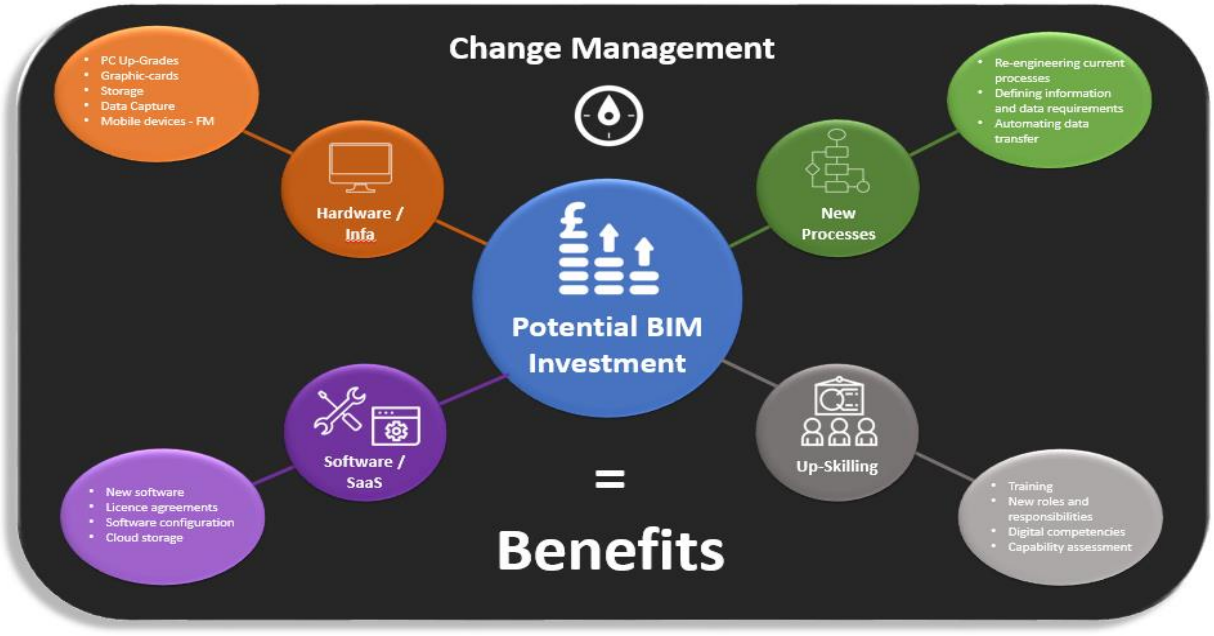

Figure 1-1 Typical bucket where BIM investment maybe required

So, at an organisational level make sure that a suitable change management allowance is made for:

- Someone to lead the BIM change programme;
- Strategic BIM workshops;
- Benchmarking, where are we now?
- Communications, early awareness messaging;
- Staff time, planning, training, implementing and refining.

The investment model needs to be considered at two levels, firstly organisational change, making BIM business as usual within a Board and secondly the costs allied to implementing BIM on a project which is a repeatable cost.

Let's now look at other more "hard" potential areas of investment:

1.1 Software

There are many technology vendors in today's digital marketplace who can supply BIM related software, and associated licences it is important however that you consider only the tools you really need and whether they are aligned with your goals and objectives. Don't be dazzled by vendors, make sure you only procure what is aligned with your BIM strategy.

It is important to determine individual user stories to inform this process, for example:

Role: Facilities Manager

User story:

- I want to be able to review, analyse and mark up models to show future adoptions or maintenance activities;
- I need access to reliable and accurate data about the operating and maintenance of our systems and components especially when I am out on the project sites;
- I need to be able to search for objects and data across our portfolio.;
- I need to give controlled access to CAD and Models to our supply chain who will be undertaking maintenance task;.
- I want to be able to submit new work order from an intuitive and mobile platform.

This will help you engage the user community and start to create a demand analysis; the specimen matrix, figure 1-2 should help determine the software requirements against key personas. There needs to be a clear distinction between those that create or amend models and those that receive models created by others.

Figure 1-2 Demand analysis matrix;

In most client organisations the creation or adaption of graphical models only happens when there is an in-house design team or where the FM team deal with any updates to reflect reconfigurations or adaptions to the estate. Generally, the creation or updating of models is undertaken by the supply chain such as designers and specialist sub-contractors who will most likely have already invested in such design authoring software suites. For most Boards the biggest demand and hence investment will be related to a common data environment (CDE) and associated information management workflows. A high specification CDE can incorporate many client workflow requirements.

Tip: *Remember some of your BIM technology you may be able to get for free! Check to see if any of your workflow solutions have free technologies e.g. model viewers.*

Having determined a technology stack landscape, it is then important to create a schedule of functional requirements to fully articulate needed outcomes as part of any request for proposal (RFP) the user stories should help inform this process. Other key areas to address in relation to the RFP may include:

- Overall vision for BIM;
- Desired outcomes from the software;
- Technical functionality – aligned with user stories;
- Experience – the vendors approach on similar projects;
- Product architecture – for instance is it modular and or scalable to align with your growth strategy?
- Integration and interoperability - will it integrate well with your other existing solutions?
- Configuration – how will you support deployment and configuration?
- Help and maintenance support - how will they support and maintain? Does it include fixes, patched and upgrades?
- Standards – does it comply with current BIM standards?

- Security – does it meet your security criteria and that of PAS1192-5?

The next key question relates to procurement strategy, consider are you buying strategically or tactically:

A. At an enterprise level solution across your Board
B. To support an individual project needs

Some elements of your technology stack where there is high demand across all persona's often fits the strategic procurement category, other more specialist workflows are often best procured on demand via a technology reseller.

You will now be in a position to issue an RFP, you may consider using a two stage approach where you first issue a light RFP focusing on your key requirements (such as security) as a means of quickly shortening the list followed by a more detailed second round to those that have passed stage one with a more detailed but less crucial list of requirements.

Typical stage 1 key questions:

- Security and data storage – do they comply with your organisation's security and data storage requirements? [Note: many fail on these foundation tests!]
- Hardware – will they require you to upgrade or invest in new hardware e.g. graphic cards or processors?
- Ease of use – will the team be able to easily adopt it?
- How have others got on with it? – speak with current customers if possible.
- Flexibility of licence models – do they offer pay as you use models or let you start with a few licences and ramp up as demand builds?

It is also important to consider which licence model will work best for you:

Standalone licence

Allows a single user exclusive access to the BIM software at any time. It is installed on a single PC and can be used only on that PC. This is best used when there is low demand for a specialist product.

Network licences

Allows the BIM software to be installed on multiple PCs, with a central database installed on a server. It allows a set number of current users. For example, an organisation can have 5 licences shared amongst 8 users, with any 5 users able to access the software at any particular point in time. Network licences also allow multiple users to work on the same project together.

Token-Flex Licensing

Like network licencing some vendors offer a licence based on actual usage, targeted at their enterprise customers, called Token-Flex which uses consumption as a foundation for licensing costs.

Enterprise Business Agreement

This is model is generally only open to those that have a large digital estate and is typically a 3-year agreement covering both flexible licences, consultant support and access to a large range of software products. This solution needs a high level of demand, usually a global footprint to make it economic.

Note: Many vendors are moving to software solutions via subscription only. Some vendors offer bundled solutions or suites which might be more economic.

For some boards the move to BIM maybe an extension to their current software agreements. It is worth then doing an audit of the current software estate to see what already exists and ensure that all licence agreements are being complied with before moving to the next stage.

1.2 Hardware and Infrastructure

There may be a need for a Board to upgrade their hardware and infrastructure to support their BIM strategy, technology stand and maximise performance. Key investment considerations should include:

1.2.1 Storage

One of the key BIM Level 1/2 BIM decisions will relate to data storage and whether you choose cloud vs on-premise vs a hybrid deployment in which cloud software is hosted on a Board's private servers.

Should a board decide that an on-premise solution is their preferred route then a study should be taken to determine if there is enough capacity and indeed the additional energy costs factored should be factored in.

This is a key decision especially in any CDE procurement strategy.

Refer to section 3.0 for a more detailed overview of CDE procurement.

1.2.2 Computers

In concert with the software demand it may be necessary to renew or more likely upgrade existing computers, in most cases this is likely to be upgraded video graphics card and graphics memory, 2 GB video RAM is the minimum recommended for typical usage. A 64bit operating system may also be required.

1.2.3 Mobile devices

Depending on the user stories it may also be necessary for mobile devices such as tablets to be invested in for those that are making decisions on the project site where access to models is required or conversely to input data such as a new work order.

1.2.4 Data capture

For some Boards there may also be a desire to self-perform on data capture workflows from laser scanning to 360-degree 3D walkthroughs of the progressing project as a means of validation these should be considered as part of the investment model.

1.3 Upskilling

Often BIM fails to meet organisational objectives because those implementing the technologies have limited capability or teams have limited capacity. Ensuring then that staff are adequately trained both in terms of complimentary knowledge and skills is very important. Consideration should be given to the following:

- BIM Learning outcomes framework
- Job profiles v BIM competency framework
- Standard BIM knowledge level training materials
- Technology skills training courses

It is also worth noting that there are many free BIM 101 courses on offer such as the Construction Scotland Innovation Centre (CSIC), supported by Scottish Enterprise and in partnership with the Scottish Futures Trust, BIM Region Scotland and the Scottish BIM Suppliers Group who are helping industry get ready for BIM Level 2 with a programme of free awareness & implementation events.

http://www.cs-ic.org/innovationcentre/skills/bim/

As with most client organisation it is important that the training is biased towards information management and the defining of information as opposed the authoring of models.

From a technology perspective model navigation, in house model reviews, and CDE use will be the main concepts that need addressed.

1.4 Process Mapping

Time should also be set aside for re-processing of workflows to help determine how the new technology stack can help lean or automate current ways of working and support SCIM decision making. (Figure 1-3)

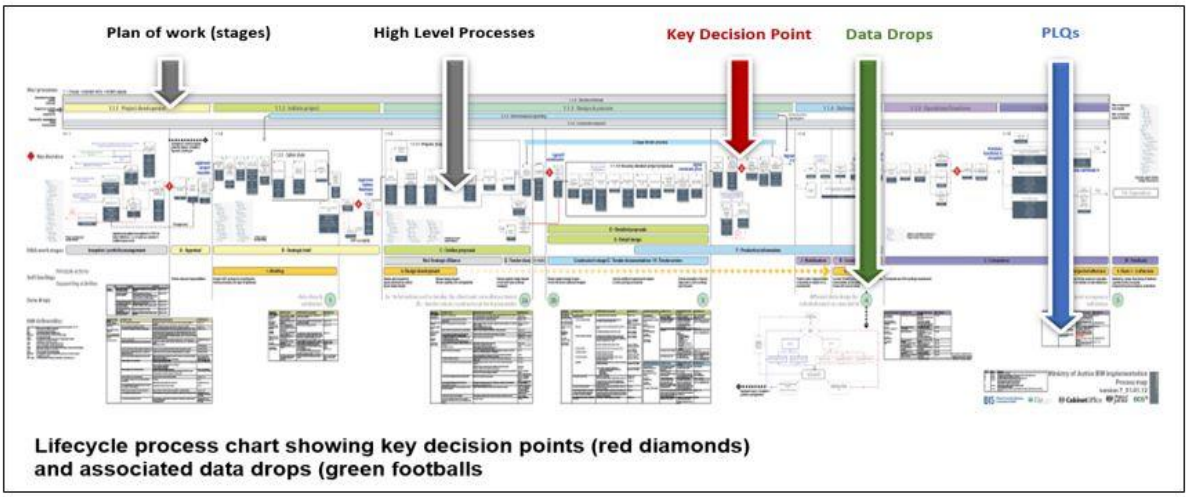

Figure 1-3 Lifecycle process chart

1.5 BIM Level 2 Templates

NHSScotland have a wealth of templates to support the delivery of BIM Level 2 such as Employers Information Requirements [EIRs] and Information Delivery Plans [IDPs]. However it is worth considering who will populate them for a project, either using internal time or external consultancy support.

1.6 Information Management Services

Project information management services are dealt with later in this report however the Board should consider at an enterprise level, especially to support smaller projects, particularly on those without a dedicated Project Manager creating a Board Information Manager position to support same. The Board Information Manager could also curate the Board's operational digital environment.

1.7 Legacy Data and the Digital Estate

A Board may decide that it wishes to create a portfolio wide Asset Information Model (AIM) or Digital Estate that leverages all their existing data and information in a CDE Environment.

The Digital Estate will make it easy for a Board to search, retrieve and make sense of their existing information. Owner operator clients such as Sainsbury's have already undertaken such models. (Figure 1-4)

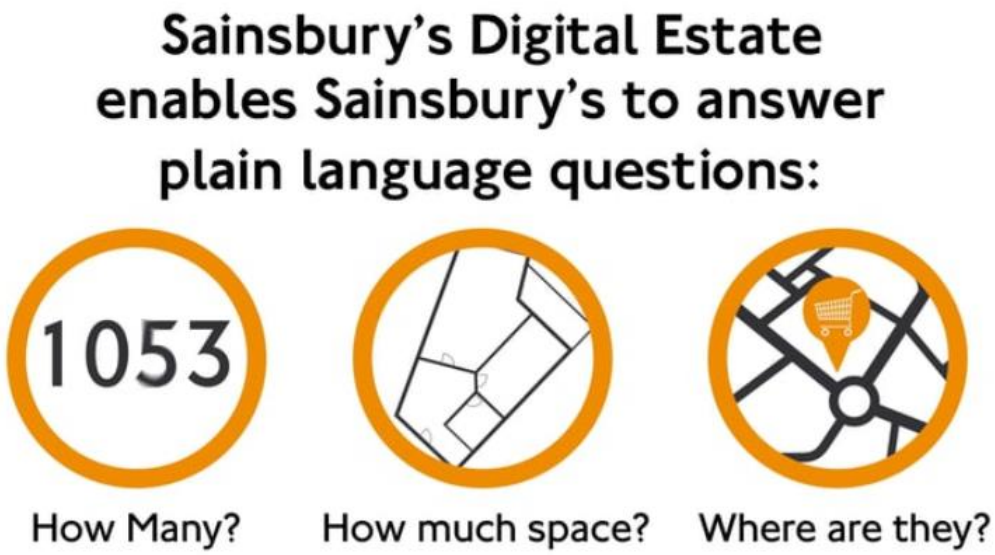

Figure 1-4 Sainsbury's Digital Estate

Investment costs to consider other than the CDE itself include a data quality audit and potential cleansing of same such as improved naming conventions and metadata fields. Costs vary but usually around £50,000 per Board should be set aside as a contingency. Table 1-1 can be used as a basis to create an investment plan aligned with a Board's strategic journey plan.

Table 1-1 Board investment framework

Potential investment need	Cost Type	Likely approximate investment cost (£)	Board Notes
BIM Change Management – Budget Considerations			
Create a road map to identify and inform BIM strategy and BIM vision for Health Board	Potential consultant cost to support and indirect cost of stakeholder attendees at workshop.	£2,500 Direct cost of consultant	
BIM Strategy implementation framework and timeframe	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£3,200 Direct cost of consultant	
Board BIM Lead	Direct staff cost say 40% of week.	Circa £26K per annum	

Potential investment need	Cost Type	Likely approximate investment cost (£)	Board Notes
Develop BIM education strategy for internal and external staff & stakeholders	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£2,800 Direct cost of consultant	
Develop training material: BIM Learning outcomes framework Job profiles v BIM competency framework Standard BIM knowledge level training materials	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£7,200 Direct cost of consultant	
Staff training: general masterclasses and technology specific training	Potential consultant cost to support and indirect cost of stakeholder attendees at workshop.	£1,600 Direct cost of consultant to facilitate / per course [excludes venue hire]	
In-direct cost of staff time for awareness and training sessions	In-direct staff costs.	Board to determine	
Gap analysis report with recommendation to bridge each gap	Potential consultant cost.	£1,600 Direct cost of consultant	
Technology requirements definition	Direct staff cost – BIM Lead or Potential consultant cost	£2,400 Direct cost of consultant	
Technology stack procurement	Direct cost IT procurement team.	Board to determine	
Process mapping – re-engineering key workflows to create digital pathways	Potential consultant cost to support and indirect cost of stakeholder attendees at workshop.	£2,400 Direct cost of consultant	
BIM Implementation Costs – Software and Hardware			
Technology stack licence costs, deployment, training and configuration	Direct costs – annually.	Board to determine	
PC upgrades if required	Capital cost and associated IT build costs.	Board to determine	

Potential investment need	Cost Type	Likely approximate investment cost (£)	Board Notes
New mobile technology if required by BIM strategy	Capital cost and associated IT build costs.	Board to determine	
Server upgrades [if an on premise CDE route is decided upon]	Capital cost and associated IT costs.	Board to determine	
BIM Level 2 Templates			
Configure NHS L2 templates, including: • OIR • AIR • BSAIR • EIR • Soft Landings Plan • Responsibilities Matrix to meet Board specific requirements.	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£6,000 Direct cost of consultant	
Model content plan	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£4,000 Direct cost of consultant	
Common Data Environment			
Scoping of user stories	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£1,200 Direct cost of consultant	
Develop functional requirements	Potential consultant cost to support and indirect cost of stakeholder attendees at meetings.	£800 Direct cost of consultant	
CDE Procurement	Potential consultant cost.	£10,000 Direct cost of consultant	
Configuration, training, data migration deployment and training	Potential sub-contractor cost.	£10,000 Direct cost of consultant	
Licence costs	Year on Year costs	Allow £45,000 annum for AIM CDE minimum [plus year one, one off, implementation costs circa £35,000.	
Information Management Services			
Potential Board Information Manager	Direct staff costs.	Board to determine But suggest circa £55K annum	

Potential investment need	Cost Type	Likely approximate investment cost (£)	Board Notes
BIM Triage Support			
Support to mobilise and support early adopter projects and capture lessons learned	Direct staff costs.	Included in Board Information Manager costs	
Asset Information Model (Digital Estate)			
Develop AIM strategy and schema	Potential consultant cost.	Board to determine But suggest £50K	
Data audit and cleansing	Potential consultant cost.		
Data integration	Potential consultant cost.		
Dash boarding and digital queries	Potential consultant cost.		
Other Digital Workflows			
Continuous data capture and 360 Degree walkthroughs	Potential consultant cost.	Board to determine but suggest £25-45k Project £25K small £35K medium £45K large	

Costs shown are based on a typical medium size Board and larger Board's may need to slightly increase allowances and conversely smaller Boards reduce them.

2 Health Board BIM Investment – BIM Level 1 (Creating the Digital Estate)

Let's now look at likely investment costs for the creation of a BIM Level 1 ecosystem for a Board. The most likely and primary investment need at Health Board level is the Common Data Environment (CDE) which is a central pillar to BIM both in the context of BIM Level 1 and 2, without which it would be difficult to achieve and realise the Scottish Government's BIM Policy. A centralised approach to information management at a portfolio is also where most of the benefits exist.

PAS 1192-2 (2013) defines the CDE as 'a single source of information for any given project or asset, used to collect, manage and disseminate all relevant approved files, documents and data for multidisciplinary teams in a managed process'.

A typical CDE is conceptualised in figure 2-1 where there are two distinct Information Models that are being managed:

Project information model (PIM) information model developed during the design and construction phase of a project [from PAS 1192-2]

Asset information model (AIM) maintained information model used to manage, maintain and operate the asset [from PAS 1192-2]

Data and information that relate to assets to a level required to support an organization's asset management system [from PAS 1192-3]

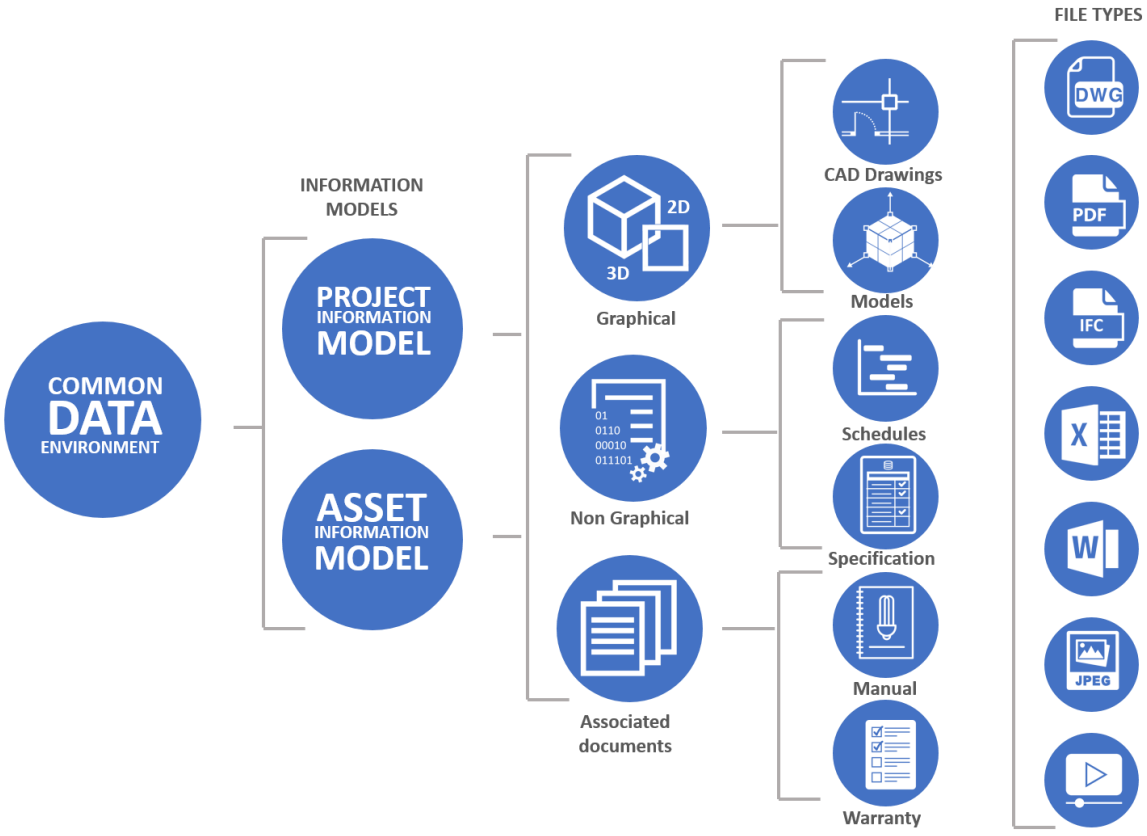

Figure 2-1 CDE concept

Selection of a CDE strategy needs mindful consideration and especially around the typical challenges for a Health Board may encounter including:

- Multiple user and functional requirements to capture
- Complex IT procurement process;
- Cost and resources to procure a system;
- Varied CDE market offerings;
- Varied approached to CDE implementation;
- Developing a system solution compatible to existing Health Board organizational systems such as CAFM.

From discussions most Health Boards are currently focused on the CDE for the PIM [Capex] and in most cases leaving the choice of technology up to the principal supply chain partners however few if any have started their journey towards a centralised AIM which can search a data and information store across the portfolio.

Unless there is a suitable central store for data and information on completion of a project it is unlikely that a Board will unlock the full benefits of BIM Level2.

There are various AIM CDE procurement options that should be considered:

- Procure at a National Level – NHS National Services Scotland
- Procure at a Regional Level
- Procure at a Health Board Level
- Procure on a Project by Project basis

We will now explore these options in turn.

2.1 Option A: Procure at a National Level – NHS National Services Scotland

A national and centralised NHSScotland CDE would have enormous benefits where data can be mined at a strategic level, similar to the 3i studio approach. This solution would also provide each Health Board with their own AIM and PIM environments as illustrated in figure 2-2.

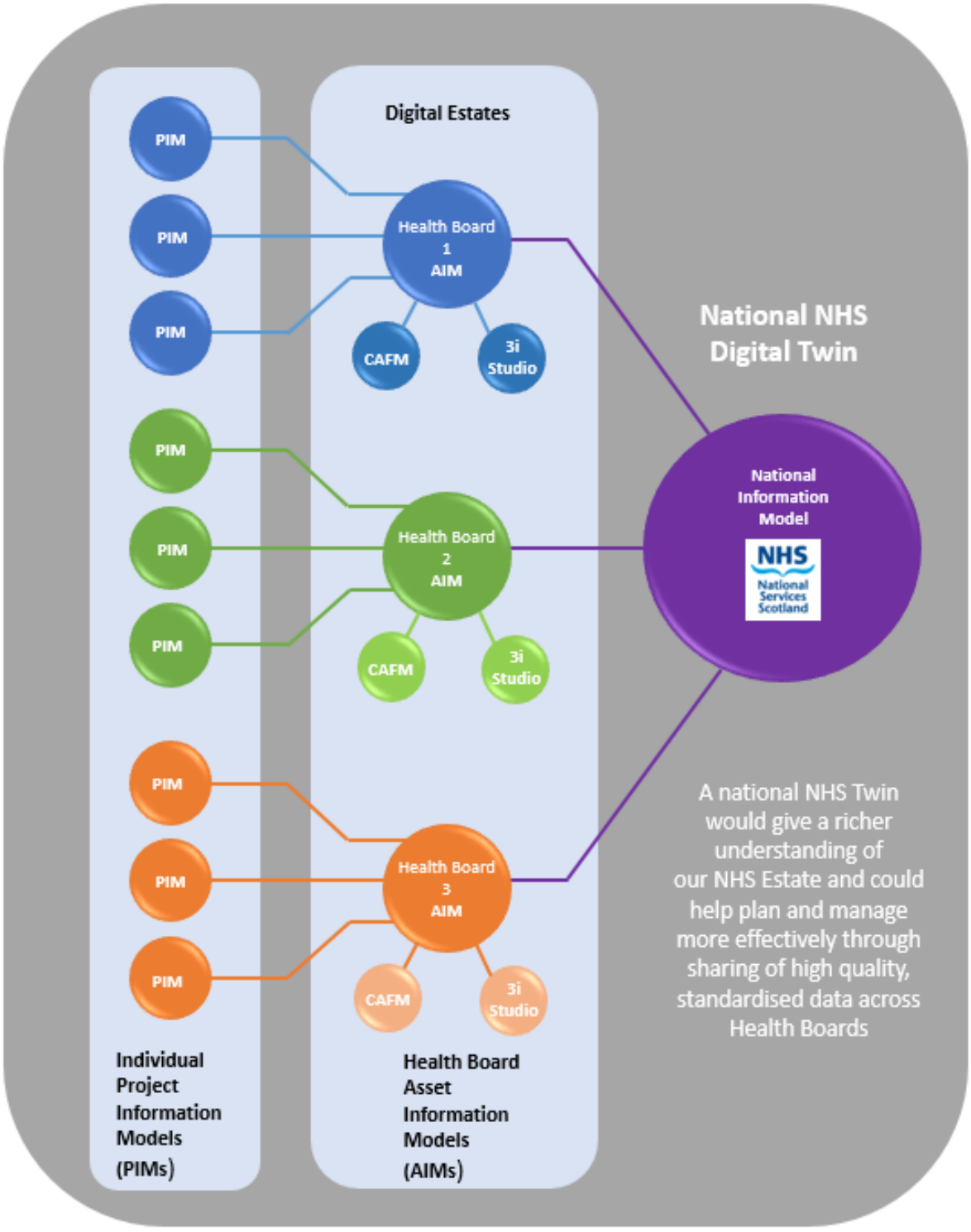

Figure 2-2 A national and centralised NHSScotland CDE

Asset Information Management systems are used by asset-owning organizations. They provide simple, secure access to information for all assets in a portfolio or estate.

It can be helpful to think of the PIM and the AIM as being virtual representations of the assets themselves, containing structured information about the physical and functional characteristics of the assets. They are a collection of model files, drawings, documents and structured data in COBie format.

The AIM ideally contains information about all assets (the portfolio, or 'digital estate'); not just one. It also contains additional and sometimes different information to the PIM, based on what's needed by the Asset owner/operator. For example some construction information may not be deemed relevant for FM/AM purposes.

The estimated cost of a NHSScotland National Level enterprise CDE with unlimited users and unlimited storage would be around £20,000/Month circa £240,000 year [plus a one off estimated implementation cost of £70,000]

This budget would, in addition to product licences for a hosted cloud solution include:

- Support and maintenance
- Access to a BIM viewer and document mark-up tools
- Daily data backup

For some vendors such a deal would require an upfront payment therefor the contract may require some degree of financing.

This over-arching solution would give in turn give every Health Board free access to the CDE each with their own programme and project space.

NHSScotland would be able to aggregate Board level meta-data for reporting, enterprise searching and supporting forward investment planning decisions.

Procurement of such as system would likely need a period of discovery and definition with each Health Board to determine all-encompassing functional requirements harmonised across all. To make the National model work it would need the buy in of all NHSScotland Health Boards.

Benefits could also be unlocked if Boards were to retire existing storage solutions such as on premise servers.

It is recommended that an additional year one budget of **£40,000** be set aside to help assist in the creation of such an RFP and support the CDE tender and procurement process.

Buying the CDE once would also save time and burden as opposed to each Health Board having to go through parallel procurement exercises which would be extremely costly and wastely.

It would also be prudent for each Health Board to set aside a budget for configuring their own Asset Information Model using the NHS Enterprise AIM and for data migration.

2.2 Option B: Procure at a Regional Level – NHS National Services Scotland

A lighter version of the National AIM CDE could be achieved by procuring at a Regional level where the clusters of Health Boards come together.

This would likely be quicker to procure than National level as it would take less time to agree to a common solution however conversely it would lack the volume of users and hence any discount

would be less than a national level. It would also fundamentally lack the aggregated decision making of a National NHS digital twin with only the aggregation of a few Health Board's asset information models.

2.3 Option C: Procure at a Health Board level

With this option each Health Board is going to go through the same procurement exercise individually which has a big multiplier say 16 boards x £10,000 average = £160,000 obviously doing this once, nationally is a more cost-effective option.

Data and information are also now limited to a Health Board Digital Twin so whilst still very valuable it is considerably less so than at a National or Regional level.

There is also less of a licence footprint, say 100 per Board, this would equate to circa **£3,500 month or £42,000 per annum per Board** [plus a one-off estimated implementation cost of £30,000] which is more expensive than a National CDE model where the cost share is likely to be closer to £20k per annum.

A board should also budget additional year one costs for staff training and data migration to the new CDE environment, approx. £15,000 per Board. (Table 2-1)

Table 2-1 Suggest CDE budget for enterprise CDE procurement at Health Board Level

Item	Year 1 Cost £ per Board	Year 2 and then annually. Cost £ Per Board
CDE Procurement	10,000	
CDE Licence Provision	42,000	42,000
Year one estimated implementation costs	30,000	
Training, configuration and Data Migration	15,000	
Contingency	3,000	3,000
Total (£)	**100,000**	**45,000**

2.4 Option D: procure at a Project Level

With this option we are only thinking of buying the Project Information Model (PIM) of the CDE technology to facilitate the capital information delivery cycle as figure 2-3. It is recommended that

for Work In Progress, Shared and Published Documentation this be facilitated through the supply chain; unless there is any explicit reason such as security why this is not practical.

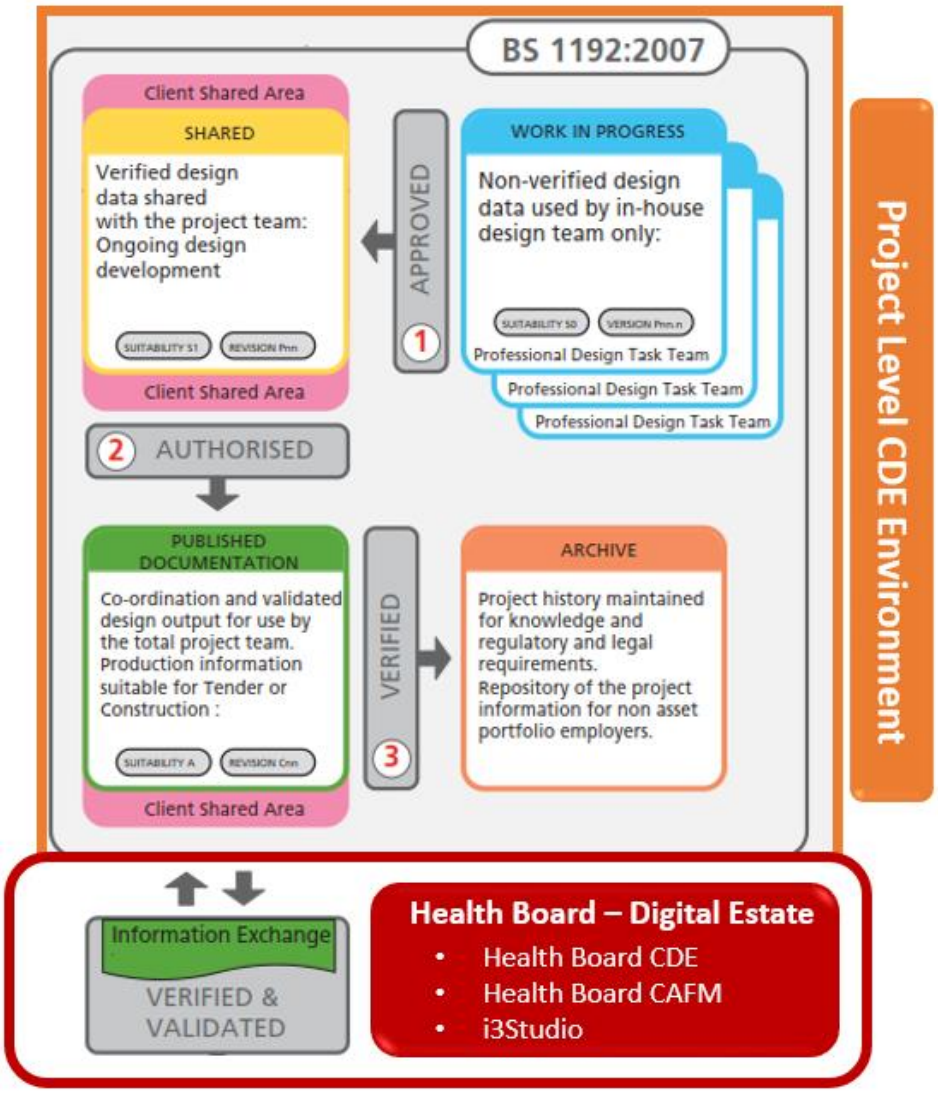

Figure 2-3 Project level CDE

Each Design Discipline and the Main Contractor should ideally remain responsible for their own work in progress (WIP) CDE technologies to hold unapproved information. These technologies will vary from practice to practice and will be aligned with their own internal workflows.

During the initial design stages the lead designer should in addition to their WIP space supply the CDE for the project SHARED area and then pass responsibility to the Main Contractor who, once appointed, will also take responsibility for the PUBLSIHED Documentation area. The responsible party should provide the Health Board and their Project Representatives access to the CDE and a Client Shared Area.

Once information has passed through the PUBLISHED area and has been verified and validated it should then be exported into the Health Board's CDE and data transferred into i3Studio and the CAFM system for curation during the operational stages.

In summary the Board is not buying a technology directly for the project stage but in-directly through the designer and main-contractor appointments. These technology requirements need to

be clearly articulated in the BIM Level 1/2 Employers Information Requirements (EIRs). The Heath Board should not specify a particular technology but be clear on the outcomes they require from their principal supply chain for example:

"The main contractor will be responsible for providing and maintaining a proprietary cloud based Common Data Environment (CDE) system during the project up-to and including completion and handover. The CDE shall have the ability to support managed BIM Level1 / 2 [delete as appropriate] *document management including data store and file repository. The main contractor will be responsible for all information and data storage costs as part of this provision.*

The main contractor shall provide access to all project stakeholders as instructed by the Client's Project Manager. The system will be set up to include a restricted Client Shared Area for Shared and Published documentation. The system will be configured to meet with the requirements of "BS 1192:2007 + A2:2016 Collaborative production of architectural, engineering and construction information. Code of practice." All archived digital information and data will, once verified, be passed to the Client on an agreed portable storage system.

The CDE will require to meet with the requirements of PAS 1192-5:2015 Specification for security-minded building information modelling, digital built environments and smart asset management and any specific client data security standards.

The main contractor shall include for training the client, their representatives and the supply chain as part of the contract in the use of the CDE.

Proposals for the provision of the CDE should be included as part of this response including relevant case studies and details of those within your organisation who will be responsible for the deployment and management of the CDE."

Note: Most lead designers and contractors should have an enterprise level CDE as part of their standard toolkit and the PIM CDE should already be included in Framework 2 allowances.

Table 2-2 illustrates typical project CDE costs.

Table 2-2 Typical project CDE costs where the PIM sits out with the NHS Framework 2

Project Value (CapEx)	Number of licences	Typical Cost / Month
£1-2 Million	25	£1,125
£2-5 Million	50	£2,250
£5-10 Million	100	£3,500
£10+	500	£10,000

2.5 Soft landings

BIM Level 1 and 2 also includes the need to deliver BS 8536-1:2015 Briefing for design and construction. Code of practice for facilities management (Buildings infrastructure). This is essentially a Soft Landings process and requirements for same should be included in the Employers Information Requirements (EIR) or general ER.

BSRIA (owned by The Building Services Research and Information Association) advises that early experience with Soft Landings strongly suggests that first four stages of Soft Landings (inception to handover) should not involve appreciable additional cost. The additional fees and costs will mostly be in the post-handover aftercare stages, to pay for enhanced after-care and independent post occupancy evaluation.

As a reasonable minimum budget allow 0.35% of construction cost on a small [up-to £5m] or complex project and 0.3% on a large or simple project this should also include for soft landings meetings between the supply chain partners and the Health Board's Facilities Management team.

As a minimum, a budget of £6,000 per project should be set aside for a soft landings process.

Further details on Soft Landings can be found at

https://bimportal.scottishfuturestrust.org.uk/level2/nhs-scotland/stage/1/task/5/determine-the-soft-sandings-approach

It is important that PSCPs are made aware of their Soft Landings obligations in the tender documentation including potentially:

- Delivering Soft Landings using: BS 8536-1:2015 Briefing for design and construction. Code of practice for facilities management (Buildings infrastructure);
- Engaging with End Us need to double check this as I don't have an account er stakeholder groups to ensure their needs are inputted into the project design and delivery;
- Facilitation of Soft Landings review meetings using BIM as a basis to support client decision making [for example: 3D walkthroughs and data exchanges to test operational Plain Language Questions];
- Procedures and processes to ensure that their design teams and other appointed parties under their control are aligning their delivery methodologies with the client's operational and performance targets;
- Creating Project Information Models [PIM] with validated information and data at each stage consistent with the project's Master Information Delivery Plan [MIDP];
- Working collaboratively in conjunction with clients to test early on BIM data exchanges into asset registry and computer assisted facilities management systems;
- Preparation of building readiness programmes [pre-commissioning];
- Pre-handover orientation and training with FM Teams and End User communities;
- Creation of validated as-built PIMs linked to operator guides and digital O&Ms;
- Implementing After-Care plans and fine tuning of systems;
- Resolution of operational issues in the after-care process working with the clients FM teams

2.6 BIM Level 1 Tender Documentation

BIM Level 1 also advocates the implementation of PAS 1192-5:2015 Specification for security-minded building information modelling, digital built environments and smart asset management. Whilst initially written for BIM Level 2 it can be simply applied to BIM Level 1 and the Project Team should make suitable allowance for creating a:

- Built asset security strategy (BASS)
- Built asset security management plan (BASMP)
- Built asset security information requirements (BASIR):
- Built asset risk management strategy

In addition to the foregoing as part of the tender documentation the Health Board should define the information management strategy for the project, including the employer's information requirements (EIR) and subsequent arrangements for the capture and transfer of project information and data for operational purposes.

The BIM Level 1 EIR should define its requirements adequately and clearly in terms of the information to be delivered by the design and construction team and its timing, and the standards and processes to be adopted in this regard. The points at which information exchanges are required should be specified in the EIR by reference to the applicable work stage and decision gate (or point). The EIR may incorporate a schedule of plain language questions.

The Health Board should as part of the EIR define the asset information requirements needed for 3iStudio and the CAFM system.

As a reasonable budget allow circa 0.1% of construction costs for the population of these documents using the NHSScotland templates as a base reference.

Table 2-3 summarises typical Level 1 Costs.

Table 2-3 BIM Level 1 Typical Cost summary

	Budget as a % construction cost	Typical budget on a £4.8M (Construction Value) Project
Provision of the Common Data Environment (PIM) Already included in Framework 2 costs	50 Licences X £2,250/Month x 14 months 0.65%	31,500
Soft Landings	**As around £5m then 0.3%**	14,400
Compile BIM Level 1 Tender Documentation	**0.1%**	4,800
Total Budget Allowance [Including CDE]	1.05%	£50,700
Total Budget Allowance [Excluding CDE]	**0.4%**	**£19,200**

Therefore the overall a project allowance for BIM Level 1 should be between:

1.1-1.3% of construction cost where a project information model [PIM] CDE is required

0.4 -0.45% of the construction cost where the PIM CDE is already in the Framework.

3 Health Board BIM Investment – BIM Level 2 (Building on the foundation)

On larger projects or where the SFT BIM Grading tool dictates a BIM Level 2 outcome we now need to consider additional investment costs.

3.1 Model Creation and Management

On larger projects it is likely that the supply chain will already be using BIM tools for the creation of models as part of their day-to-day business as usual and will not require any additional fee.

It is important that model creation, co-ordination, clash reporting and resolution are included in the design appointments

On smaller projects where there may be a need for supply chain upskilling then a small allowance should be budgeted for same, circa 0.4% of construction costs.

Note: BIM and Information Management services are two distinct requirements.

3.2 Information Management Services

The Information Management role should already be part of existing scopes of service however it is worth reviewing and if not then allowance should be made for same.

The British Standard Institute (BSI) describes the Information manager as an organisational representative appointed by the employer or asset owner, who is responsible for establishing governance and assuring data and information flow to and from the common data environment (CDE) during the design, construction, operation and maintenance, and disposal or decommissioning of a built asset [from PAS 1192-5]

Due to the importance of Information Management to the BIM Level 2 process the Information Manager role is mandated in the Construction Industry Council (CIC) BIM Protocol which can be accessed by the link below.

http://cic.org.uk/download.php?f=outline-scope-of-services-for-the-role-of-information-managment.pdf

The role has three main constituents:

- Managing the Common Data Environment
- Project information management
- Collaborative working, information exchange and project team management

It is expected that the Information Manager role will be incorporated into existing appointments. The BIM Task Group noted that the best fit is with either the Design Team Leader or the Project Lead depending on the procurement of the project. However, the skill set required is focused on management disciplines – there is no design responsibility. As a result, other disciplines could potentially undertake the role. Only in exceptional circumstances should a stand-alone appointment be considered by the employer.

The role, if not already included would typically equate to 0.35% of construction costs

Note: It is suggested that the Board assess the capability of their existing supply chain to deliver such a role.

On smaller projects especially on those without a Project Manager the Board should consider creating a Board Information Manager to support same.

3.3 BIM Level 2 Tender Documentation and Supply Chain Capability Assessment

The BIM Level 2 framework places additional emphasis on defining information requirements and assessing the capability of the supply chain. It is therefore suggested that the budgetary allowance is therefore higher than a Level 1 project.

As a reasonable budget allow circa 0.13% of construction costs for the population of these NHSScotland template documents.

3.4 Legal and BIM Protocol

In most cases there will be need for some degree of Legal support for BIM Level 2 projects, from a common addendum to appointment documents to putting in place a BIM Protocol and additional rights and obligations for the employer and the contracted party associated with Building Information Models.

Once a Board has agreed the standard wording for a BIM protocol and standard contract amendments then there is less likely for legal support however a budget of £3,000 should be set aside for a light touch support.

Table 3-1 summarises typical Level 2 Costs.

Table 3-1 BIM Level 2 Typical Cost Summary

	Budget as a % construction cost	Typical budget on a £10M (Construction Value) Project
Provision of the Common Data Environment (PIM) If not already in the framework	100 Licences X £3,500/Month x 18 months 0.63%	63,000
Model Creation and Management	Assumed included in framework or commission fee	0
Information Management Services	0.35%	35,000
Compile BIM Level 2 Tender Documentation	0.13%	13,000
Soft Landings	0.3%	30,000
Legal and BIM Protocol	0.02%	3,000

	Budget as a % construction cost	Typical budget on a £10M (Construction Value) Project
Total Budget Allowance [Including CDE]	**1.44%**	**£144,000**
Total Budget Allowance [Excluding CDE]	**0.81%**	**£81,000**

Therefore, the overall a project allowance for BIM Level 2 should be between:

1.4-1.5% of construction cost where a project information model [PIM] CDE is required

0.8 – 0.9% of the construction cost where the PIM CDE is already in the Framework.

Other complimentary BIM services should be considered over and above the foregoing:

- Virtual Reality Walkthroughs
- 4D programme simulation models
- Progress monitoring using photogrammetry

3.5 Large project cost BIM costs

The percentages offered in the foregoing will typically support a project up to a £25M capital budget. Above this threshold a bespoke investment plan should be developed as there maybe a need for enhanced IT infrastructure or more dedicated BIM and information management roles.

It is recommended that a BIM Healthy Start checklist be undertaken for projects above this threshold to ensure that suitable allowances have been considered for the budget. This will likely involve a meeting with the Board's IT team.

3.6 Summary

This report focuses on the investment costs of implementing a BIM Level 1 or 2 project or Board level enterprise digital estate journey. It should be recognized that there is conversely a significant return on investment if a holistic approach is applied appropriately. It should be recognised that the implementation at an organisational level is a journey and ensuring a committed long-term road-map and strategy that leadership is bought into is a must.

Expectantly this paper will allow you to now create a specific strategic plan for your Board or project.