BILINGUAL PUBLISHING CO.
Pioneer of Global Academics Since 1984

Journal of Construction Research
https://ojs.bilpublishing.com/index.php/jcr-b

ARTICLE

BIM and Design Briefing Integration: Feasibility Study and Conceptual System Framework Development

Supreet Lama Changfeng Fu*

School of Computing and Engineering, University of West London, Ealing, London W5 5RF, the U.K.

ARTICLE INFO

Article history
Received: 11 March2021
Accepted: 14 April 2021
Published Online: 10 May 2021

Keywords:
Design briefing
Conceptual design
BIM
Stakeholder collaboration
POE

ABSTRACT

Design briefing plays a crucial role in the success of a building project. Some new methods of design briefing have been developed recently, but rarely integrated with Building Information Modelling (BIM). This paper presents a feasibility study of implementing BIM in the design briefing and develop a conceptual system framework to present possible functionalities and processes of BIM-based design briefing. This study started with a series of the interviews with professionals in the industry as well as academics in various universities in the UK. A thematic analysis has been carried out to analyse the interview transcripts. The development of conceptual system framework following the software engineering method presents the major functional modules and relevant datasets of a BIM-based design briefing system which identified in the interviews. The paper also discusses on both the benefit and the potential difficulties of BIM-based design briefing, although 93 % of the interviewees agree that BIM technology should be adopted in design briefing to improve the quality & process of design and to involve other stakeholders and POE data in design briefing.

1. Introduction

Design briefing is a process of identifying, developing, and communicating clients' visions, requirements, and aspirations in the pre-design stage of a construction project [1,2,3]. The document developed as a result of this process is the design brief. Briefing is a crucial part of every project, but it is treated more as an obligatory event than a process [4]. The briefing process also provides the design team with an insight into the client's aspirations, wants, requirements and constraints, which are used by architects and design team to develop one or more design solutions [5]. Hence, the efficient management of the briefing process and a structured, holistic, and integrated design brief is crucial to the success of every project [6,7,8] (Tunstall 2007, Bogers et al 2008, Chung et al. 2009).

The importance and value of the design briefing process and the design brief itself have been stressed in numerous literature such as The Latham Report [4], Barrett & Stanley [5], Hansen & Vanegas [10], Murphy & Hands [11]. However, the briefing process has been undermined and undervalued, and have not received equal devotion and improvement relative to other phases such as design, construction, procurement, management methods and technologies [4,12,13,14]. One example of such development is Building Information Modelling (BIM), which has provided improvements to almost all the aforementioned phases but has left out of the briefing process [14]. Past re-

**Corresponding Author:*
Changfeng Fu,
School of Computing and Engineering, University of West London, Ealing, London W5 5RF, the U.K.;
Email: Charlie.fu@uwl.ac.uk

DOI: https://doi.org/10.30564/jcr.v2i2.2960

search in design briefing have focused on improving parts of the briefing process such as communication between stakeholders in the briefing stages [8,15], data collaboration between the client and the contractor [16] and the development of a web-based briefing tool [10] amongst others. However, none of the studies have proposed an implementation of BIM in the design briefing process.

The Banwell Report [17] published in 1964, was one of the earliest documents to raise concerns regarding briefing practices. The report summarises the client's lack of knowledge regarding their need at the outset, even though they are investing money in the project, as well as the lack of resources in defining project requirements. The Latham Report [4] published in 1994, reiterated the need to understand the needs of the client and stressed on the importance of spending enough time for a good brief to avoid delays and cost overruns later in the project. The report also suggested getting the brief 'right' as a means of delivering a project effectively, which requires an efficient process of collecting and translating client requirements.

Currently, based on the checklist provided by RIBA [18,19], only 'preparation for use of BIM' in a project is carried out during stages 0-1, with the actual graphical and non-graphical BIM data being added during Stage 2: Concept Design. Hence, this research aims to novelly explore, study, and depict an effective and integrated method to implement a computer software solution for the development of BIM data in the pre-design stages. This can assist the client in making decisions early in the project, realise what may or may not be possible and provide the design team with early support and data from stakeholders that can be integrated into the project.

Due to the nature of this research, which seeks to ultimately develop a software solution and verify its effectiveness, the principles of software engineering have been followed as the methodology. This methodology follows the procedure of feasibility study, requirements engineering, conceptual system framework development, prototype development and testing/verification [20,21]. This paper, however, focuses only on the feasibility study of implementing BIM into the design briefing stage, requirements engineering and the development of a conceptual system framework.

2. Background

2.1 Traditional Process of Design Briefing

The illustration in Figure 1 depicts the traditional process of design briefing up to concept design as suggested by the updated RIBA Plan of Work (PoW) 2020. While this is simply a guidance developed by RIBA, the actual process of how design briefing is conducted and how information is processed depends on individual practices and practitioners. However, since RIBA is the professional body for architects and their PoW is one of the oldest (since 1963) and widely used within the field of architecture, the decision was made to use this as the base for this study. While the PoW template itself does not mention BIM, the overview document [22] suggests how and in what form BIM can be used in a project. However, this document does not contain any mention of the use of BIM before the stage 2: concept design.

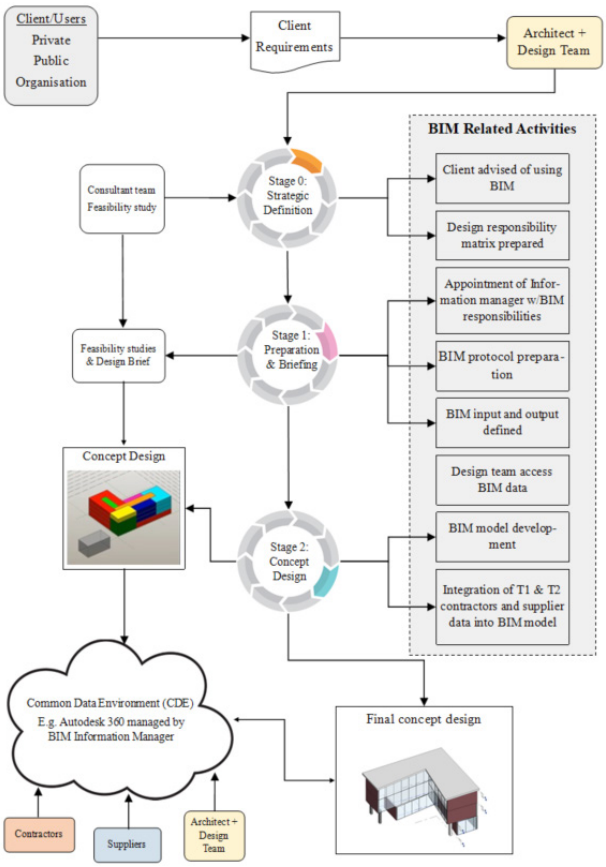

Figure 1. Project development with traditional method of design briefing based on the RIBA Plan of Works 2020.

There are a number of BIM activities that can be carried out in the pre-design stages. However, these are mostly concerned with preparation for use of BIM at later stages, which includes activities such as advising the client on the purpose and benefit of using BIM, designing a responsibility matrix, and appointing a BIM manager among others activities [23]. The actual process of briefing, where the client presents their requirements, based on which various design solutions are developed by the architectural team does not make use of BIM in any form.

There have been some developments in the past, aimed at improving the traditional design briefing process. Ka-

mara et al. [1] developed a Client Requirement Processing Model (CRPM), which would rigorously process client requirements for better understanding before commencing any design as well as facilitate design innovation. Hansen and Vanegas [10] proposed a more robust approach to improve the briefing process through automation of the design briefs with the development of a web-based tool. More recent study such as Koutamanis [14] has proposed the use of BIM to automate brief-related analysis and guidance. Koutamanis [14] describes that "*the approach is characterised by feedforward and feedback…connection of briefing goals to performance analysis and correlation of requirements in the brief to BIM objects and relations.*" Meel and Størdal [24] also briefly explain the possible uses of BIM to link client requirements directly to the BIM model. Their focus is particularly on larger projects such as hospitals with a vast number of requirements and documentation.

2.2 Design Briefing and BIM Implementation

The word BIM, its uses and capabilities have been interpreted in various manners. BIM can mean different things to people with different professional background. Some perceive it as a software tool or technology, while others view it as the 3D model that can be generated by that software. This paper agrees with Vanlande et al. [25] & Eadie et al. [26], that BIM is a "*process of generating sorting, managing, exchanging, and sharing building information in an interoperable and reusable way.*" The definition suggests that BIM is incorporated in all stages from inception to use and maintenance of the asset. However, after an extensive review of literature it was concluded that currently BIM is not implemented in the pre-design stages, particularly due to the lack of 3D model development and collaborative working. One of the prominent BIM-related tasks in stage 1 of the PoW is the development of Employer Information Requirement (EIR) and a BIM Execution Plan (BEP) [22], which is one of the elements of BIM but is different from the design brief. There is no requirement for development of conceptual 3D drawings or models as this is carried out in the conceptual design stage.

For projects to be considered BIM Level 2 compliant, as a minimum, the development of building information needs to be carried out collaboratively in a 3D environment with the possibility of attaching data to the models [27,28]. Similarly, in order to implement BIM in the pre-design stages, development of conceptual 3D mass/model along with the ability to attach information will be necessary. As collaborative work is one of the key requirements of BIM, early integration of stakeholders may also be required for implementing BIM in the design briefing process.

Some significant studies have been undertaken within the field of design briefing and BIM, such as Shen et al. [29], which developed a method of enhancing the designer-client communication with the use of BIM, user activity simulation and requirement management techniques. Baldauf[30] proposed a set of guidelines for using BIM in the management of client requirements in social housing projects. Innovations such as BriefBuilder - a requirement management tool, which among many other features allows the structuring and analysis of requirements. This tool can also be used to link requirements with models in Autodesk Revit that can be used to check for compliance with the brief.

This study, however, seeks to integrate the briefing process with BIM, by structuring client requirements into a spreadsheet format that can be imported by the aspired prototype BIM-based tool and developed into a conceptual BIM mass model. In this study, a conceptual BIM mass model refers to a conceptual mass model that has various information embedded into the elements of the model. The goal of this development is not to replace the human element from the design process, but to assist in the decision-making process by automating some of the preliminary massing designs and attaching vital information to the mass model extracted from the design brief.

3. Methodology

This paper is part of a wider research currently being conducted, where the ultimate aim is to develop a BIM-based design briefing prototype system and analyse its effectiveness in the design briefing process. Keeping this target in mind, this research will follow a software engineering methodology. This paper presents findings from the interview that was conducted as part of the feasibility study and requirements engineering along with the developed conceptual system framework. The illustration in Figure 2 shows the stages this study will go through for the development of a conceptual system framework.

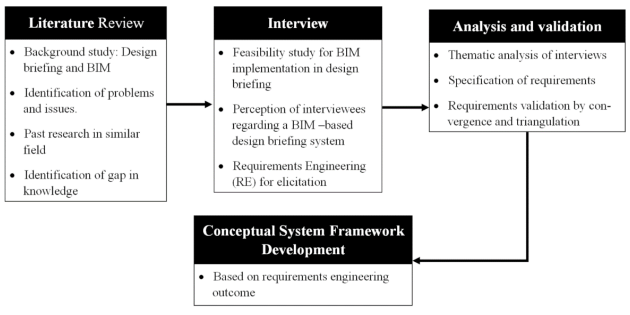

Figure 2. Research methodology for the development of a conceptual system framework.

DOI: https://doi.org/10.30564/jcr.v2i2.2960

The research commenced with literature reviews of design briefing and BIM to gain a theoretical understanding of design briefing process as well as the developments in BIM. Through this review, past researches in similar fields were also identified along with some gaps in knowledge. This research was then designed with two initial focuses, i.e., to determine the feasibility of implementing BIM in the design briefing process and to develop a conceptual system framework for a BIM-based design briefing system. Sommerville [21] reaffirms the importance of carrying out a feasibility study to understand if there is a need for a software solution. A qualitative approach was taken in the form of interviews to determine the feasibility of BIM implementation and to understand the perceptions of interviewees regarding a BIM-based design briefing approach. The interview was also used as a requirements engineering process to determine possible functional requirements that can be implemented in the prototype system that will be developed in the future. Requirements engineering is a process used to understand and define the function and service requirements from a system that is to be developed[21]. This process was used during the interview to identify user needs and gather some of the desired functionalities that can help shape the conceptual system framework.

The target samples for the interview were architects and BIM managers with at least 7 years' experience in their fields; and academics in UK universities with research interest in the field of design briefing and BIM. Hence, 3 separate questionnaires were developed with the addition, omission or replacement of some questions depending on their profession. A total of 89 professionals including architects, BIM managers and academics were contacted, out of which 11 participated in the interview. The participants consisted of 6 architects, 4 academics and 1 BIM manager. The average length of the interview was 70 minutes. Creswell [31] argues that in a phenomenological study an average sample size of 10 interviewees is acceptable where a long form of interview takes place. Based on this information, it was decided that the sample size was acceptable.

Audio from the interviews were recorded, with the interviewee's written consent, and manually transcribed. A thematic analysis approach was chosen to, initially, organise the data set and then to analyse and find patterns, commonalities, and shared views across the data set. As argued by Braun & Clarke [32], thematic analysis is an excellent method for analysing the perspective of all interviewees, which was essential for this research to identify the view and sentiment of the interviewees towards a BIM-based briefing method.

The analysis was carried out using NVivo, a qualitative data analysis software. The process of analysis roughly followed the phases outlined by Nowell et al [33]. The *first phase* included familiarisation with the data, which began with manual transcription of interview recordings, reading through the transcripts, structuring data under anonymised alphanumeric ID and highlighting general areas of interest.

The *second phase* included generating codes under specific nodes with descriptive titles, such as 'inadequate brief', 'vague brief', 'client uncertain', 'acknowledgement of the importance of collaboration', 'trust in FMs experience', 'disagreement with the use of BIM in briefing process' etc. This helped in structuring the vast amount of data into more manageable pieces based on similar views.

The *third phase* included identifying themes and patterns amongst the codes. For example, the above-mentioned codes, 'inadequate brief', 'vague brief', 'client uncertain', were grouped under a theme titled 'briefing issues.' 'Acknowledgement of the importance of collaboration', 'trust in FMs experience' were grouped under another theme titled 'positive about stakeholder collaboration.' The themes were reviewed for a final time, and changes were made where necessary.

The fourth phase included writing up the analysis of the data set.

4. Analysis

4.1 Feasibility of BIM Implementation in Design Briefing

The analysis of the interview showed strong support for the implementation of BIM in the design briefing process where 93% of the interviewees agreed that the design briefing process would benefit from this. An early implementation of BIM was mostly suggested, however one of the interviewees cautioned that this might not be appropriate for every type of project and the decision should *"depend on the scale and typology of the project."*

The analysis has also shown that 7 out of 11 (64%) interviewees believed that there was a need for change and/or improvement to the traditional process of briefing. The analysis also showed that all architects interviewed used sketches, with the help of pen and paper, as a means of communicating design ideas with the client. While this seems to be the norm, Norouzi et al. [15] identified that this can cause confusion among clients regarding the architect's design ideas, which can often mean that client requirements are not met, or re-work needs to be carried out during the construction phase. Hence, the use of conceptual mass modelling seems viable for communicating

 DOI: https://doi.org/10.30564/jcr.v2i2.2960

design ideas. This, however, can prove to be time consuming for the architects and not everyone might be willing to develop additional digital drawings that may not be approved by the client. Here, the use of automated spatial development and massing tool may be beneficial for both parties to communicate design ideas and developments along with the use of traditional sketches.

One of the interviewees, an architect, believed that BIM implementation in the design briefing process had already begun to take place in their practice with the development of EIRs by saying that, "*I think we do* [use BIM in the briefing stage]. *We have been doing this with the consultancy elements with the strategic EIRs and we are doing that with people like the housing associations*…" However, it should be pointed out that EIR (Employer's Information Requirement) is BIM information that is required by the employer/client for the development and operation of the project [28] and plays no role in defining the design requirements of the client.

4.2 Identification of Issues Related to Design Briefing

The second theme of the interview was related to issues with the current process of design briefing. The focus of this part of this interview was to gather data related to the issues faced by the interviewees and compare the outcome with findings from the literature review to understand recurring issues. This will also assist the researcher by providing issues that need to be addressed during the development of the conceptual system framework. The analysis of interview transcripts did reiterate most of the common design briefing issues identified during the review of literature, such as the client's lack of understanding their needs, vague or incomplete requirements, communication gap between the designer and client, and the sheer volume of the brief due to the high level of detail. This has reaffirmed the existence of a gap in knowledge, possibly due to the lack of research and development in the area of design briefing.

Lack of involvement of other stakeholders such as contractors, Project Managers (PM), Facility managers (FM), suppliers in the design briefing process, was one of the main issues identified during the desktop study. Hence, the interviewees were asked 'Who are the stakeholders present during the design briefing meetings?' The analysis showed that the clients and the architect/design team are always present in all design briefing meetings. Two of the interviewees also claimed to include the local council, planning and landscape consultants, traffic analyst in some of the briefing sessions. Only 1 of the interviewees recalled an FM being included in design briefing meetings. However, when asked if these stakeholders could provide value to the briefing process, 9 out of 11 interviewees agreed. One of the architects responded saying "*Yeah, absolutely. I think contractors do have a lot to offer. But I think it is important that they don't dominate… I think operations manager should do as well because I think buildings ultimately have to be able to work both on a technical sense and operational sense. And I think as designers it's crucial that we understand those things*."

The inclusion of non-design related stakeholders in the design briefing process is crucial for a collaborative way of working on projects, which is one of the requirements of level 2 BIM [28]. Although these stakeholders are currently not brought in this early into the project, possibly due to client's way of working or financial reasons, in a BIM-based design briefing process, contributions from these stakeholders can be extremely beneficial. A study by Enoma [34] has shown that the inclusion of facilities managers at the design stage can influence and contribute to the design process thereby making provisions for future day to day maintenance of the facility that can be efficient and cost effective. A similar argument can be made for the inclusion of stakeholders such as facility managers in the briefing process for the development of a more robust building design that can also assist the client in the decision-making process.

The lack of use of Post Occupancy Evaluation (POE) data was also mentioned by a couple of interviewees as an issue with the briefing process. In today's digital age, where any piece of data can be searched with a few keywords, the lack of use of POE data in the briefing process may hold back the quality of the final brief. One of the architects commented that, "*After the years of BIM and Level 2, getting all the FM people involved in is the fact that you have a feedback…but they are not there in the early process. The feedback is not always there.*" POE data have become one of the useful methods of determining the success of a project and analysing if the final asset meets the client's requirements or not [35]. Use of POE data in the early stages, particularly in more complex projects such as schools and hospitals can prove to be extremely beneficial.

4.3 Functional Requirements

The final theme of the analysis relating to functional requirements presented some interesting results. This section of the study was also met with a few challenges during the interview process as some of the responses were vague. As this is a new area of study and the question pertained to the possible functionalities of a prototype yet to developed, the vagueness of the respondents was

DOI: https://doi.org/10.30564/jcr.v2i2.2960

justified. However, one of the main ideas that was emphasized by all academics and some of the architects was that the aspired prototype BIM-based design briefing tool would require some form of automation to make a significant difference from the traditional process. Currently, concept designs are developed from the design brief manually i.e., architects read the client requirements in the design brief and translate them into design solutions. This was also identified as a gap in knowledge that this study could possibly fulfil.

Even though responses relating to the functional requirements were not significant, the analysis of overall responses provides some answers. The need of a function for non-design related stakeholders to be able to provide their input, a function for importing client requirements and POE data from previous projects were the requirements identified, through which functional requirements can be deduced [21].

Further requirements can also be derived from the requirements of BIM itself. Collaboration between stakeholders, use of 3D and common data environment, ability to attach various information related to building components and elements are some of the few basic requirements for a project to comply with the process of BIM. These BIM requirements can be used to create functional requirements and implement BIM in the design briefing process.

5. Conceptual System Framework

Based on the identification of issues and requirements through the analysis of data, a conceptual system framework is proposed, as shown in Figure 3, which seeks to implement BIM in the design briefing process i.e., stage 1 of the RIBA PoW. The use of BIM in this stage can enable the development of parameterised spatial massing designs on a conceptual level, which in this study is referred to as a conceptual BIM mass model. The participation of non-design related stakeholders at this stage can assist with the addition of early elemental data in the conceptual BIM mass model developed through the prototype. These data can, at a later stage, be transferred to BIM models created by the design team. This early development of conceptual BIM mass model can also act as a medium for communicating design solutions with the client along with any sketches the architect and design team may produce.

The proposed framework can also affect the process of design briefing based on the RIBA PoW. Earlier in section 1.1, a traditional process of BIM-based design briefing process along with the BIM related activities was illustrated in Figure 1. The illustration in Figure 4 shows the potential process that may be followed with BIM implementation in the design briefing process, which has been developed with considerations made in the proposed conceptual system framework.

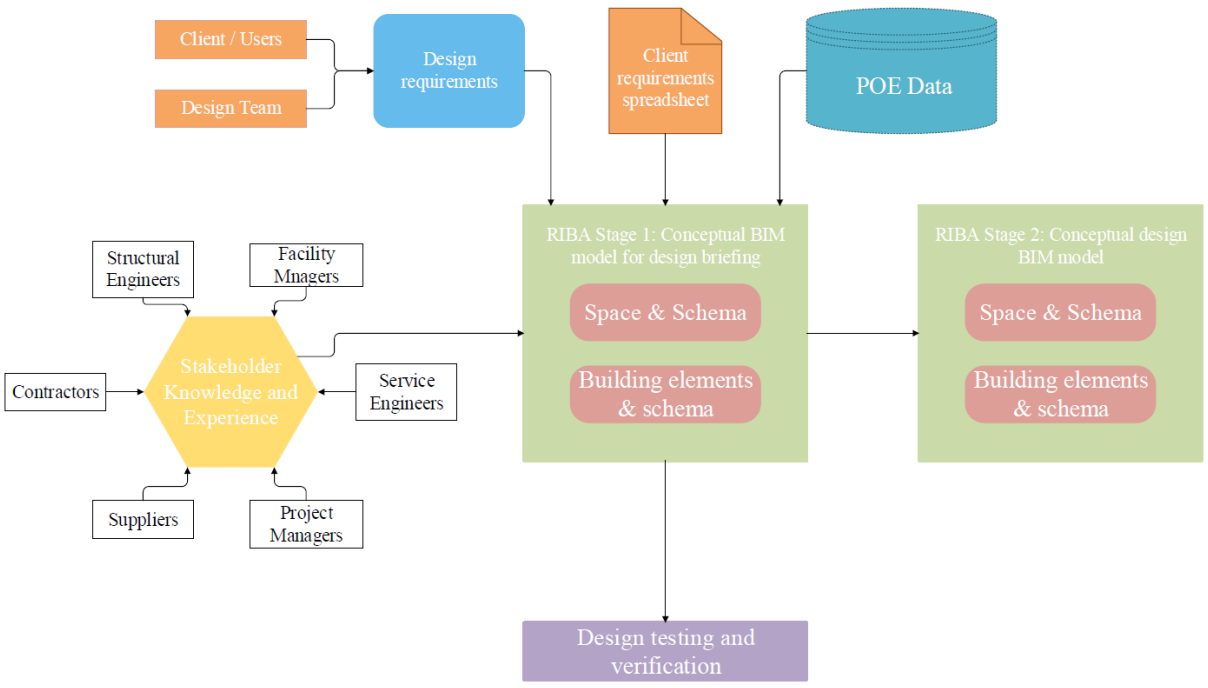

Figure 3. Conceptual system framework for BIM-based design briefing.

 DOI: https://doi.org/10.30564/jcr.v2i2.2960

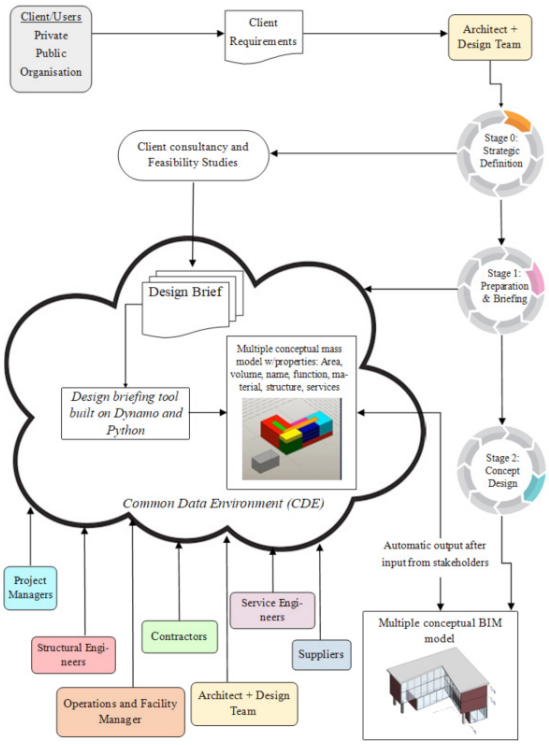

Figure 4. Potential project process with BIM-implementation in the design briefing process.

The implementation of BIM with the aspired tool at stage 1 of the RIBA PoW would mean early development of conceptual 3D mass models based on a client's initial requirements. As the project moves forward and more requirements are added, the conceptual model can further develop. Early integration of stakeholders for collaborative work is essential as they can contribute their knowledge and experience early in the project that can assist the clients make major decisions and the design team to create design solutions accordingly. Finally, the addition of POE data from previous projects in the design briefing stages may also provide some early guidance in the project in order to mitigate errors.

6. Discussion

Over the past few years, BIM has evolved into a process rather than simply being categorised as a 3D modelling tool. The scope of BIM has widened and contributes towards the facilities management sector as well. Similarly, this study believes that BIM has the potential to further widen its scope and contribute to the design briefing process to further improve and reinforce collaborative working, communication, and accuracy of design solutions.

A high level of optimism for the use of BIM methodology in the pre-design stages has been recognised through this study. Majority of the interviewees agreed that implementation of BIM in the design briefing process would provide benefits such as improvement in communication and assistance with design developments. There were also beliefs that BIM was already being used in the briefing process through the development of EIRs. However, this may not be completely true as EIRs are information required by the client for the development and operation of a building, and do not contribute to the design briefing process. Although not completely accurate, this argument demonstrates the willingness to adopt BIM from the early stages of a project.

A concern was also raised regarding the actual use of BIM in the design briefing process due to the lack of geometric concept drawings/designs at this stage. However, it should be taken into consideration that BIM is a process that is defined by a wide range of activities carried out over a project's lifecycle, where the development of a 3D model is only one of many aspects. The wider scope of this research has considered this issue and has proposed the development of the aspired prototype with the ability to develop conceptual BIM mass model in the pre-design stage.

Majority of the issues related to design briefing identified in this study were re-iterations of those identified through review of past studies. Involvement of stakeholders such as the project manager, engineer, contractor, suppliers and facility manager were one of the new issues identified in the design briefing process. Some studies have been conducted in the early involvement of stakeholders in construction projects such as Dowlatshahi [36] & Valkenburg et al. [37]. However, no evidence of study related to stakeholder integration in the design briefing process for the purposes of BIM implementation was identified. Integrating these stakeholders in the design briefing process can provide a project with multiple benefits, however, one of the major advantages of early collaboration can be the added value and knowledge to the design brief. With their experience, stakeholders can provide valuable information and suggestions based on the client's initial requirements that can help optimise the project from the early stages. Moreover, as collaborative work is one of the fundamental requirements of BIM methodology, collaboration during the design briefing process can also be considered a necessity for BIM implementation.

Another issue identified in the briefing process is the lack of use of POE data. POE is conducted during the use phase of the building to determine if the building has met the requirements set in the brief and if any changes are required. However, these data or knowledge from POE can also be used in the briefing stages of the next building in order to avoid mistakes or carry forward a solution that

DOI: https://doi.org/10.30564/jcr.v2i2.2960

has worked in the past. These data can act as information that can be utilized through BIM methodology in the briefing process.

The interview provided little towards the functional requirements for the BIM-based design briefing tool. However, the need for automation in the design briefing process was identified as one of the key functionalities. Automation in this scenario refers, not to the development of the design brief, but to the development of a parametric geometry based on structured requirements, which may be in the form of a spreadsheet. Development of such a tool could assist the design team to develop 3D spatial model before the conceptual design stage based on a number of criteria defined by the user. This model can be used by the design team for various tasks, such as communicating ideas related to area, space, adjacency and building elements with the client. Based on the initial requirements of the client, stakeholders such as the engineers, contractor, supplier, and facility managers can provide support to the design team. Their involvement may also help achieve the client's as well as the local authority's sustainability criteria from an early stage.

Based on the findings from the review of literature and analysis of interviews, a conceptual system framework was proposed. The next stage of this study will focus on the development of the proposed BIM based design briefing tool. Dynamo for Revit has been considered as the programming language for this tool along with Python, which may be used for the development of the user interface.

7. Conclusions

The design and construction industry today are facing immense challenges with regards to improving quality, sustainability, efficiency, keeping costs low and adopting new technologies to stay ahead of competition. There is no denying that BIM is a major factor that can help achieve these needs of the industry, but the current process of traditional briefing does not make use of BIM. The analysis of empirical data gathered for this research, however, points towards the industry's willingness to adopt and implement, not only traditional BIM, but also innovative methods of BIM such as the one this paper seeks to develop.

The results of this study highlighted that majority of the interviewees believed that there was a need for improvement of the design briefing process, and this could be achieved with the implementation of BIM in the design briefing process. Furthermore, a number of issues identified during the literature review were reaffirmed by the interviewees and some new issues such as the lack of use non-design stakeholders and POE in the early stages were also identified. One of the key requirements identified was achieving a level of automation in the design briefing process that is capable of translating structured requirements into conceptual design solutions. Other functional requirements were not directly identified within the requirements engineering section of the questions; however, some requirements were deduced from other sections of the questionnaire.

A conceptual system framework was proposed for the development of the aspired tool, which along with the development of conceptual BIM mass model, prioritises the inclusion of stakeholders such as the PM, FM, contractors etc. in the design briefing process. Stakeholder integration is imperative for the implementation of BIM in the briefing process as their knowledge and experience will not only help shape the conceptual BIM based model, but also allow for the addition of information to the model which is a core requirement of BIM methodology.

References

[1] Barrett, P., Hudson, J. & Stanley, C. (1999). Good practice in briefing: the limits of rationality. Automation in construction. 8(6), p. 633-642.

[2] Kamara, J. M., Anumba, C. J. & Hobbs, B. (1999). From briefing to client requirements processing. Association of Researchers in Construction Management, 1, p. 317-326.

[3] Shen, Q., Li, H., Chung, J. & Hui, P. (2004). A framework for identification and representation of client requirements in the briefing process. Construction Management and Economics, 22(2), p. 213-221.

[4] Latham, M. (1994). Constructing the team: Joint Review of Procurement and Contractual Arrangements in the United Kingdom Construction Industry. 1st ed. London: HMSO

[5] Barrett, P. & Stanley, C. (1999). Better construction briefing. Oxford: Blackwell Science.

[6] Sailsbury, F. (1998). Briefing your architect. 2nd ed. Oxon: Routledge.

[7] Tunstall, G. (2007). Managing the building design process. 2nd ed. Oxford: Butterworth-Heinemann.

[8] Bogers, T., Meel, J. V. and Voordt, T. J. M. (2008). Architects about briefing: Recommendations to improve communication between clients and architects. Facilities. 26 (3/4), p.109-116.

[9] Chung, J. K.H., Kumaraswamy, M. M. and Palaneeswaran, E. (2009). Improving megaproject briefing through enhanced collaboration with ICT. Automation in construction. 18(7), p. 966-974.

[10] Hansen, K. L. and Vanegas, J. A. (2003). Improving

 DOI: https://doi.org/10.30564/jcr.v2i2.2960

design quality through briefing automation. Building Research and Information, 31(5), p. 379-386.

[11] Murphy, E. & Hands, D. (2012). Wisdom of the crowd: How participatory design has evolved design briefing. Swedish Design Research Journal. 12(2), p. 28-37.

[12] Ryd, N. (2004). The design brief as a carrier of client information during the construction process. Design Studies, 25 (3), p. 231-249.

[13] Yu, A. T. W., Shen, Q., Kelly, J. & Hunter, K. (2006). Investigation of critical success factors in construction project briefing by way of content analysis. Journal of Construction Engineering and Management, 132(11), p. 1178-1186.

[14] Koutamanis, A. (2017). Briefing and building information modelling: Potential for integration. International Journal of Architectural Computing. 15(2), p. 119-133.

[15] Norouzi, N., Shabak, M., Embi, M. R. B. & Khan, T. H. (2015). The architect, the client and effective communication in architectural design practice. Procedia – Social and Behavioural Sciences, 172, p. 635-642.

[16] Ryd, N. and Fristed, S. (2007). Transforming strategic briefing into project briefs, Facilities, 25(5), p. 185-202.

[17] Banwell, Sir H. (1964). The placing and management of contract for building and civil engineering work. London: HMSO.

[18] RIBA (2020a). Stage 0: Strategic definition. [Online]. Available at: https://www.architecture.com/-/media/GatherContent/Test-resources-page/Additional-Documents/0strategicdefinitionchecklistpdf.pdf [Accessed: 03/10/2020].

[19] RIBA (2020b). Stage 1: Preparation and brief. [Online]. Available at: https://www.architecture.com/-/media/GatherContent/Test-resources-page/Additional-Documents/1PreparationandBriefchecklistpdf.pdf [Accessed: 03/10/2020].

[20] Wohlin, C., Höst, M. & Henningsson, . K., 2003. In: Empirical Research Methods in Software Engineering. In: Conradi, R. & Wang, A.I.. Berlin: Springer-Verlag.

[21] Sommerville, I. (2016) Software Engineering. 10th ed. Essex: Pearson.

[22] RIBA (2020). RIBA Plan of Work 2020 Overview. London: RIBA.

[23] Ostime, N. (2020). RIBA Job book. 10th ed. London: RIBA Publishing.

[24] Meel, J. V. and Størdal, K, B. (2017). Briefing for Buildings: A practical guide for clients and their design teams. 1st ed. Netherlands: ICOP.

[25] Vanlande, R., Nicolle, C. & Cruz, C. (2008). IFC and building lifecycle management. Automation in Construction, 18(1), p. 70-78.

[26] Eadie, R., Browne, M., Odeyinka, H., McKeown, C. & McNiff, S. (2013). BIM implementation throughout the UK construction project lifecycle: An analysis. Automation in Construction, 36, p. 145-151.

[27] Barnes, P. & Davies, N. (2015). BIM in principle and in practice. 2nd ed. London: ICE.

[28] Sacks, R., Eastman, C., Lee, G. & Teicholz, P. (2018). BIM Handbook: A guide to building information modelling for owners, designers, engineers, contractors, and facility managers. 3rd ed. New Jersey: John Wiley & Sons.

[29] Shen, W., Zhang, X., Shen, G. Q. & Fernando, T. (2013). User pre-occupancy evaluation method in designer-client communication in early design stage: A case study. Automation in Construction, 32, p. 112-124.

[30] Baldauf, J. P., Formoso, C. T., Tzortzopoulos, P., Miron, L. I. G. & Soliman_Junior, J. (2020). Using building information modelling to manage client requirements in social housing projects. Sustainability, 12(7), 21.

[31] Creswell, J. W. (2013). Qualitative enquiry and research design: Choosing among five traditions. 3rd ed. London: Sage Publications.

[32] Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), p. 77-101.

[33] Nowell, L. S., Norris, J. M., White, D. E. & Moules, N. J. (2017). Thematic analysis: Striving to meet trustworthiness criteria. International Journal of Qualitative Methods, 16(1), p. 1-13.

[34] Enoma, A. (2005). The role of facilities management at the design stage. In: Khosrowshahi, F (Ed.), 21st Annual ARCOM Conference, 7-9 September 2005, SOAS, University of London. Association of Researchers in Construction Management, 1, p. 421-30.

[35] RIBA and Hay, R., Bradbury, S., Dixon, D., Matindale, K., Samuel, F. & Tait, A. (2016). Pathways to POE. University of Reading: RIBA.

[36] Dowlatshahi, S. (1998). Implementing early supplier involvement: A conceptual framework. International Journal of Operations and Production Management, 18(2), p. 143-167.

[37] Valkenburg, M.V., Lenferink, S., Nijsten, R. & Arts, J. (2008). Early contractor involvement: a new strategy for 'buying the best' in infrastructure development in The Netherlands. Proceedings of the 3rd International Public Procurement Conference. 28-30 August 2008.

DOI: https://doi.org/10.30564/jcr.v2i2.2960