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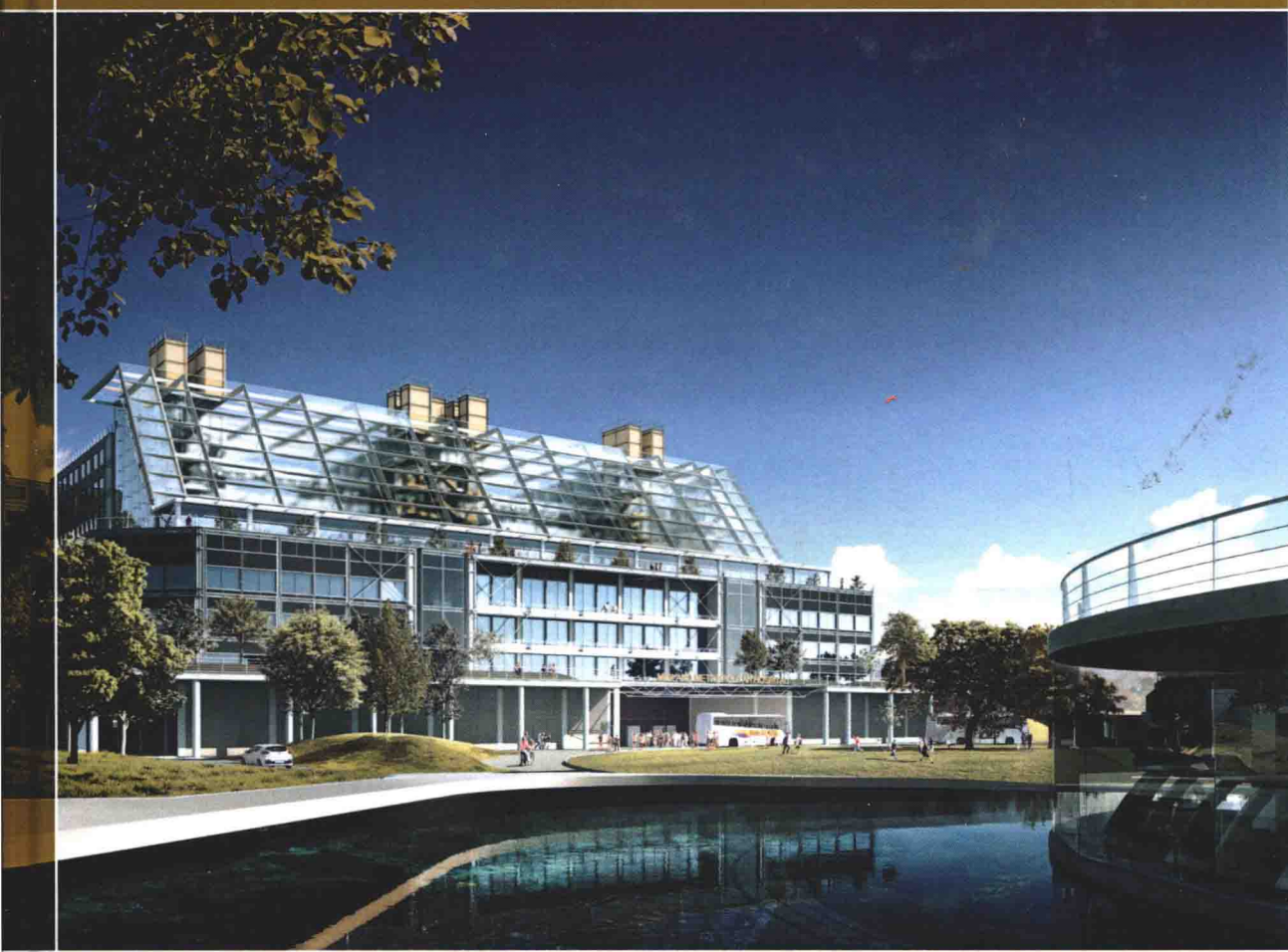

Michael Phiri

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Foreword

Building information modelling (BIM) and the virtualisation of our built environment is becoming increasingly important, especially in market sectors such as healthcare where the UK Government mandate is to 'pull' data-rich projects. The creation of a digitised information management process within healthcare estates will help ensure consistency and facilitate collaborative working, which will in turn reduce waste and non-conformance.

Hospital infrastructure is notoriously challenging, with multiple assets – buildings, systems and equipment – that need to be constantly maintained, adapted or replaced in concert with ever-changing needs. BIM is a great opportunity to help ameliorate these challenges and ensure that computer-readable data flow through the healthcare asset life cycle, supporting the operational delivery and decision-making process. This is especially true in the early stages of a potential project, where BIM (often at a macro level) and cousin data, such as geographical information system data, can help support justification of the business case, such as in determining site options, scenario planning and the creation of a stable, virtually tested brief.

Healthcare operates in a multi-stakeholder environment, where BIM can help facilitate better user engagement, and clear and easier understanding of the proposed options through a data-rich environment. Using 3D models and other immersive techniques it is easier to inform and optimise the clinical planning process and understand how clinical performance can be optimised through simulation techniques. These virtual techniques will help eliminate waste from the design, construction and commissioning process, which is particularly challenging in a healthcare environment. The BIM process will allow the facilities management team and the end users of the asset to test the visualisation and life-cycle solution at the preconstruction stage. The BIM process is about starting with the end in mind through this virtualisation, to ensure that the very best solutions can be realised, be it energy performance, infection control or, indeed, the best design solution that will aid patient recovery. Essentially, BIM needs to be coupled with soft-landings to ensure that the operation and in-use phase is considered and woven throughout the healthcare cycle, and includes a pre- and post-occupancy evaluation process where business intelligence can be derived for asset refinement and adaptation.

The foregoing is particularly relevant, as most healthcare projects are the adaptation, refurbishment or maintenance of retained estate within the context of a live environment. BIM can help rapidly assess key criteria, such as energy performance and logistical planning, for the construction activities, to ensure that they can be undertaken safely and within the stricture of hospital regulations, especially infection control.

Ultimately, BIM will help create and maintain smart intelligent assets that are fit for the provision of twenty-first century

healthcare. The value proposition of BIM will continue to grow, with real-time performance data and the internet of things just around the corner.

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Glossary

AEC – architecture, engineering and construction

AIA – American Institute of Architects

AIM – architectural information model (spatial and material design models)

BEP – BIM execution plan. This outlines the overall vision and implementation details for the project team to follow throughout the project. By developing a BEP, the employer and project members can:

- clarify the strategic goals for implementing BIM on the project
- increase understanding of their roles and responsibilities for BIM model creation, maintenance and collaboration at different stages of the project
- design a suitable process for them to engage in during the implementation
- outline additional resources and services that may be needed
- provide a baseline to measure progress throughout the project cycle.

The content of a BEP includes the following: project information, BIM goal and uses, each project member's role, staffing and competency, BIM process and strategy, BIM exchange protocol and submittal format, BIM data requirement, collaboration procedures and method for handling shared models, quality control, and technology infrastructure/hardware and software.

BIM – building information modelling

- *Building information model – Product.* An object-based digital representation of the physical and functional characteristics of a facility. The building information model serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during the life cycle of the facility, from inception onwards.
- *Building information modelling – Process.* A collection of defined model uses, workflows and modelling methods used to achieve specific, repeatable and reliable information results from the model. Modelling methods affect the quality of the information generated from the model. When and why a model is used and shared impacts the effective and efficient use of BIM for desired project outcomes and decision support.
- *Building information management – Data definition.* Building information management supports the data standards and data requirements for BIM use. Data continuity allows for the reliable exchange of information in a context where both the sender and receiver understand the information.

BMP – BIM management plan – provides a master information/data management plan and assignment of roles and responsibilities for model creation and data integration at project initiation. The BMP aligns the project acquisition strategy needs and requirements with technical standards, team member skills, construction industry capability and technology maturity. Through this process, the team members and project management jointly agree on how, when, why, to what level and for which project outcomes BIM will be used.

- Design BMP: outlines the strategy and schedule for using BIM technology to execute design activities and project coordination.
- Construction BMP: outlines the strategy and schedule for using BIM technology to execute construction-related activities and project coordination.

BRE – Building Research Establishment

BREEAM – BRE's Environmental Assessment Methodology

BSI – British Standards Institution

BSIM – building services information model

BSRIA – Building Services Research and Information Association

CAD – computer-aided design – a geometric/symbol based computer drawing system that replicates hand-drawing techniques

CAFM – computer-aided facility management

CAM – computer-aided manufacture

CDE – common data environment. This brings together all project information in one place – it is the central point for data. Multiple parties feed their data, such as documents, drawings and plans, into the CDE, and even though each stakeholder might be using different software, all the data are integrated, and so can be accessed by everyone – there are no technology barriers. Utilised across the full life cycle, the CDE is vital for control and visibility, efficiency and performance, plus delivery of the quality of information necessary for asset phase utilisation. Who you are dictates what data you need from the CDE, with data being the key driver for BIM.

CIAT – Chartered Institute of Architectural Technologists

CIBSE – Chartered Institution of Building Services Engineers

CIC – Construction Industry Council

CIOB – Chartered Institute of Building

COBie – Construction Operations Building Information Exchange. The model and facility data for the commission, operations and maintenance of the project. The COBie spreadsheet is part of the US National BIM Standard (NBIMS) requirements, and must be submitted in compliance with the commissioning requirements. The data expected from BIM for facility handover shall conform to the following standards: Uniformat, OmniClass, Geospatial, NBIMS, COBie, US National CAD Standard, and IFC standards for building information. COBie data in the form of the COBie Excel spreadsheet and related commissioning information shall be delivered electronically in formats suitable for integration into current and future CAFM systems.

CPIC – Construction Project Information Committee

EIR – Employer's Information Requirements

FIM – facilities information model

FM – facilities management

FTP – file transfer protocol

GIS – geographical information system

GSL – Government Soft Landings

HIM – healthcare information modelling

HTML – Hypertext Markup Language

iBIM – integrated BIM

ICE – Institution of Civil Engineers

IDM – information delivery manual

IFC – Industry Foundation Classes (data format). A system of defining and representing standard architectural and construction-related graphical and non-graphical data as 3D virtual objects to allow data exchange among BIM tools, cost-estimation systems and other construction-related applications, in a way that preserves ability to perform analysis on those objects as they move from one BIM system to another, with the latest IFC format accepted. For many projects, a

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design professional either saves or exports an IFC file from the BIM-authoring software of their choice for the following tasks:
- coordination of BIM models and related design disciplines
- clash detection
- rules-based checking
- building code compliance
- sharing models between different BIM-authoring software systems
- COBie data derived from BIM models
- energy-testing data derived from BIM models
- systems simulation.

IFD – International Framework for Dictionaries

IPD – integrated project delivery

IS – information system

ISO – International Organization for Standardization

IT – information technology

JCT – Joint Contracts Tribunal

LEED – Leadership in Energy and Environmental Design assessment methodology

MEP – mechanical, electrical and plumbing

NBS – National Building Specification

NIBS – National Institute of Building Sciences (USA)

NLP – Natural Language Processing

OGC – Office of Government Commerce

OmniClass – The OmniClass Construction Classification System is a classification system for the construction industry developed by the Construction Standards Institute. It is used as a classification structure for electronic databases. As the basis of its tables, OmniClass incorporates other existing systems currently in use, including MasterFormat for work results, UniFormat for elements and EPIC (Electronic Product Information Cooperation) for structuring products.

open BIM – A universal approach to the collaborative design, realisation and operation of buildings based on open standards and workflows. Open BIM is an initiative of buildingSMART and several leading software vendors using the open buildingSMART data model.
Open BIM Programme is a marketing campaign initiated by GRAPHISOFT, Tekla and other members of buildingSMART to urge and facilitate globally coordinated promotion of the open BIM concept throughout the AEC industry, with aligned communication and common branding available to programme participants.
Open BIM Certification is a technical certification system being developed by buildingSMART to help AEC software vendors improve, test and certify their data connections in order to work seamlessly with other open BIM solutions.

pBIM – proprietary BIM

PDF – portable document format

QA – quality assurance

QC – quality control

RIBA – Royal Institute of British Architects

RICS – Royal Institution of Chartered Surveyors

RFI – request for information

ROI – return on investment

SIM – structural information model

Space measurement – A fundamental method for measuring area that synchronises in a practical way with major BIM authoring tools. *Tip*: When representing a double wall in the BIM model, build the wall components or layers as a single-wall object. This allows for quantity takeoff by material, or by system, and simplifies the overall building of the model.

- *Area*. The area bounded by the inside faces of surrounding walls, minus the area bounded by the outside faces of contained full-height columns will be the net area of a space. BIM authoring tools allow areas to be automatically delineated based on the footprint of surrounding walls, which create a polygon, or based on a manually drawn polygon. The areas of contained columns can be automatically subtracted in a flexible, size-dependent way, to yield a net area. Manual methods for delineating areas are required to allow centerlines of adjacent spaces to be used while allowing the corridor face to bound the space on the corridor side.
- *Volume*. Space volume is determined manually and geometrically by specifying an area footprint and assigning a height to it. Volumetric calculations may require some adjustments in how the BIM model is constructed and how space is delineated, in particular with regard to multistory spaces and cavity walls. As with BIM tools that create and place building elements, BIM 'space objects' must be used in the way prescribed by the BIM authoring software if volumes are to be correct, if equipment location reports are to be correct, and if the exported IFC model for analysis is to yield correct results. For example, the count of occupied space volume under sloped building elements is typically adjusted to accommodate concepts of usable space. On the other hand, equipment can occupy the space otherwise not counted as usable. The design team may find that for correct reporting purposes, different categories of space enclosing nearly the same volumes will have to be defined in the BIM and reported out judiciously.

UKCG – UK Contractors Group

UniClass – Unified Classification System. A coding system for building components (published by CPIC)

VDC – virtual design and construction

VO – variation order

WR – work results table (CPIC UniClass 2)

XML – Extensible Markup Language

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