The Role of BIM in Retrofit 2050 Within the UK Social Housing Sector

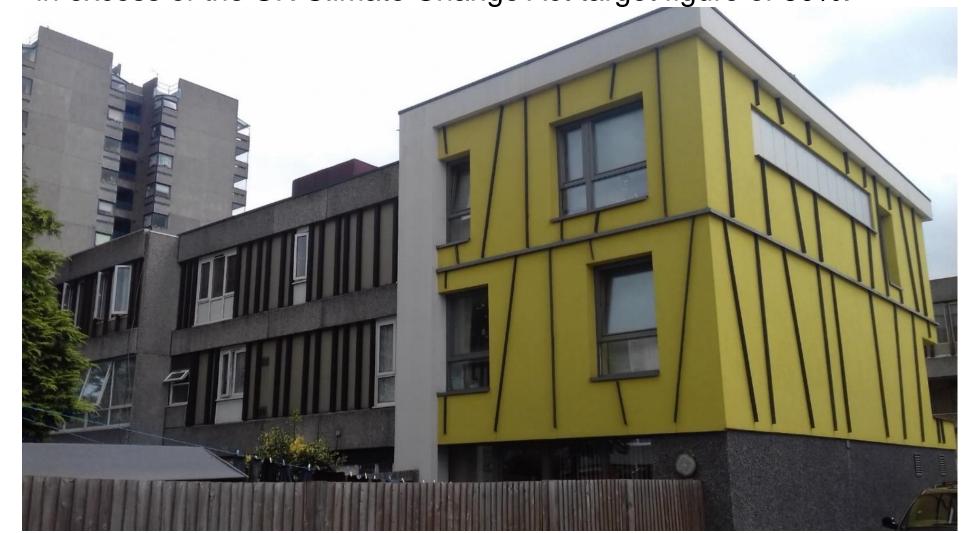**Presented by Steve Phillips. Supervised by Dr Tim Forman.**

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INTRODUCTION

- Building Information Modelling (BIM) is a process that creates value through the whole life of an asset, underpinned by the production, collation, and exchange of shared 3D models with intelligent structured data attached to them which may include full integration of carbon data.

- The benefits of using BIM are that it; increases stakeholder collaboration, reduces errors and omissions during the design phase, minimises on-site rework due to clearer working drawings, it provides a mechanism for better cost control during both the construction and maintenance of a building and can lead to savings in overall project expenditure.

- However utilising BIM on existing buildings can pose unique technical challenges with respect to; the capturing of as-built data which is normally incomplete, problems with point cloud location accuracy and issues of interoperability in data exchange between construction professionals can also occur.

BIM AND ENERGY EFFICIENT RETROFIT

- Energy efficient retrofit introduces new materials, products and equipment into an existing building with the aim of reducing the use of energy of the building.

- There is strong synergy between BIM and retrofit as BIM allows a designer to undertake Environmental Performance Modelling which uses analytical and simulation technologies to improve sustainable outcomes

- In the dwelling house shown below BIM was used to design the project ,plan the work flows and monitor the energy with respect to the retrofitting work.

- Insulation levels were increased by recladding the property and allowing the mass of the original concrete building to act as a heat store thus reducing the demand for space and water heating.

- Coupled with a whole house ventilation system the energy efficient retrofit works reduced the property's carbon emissions by 87% which is in excess of the UK Climate Change Act target figure of 80%.

FRAMING THE PROBLEM

- 2050 is the deadline for CO_2 emissions in the UK to be reduced by 80% with 25% of these emissions being attributable to the residential sector.

- Approximately 4 million homes are being managed by social housing landlords. 80% of these dwellings will still be in use in 2050.

- The UK Government advocates energy efficient retrofitting of the existing housing stock to help meet the carbon reduction targets.

- The Government's industrial strategy supports the adoption of BIM as a collaborative way of working throughout the UK construction supply chain.
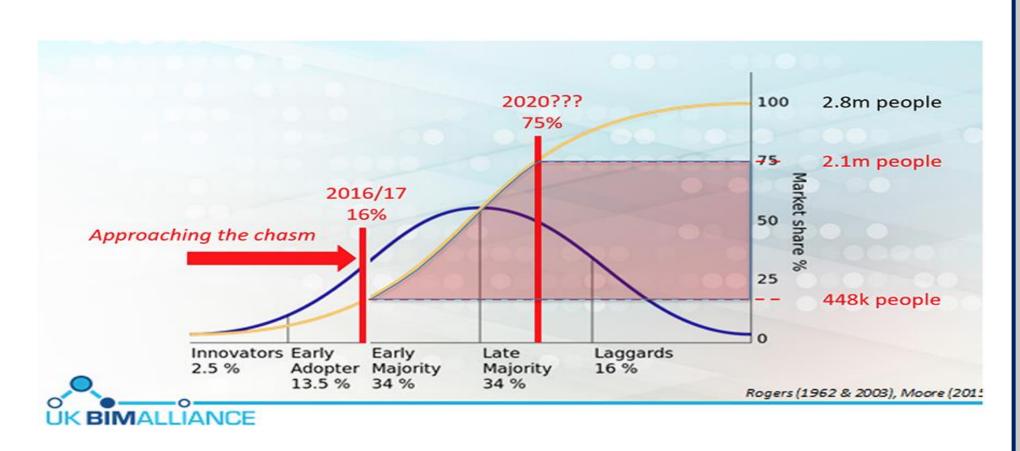
RESEARCH OBJECTIVES

1. Has the innovative use of BIM been accepted within the UK social housing sector with respect to retrofitting works and, if not, what are the drivers/barriers to its implementation?

2. Identification of areas and roles where BIM could contribute to the Retrofit 2050 challenge.

RESEARCH METHODOLOGY

- The methodology used was an exploratory sequential mixed method approach with data being collected by semi-structured interviews and an online questionnaire. In part it seeks to ascertain if Roger's diffusion theory can be used to predict whether BIM can "cross the chasm" within the social housing sector?

CAN BIM CROSS MOORE'S CHASM ?

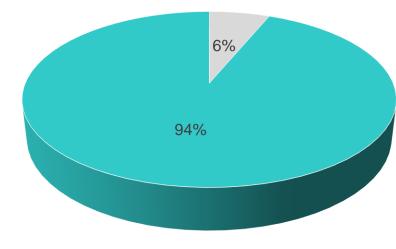Rogers (1962 & 2003), Moore (2013)

UK BIM ALLIANCE

- 10 interviews were conducted with senior figures across the UK Social Housing sector including; senior managers of major housing associations, managing partners of large AEC consultancies, the chief engineer of an innovative energy efficient retrofitting company, a BIM software expert and a leading expert witness in the field of unintended consequences.

- The online questionnaire, which contains both open and closed questions, used purposive sampling to collect data by sending participation emails to 100 senior decision makers and procurement directors within the social housing sector.

RESULTS

- Only 6.25% of the questionnaire respondents are currently using BIM for their residential retrofit projects.

Use of BIM on Retrofit Projects

- Yes ■ No

- The most common reason given for not using BIM was that they "did not really understand how BIM operates".

- **THEMATIC ANALYSIS-** Preliminary codes and themes have been identified within the interview data which indicate the following drivers and barriers with respect to the adoption of BIM;

+ CITIES & URBAN RETROFIT - BIM may play a core role in the socio-technological transition of scaling up sustainable urban retrofit from an individual building level to a city wide basis as it has the functionality to deal with the complexity and uncertainty of the change process.

+ CONSTRUCTION INNOVATION - BIM in conjunction with 3D laser scanning is being used to produce technical drawings that steer a flexible factory in making prefabricated elements for innovative zero carbon retrofits to social housing dwellings.

▬ DIFFUSION THEORY - A perceived relative advantage is an important predictor in the adoption of BIM but if any perceived advantage is minimal then a decision maker can decide to reject BIM based solely on this single assessment.

▬ UNINTENDED CONSEQUENCES - Proprietary BIM software can be used to model issues such as humidity, indoor air temperatures, and air flow at the design stage which could assist in reducing the incidents of unintended consequences such as damp and mould growth but there is no appetite to use the software.

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