

The Role of FM in Preparing a BIM Strategy and Employer's Information Requirements (EIR) to Align with Client Asset Management Strategy

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ABSTRACT

Purpose: To investigate the role of Facility Management (FM) in developing client strategy for Building Information Management (BIM) and Employer's Information Requirements (EIR) in order to define what information is needed, in which format and when in the BIM process.

Design methodology/approach: BIM/FM related scientific literature and UK standards/guidelines were reviewed to establish key documents/terminology facility managers (FMs) should be familiar with when engaging in a BIM project. A workshop questionnaire assessed UK FMs level of understanding of BIM documents/terminology. An *FM-BIM Strategy Concept Model* was subsequently developed to summarise the role of FM in the BIM process.

Originality: The research address a significant research gap regarding the FM role in developing a BIM-strategy/EIR at the start of the BIM process aligned with the client's Asset Management (AM) strategy. The concept model outlines the process for co-creation with clients and other whole life stakeholders to prepare a BIM strategy/EIR based on a solid understanding of BIM standards, guidelines and tools. The *FM-BIM Strategy Concept Model* is based on UK standards. However the general principles could be applied to any country with a similar whole life cycle design, build and operate processes and standards.

Findings: Most FMs have heard about BIM but few have a deep understanding or practical experience. Guidance is needed focusing specifically on what FMs need to know when developing the client BIM strategy/EIR. These documents can then be used to brief stakeholders in the creation of assets to ensure the right information is handed across for operation.

Keywords: Facility Management (FM), Building Information Modelling (BIM), Organizational Information Requirements (OIR), Asset Information Requirements (AIR), Employer's Information Requirements (EIR).

1 INTRODUCTION

Across the world BIM as a process is rapidly becoming the norm in the design and construction industry. Increasingly Governments are now mandating BIM for the acquisition, design, build and operation of their public assets, buildings and infrastructure projects. According to UK BIM

standards the BIM process should start with the client (or FM Representative) carrying out a review of the client's Organizational Information Requirements (OIR) and Asset Information Requirements (AIR) using Plain Language Questions (PLQ) to define what information the client needs from the capital expenditure phase regarding their assets in order to meet the needs of their organization and asset management strategy in the operational expense phase.

Key issues are; FMs practical experience of BIM projects and the time they need to become familiar with the wide range of available standards in order to piece together how to engage in the BIM process. The authors believe the UK Government and industry has done an excellent job in providing industry with a wealth of information/guidance about BIM in terms of standards, guidance and tools. However getting a good overview of the whole BIM process takes time and requires familiarity with a range of different standards and documents which need to be read as a whole in order to make sense of the big picture. In practice many FMs do not have the time to read all the guidance in depth which makes it difficult to piece together how they can best engage. The lead author believes the *FM-BIM Strategy Concept Model* can help give an overview of the role of FM in the BIM process and which documents/terminologies they need to get to grips with.

2 LITERATURE REVIEW

In order to deliver best value from assets it is essential to consider value from a whole life perspective. According to Akcamete et al (2010) the operational cost of assets equate to approximately 60% of the total cost. Early engagement by FM is thus critical in the whole life design RIBA process as “up to 80% of the operation, maintenance and replacement costs of a building can be influenced in the first 20% of the design process” (BSi, 2008, p. 20). Eastman et al (2011) note that “clients stand to benefit on their construction projects by adopting BIM technologies and workflows to guide their delivery process to higher quality and performance for a whole building life approach”. Research by a CIB team broadly concludes BIM can be considered to add value across all the life stages of an asset (Schultz et al, 2103).

Research by Eadie et al (2013, p. 150) indicates that “clients followed by facilities managers benefit most from BIM implementation”. However, they also note that BIM adoption in the operation and maintenance (O&M) phase is currently less than 10% and potentially significant unrealised benefits could be achieved if more focus was given to the impact of BIM in the O&M phase (Eadie, et al., 2013). This aligns with other research on *literature in information technology in FM* (Ebbesen, 2015) which indicates only 25% of research focuses on technology implementation and use in organisations and BIM is the technology most in focus. However the research indicates currently CAFM is the key technology actually being used in practice. According to Burcin et al (2012, p.441) “FM organizations have already started implementing BIM or plan to implement BIM in their processes in the immediate future”. Further research by Adamu et al (2105) considered co-creation through BIM, concluding a procedural framework for Social BIM could be created and demonstrated using real-time shared situation awareness amongst remotely located users. Shepard (2015) suggests in order for the BIM process to deliver maximum value to clients there should be a BIM strategy in place which aligns with the client asset management strategy.

Akcamete, et al (2010, p. 8) also highlight a worrying trend; “the opportunities for leveraging Building Information Models (BIMs) for facility operations are compelling and yet utilization of

BIMs during building operation and maintenance is falling behind the BIM implementations for design and construction”. Liu & Issa (2103 p. 417) suggest “research on BIM use for facility management is lagging behind the study of BIM in design and construction phases”. There is a strong need for FMs and clients to be involved early in the design phase as this is the most appropriate time to ensure decisions are “based upon accurate and relevant information and data, and their impact on operational needs has to be understood before they are committed to construction work and/or installation” (BSi, 2015, p. 7).

BS 8536 is a critical reference document for UK FMs starting to be involved in a construction project. It uses an evidence-based approach and incorporates the essential elements of the UK guidance/standards: Government Soft Landings (GSL), BS 1192, PAS 1192-2, PAS 1192-3, BS 1192-4 and PAS 1192-5 with the focus of preparing a brief for the design team from the client perspective for BIM level 2 projects. It clearly endorses early FM involvement:

The appointment of the operator, operations team or facility manager, as appropriate, should be made before any decision is reached on whether or not to proceed with the project. Where this is impractical, the owner should ensure that expertise on asset/facilities management is available so that operational requirements and the expected performance of the asset/facility form an integral part of the decision making. (BSi, 2015, p. 13)

BS 8536 also promotes the need for the client to assess the organisation’s AIR and manage the production of the EIR (BSi, 2015, p. 21) and “extends the commitment on the part of the design and construction team to aftercare post-handover of the asset/facility and its correct, safe, secure and efficient operation in line with environmental, social, security and economic performance targets”. (BSi, 2015, p. 7).

PAS 1192-3 notes the BIM process should start by defining and specifying what information/data is required at handover to the FM operational team to support the client’s asset management system i.e. in the Asset Information Model (AIM) (BSi, 2014, p. 3). This will ensure the FM team can manage the asset as effectively and efficiently as possible and optimise its performance during operation. Figure 4 in PAS 1192-3 (BSi, 2014, p. ix) depicts a process flow diagram showing the relationship between the various elements of information management. It starts with a review of the client’s OIR in order to generate the AIR, i.e. “the data and information requirements of the organization in relation to their assets” (BSi, 2014, p. 3). The AIR is then used to specify the information requirements for the client’s AIM. The AIR with the use of PLQ helps inform and generate the client EIR. The EIR is defined in PAS 1192-2 as a “pre-tender document setting out the information to be delivered, and the standards and processes to be adopted by the supplier” (BSi, 2013, p. 4). The EIR helps the construction contractor understand what information is needed by the client, in what format and when during each stage of the RIBA whole life stages (RIBA, 2013).

The contractor responds to the client EIR with a BIM execution plan (BEP) which explains “how the information modelling aspects of a project will be carried out” (BSi, 2013, p. 3). On contract award the BEP is developed in the contractor’s master information delivery plan (MIDP) to determine “when project information is to be prepared, by whom and using what protocols and procedures” (BSi, 2013, p. 5). Information is then gradually built up in the contractor’s Project Information Model (PIM) which is the “information model developed during the design and construction phase of the project” (BSi, 2013, p. 5) by the contractor and its supply chain. This is used to deliver information to the client at agreed information exchange points, i.e. “pre-defined

stages of a project with defined format and fidelity” (BSi, 2014, p. 4). This then allows and empowers the FM/client to make informed comments on design and decisions about the continuing project.

However, getting a good understanding of what the client’s OIR and AIR actually are is not as easy as it sounds. This is because each organization is unique and in some case there is no AM strategy written down. In practice, few real examples or templates exist that FMs can refer to for guidance. When starting the development of a BIM strategy FMs need to first review both the client’s existing corporate and AM strategies. The corporate strategy will define the organisation’s vision, mission, aims and objectives. The AM strategy (if one exists) should be aligned with the corporate strategy and might be developed around a standard such as BS ISO 55000 which aims to enable the “organization to achieve its objectives through the effective management of its assets. The application of an asset management system provides assurance that those objectives can be achieved consistently and sustainably over time” (BSi, 2014c, p. v). A good AM system is important to an organisation to help improve informed decision making, financial performance and efficiency and effectiveness of assets, reduce risk, improve services and outputs, demonstrate legal, statutory and regulatory compliance as well as demonstrate social responsibility in terms of reducing emissions, reducing energy use, ensuring ethical business practice and providing better assets to society (BSi, 2014c, p. 2).

By spending more time at the start of the process to fully understanding the organisation’s corporate and AM strategy the OIR and AIR will be easier to define. An ideal place for FMs to start is to ensure they read and have a good understanding of BS 8572 (BSi, 2011). It acts as a guide to the procurement of facility-related services. In addition BS 8536 (BSi, 2015) which explains how to prepare FM briefing documents for design and construction projects. Also important is GSL which provides guidance regarding “a way to improve performance of buildings and to meet the requirements of those that use them” (BSRIA, 2013, p. 1). Taking this approach will allow the creation of a BIM strategy that reflects the AM strategy of the client (Shepard, D, 2015).

As well as the aforementioned documents FMs should also familiarise themselves with other key documents when developing the BIM strategy. PAS 1192-5 (BSi, 2015b) addresses security issues which need to be taken into account in the BIM process. BS 1192-4 (BSi, 2014a) addresses the critical issue for most FMs of data population in their Computer Aided Facility Management (CAFM) tools using the COBie information exchange format to transfer the non-graphical data from the BIM models via Excel exports quickly and accurately into the client’s CAFM tool. FMs may also benefit from an understanding of PAS 91 (BSi, 2013a) which is essentially a client pre-qualification-questionnaire to help establish contractors’ BIM competence. The UK CIC suite of documents are also important for use in standard client contracts. They include; the BIM Protocol (CIC, 2013, S. iv) which “identifies the Building Information Models that are required to be produced by members of the Project Team and puts into place specific obligations, liabilities and associated limitations on the use of the models”, the BIM Protocol-Appendix 1 (CIC, 2013a) which makes suggestions for who should be responsible at each stage and what levels of detail is required for information, whilst Appendix 2 (CIC, 2013b) is a rough framework for generic information requirements. The CIC Scope of Services for Information Management (CIC, 2013c) is a contractual template for outlining the role of the individual who is responsible for Information Management. The CIC Best Practice for

Professional Indemnity Insurance when Using Building Information Models (CIC, 2013d) can be used to cover insurance issues in a contract.

Finally FMs should be familiar with the NBS BIM Toolkit and Digital Plan of Works tool (NBS, 2016), the NBS BIM Library (NBS, 2016a) and Uniclass 2015 system (NBS, 2015) which are important as the BIM Library and Uniclass are used to define BIM objects and their parameters which will end up providing the data for the FM CAFM tool, and the BIM Toolkit which is used to manage responsibilities for outputs in BIM projects (which should include the FM role).

3 METHODOLOGY

A mixed method approach was adopted using data/findings from the authors' previous research to inform the start of the research. A literature review of relevant academic papers and industry standards, guidelines and publications was carried out to establish current levels of BIM use in the operational phase and to identify the key UK BIM standards/guidelines available to help FMs manage and be proactively involved with BIM projects.

A questionnaire was then designed based on the initial research for use at a BSRIA "FM and BIM workshop" in London on 5.2.2016. The purpose of the workshop was to assess FM practitioners (from across various industry sectors) knowledge of the BIM process and understand perceptions of how BIM might be used by, and benefit the FM industry. Six research questions (in a UK context) were investigated: a) What is the current level of use of BIM by FM?, b) When will BIM impact on FM in the future?, c) What is the level of understanding by FMs of the suite of BIM Standards and guidelines?, d) What is the level of understanding by FMs of specific BIM terminology orientated towards FM?, e) What are the FM perceived benefits of BIM? , and f) What do FMs feel are possible concerns and barriers to BIM use and adoption in the FM industry? The literature research and questionnaire findings were then used to develop the *FM-BIM Strategy Concept Model* as part of one of the lead author's ongoing PhD work.

4 FINDINGS

33 members of the workshop completed the questionnaire. Respondents were asked if their company was currently using BIM; 69% said their company was and 31% not. Regarding if their company had a BIM strategy; 67 % reported their company had one and 33% said no. They were also if they were using BIM strategy did it currently align with the company's asset management strategy. 59% said it did align and 41% said it did not. When asked if they expected BIM to impact on the FM industry and their job in the future 100% of the respondents answered yes. With respect to the timescale for BIM to impact on FM; 53% felt that BIM will have a significant impact on FM in 5 years, 21% in 2 years, 15% in 1 year, 11% thought longer than 5 years and no one answered BIM would have no impact. 94% felt that BIM would be beneficial to FM in the future whilst 6% were unsure. When asked if BIM would offer a competitive advantage to companies adopting it (over those that don't) 88% agreed and 12% were not sure. The level of familiarity and knowledge of key standards needed in the BIM process are shown in Table 1. Note: Shortened titles are used in the table with full titles found in the Reference list.

Table 1: FM familiarity with BIM standards and guidelines in the UK

Key BIM standards and guidelines for FM n = 33 for all answers	No knowledge %	Heard of but not familiar %	Know fairly well %	Know well %	Know well and use in Practice %
BAS 1192: Collaborative production of information	9.09	54.55	15.15	3.03	18.18
PAS 1192-2: Construction phase of BIM	12.12	42.42	21.21	6.06	18.18
PAS 1192-3: Operational phase of BIM	12.12	39.39	21.21	9.09	18.18
BS 1192-4: COBie use with BIM	12.12	33.33	27.27	9.09	18.18
PAS 1192-5: Security and BIM	15.15	60.61	12.12	3.03	9.09
CIC BIM Protocol	33.33	27.27	30.30	3.03	6.06
CIC Guide: PI Insurance when using BIM Models	48.48	39.39	6.06	6.06	0.00
CIC Scope of Services: Information Management	45.45	33.33	9.09	3.03	9.09
Government/BSRIA: soft landings	9.09	33.33	27.27	18.18	12.12
Digital Plan of Work (dPoW): NBS Tool	21.21	42.42	15.15	15.15	6.06
Uniclass 2015: Classification system	21.21	36.36	18.18	12.12	12.12
BS8536: FM Briefing for construction	18.18	57.58	9.09	3.03	12.12
PAS 55: Asset Management Guidance	21.21	36.36	24.24	6.06	12.12
ISO 55000: Asset Management	18.18	42.42	27.27	6.06	6.06
PAS91: Construction <u>Pre-Qual</u> Questionnaire	27.27	48.48	18.18	6.06	0.00

The level of familiarity with key BIM terms used in the BIM process is shown in Table 2.

Table 2: FM familiarity with key BIM Terminology in the UK

BIM Process “Term / Terminology” n = 33 for all answers	No knowledge %	Heard of but not familiar %	Know fairly well %	Know well	Know well and use in Practice %
Organizational Employers Requirements (OIR)	12.12	39.39	24.24	9.09	15.15
Asset Information Requirements (AIR)	9.09	33.33	27.27	15.15	15.15
Asset Information Requirements (AIR)	6.06	36.36	30.30	9.09	18.18
Plain Language Questions (PLQ)	12.12	39.39	27.27	12.12	9.09
Asset Information Model (AIM)	6.06	36.36	27.27	12.12	18.18
BIM Execution Plan (BEP)	12.12	36.36	30.30	9.09	12.12
Common Data Environment (CDE)	15.15	33.33	21.21	12.12	18.18

Respondents view as to possible benefits to FM in the future are shown in Table 3.

Table 3: Possible benefits of BIM to FM in the UK

benefits of BIM to FM in the future	Agree	Disagree	Don't know
Note: more than one answer was possible	%	%	%
Visualization of buildings for FM and Clients and Investors	100.00	0.00	0.00
Improved asset management and maintenance time	93.94	3.03	3.03
Improved space management	87.88	9.09	3.03
Quicker cost estimating and long term life cycle costing	84.85	3.03	12.12
Simulations e.g. energy, fire evacuations etc.	87.88	6.06	6.06
Improving the transition handover between build and operation	90.91	0.00	9.09
Lowering carbon emissions	51.52	15.15	33.33
Lowering insurance costs for buildings	45.45	9.09	51.52
Improving health and safety for FM tasks in operation	78.79	3.03	18.18
Direct data transfer into FM management systems (e.g. CAFM)	93.94	3.03	3.03
Adopting BIM can increase profitability	63.64	3.03	33.33

Personal concerns regarding the use and adoption of BIM are shown in Table 4.

Table 4: Concerns regarding the use and adoption of BIM in the UK

Concerns regarding the use and adoption of BIM	Respondents
Note: more than one answer was possible	%
Data Management	63.64
Unknown technology and integration with CAFM tools	48.48
How to include BIM into contracts and legal Issues	42.42
Knowledge regarding BIM standards, guidelines and specifications	39.39
The cost of implementation (resources or time)	33.33
Knowledge about how to set up a BIM strategy (OIR, AIR and EIR etc.)	30.30
Basic knowledge and training about BIM and its usefulness to our organization	24.24

Possible barriers to BIM adoption are shown in Table 5.

Table 5: Possible barriers to BIM adoption in the UK

Possible barriers to BIM adoption	Respondents
Note: more than one answer was possible	%
Lack of in-house expertise	51.52
Cost of set up and implementation	45.45
Lack of client demand	36.36
The projects we work on are seen as too small	12.12
BIM is not always relevant to the projects we work on	9.09

5 DISCUSSION

With respect to the six research questions investigated (in a UK context):

a) *What is the current level of use of BIM by FM?:* Eadie et al. (2013) report current BIM use in operation low at approximately 10%. However, the survey indicates a 100% expectation that BIM will impact on the industry. The findings indicate a gap between expectation and reality and broadly correspond with previous research by Ashworth (2016). The figures indicating 94% of FMs believe BIM will be beneficial to their industry and 88% believing companies who adopt BIM will have a competitive advantage over those that do not also align with research by Eastman et al. (2008) and Eadie et al. (2015).

b) *When will BIM impact on FM in the future?:* The survey indicates most FMs expect BIM to significantly impact on their industry and their jobs within 5 years.

c) *What is the level of understanding by FMs of the suite of BIM Standards and guidelines?:* It is difficult to draw clear conclusions regarding the level of understanding but in terms of generalisation the research shows the majority of FMs have heard of, but are not familiar with key BIM standards and guidelines e.g. BS 8536 (57.58%) and PAS 1192-3 (39.39%). This is of concern as these are key documents for FMs involved in any BIM project. FMs that did have a high level of familiarity tend to work in consultancy or managing/technical director roles.

d) *What is the level of understanding by FMs of specific BIM terminology orientated towards FM?:* The majority of respondents had heard of but were not familiar with the key BIM terms asked about. The answers indicated 6-15% had no knowledge of the terms.

e) *What are the FM perceived benefits of BIM?:* The majority of respondents felt BIM would provide benefits to FM; visualising a building being top of the list followed by improved asset management and maintenance time and direct data transfer into FM management systems (e.g. CAFM). However a significant percentage (51.52%) were not sure if BIM would make any difference to “Lowering insurance costs for buildings” and 33.33% were unsure if BIM can increase profitability and lowering carbon emissions.

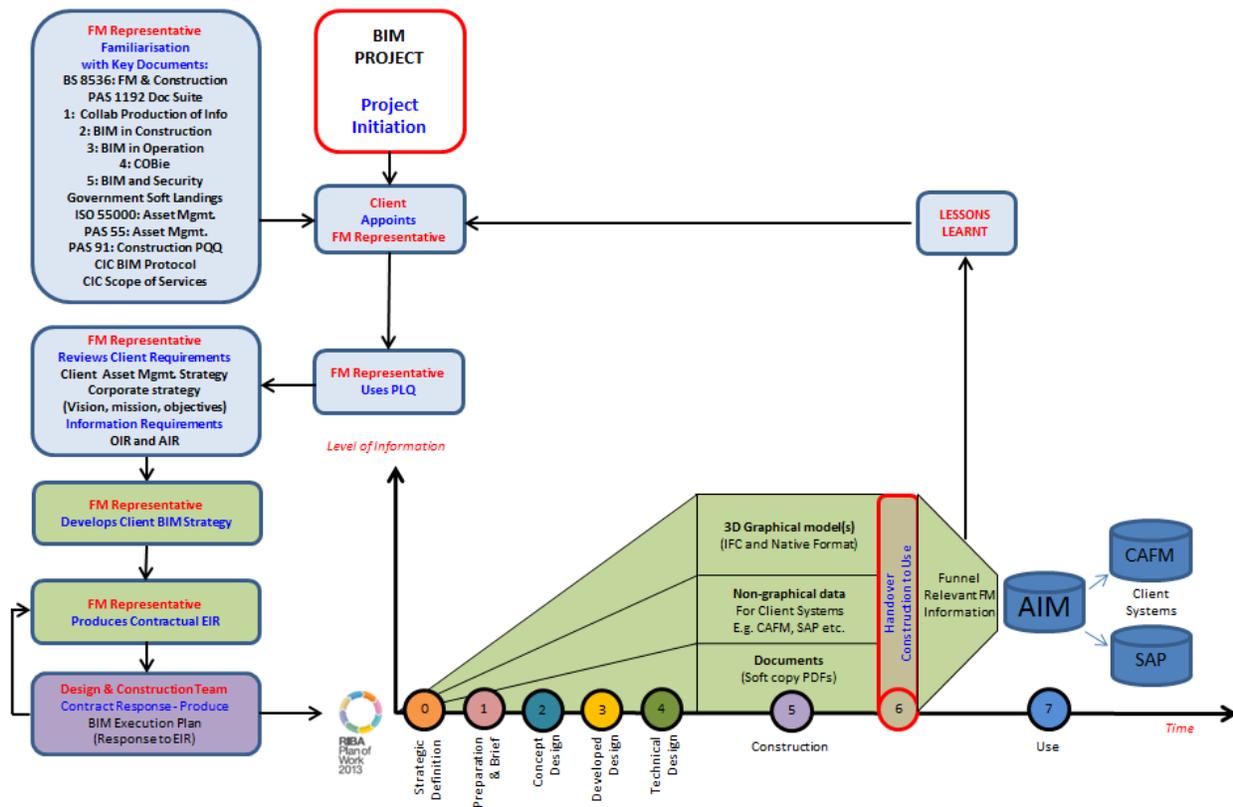
f) *What do FMs feel are possible concerns and barriers to BIM use and adoption in the FM industry?:* The top three concerns were; 1) data management, 2) unknown technology and integration with CAFM tools and 3) how to include BIM into contracts and legal Issues.

The survey was limited in the sense that a wider number of participants than 34 might provide more informed results. It is also UK focused but this was intentional as the guidelines/standards used in the development of the conceptual model are from the UK. However the results do not differ significantly from other research by the authors in the Swiss FM industry. The Author also believes that although a model might need to be tailored to a specific country the basic principles could be easily applied to any country with a similar design, build and operate whole life process.

6 FM-BIM STRATEGY MODEL

The research findings indicate the need for further guidance for FM. The lead author is investigating this further as part of a PhD. Research on the BIM process/UK standards impact on FM was used as the basis for the development of the *FM-BIM Strategy Conceptual Model* (Figure 1) which attempts to summarize key elements of the role of FM in the BIM process.

Figure 1: FM-BIM Strategy Concept Model (Ashworth, 2016)



The Concept model is a graphical representation of FMs role in the BIM process. According to UK standards and key documents e.g. BS 8536, on inception of a BIM project the client should elect a representative to act on their behalf. The Authors view is that this should be a facility manager, as it is especially important if a meaningful early FM input is to be achieved. FM is also ideally placed to understand the organizations needs in terms of its culture, corporate strategy, vision, mission, objectives. They are well placed to understand the asset management strategy (made up of organizational and asset information requirements; the OIR and AIR) and discuss these needs with clients through the use of plain language questions.

The results form the basis of putting together a BIM strategy which includes the client employer’s information requirements (EIR). This document defines what information is required, in which format and when over the whole life process. The EIR becomes a contractual document which is then used by the design and construction team to produce their BIM execution plan stating how they will meet the information needs laid out in the EIR. The whole life (design, build and operate) process then starts (shown in the model based on the stages of the UK RIBA process, but it could apply to any country). As the project develops through the various stages 3 types of information are built up; 1) 3D graphical BIM models, 2) non-graphical data (for use in client CAFM tools), and 3) reference documents. However FM does not need all the information generated in the project. As such the BIM handover planning process should incorporate a reduction process (represented by the “relevant FM information” funnel). This will ensure that only data relevant to FM is transferred into the Asset Information Model (AIM) using COBie or another selected process. This data can then be used in many ways e.g. in CAFM or CRM tools such as SAP.

7 CONCLUSION

In order for FMs to fully engage and participate in the BIM process they need to be engaged early to help ensure the client's information requirements are clearly defined. To properly fulfil this role they need to understand in as much depth as possible the relevant standards and guidelines so they can ensure a BIM strategy and EIR is developed which aligns with the client AM strategy. This will ensure the design and construction supply chain can deliver the right information.

At present the level of understanding of the BIM standards, guidelines and terminology needs to be improved through ongoing education and familiarisation. The author aims to follow a recommendation from the research as part of an on-going PhD to develop a *FM-BIM Mobilization Framework* using the concepts outlined in the *FM-BIM Strategy Concept Model* to provide specific advice for FMs regarding how they can best use the existing suite of BIM standards and guidelines to help develop a client focused BIM strategy and EIR at the start of the BIM process and remain engaged as the project moves from design and construction to build and handover for operation.

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