Employer's Information Requirements (EIR): A BIM case study to meet client and facility manager needs

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ABSTRACT

Purpose: This paper describes the development, testing and case study use of an *Employer's Information Requirements (EIR) Template and Guidance* document designed to meet client and facility management (FM) needs in the Building Information Modelling (BIM) process.

Theory: UK BIM standards and EIR examples formed a basis for drafting the EIR.

Design/methodology/approach: Triangulation using:1) a review of literature and BIM standards, 2) a focus-group; with the *British Institute of Facilities Management (BIFM),* 3) a case study interviews; with the *Glasgow Life Burrell Renaissance Project* who trialled the EIR, and 4) peer-reviews and interviews with BIM/CAFM experts from *BIM Academy[1]* and *FM180[2]*.

Findings: There is need for FM and client specific guidance including how to prepare an EIR. Practitioners are aware of key BIM standards but not in detail. The case study EIR was used by clients, FMs and the design team as a collaboration-tool to bring stakeholders together to discuss and understand the client's information needs.

Originality/value: The full version of *EIR Template and Guidance* document is available at http://www.bifm.org.uk/bifm/knowledge. It provides a practical starting-point for capturing client information requirements in a structured way. It provides design/construction professionals with clear client instructions allowing a well aligned BIM Execution Plan (BEP) in their tender response. This will in turn ensure the BIM process delivers the right information for optimising asset usability and costs over the long term in operation.

Keywords: Facility management (FM), Building Information Modelling (BIM), Operational Information Requirements (OIR), Asset Information Requirements (AIR) Asset Information Model (AIM)

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[1] The BIM Academy website is https://collab.northumbria.ac.uk/bim2

[2] The FM180 website is http://fm180.com

1   INTRODUCTION

Reference to BIM in the construction and FM industries has snowballed in recent years. There is now an almost overwhelming range of BIM standards, best guidance and an increasing body of scientific literature on BIM as everyone tries to jump on the BIM bandwagon. This often presents a problem to FMs engaged in a BIM project who often also have busy day jobs and simply want to find out what they really need to know to get themselves up to speed. This paper addresses one key element of this pressing problem; how FMs can prepare an EIR which is tailored to the needs of the client and facility managers in the BIM process. The research aimed to publish an EIR template (via BIFM) and make it available to their 14,000+ members as well as other stakeholders in 2017. This paper presents the lessons learnt from creating the EIR and its use in practice.

2   LITERATURE REVIEW

One might ask why do FMs and clients need to have a good understanding of the BIM process? A good reason is provided by Eadie, et al. (2013) indicating that in relation to financial benefits for stakeholders in the BIM process, clients will benefit most financially from BIM followed by FMs. This is largely because the operational phase of the whole life cycle (WLC) offers the largest opportunity for delivering value in terms of cost savings, sustainability and usability of assets cost of assets. Akcamete, et al. (2010) note that the O&M of a building equate to 60% of the overall costs of a project and the potential benefits of using BIM for facility operations are compelling. Another good reason is waste. Gallaher, et al. (2004) looked at waste in the U.S. facilities industry. They estimated potential annual savings of; $67 million with respect to wasted time recapturing and transferring of the information provided by architects, engineers, and contractors and $613 million with respect to the automated transfer of information into available CAFM tools.

Dawood and Vukovic (2015) note the "WLC information flow is defined as the steady and continuous evolution and use of BIM information and knowledge from the design stage, through the construction stage, to the facility management stage" (p.1). However, Akcamete, et al. (2010) highlight a worrying trend; the utilization of BIM during building operation and maintenance is falling behind the BIM implementations for design and construction. If this continues and clients and FMs do not engage and define their requirements clearly in the BIM process, many of the potential benefits and savings will not be fully realised in operation.

BIM was mandated for all UK government projects as of April 2016 as part of the *Government Construction Strategy* (Cabinet Office, 2011). It sees BIM as essential to the digitalisation of the built environment sector. All central Government departments must now tender with suppliers to demonstrate collaborative 3D Level 2 BIM maturity through defined and compliant information and data on projects" (BSi, 2016). One of the fundamental principles of achieving BIM level 2 information modelling is the provision of a clear EIR. The UK BIM standard PAS 1192-2 (BSi, 2013) defines the EIR as a "pre-tender document setting out the information to be delivered, and the standards and processes to be adopted by the supplier as part of the project delivery process" (p.4). It notes the "EIR should be incorporated into tender documentation to enable suppliers to produce an initial BIM Execution Plan (BEP)" (p.10). The EIR aim is to ensure user's information needs are clearly defined at the start of the BIM process and it provides a mechanism for collaboration allowing project stakeholders to communicate, manage and deliver client's requirements. However, this requires a clear EIR that sets the processes and standards to be adopted by the suppliers throughout the project life cycle" (Hafeez, et al., 2016, p. 199). Dawood

and Vukovic (2015) note that "lack of in-house expertise is one of the key barriers to BIM adoption" (Dawood and Vukovic, 2015, p. 6). As such it is critical that FMs and clients acquire the skill sets to be able to fully engage in the BIM process and create an EIR that clearly states their information needs and aligns with the client asset management strategy.

3   METHODOLOGY

A triangulation approach was adopted for the development and refinement of the EIR as illustrated in figure 1. This started with a review of literature, industry standards and guidelines. This included the BIM Task Group own *Employer's Information Requirements - Guidance notes version 07* (BIM Task Group, 2013). These were not particularly FM/client orientated and so a new version was drafted focusing on the needs of the client.

The content was further refined through; 1) iterative focus group reviews via eight members of the *BIFM Operational Readiness Steering Group*, 2) parallel feedback from the case study; the *Glasgow Life Burrell Renaissance Project*, and 3) peer-reviews by BIM/CAFM competence experts via the *BIM Academy* and *FM180* organisations. 21 iterations were reviewed in total over a 9-month period whilst the project was running.

Figure 1: Methodological approach to developing the EIR
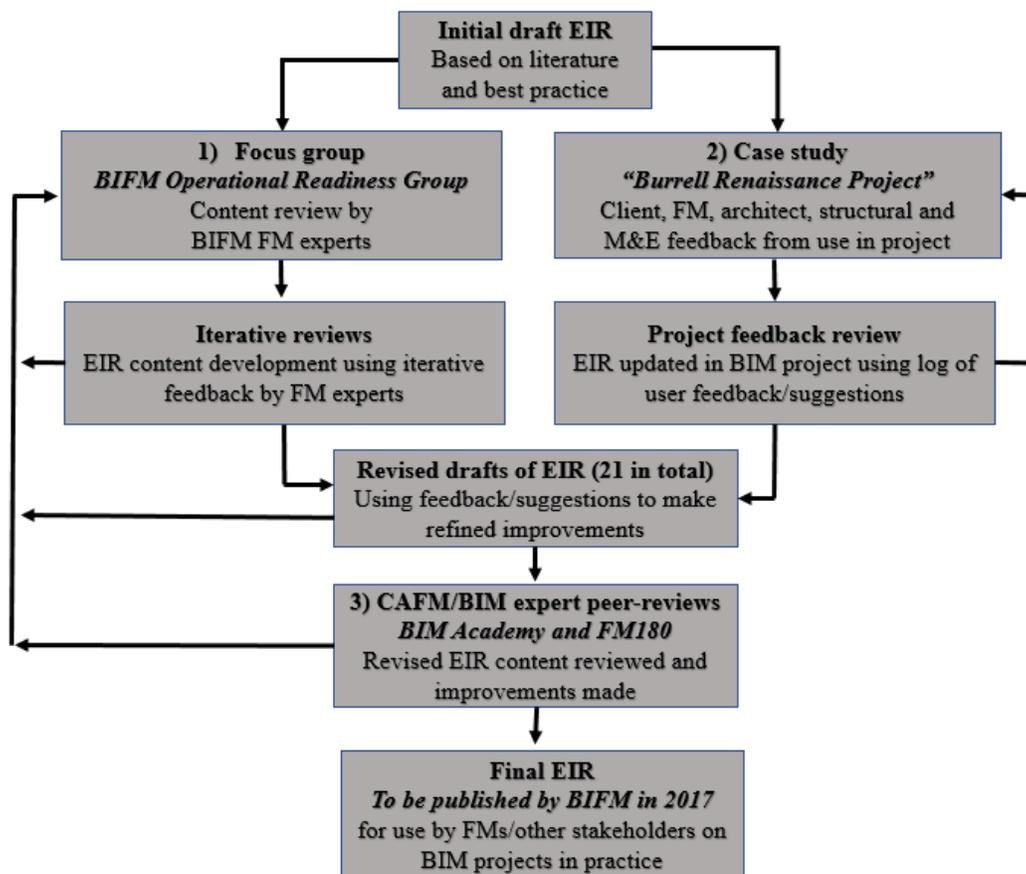
Fifteen people were involved in total as shown in Table 1. Seven stakeholder interviews were held to get user feedback; 5 from the case study, 1 FM consultant from BIFM and 1 BIM/CAFM expert

Table 1: Team members by stakeholder group

Stakeholder group	Key role	Focus Group (8)	Case Study (5)	Peer review (2)	Interviews (Total = 7)
Client/FM	Client – asset/information needs	1	2		2
FM Consultants	FM - information needs	5			1
Architect	Design - architectural input		1		1
Structural Engineer	Design - structural input		1		1
M&E Engineer	Design - M&E input		1		1
BIM/CAFM Expert(s)	BIM/CAFM - compliance			2	1
Academic/researcher	BIM/EIR/FM - research input	2			

Regular focus group meetings were organized (by conference-call) to review feedback/suggestions for improvement. New EIR versions were issued between meetings allowing individual members time to review amendments and provide further comments using the MS-Word track-changes function. In the case study the client/FM team circulated the EIR to the design team for initial feedback. Changes/suggestions were tracked in a change-log and new versions were issued accordingly. Interviews were also held with project stakeholders (see Table 1) to capture ongoing feedback on the EIRs usability. These were then fed into the focus group reviews.

A final round of feedback was collected through external peer-reviews/interviews with BIM/CAFM practice experts. Their comments were also fed back fed for a final review by the focus group. The EIR document was then finalized and will be officially published by the BIFM as part of a suite of BIM guidance documents for FMs in 2017.

3   FINDINGS

The *key topics*, *issues raised* and the *actions taken* to iteratively improve the EIR via the various methods are summarized in the following tables.

Table 2: Feedback and issues raised by the focus group

Key topics	Issues raised	Action taken
FM/Client orientated EIR	Group members agreed there was a clear need to develop an FM/client orientated EIR to address their needs.	The EIR was written and developed from the perspective of the client and FM with the aim of meeting their needs in a BIM project.
Need for guidance on use of the EIR and other BIM guidance documents	Early versions had a mix of general guidance and template text. Also, there was a feeling additional general BIM guidance documents should be provided to help FMs and clients understand how to engage in a BIM project and prepare/use the EIR.	The EIR template was restructured to move all guidance to a guidance section at the start which can be removed on formal issue. The BIFM also now plan further support documents to help get an overview of the BIM process. These are in development and listed in the conclusion section.
Use and reference to existing BIM standards/guidance	In order to be successful, the group agreed the "EIR should make reference to existing BIM standards/guidance" and not attempt to "re-invent the wheel".	BS and PAS BIM standards as recommended by the BIM Task group were used throughout the development of the document and are listed in Appendix B.

Level of Definition (LOD)	There was confusion regarding the term LOD used in the BIM process and if the D referred to Definition, Detail or Development.	It was agreed to use the NBS "Level of Definition" reference as this is actively being used in industry as best practice guidance. The NBS LOD are included in appendix E.
Viewing BIM models and Training	How will FMs view BIM models and get training to understand how to access and use the data in practice.	The EIR includes explicit sections to address how BIM models will be viewed. Training requirements is also addressed as a key topic
Asset Data	How to present the client's needs over the RIBA stages with respect to asset data. Early versions had long lists of tables for each RIBA stage. This was seen as useful but expanded the document considerably.	The decision was taken to remove the tables and use an Excel sheet for the "Information delivery schedule for maintainable assets". The MOJ publicly available example was suggested as a good reference (appendix C).

Table 3: Feedback and issues raised in the case study

Key topics	Issues raised	Action taken
EIR template used as a starting point for client and FM to develop EIR and define roles and responsibilities of stakeholders	The client and FM had little BIM experience. Initially they thought they could simply "ask for a BIM level 2 project and the supply chain would deliver what was needed". They were "unsure how to start the EIR" and "having a template was great help to kick-start the process". It "helped them define roles and responsibilities".	The EIR template has been structured to offer FMs, clients and other stakeholders a starting point to create an EIR. However, it makes clear the client needs to tailor the EIR to their own BIM project. The guidance makes it clear that the client should start by understanding their own OIR, AIR and using PLQ to help prepare an EIR at the start of the BIM process.
Complexity and ease of reading	The early EIR draft used in the case study was seen as trying to provide guidance and also a template. This was seen as helpful but also potentially confusing as it was not clear what to leave in and take out.	The EIR was reorganized to include a guidance section at the front of the EIR template. This can be later removed after the draft has been developed and is ready for formal issue in the BIM project.
Appendices	The early draft was seen as good but it was suggested it could be made better by moving some elements to the appendices.	Eight appendices (A-H) were implemented to help make the document easier to read. These can also be edited out if required.
Knowledge and use of existing BIM standards/guidance and	Some people felt it seemed like "walking through a minefield" trying to "understand all the BIM standards/guidance". Simpler and more specific guidance was seen as needed to help FMs and clients engage. Surprisingly BS 8536 was not referred to at all by stakeholders in practice.	The EIR is one of a suite of documents being worked on by BIFM to help FMs get guidance which focuses specifically on their needs. The EIR points clients/FMs towards using BS 8536 and other useful standards/guidance which are listed in appendix B.
BIM terminology such as OIR, AIR and EIR	The project team refer to the EIR but do not use the terms OIR and AIR. They refer to a project Master Plan.	The terms OIR and AIR are explained in the EIR and guides are planned to provide practice examples by BIFM in 2017.
COBie and the transfer of data to CAFM systems	COBie[3] was understood by all stakeholders as "a key part of the plan to transfer data into Glasgow Life's management systems" (including yet to be defined CAFM). However, there was concerns regarding the LOD with respect	The EIR includes COBie as part of the strategy for data transfer. Stakeholders are advised to use BS 1192-4 (BSi, 2014b). Guidance notes advise the client to consider in the EIR how the LOD is developed for COBie drops and tailored to individual project

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[3] COBie (Construction Operations Building information exchange) is a standard format for data exchange

	to COBie data to be provided by the design team in the early design stages.	needs. (as these could change specific to a project).
BIM as a collaborative tool.	The EIR was generally very well received and is being used as a tool to encourage collaborative working as everyone gets up to speed with BIM.	The EIR can be issued as a draft document for discussion with stakeholders. Questions and issues can be raised and addressed before a final version is formally issued.
Alignment with the RIBA PoW	The initial EIR did not fully align with the RIBA stages which caused some confusion.	The EIR was revised to ensure full alignment with the 2103 RIBA Plan of Work and use the industry standard approach.
Multiple stage EIR	There was some debate as to if two EIRs would be issued. One to the design team and then one for main tendering purposes.	It is recognized that depending on the project procurement route the EIR might be tailored to suit a specific project requirement.

Table 4: Feedback raised by the external peer review

Key topics	Issues raised	Action taken
Clarity and complexity of the EIR	The EIR was seen as "good but fluffy". As a "document issued as part of a contract the EIR needs to be clear and specific".	The EIR was reviewed to remove any unnecessary wording or sections which were considered ambiguous.
Guidance vs. Template	Early versions were seen as trying to provide too much guidance whilst at the same time attempting to be a EIR template	Guidance notes were moved to a single section at the front of the template which can be later deleted prior to contract issue.
Client responsibility to define expectations	Initial drafts did not put enough emphasis on the client responsibility to provide the supply chain with clear requirements which were unambiguous.	The EIR was amended to emphasis the need for clients to take ownership of the EIR and ensuring clear requirements for the supply chain to use for BEPs and tender pricing.
Model ownership	The CIC BIM protocol4 should be used as an industry recognized best practice document to address model ownership.	The EIR section on model ownership was amended to point clients towards using the CIC BIM protocol as part of the EIR.
Using best practice public domain documents	It was recognized that best practice should be referred to where possible. The MOJ released some examples of support documents for the BIM process were recommended as reference documents.	The EIR appendices point to using the MOJ references for both a list of the "PLQ" and a development table "information delivery schedule for maintainable assets".

This paper cannot provide significant detail in the limited pages regarding the final EIR. The full EIR Template and Guidance document content is significant and runs to 69 pages. The full document can be retrieved from BIFM at http://www.bifm.org.uk/bifm/knowledge.

However, Table 5 attempts to give readers an overview of the level of detail and topics covered by the document. It shows the final overall structure of the FM and client orientated EIR.

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4 The CIC BIM Protocol (CIC, 2013) is a best practice document used in contracts to manage model ownership

Table 5: Overall structure of the final version of the "FM and Client Orientated EIR"

0.	General guidance and notes (note: this section is provided as guidance and is removed on formal issue)		
1.	**Purpose and scope** 1.1 The purpose of the EIR 1.2 Use of the terms client, client's representative and contractor		
2.	**Client BIM and asset management strategy and objectives**		
3.	**Project details** 3.1 Project information 3.2 Project contact list		

4. Management Requirements	5. Technical requirements	6. Commercial Requirements
4.1 Applicable standards and guidelines	5.1 Software	6.1 Exchange of information in line with RIBA project stages
4.2 CIC BIM protocol	5.2 IT and system performance constraints	6.2 Supplier BIM assessment form
4.3 Project roles and responsibilities	5.3 Data exchange formats	6.3 BIM tender assessment
4.4 Existing client CAFM/IWMS or enterprise asset management systems	5.4 Common co-ordinates system	
4.5 Model creation and ongoing management	5.5 Levels of definition	
4.5.1 Planning the work and data segregation	5.6 Specified model and information formats	
4.5.2 Model management plan	5.7 Site information, floor and room data information	
4.5.3 Collaboration process		
4.5.4 Model size		
4.5.5 Model viewing		
4.5.6 Volumes, zones and areas		
4.5.7 Naming conventions		
4.5.8 Model co-ordination, quality control and clash-detection process		
4.5.9 Use of BIM to help health and safety		
4.5.10 Delivery of asset information to the client		
4.5.11 Information publishing process		
4.5.12 Security of model information		
4.5.13 Training		
4.5.14 Model audits by the client		

Following feedback from the focus group and case study a lot of information was also moved to eight appendices to help make the document easier to read.

Referring to feedback during the interviews the following generalizations were made; There were varying levels of direct BIM experience; the case study client had none whilst the facility manager had worked on one BIM project; Glasgow Life's Kelvin Hall. Interviewees all agree BIM will have a significant impact on the FM industry but the time period for this impact to be felt by the FM industry varied between "it is having a significant impact now" up to "the real impact will be felt over the next ten years". All the case study stakeholders agreed there is some way to go before all parties are up to speed on the BIM process. However, it was interesting that for both the focus group and case study the EIR was seen very much by all stakeholders as a collaborative tool, which could be used to help a project team get up to speed on the BIM process. There was also no clear idea of what content should be in an EIR.

"Having a good understanding of BIM standards", "early and active engagement with the BIM process" and "understanding how the EIR should be used at the start the BIM process" were seen as key issues that need to be addressed if real value is to be delivered in the operation phase. There was general agreement by all interviewees that the EIR would help benefit not only FMs and clients but also design teams and contractors by giving clear direction to the supply chain regarding the client's information needs. However, they also indicated that clients would need to take the time to create a quality EIR and not use the template with a "copy-paste mentality".

4 DISCUSSION

The UK government has developed standards and guidance in place for the BIM process. They have also set up the *BIM Task Group5* and *BIM Level 26* websites providing free access to most standards and guidance. However, the findings from the interviews and the case study indicate that people are often overwhelmed by the sheer volume of information and do not know where to start when they need to prepare an EIR. This often results in people not knowing what is important to their role and sometimes prevents a full understanding the BIM process as a whole. This was evident in the worrying lack of reference by practitioners to key documents to FM in the BIM process such as BS 8536-1:2015 *Briefing for design and construction – Part 1: Code of practice for facilities management (Buildings infrastructure).* This may be due to it not being originally reviewed on the BIM Task Group site, although it is now referenced on the Bimlevel2 website.

Interviewees noted a lack of examples of key reference documents underpinning the BIM process, namely; the OIR, AIR and EIR. This issue is critical as PAS 1192-2 (BSi, 2013) and PAS 1192-3 (BSi, 2014a) both note that start of the BIM process should be a clear understanding of the client`s OIR and AIR. However, a framework of reference examples in practice are rare and people don't know how to start. This aligns with research from Dawood and Vukovic (2015, p.2) in which they note a framework is required to enable the "whole lifecycle information flow underpinned by BIM". They refer to "four pillars: processes, technology, policy and people". The case study and focus group feedback provided information critical to finalizing the EIR Template and Guidance document over 21 iterations. The key issue highlighted by the research is that people and their knowledge of the process is key to the success of the BIM process. Dawood and Vukovic (2015) sum this up as the *people pillar* including training, competency assessment standards for both, people and organisations leadership, teamwork and others. They observe that the people pillar cuts

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5 UK BIM Task Group website is http://www.bimtaskgroup.org
6 UK BIM Level 2 website is http://www.bim-level2.org

across all three other pillars, as technology, processes and policy will not operate properly unless well-trained and developed human resource are available.

5　　CONCLUSION

The main lessons from the whole process can be summarised as follows: 1) Trying to fully understand and comprehend the BIM process is not easy. This is largely due to the sheer amount of information individuals need to read, understand and internalise. 2) BIM requires a paradigm change in thinking by all stakeholders with a focus on improved planning of client information needs for the future right from the start of a project. 3) FM professionals (and other stakeholders) are not sure where to start when it comes to preparing an EIR. 4) The FM industry would benefit from a framework of easily digestible guidance documents specific to FMs and client needs.

A key aspect from the research with respect to preparing an EIR is that practitioners are looking for good reference examples and guidance. The research has provided such a document and has tested in a real life BIM project as a case study. Based on the findings further BIM guidance is now being developed and provided by the researchers and other BIFM members through a suite of BIM guidance documents available at http://www.bifm.org.uk/bifm/knowledge/resources/BIM. The interviews revealed the need for such guidance and interestingly also referenced the UK Ministry of Justice which has produced a similar framework of BIM documents (Ministry of Justice, 2016). This indicates there is a significant audience who are waiting for such reference examples specifically with their needs in mind.

Ongoing research work is planned with the BIFM to benchmark FM awareness of BIM and address guidance documents for the OIR and AIR. The authors recommend that further research might consider looking at contractually issued EIRs with their respective BEPs to see how they align and to consider further reviews with practice to help improve the current template.

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