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GENERAL NOTE:

An Investigation into Irish Clients understanding of the Capabilities of Building Information Modelling and their Role within a Construction Project

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ABSTRACT

With an Irish BIM mandate on the horizon there appears to be a growing frustration within the Irish construction industry around the implementation, adoption and use of BIM in construction projects. With many industry professionals highlighting the clients lack of understanding in the capabilities of BIM and their role within a BIM enabled project as the cause to this frustration. This paper aims to investigate these claims by analyzing the findings of recent publications against data gather through interviews held with various Irish construction clients. The results of this paper question the claims of the industry professionals and goes on to highlight other issues which may be leading to this frustration within the Irish construction Industry.

1 Introduction

Over the last few years the adoption and implementation of Building Information Modelling (BIM) has grown steadily within the Irish construction industry. This is evident from the results published by Construction IT Alliance (CitA) and Enterprise Ireland in their digital transition surveys (Hore & Hunt, 2015; Hore, Hunt, & McAuley, 2017). These surveys have highlighted that Irish consultancies and contractors have seen an increase in the demand for BIM on a year on year basis of approximately 75%-80% between the end of 2015-2017(Hore & Hunt, 2015; Hore et al., 2017).However, within all three reports published by CitA and Enterprise Ireland (Hore & Hunt, 2015; Hore, Hunt & McAuley, 2016; Hore et al., 2017) the following barriers to the adoption of BIM have been highlighted:

- Lack of Client understanding
- Lack of Client demand
- Lack of Public sector mandate
- Lack of guidance documents
- Lack of BIM ready contracts

The lack of client understanding or demand has ranked as the highest or second highest reason against the adoption of BIM within the Irish construction industry (Hore & Hunt, 2015; Hore et al., 2017). This is surprising due to the many papers published within the industry such as (Byrde, Broquetas, & Marc Volm, 2013; Ghaffarianhoseini et al., 2017; Liu, Van Nederveen, & Hertogh, 2017; Migilinskas, Popov, Juocevicius, & Ustinovichius, 2013). These outline the benefits and advantages of implementing BIM software and processes to clients.

Ralph Montague has recently outlined that significant savings can be made throughout the capital expenditure (CAPEX) and operational expenditure (OPEX) stages of a project through the implementation of digital technologies such as BIM (BIMireland, 2018). However, Ralph goes onto state that he felt more informed and mature clients willing to follow the processes would be required in order to create a better way of working within the industry(BIMireland, 2018).

Therefore, this paper will aim to examine and investigate the Irish construction client's understanding of BIM, it's capabilities and their role throughout a construction project. This data will be gathered through recorded interviews with various public and private clients as well as leading BIM consultants throughout the Irish construction industry. This data will then be reviewed against the current capabilities of BIM and the client's role as outlined by academic and conference papers. This is in an attempt to examine whether this growing

frustration is due to the lack of upskilling or understanding on the client's behalf or whether it is an accumulation of all the above elements in which some are out of the control of the client (Hore & Hunt, 2015; Hore et al., 2017; Martineau, 2017). The outcome of this investigation will then establish whether there is a requirement for training or educational methods, to better inform Irish clients of BIM it's capabilities and their role within a construction project.

2 Literature Review

Byrde, Broquetas, & Marc Volm (2013), states similar to CitA that BIM is becoming more and more common within the design and construction industry. This is due to increased complexity in structures and the management of a construction project.

Ghaffarianhoseini et al (2017), states that the reasoning for this increased use is due to the several benefits, which are associated with the implementation of BIM technologies and processes on a design and construction project. These include technical superiority, increased interoperability, improved cost control, early building information capture and it's use throughout the building life-cycle (Ghaffarianhoseini et al., 2017). These benefits can be linked directly to various parties at different stages within a construction project, while also being interlinked throughout the entire construction project (Kumar, 2015). This literature review will examine and expand on these benefits in relation to the following stages of a construction project: Design, Construction and Facility management.

2.1 BIM Technologies in Design

The implementation of BIM technologies can offer numerous benefits to designers and clients during the design stage of a construction project (Ghaffarianhoseini et al., 2017; Kumar, 2015).

2.1.1 Visual

BIM technology is an advancement of traditional computer aided design (CAD). It provides a platform in which complex digital representation of building elements and structures can be parametrically modelled in 3D (Migilinskas et al., 2013). This digital representation enables increased spatial visualisation verification and early client involvement within the design process (Ghaffarianhoseini et al., 2017).

This early client involvement and increased visualisation allows for, early decision making around design options along with identification and resolution of construction issues. It therefore reduces unnecessary cost and time impacts on the overall construction project (Ghaffarianhoseini et al., 2017). This visualisation and process aligns with the Government Soft Landings (GSL) policy, which identifies the need for early end-user engagement to improve overall building performance and usability (UK Cabinet Office, 2013a).

2.2 BIM Technologies in Construction

2.2.1 Visual / H&S:

In addition to its visual use within the design stage of a construction project, BIM also assists construction managers and personnel to visually understand complex sites and working conditions prior to commencement on site. It can help to identify potential hazards which could then be eliminated at an early stage of the project (Martinex-Aires, Lopez-Alonso, & Martinez-Rojas, 2018).

Martinex-Aires et al (2018), also states during construction “BIM helps to identify the risks, prepare for the work at hand and, therefore, complete the task more efficiently and safely, identifying each task and work area with their corresponding hazards, enabling communication and collaboration between different team members, both in the design stage and construction.”(Martinex-Aires et al., 2018, p.16)

2.2.2 Time/ 4D:

Jupp (2017), outlines that the use of 4D modelling has increased over the last decade. 4D modelling is defined as 3D modelling plus time scheduling, therefore creating a virtual construction programme (Martinex-Aires et al., 2018). Jupp (2017), goes on to outline that 4D BIM can help improve on site logistics and materials handling, by simulating the virtual construction of a project and it's site constraints. This allows contractors to plan site storage and logistics more efficiently.

2.2.3 Cost/5D:

5D BIM can be used to create robust contract sums by those tendering to deliver the project throughout the construction stage. This is achieved by adding proposed costs to the design model allowing the contractor to predict anticipated costs. This can then be used to track anticipated costs against actual costs leading to effective cost reporting and budgeting (Mills, 2015).

2.2.4 Coordination:

Hardin & Mc Cool (2015), outlines that BIM is used in two forms of coordination during the construction stage of a project. One of these forms being site coordination which has been touched on above. This highlights that BIM can be used to manage site restrictions and logistics to create safer construction sites. The other form of coordination is clash detection. Like in the design stage, this technology has allowed construction managers to coordinate the building elements more efficiently prior to construction, reducing delays and additional costs during the construction stage (Andersson, Farrell, Moshkovich, & Cranbourne, 2016).

2.2.5 Prefabrication:

Andersson et al (2016), states that it is possible to increase the use of prefabrication on projects. This is due to the implementation of BIM which has increased coordination and site planning, allowing sub-contractors to prefabricate sections of systems off-site with a simple installation on-site. This helps increase accuracy and health and safety while reducing material waste and on-site delays (Andersson et al., 2016).

2.2.6 As- Built Models/Drawings:

Andersson et al (2016) and Hardin & Mc Cool (2015), both outline that BIM has a role to play in as built verification during the construction

2.1.2 Interoperability/ Reduced Re-work:

BIM provides a digital representation of physical and functional characteristics of a facility. This data can then be transferred between various software applications within individual organisations or multi-disciplinary design teams. This is due to BIM interoperability opportunities and the introduction of IFC (Industry Foundation Classes) (Ghaffarianhoseini et al., 2017). This enables designers to preform building behaviour simulations such as, energy or structural analysis allowing designers to create more efficient structures and buildings (Byrde et al., 2013). Any changes which are required to be made can be stored and transferred between different software applications. Therefore, contributing to systematise changes which reduces a large amount of re-work, making significant cost saving within the design stage (Ghaffarianhoseini et al., 2017).

2.1.3 Interoperability/ Coordination:

Byrde et al (2013), outlines that BIM's interoperability to transfer data and geometry between software applications also leads to improved coordination over that of traditional construction processes. Liu, Van Nederveen, & Hertogh (2017) and Kumar (2015) outlines this improved coordination is due to the ability to visually review the 3D building elements. This allows multi-disciplinary design teams to resolve any issues. Whereas, Yang et al (2018) outlines this improved coordination is due to BIM's ability to perform clash detection among the modelled building elements, which in turn allows designers to reduce any unnecessary conflicts in real time.

2.1.4 Cost/ 5D:

“5D BIM is a five dimensional representation of the physical and functional characteristics of any project” (Agarwal, Chandrasekaran, & Sridhar, 2016, p. 15). This includes project cost in addition to the 3D spatial requirements. The use of 5D BIM can be used by design teams to cost the individual packages within the Capex stage of a project. These packages can then be combined to determine an overall project/capital cost (Mills, 2015). This information can be used to determine the running or renewal cost of the asset during the OPEX stage of the project (Mills, 2015).

2.1.5 BIM Collaboration / Cloud Collaboration:

Khairil Izam, Ibrahim, & Belayutham (2019), outlines the collaborative capabilities of BIM as the ability to share and exchange data over time to allow for effective decision making. Similarly Liu et al (2017) highlights these capabilities but outlines that the use of BIM allows for open communication among parties. However, she goes on to highlight that project separation between teams hinders effective communication. Although, Howe (2017) and Somani (2019), outline that the implementation of a cloud-based collaboration platform would allow for effective data sharing and communication in real time. Therefore, improving overall project coordination and reducing project delays.

stage of a project. They outline that with the use of BIM-driven tools such as total stations it is possible to reduce on site inaccuracies. This increases ongoing verification of installed systems although, this suggests that this process must be integrated as part of the installation process (Andersson et al., 2016).

2.3 BIM Technologies in Facilities Management

Kelly (2018), outlines that one of the main drivers for the adoption and implementation of BIM is its potential use in the handover process and facilities management (FM) stage of a construction project. Similarly Edirisinghe, London, Kalutara, & Aranda-Mena (2017) suggest whether the building is new or existing the ultimate objective of implementing BIM is for its benefits within the FM stage. This suggests these benefits can reduce the life-cycle cost of the asset significantly. This use of BIM in the FM stage can be significantly assisted with the implementation of a GSL policy, which increases early end-user engagement in a hope to improve overall asset performance while ensuring efficient asset usability (UK Cabinet Office, 2013b).

2.3.1 Improved documentation system:

Aziz, Nawawi, & Muhamad Ariff (2016) outline that FM staff experience difficulty maintaining facilities and assets when relying on paper based documentation. Similarly Gao & Pishdad-Bozorgi (2019) outlines information accessibility as an FM managers number one issue. However, both go on to suggest that these tasks are more efficient with the use BIM models with integrated asset data instead of paper-based drawings and documents. This is due to BIM's ability to integrate the fragmented FM information gather throughout the project creating a central source for asset information. In addition to this, BIM offers early 3D visualisation allowing FM personnel to guide themselves through the asset or system. This allows them to promptly execute required maintenance or repairs (Aziz et al., 2016; Gao & Pishdad-Bozorgi, 2019).

2.3.2 Preventive Maintenance:

Aziz et al (2016) outline that maintenance repair activities cost three to four more times than if they were performed as a planned maintenance. Pishdad-Bozorgi, Gao, Eastman, & Patrick Self (2018) suggests that due to the OPEX stage lasting longer than the CAPEX stage of a project any efficiency's BIM can offer would introduce greater savings within the OPEX Stage. Both papers suggest that BIM can support preventive maintenance planning with Edirisinghe, London, Kalutara, & Aranda-Mena (2017) highlighting this as a motivator for clients to implement BIM. This is due to BIM's ability to act a single source of asset information in contrast with multiple software system currently in common use (Edirisinghe et al., 2017). Edirisinghe et al. (2017) go on to suggest that future integration with data analytic and automated monitoring systems will lead to improved decision making and planning of preventive maintenance.

2.3.3 Space management:

Areo blog (2015), outlines the need to manage spacial needs and usage as an important part of FM. Brinda & Prasanna (2014) and Hore, McAuley, West, & Rowland (2013) all outline that BIM can be used by clients and FM teams to assist in space management. The use of BIM allows FM teams to analyse the existing use of the space, while allowing them propose changes and plan for future needs.

2.3.4 Energy Efficiency / Management:

Gao & Pishdad-Bozorgi (2019), outline that FM teams can improve energy management through the implementation of BIM. This highlights that BIM can be used as a platform in which various energy consumption and thermal data can be integrated. This in turn will provide, the FM team with the capability to monitor and analyse the assets performance. While Oti, Kurul, Cheung, & Tah (2016) highlight that various software packages can display the energy data as an overlay on the 3D model allowing FM teams to visualise energy loss and consumption easily. Further to this Gao & Pishdad-Bozorgi (2019) state that BIM can be used by FM teams to simulate and forecast energy performance.

2.3.5 Building Automation Systems:

GhaffarianHoseini et al (2017), outline that due to the uncertainty in occupancy behaviour during the post-construction phase of a project, buildings may require a building management system (BMS) to assist in operating and management of a facility. They also indicate that with the correct integration of BIM and BMS, they can reduce energy consumption due to the ability to automatically control building systems.

2.3.6 Communication / Collaboration:

Aziz et al (2016), suggests that the implementation of BIM within the FM phase of a project can significantly improve communication and collaboration of the FM team. This is due to BIM's ability to compile and exchange building data between various parties throughout the building lifecycle. This creates an easy accessible set of operation and maintenance manuals which can be accessed and transferred between team members in real time(Aziz et al., 2016).This combined with a preventative maintenance schedule can also be produced using BIM as highlighted above reducing inefficiencies and improving productivity (Aziz et al., 2016; Edirisinghe et al., 2017; Pishdad-Bozorgi et al., 2018).

2.4 Clients understanding of their role/ responsibility within a BIM project

As outlined within the introduction, the lack of client understanding and demand rank as the highest barriers to the implementation and adoption of BIM as outlined within the CitA and Enterprise Ireland digital transition surveys (Hore & Hunt, 2015; Hore et al., 2017). Bosch-Sijtsema, Isaksson, Lennartsson, & C.J.Linderoth (2017), outlines that the lack of client demand is created due to the lack of client knowledge of BIM and there role and responsibility within a project.

The RIAI BIM Committee (2019) have prepared an advice notice outlining the clients role and responsibilities as outlined with PAS1192-2:2013. This outlines the specification for the information management for construction projects using BIM. This advice notice outlines that the client is responsible for the establishment of the Organisational information requirements (OIR) and an Asset information requirement (AIR). The OIR is a high-level strategic document which sets out the organisation's goals for future developments, whereas the AIR is a document which outlines the strategy for maintaining the client's assets. Both these are for internal use within the organisation.

The RIAI BIM Committee(2019) outline that at the beginning of a project the client is responsible for establishing their project specific requirements within a document known as an employer's information

requirements (EIR). This document should outline what information the client requires at what stage and to what level of detail. Similarly Ahmad Latiffi & Fathi (2016) outline that it is the clients responsibility to specify the use of BIM along with outlining to what level of detail they require BIM to be modelled. The RIAI BIM committee (2019) go on to outline further responsibilities of the client within this advice notice. Such as, the appointment of the information manager and the authorisation of information within the client shared area of the common data environment (CDE). However, with the new addition of ISO 19650-2:2018 standard around the use of BIM on construction projects an updated or additional advice note will need to be created to capture any changes from PAS 1192-2.

3 Research Methodology

Research methodology refers to the theory of getting knowledge, considering the best ways, methods and procedures, by which data will provide evidence and answers to the topic being investigated (Sikes, 2008). The approach adopted and the methods of data collection employed will depend upon the nature of the inquiry and the type of information required (Bell, 2008).

This capstone experience project sets out to, develop and communicate a question relative to the subject area and learning outcomes of the programme and subsequently proffer an answer. It was the intention at the start of the project to keep a close-fit between the question and the answer (Dunleavy, 2003) to maintain a structured and focused approach to achieve the objectives of the research. To achieve this close-fit, at the start of the project I tried to work out what I would be able to say at the end and then framed the research question around this. Although a lot of secondary research, mainly through literature reviews, needed to be carried out to inform parts of the research, the overall project remained very focused on the main objectives.

As the research strategy can be defined as the way in which the research objectives can be questioned (Naoum, 2013), the style most appropriate to this applied research technical project (Fellows & Liu, 2003) was the pragmatic mixed methodology approach (Newby, 2014) (technical, qualitative & quantitative). The research methods used within this methodology were:

- Literature Reviews
- Semi-structured interviews

While maintaining rigour and objectivity throughout, these methods successfully combined to provide data to answer the main project question. The mixed methodology approach used for this technical project also enabled triangulation (Savin Baden & Howell Major, 2013) between the research methods to further validate and synergise the outcomes.

4 Data Collection Method

The objective of this paper is to examine the Irish constructions clients understanding of BIM along with its capabilities and their role within a construction project. In order to investigate this objective, the author held one to one interviews with a number of different Irish construction clients in both the public and private sector across a wide variety of sectors including sports, health and accommodation. The interviews were recorded digitally, and the raw data was gathered through edited transcription. The aim was to review the raw data gathered within these interviews against the data gathered within the literature review. Therefore, establishing whether there are any similarities or differences thus outlining a small proportion of the Irish construction clients understanding of BIM.

In addition to this the author held one to one interviews with a handful of industry professionals in the field of BIM to establish their

thoughts on the objective. The industry professionals were chosen due to their expertise in the field of BIM, but the author also wished to investigate the experiences they have had with Irish construction clients during a live construction project. This is to establish the clients understanding of their role within a construction project. Like the client interviews, the interviews were recorded digitally, and the raw data was gathered through edited transcription.

5 Findings

Following the analysis of the interview data it became apparent that the majority consensus of the industry BIM consultants interviewed was that of Martineau (2017) and Hore, Hunt and McAuley (2015; 2017). In which they highlighted that most Irish clients had little or no understanding of BIM, it's capabilities and their role within a construction project. In addition to this the majority of BIM consultants interviewed stated they felt that clients were not committed to the adoption of BIM. Outlining clients don't want BIM specifically they just wish for more efficient projects with improved cost certainty, information management and project delivery. Further to this the consultants highlighted this lack of adoption may be due to clients having a business to run, therefore not interested or willing to get involved in an additional process expecting the professionals design teams to manage this on their behalf.

Contrary to this all the clients interviewed highlighted their understanding of BIM as a collaborative process enabled by technology which is used by all parties to assist in the design, construction and maintenance of an asset and the associated information throughout the project lifecycle. This being similar to the definition of BIM provided by the NBS (2016) which states "BIM or Building Information Modelling is a process for creating and managing information on a construction project across the project lifecycle." (NBS, 2016, p. 2). In addition to this the clients interviewed had significant knowledge of the capabilities of BIM similar to that raised within the literature review. With the majority of clients highlighting the expected capabilities and benefits of BIM in the CAPEX stage as increased visual use, reduced re-work, improved cost certainty and reduced clashes/ improved coordination therefore improving project delivery. This is similar to Byrde et al, Ghaffarianhoseini et al, Hardin & Mc Cool, Migilinskas et al and Mills (2013; 2017; 2015; 2013; 2015) who highlight these various capabilities and benefits in a number of different publications referenced above in the literature review. These clients then highlighted improved construction documentation, preventative maintenance schedule and the ability to track components and assets as capabilities and benefits of BIM in the OPEX stage. Again, stating similar capabilities and benefits to Aziz et al, Edirisinghe et al and Gao & Pishdad-Bozorgi (2016; 2017; 2019) highlighted within the literature review.

Surprisingly, the majority of clients interviewed went on to state that they were implementing BIM due to the large number of benefits it offers them and their organisation rather than due to the BIM mandate. With one client stating, they were implementing BIM knowing they would not receive any direct benefits during the CAPEX stage, outlining this was acceptable due to the benefits BIM offers within the OPEX stage. This mentality is that of Kelly (2018) and Edirisinghe et al (2017) who both outline the FM benefits of BIM as a main driver in the implementation of BIM. However, this client stated that their FM team have yet to fully commit to the use of BIM, outlining lack of staff training as the main issue around this lack of adoption.

However, the minority of clients outlined that they had yet to see any benefits from the implementation of BIM. Most clients suggested they had yet to receive a full BIM process from industry professionals suggesting design teams and contractors are unable to provide such

a service at this moment in time. Similarly, the minority of BIM consultants interviewed highlighted a lack of professional skills as a potential drawback to the implementation of BIM within the Irish construction industry. With one consultant stating, the Irish construction industry requires a reboot as it is currently failing to deliver key infrastructure projects, highlighting the current way in which projects are delivered as a broken process suggesting BIM as a potential answer to this issue.

As outlined above, the majority of BIM consultants stated that Irish construction clients had little or no understanding of their role and responsibilities within a BIM enabled construction project. This mentality would be the same as many industry professionals as outlined by Hore & Hunt (2015; 2017) following their digital transition surveys. However, following the interviews with the clients it became apparent that many of the clients had an understanding of their role and responsibilities with a BIM enabled construction project. As the majority of clients outlined that they have produced a project specific Employers Information Requirements (EIR) which is in line with the roles and responsibilities as outlined by the RIAI BIM Committee (2019) within the literature review. Whilst the minority of clients highlighted that they were aware or had produced an Asset Information Requirements (AIR) or Organisational Information Requirements (OIR), outlining that they had not produced these due to the chosen procurement route.

Most of the clients went on to outline, that they would expect to receive a BIM execution plan (BEP) in response to their EIR to ensure that their requirements were being met. Interestingly the minority of clients went on to state that they would not expect BIM technologies or a BEP from certain professions, stating they feel these professions are not capable of providing BIM.

Surprisingly, some of the clients highlighted that they have had to adapt and change their documentation and approach following the implementation of BIM on previous projects. This suggests a clear understanding of BIM by these clients, as they are aware of changes that they can make in an attempt to rectify previous issues which arose on previous projects.

5.1 Issues or barriers to the BIM Mandate:

As part of the interview process, both the BIM consultants and clients were asked, whether they envisaged any issues or barriers to the implementation of the Irish BIM mandate within the construction industry. Remarkably the majority of the interviewees stated that they would envisage issues or barriers to the implementation of a BIM mandate within the Irish construction industry.

With the consultants outlining potential issues to the mandate as the following: Leadership, standards, training/education and procurement.

One of the consultants went on to suggest, that currently within the Irish construction industry there is a misconception at leadership level around BIM, it's cost and its capabilities. This highlights the need for good leadership on projects who understand and appreciate BIM. In addition to this most of the consultants outlined the lack of adherence to industry standards as a major downfall to not only the implementation of BIM but the industry as a whole.

Similarly, to the consultants the majority of clients interviewed outlined training/education and procurement as potential issues to the BIM mandate.

While most of the clients interviewed stated they would not be subject to a mandate, they did highlight from their knowledge that there was a lack of training and resources being provided by the office of Government Procurement (OGP) and the Irish government following the announcement of the BIM mandate to assist public clients.

While most of the consultants agreed with the clients there was an interesting split amongst them. With some consultants stating, that there is adequate training within the market on the technologies but not around the processes, although not being directly provided by the OGP or government. Some have stated that there are scheme's being provided by Enterprise Ireland to assist client and industry professionals with the implementation and adoption of BIM. These consultants went on to suggest that maybe the OGP is working on such schemes and resources internally prior to release to the market, but to date nothing has been issued. Whereas the other consultants went on to state that they feel this lack of resources and training was due to clients not wanting to learn. Contrary to this one of the BIM consultants went on to suggest that the Irish construction industry is placing too much exception on clients to have a full understanding of BIM and the process. They go on to state that industry personnel are the experts and should be providing clients with a professional service. The majority of consultants suggest that many of the industry professionals are only providing clients with the service they want, rather than what the client requires. The consultants suggest that design teams are writing EIR's to suit their capabilities.

The second issue or barrier in which both clients and consultants stated as a potential barrier to the implementation and adoption of BIM following the BIM mandate, was that of procurement.

With the majority of clients and consultants interviewed stating that the current Irish contract forms do not allow for the effective adoption/implementation of BIM. With most of the interviewees suggesting, that there would need to be changes to the current contract forms in order to allow effective adoption of BIM within the industry. However, the majority of clients were unable to suggest any potential changes to the current Irish contract forms. Whereas most consultants recommended an integrated project delivery (IPD) type of contract as a potential change to the government contracts committee for construction (GCCC) form of contract. This is because an IPD contract type allows for effective integration of people and systems to work collaboratively with various participants to optimise project results throughout all phases of a project (Institute of American Architects, 2007). Contrary to this type of contract, the minority of clients had stated they would still expect to see design teams and themselves on the opposite side of table to the contractor. Whereas the consultants outline that this type of scenario increases conflict, arguing and fighting on projects, thus creating non-value-added activities highlighting the need for a more integrated process.

6 Discussion

The data presented within the findings suggests that Irish clients do have an understanding of BIM and their role within a construction project. Contrary to Martineau (2017), Hore & Hunt and McAuley (2015; 2017) and the BIM consultants interviewed within this study who suggest that there is very little understanding on the clients behalf. This is evident within the findings as the majority of clients were able to suggest capabilities and benefits of BIM within the CAPEX and OPEX stages of a project. Identical to that of academic papers and journal articles prepared by industry professionals such as Byrde et al(2013), (Ghaffarianhoseini et al (2017), Hardin & Mc Cool (2015), Migilinskas et al (2013), Mills (2015), Aziz et al (2016), Edirisinghe et al (2017) and Gao & Pishdad-Bozorgi (2018). In addition, to this the findings highlighted that the majority of clients interviewed had an understanding of their role within a construction project. With some clients showing a higher understanding than others outlining the need to adapt their documentation or approach following issues arising on previous BIM lead projects. However, some of the clients then went on to suggest that they would not expect BIM technologies or a BEP from certain members of the design team. The author sees this as counterproductive to the implementation of BIM, as it creates a

broken process throughout the project. While the findings suggest that Irish clients do understand BIM, its capabilities and their role within a construction project. Both interview parties outline that there are still elements of learning which clients are undertaking or acquiring through the implementation of BIM technologies and processes. Both interview groups outline that following the introduction of the BIM mandate within the Irish construction industry, there has been little or no effort from the Irish government with regards to the introduction of standards or training. With one consultant comparing this to the UK BIM mandate, highlighting the huge investment they made to establish standards and tools and continue to do so to progress BIM level two. The consultant stated this outlined a clear commitment from the UK government outlining that they have yet to see this from the Irish government.

Interestingly, the findings do suggest that there are potential issues within the industry outside of the client's control. With one of those issues being the capabilities of the industry professionals. With most BIM consultants and clients highlighting that currently industry professionals are unable to provide a full BIM service to meet the client's needs. While the other issue raised by both interview parties is the current GCCC forms of contract, with both parties highlighting that the current GCCC forms of contract do not allow for effective implementation of BIM within a project.

6.1 Limitations

The data which has been presented within this study was gathered through a number of interviews with industry professionals and public and private clients across a wide variety of sectors, to present a third parties view across the majority of the industry to avoid biased views from either party involved within the study. However, due to assignment time constraints and personal industry exposure the number of interviews had to be limited to ensure compliance with the assignment timeline. In the ideal setting the author would have expanded the number of interviews held with both consultants and client to ensure impartiality across the market. The author also feels that additional interview data would have allowed them to more definitely conclude their findings within this study.

6.2 Area for further research

In terms of further research areas, this study has revealed that there are issues around the implementation and adoption of BIM within the Irish construction industry. With the study highlighting the lack of professional capabilities in providing a full BIM service as a potential issue to the implementation and adoption of BIM within the Irish construction industry. Therefore, a potential area for further research could be around industry professional capabilities in providing an adequate BIM service to Irish clients. It would be very interesting to review the above topic across the industry but also in a project specific scenario from all stakeholder's perspective providing a third-party view on the entire BIM process from start to finish of a project. Another area for further research would be around how a potential change to the GCCC forms of contract would assist in the implementation and adoption of BIM within the Irish construction industry.

7 Conclusions

As outlined by Hore & Hunt (2015), Hore et al (2017) and BIMireland (2018) stated within the introduction there is a growing frustration within the Irish construction industries around current BIM processes and the implementation of BIM within the Irish construction industry. With many industry professionals highlighting the lack of client understanding or demand as the cause

to this frustration. However, the findings within this paper would suggest that Irish clients do have a clear understanding of BIM, its capabilities and their role within a construction project. As majority of clients highlighted their understanding of the capabilities of BIM and their roles and responsibilities as that of the industry and academic papers referenced within the literature review. While the findings show that the majority of clients have a clear understanding of BIM and their role within a construction project, the minority of clients had suggested that they are still learning these BIM processes and their role within a construction project and will continue to do so through the implementation of BIM.

As outlined within the introduction the author suggested that the outcome of this investigation would establish if there was a requirement for educating or training clients to better inform them of BIM, its capabilities and their role within a construction project. Having completed this investigation and having reviewed the findings it would become apparent that many Irish construction clients have an understanding of BIM and their role within a construction project. The author would like to highlight that many clients suggest that they intend to better understand BIM and its processes through its implementation rather than through further education or training.

However, the question around this growing frustration within the Irish construction industry remains as the findings suggest that clients are not the root cause of the frustration. The findings and data suggest, that this frustration is an accumulation of numerous issues rather than one sole issue. With all parties highlighting the following issues as catalysts to this frustration: Lack of industry knowledge/training/ resources, lack of government assistance and the current Irish contract forms.

Both the clients and consultants outline that the entire construction industry is still learning the capabilities and processes involved within a BIM enabled project. With some of the clients highlighting that they are yet to receive the full capabilities of BIM as requested within a project, stating that some industry professionals are unable to provide such a service. While the majority of consultants highlighted that many of the industry professionals are hiding behind this of lack of clients understanding statement, suggesting that industry professionals are only providing clients with a service they can or want to provide rather than what the client requires. With both parties highlighting that there is a real requirement for upskilling across the entire Irish construction industry not just for clients but for industry professional.

One of the consultants stated that the Irish construction industry requires a re-boot as it is currently failing to deliver key infrastructure projects and housing to combat ongoing crisis's such as the current housing crisis (Mcgee, 2019). In order to combat this growing frustration and these ongoing crisis's both the clients and consultants highlight that there needs to be more effort from the Irish government. In particular around the Irish BIM mandate, with both parties outlining that they have yet to see any significant assistance, funding, training and resources from the Irish government. Whereas the consultants compare this to the clear commitment provided by UK BIM mandate who provided the industry with five a year period to prepare while also providing huge investment into standards and tools. While continuing to do so with the Digital Built Britain initiative to progress the UK from BIM level 2 to 3. Suggesting that the Irish construction industry is yet to see this from the Irish government, although the consultants acknowledge that the Irish government may working on various elements in house prior to release. One of the consultants highlights Irish government funded schemes being provided by Enterprise Ireland, such as BIM implement, and BIM enable to assist industry professional and clients adopt and implement BIM. However, they go on to outline that these services are only for Enterprise Ireland members. This

suggest that this type of scheme needs to be readily available to the entire construction industry to assist in the industry adoption of BIM.

Lastly it has become apparent that the current Irish forms of contract don't allow for effective BIM implementation. Generally leading to a disconnected and broken process within the design team, evidently leading conflict throughout the project. The majority of clients and consultants both suggested that there would need to change to the current Irish forms of contracts to allow for effective BIM implementation. With the consultants stating that the Irish government needs to look at possible integrated project delivery contract forms (IPD).

The data gathered from the consultants interviewed as part of this study would suggest that the Irish construction industry is currently failing to deliver on key infrastructure projects. However, in order for the construction industry to become more effective and deliver these key projects there needs to be more assistance from the Irish government around the BIM mandate and the use of digital technology within construction. This along with clear changes to the current Irish contract forms as they currently do not allow for effective BIM implementation and lead to conflict among contract parties. Therefore, creating a very inefficient process and industry leading to frustration among clients and industry professional.

The author believes the integration of an IPD contract form would significantly assist with increasing the efficiency of the Irish construction industry whilst reducing the growing frustration and conflict within the industry. Although the author does suggest that there needs to be further studies into the use of IPD and BIM and lean.

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9 References

- Agarwal, R., Chandrasekaran, S., & Sridhar, M. (2016). Imagining Construction's digital future. Retrieved from <https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/imagining-constructions-digital-future?reload>
- Ahmad Latiffi, A., & Fathi, M. S. (2016). Roles and Responsibilities of Construction Players in project Using Building Information Modeling (BIM). Paper presented at the IFIP International Conference on Product Lifecycle Management.
- Andersson, L., Farrell, K., Moshkovich, O., & Cranbourne, C. (2016). Implementing Virtual Design and Construction using BIM Current and future practices (First Edition ed. Vol. 1). London & New York: Routledge.
- Areo. (2015). Bim for facility managers and owners - Space Management. Retrieved from <https://www.myendnoteweb.com/EndNoteWeb.html?func=new&>
- Aziz, N. D., Nawawi, A. H., & Muhamad Ariff, N. R. (2016). Building Information Modelling (BIM) in Facilities Management: Opportunities to be Considered by Facility Managers. Paper presented at the AMER International Conference on Quality of Life, Medan, Indonesia.
- Bell, J. (2008). Doing your research project: A guide for first-time researchers in education, health and social science (4th ed.). Berkshire: Open University Press.
- BIMireland. (2018). BIM - State of the Nation with Ralph Montague. Retrieved from <http://www.bimireland.ie/2018/12/05/bim-state-of-the-nation-with-ralph-montague/>
- Bosch-Sijtsema, P., Isaksson, A., Lennartsson, M., & C.J.Linderoth, H. (2017). Barriers and facilitators for BIM use among Swedish medium-sized contractors - "We wait until someone tells us to use it". Visualization in Engineering, 5.
- Brinda, T. N., & Prasanna, E. (2014). Developments of Facility Management Using Building Information Modelling. International Journal of Innovative Research in Science, Engineering and Technology, 3(4), 11379-11386.
- Byrde, D., Broquetas, M., & Marc Volm, J. (2013). The Project Benefits of Building Information Modelling (BIM). International Journal of Project Management, 31(7), 971-980.
- Dunleavy, P. (2003). Authoring a PhD: How to plan, draft, write and finish a doctoral thesis or dissertation. New York: Palgrave MacMillan.
- Edirisinghe, R., London, K. A., Kalutara, P., & Aranda-Mena, G. (2017). Building information modelling for facility management: are we there yet? Engineering, Construction and Architectural Management, 24(6), 1119-1154.
- Fellows, R., & Liu, A. (2003). Research Methods for Construction (2nd ed.). Oxford: Blackwell Publishing.
- Gao, X., & Pishdad-Bozorgi, P. (2019). BIM-enabled facilities operation and maintenance: A review. Advanced Engineering Informatics, 39, 227-247.
- GhaffarianHoseini, A., Zhang, T., Nwadiogo, O., GhaffarianHoseini, A., Naismith, N., Tookey, J., & Raahemifar, K. (2017). Application of nD BIM Integrated Knowledge-based Building Management System (BIM-IKBMS) for inspecting post-construction energy efficiency. Renewable and Sustainable Energy Reviews, 72, 935-949.
- Ghaffarianhoseini, A., Tookey, J., Ghaffarianhoseini, A., Naismith, N., Azhar, S., Efimova, O., & Raahemifar, K. (2017). Building Information Modelling (BIM) uptake: Clear benefits, understanding its implementation, risks and challenges. Renewable and Sustainable Energy Reviews, 75, 1046-1053.
- Hardin, B., & Mc Cool, D. (2015). BIM and Construction Management: Proven Tools, Methods and Workflows (Second edition ed.). Canada: John Wiley & Sons.
- Hore, A. V., & Hunt, J. (2015). National BIM Survey - 2015. Retrieved from <http://www.bicp.ie/digital-transition-survey/>
- Hore, A. V., Hunt, J., & McAuley, B. (2016). National BIM survey 2016. Retrieved from <http://www.bicp.ie/digital-transition-survey/>
- Hore, A. V., Hunt, J., & McAuley, B. (2017). National BIM survey 2017. Retrieved from <http://www.bicp.ie/digital-transition-survey/>
- Hore, D. A., McAuley, B., West, P. R. P., & Rowland, D. (2013). Creating Interactive Facilities Management Capabilities through Building Information Modelling as a tool for Managing the Irish Public Sector Estates. Paper presented at the CITA BIM Gathering, Dublin, Ireland.
- Howe, M. (2017). Improving Collaboration on BIM Models Using Cloud-based Platforms. Retrieved from <https://www.engineering.com/BIM/ArticleID/14990/Improving-Collaboration-on-BIM-Models-Using-Cloud-based-Platforms.aspx>
- Institute of American Architects. (2007). Integrated project delivery : A guide. Retrieved from
- Jupp, J. (2017). 4D BIM for Environmental Planning and Management. Procedia Engineering, 180, 190-201.
- Kelly, G. (2018). Back to Basics - The What, How and Why of BIM and FM. Retrieved from <http://www.bimplus.co.uk/people/back-basics-what-how-and-why-bim-and-fm/>
- Khairil Izam, C., Ibrahim, C., & Belayutham, S. (2019). Towards Successful Social Collaboration in BIM-based Construction: A Review. MATEC web of Conferences, 266.
- Kumar, B. (2015). A Practical Guide to Adopting BIM in Construction Projects: Whittles Publishing.
- Liu, Y., Van Nederveen, S., & Hertogh, M. (2017). Understanding effects of BIM on collaborative design and construction: An empirical study in china. International journal of project management, 35, 686-698.
- Martineau, J. (2017). Do clients know what they want from BIM? Retrieved from <http://www.bimplus.co.uk/people/do-clients-know-what-they-want-from-bim/>

- Martinez-Aires, M. D., Lopez-Alonso, M., & Martinez-Rojas, M. (2018). Building Information Modeling and safety management: A systematic Review. *Safety Science*, 101, 11-18.
- Mcgee, H. (2019). Housing crisis: Has the Government delivered on rebuilding Ireland?
- Migilinskas, D., Popov, V., Juocevicius, V., & Ustinovichius, L. (2013). The Benefits, Obstacles and Problems of Practical Bim Implementation. *Procedia Engineering*, 57, 767-774.
- Mills, F. (2015). What is 5D BIM? Retrieved from <https://www.theb1m.com/video/what-is-5d-bim>
- Naoum, S. G. (2013). Dissertation research & writing for construction students (3rd ed.). New York: Routledge.
- NBS. (2016). What is Building Information Modelling (BIM)? Retrieved from <https://www.thenbs.com/knowledge/what-is-building-information-modelling-bim>
- Newby, P. (2014). *Research Method for Education*. Oxon: Routledge.
- Oti, A. H., Kurul, E., Cheung, F., & Tah, J. H. M. (2016). A Framework the utilization of Building Management System data in building information models for building design and operation. *Automation in Construction*, 72, 195-210.
- Pishdad-Bozorgi, P., Gao, X., Eastman, C., & Patrick Self, A. (2018). Planning and developing facility management-enabled building information model (FM-enabled BIM). *Automation in Construction*, 87, 22-38.
- RIAI BIM Committee. (2019). Information Management Roles. Retrieved from
- Savin Baden, M., & Howell Major, C. (2013). *Qualitative Research: The Essential Guide to Theory and Practice*. Oxon: Routledge.
- Sikes, P. (2008). Methodology, Procedures and Ethical Concerns. In *Doing Educational Research* (pp. 15-33). London: Sage Publications.
- Somani, N. (2019). How to know why is BIM cloud Collaboration beneficial in 3 minutes. Retrieved from <https://www.bimcommunity.com/news/load/1068/how-to-know-why-is-bim-cloud-collaboration-beneficial-in-3-minutes>
- UK Cabinet Office. (2013a). Government Soft Landings: Section 1 - Introduction. Retrieved from <https://www.cdbb.cam.ac.uk/Resources/Bimtaskgroupmaterial/GovernmentSoftLandingsSection1Introduction.pdf>
- UK Cabinet Office. (2013b). Government Soft Landings: Section 6 - Facilities Management. Retrieved from <https://www.cdbb.cam.ac.uk/Resources/Bimtaskgroupmaterial/GovernmentSoftLandingsSection6FacilitiesManagement.pdf/view>
- Yang, T., Piroozfar, P., Kang, B.-G., Wanatowski, D., Hancock, C. M., & Tang, L. (2018). Project-based pedagogy in interdisciplinary building design adopting BIM. *Engineering, construction and architectural management*, 25, 1376-1397.

Appendix 1 – Interview Questions

Interview Questions:

1. As a Client have you ever been involved in a project which has used a BIM process or BIM technologies?
 - i) If so, how many jobs have you been involved in which have specified BIM?
 - ii) If so, was this requested by yourself as a client or introduced by the contractor?
2. As a client which of the following would best categorizes your understanding of BIM?
 - (1) A Design and construction technology
 - (2) A maintenance and asset management software
 - (3) A collaborative process used by all parties to assist in the design, construction and maintenance of an asset.
 - (4) I don't have any understanding
3. If you have use BIM on a project have you seen any significant benefits through its use in the following areas:
 - i) Design
 - ii) Construction
 - iii) Facilities Management
4. Would you have any comments on the capabilities of BIM within the various stages of a Project:
 - i) Design
 - ii) Construction
 - iii) Facilities management
5. As a client what benefits would you expect through the Implementation of BIM?
 - Throughout the Capex stage of a project?
 - Throughout the OPEX stage of a Project?
6. As a client have you ever specified the use of BIM on tender documents? If so, how have you specified this as a return?
7. If you have specified BIM have you chosen to do so to benefit you as a client or due to recent changes in the Irish government (such as the BIM Roadmap 2021)
8. Does your organisation have any of the following documents and do you issue them as part of your tender documents:
 - i) OIR- Organisation Information Requirements
 - ii) AIR – Asset information Requirements
 - iii) EIR – Employers Information Requirements
9. If your organization has prepared any of the previous documents, were these prepared internally or by a consultancy?
10. Do you feel that there is adequate training for clients to help them through their BIM journey?
 - i) If so what forms of training have you or your staff undertaken to assist you in your Knowledge of BIM?
 - ii) If not what types of training do you think are required to assist your understanding of BIM?
11. Do you think that the government is providing enough training following recent introduction of BIM?

Interview Questions – BIM Consultants

1. As an expert in the field of BIM have you been approached by many clients for your services?
 - I. If so for what services have they approached, you for?
 - II. Did the clients provide you with their understanding and required outcomes from the implementation of BIM?
2. From your professional experience do you think Irish clients fully understand the capabilities of BIM and their role throughout a construction project?
3. Do you think that Irish clients are fully committed to adoption and implementation of BIM within the Irish construction Industry?
4. From the projects in which you have been involved in what were the benefits (or drawbacks) to the client following the implementation of BIM within the project?
5. With the possibility of an Irish BIM mandate in the coming years do you foresee any issues arising with such a mandate.
6. Have you had to prepare any of the following documents on behalf of a client?
 - i) OIR- Organisation Information Requirements
 - ii) AIR – Asset information Requirements
 - iii) EIR – Employers Information Requirements
7. Do you feel that there is adequate training for clients to help them through their BIM journey?
 - i) If so what forms of training do you think would benefit clients to adopt and implement BIM effectively?
 - ii) If not what types of training do you think are required to assist your understanding of BIM?
8. Do you feel that there any potential barriers to the adoption or implementation of BIM within the Irish Construction industry?
9. Do you think that there needs to be changes to the current Irish contract forms in order to allow effective adoption and implementation of BIM along with improved client integration?

Appendix 2 – Data Analysis

Due to the data analysis being completed using Excel it can be found within the Task Backlog on the E-Portfolio or can be zoomed in on within the PDF file of this below

Interviewee No.	Response Question 1: As an expert in the field of BIM have you been approached by many clients for your services? If so for what services have they approached you for? If not did the clients provide you with their understanding and required outcomes from the implementation of BIM?	Response Question 2: From your professional experience do you think Irish clients fully understand the capabilities of BIM and their role throughout a construction project?	Response Question 3: Do you think that Irish clients are fully committed to adoption and implementation of BIM within the Irish construction industry?	Response Question 4: From the projects in which you have been involved in what were the benefits (or drawbacks) to the client following the implementation of BIM within the project?	Response Question 5: With the possibility of an Irish BIM mandate in the coming years do you foresee any issues arising with such a mandate?	Response Question 6: Have you had to prepare any of the following documents on behalf of a client? i)OIR- Organisation Information Requirements ii)AIR – Asset Information Requirements iii)EIR – Employers Information Requirements	Response Question 7: Do you feel that there is adequate training for clients to help them through their BIM journey? If/so what forms of training do you think would benefit clients to adopt and implement BIM effectively? If/If not what types of training do you think are required to assist your understanding of BIM?	Response Question 8: Do you feel that there are any potential barriers to the adoption or implementation of BIM within the Irish Construction industry?	Response Question 9: Do you think that there needs to be changes to the current Irish contract forms in order to allow effective adoption and implementation of BIM along with improved client integration?	Additional comments
1	Consultant A outlines that he and his company have been approached by clients to assist them along their BIM journey. He states that it is his and their role to educate clients and to help them understand what and why to ask for various elements. He outlines that he helps clients to write their EIR's, get both legal and commercial arrangements in place so BIM is used properly. While during the project they would monitor the deliverables.	Consultant A states that yes clients come to him with some understanding of BIM, but could outline whether his was their full understanding of BIM. He goes on to state that clients are still learning and are attending industry talks to better improve their understanding. However does state that client have an understanding that BIM can benefit them and their project but do still go to Consultant A to better understand this. Consultant A goes on to say that the topic is an interesting one, stating that the industry may be putting to much exceptions on client as these are not the professionals. Consultant A goes on to state he finds it odd when people suggest it odd that clients are not asking for BIM outlining that the client again is not the professional in that arrangement. Consultant A gives an analogy of a doctor and patient and malpractice example. Consultant A states that many professionals are hiding between this excuse so that they don't have to use the best available tech, stating industrial malpractice seems to be acceptable?	Consultant A states that he doesn't think Clients want BIM. What clients want is things to go better on a project. Such as more certainty around what the final product is, cost, timeframe, quality, information and how that is going to be managed professionally by the people they employ. Consultant A goes on to state the above outcomes are dependent on the type of client, stating a developer may want cost and time certain and may not require quality information at handover. However Consultant A then states that this info will be required by someone and that without it the value of the property is diminished. Consultant A then states that clients will want BIM when you show them that can offer the above elements which they require. Consultant A states clients don't want BIM for the sake of it they need to understand why it will benefit them.	Consultant A states that there is plenty of benefits such as improved information, certain around the building and it's buildability. Consultant A states the draw backs are people are still resisting the use of BIM or are not capable of providing BIM, this leads to negotiating between team members on both the design and construction side trying to get them to use and follow these new technologies and processes	Consultant A outlines that he was involved in some of these talks and have highlighted the following potential issues. 1. Leadership: Consultant A outlines there is a misconception at leadership level as to what BIM is. What it costs and what it can offer. There needs to be a good leader in each project who understands and appreciates BIM. 2. Standards: Being a significant challenge as Consultant A states the industry in general doesn't follow standards. Outlining that the industry doesn't think about the transfer of structured data. 3. Education and training: Consultant A outlines that it is surprising how the industry has not been forthcoming with digitization and how some people still don't know how to use excel and how the industry is so embedded in using paper. He states that this change must start with colleges and undergrad but those in the industry must also adapt. 4. Procurement: Consultant A outlines that traditional procurement doesn't stop the use of BIM but states that it isn't helping the implementation of BIM. As this is a design, bid and build approach where experts at building are brought in late and very little change can take place. Consultant A outlines the concept of BIM is that the building is built twice, once virtually where all the issues are solved prior to physically building it saving money on site. In order to do this you require experts who understand how elements are constructed.	yes touch on within question 1 Consultant A states that he and his company have provided this service to clients.	Consultant A states that there wouldn't be a lot of training out there for clients. However goes on to state that not many clients are going out there looking to be trained. Consultant A guesses the reason many clients are trying to get training is because they have hired a professional to provided this service. He outlined this is his thought on this question, however states that this would be wrong as he states clients have to understand that they have certain responsibilities within a construction project and should be engaged within the process. Consultant A goes on to state that some of the clients responsibility has been performed by him and his company on behalf of the client, in the same situation Consultant A outlines that they have educated clients and trained them in the use of BIM. Outlining this benefit as discussion now took place around the model rather than drawings. He finishes by saying hopefully more of the training does become more available.	The issues and barriers were touched on within question 5 and question 9	yes there does need to be changes to the current Irish forms of contracts. Consultant A outlines that BIM can be used on these contract forms but that these forms don't allow for it's most effective use. Consultant A outlines that around the world they have implemented more effective forms of contract, such as in the USA where they have IPD contracts where everyone is working together with a common goal, rather than the Irish form where everyone is trying to harm one another. Consultant A outlines that the Ireland probably the only country in the world to have bespoke public procurement contract and states that the government has heavily invest in that so to change it would be difficult, however there is 11 different type so there is scope to change or adapt some of them. Other contracts can also be used depending on approval from the GCC	Consultant A states that he see some people have a long way to go. He also states doesn't see a lot of effort from the government, stating that there doesn't appear to be funding or programs to help. However he does go on to state that maybe they are doing some elements in the background and getting their own house in order before releasing it to the market. He compares this to the UK who mandated BIM on government projects in 2010 and then gave the industry 5 years to prepare while putting huge investment into standards and tools and the continue to do so, such as the 100 million pound invested into the digital build Britain project to take BIM from level 2 to 3. This outlines a clear commitment from the British government in funding, standards and research, however you don't see this from the Irish government, although there is a lot happening in Ireland but this is from volunteers such as colleges and CITA however these have not been supported by the government. Consultant A also states that there is a new construction sector group set up under the office of government expenditure. Consultant A outlines that Irish construction industry need a re-boot because it is currently failing to deliver key infrastructure, housing and disasters such as the recent hospital outlining that the current way of delivering projects is broken and requires a shake up, while digitalization is one thing it isn't the only changes to contracts could also be looked at so rather fighting with one another we spend our time more effectively working together to add value to the project. With the current system money is being spent arguing rather than on building materials. BK brings up the RIAI BIM Pack.
2	Consultant B outlines that yes he has been approached by clients to assist them in their BIM journey, however he does outline that it continues to grow. Consultant B outlines that there has been a change seeing him get more involved in helping clients through their BIM journey rather than their traditional service of supplying handover data. Consultant B outlines that this is dependent on how you perceived BIM whether that is as just 3D modelling or as the information stored within the 3D elements. However Consultant B outlines that this information also goes into other systems. Consultant B outlines that what they have been trying to do is teaching clients the process of linking the various elements and data. Consultant B does outline that the client learning and teaching element is growing.	Consultant B outlines that from the clients that have approached he for his services none or very few had any understanding of BIM and what they hoped to achieve out of it's use. Consultant B outlines that he is trying to inform clients of the requirement to produce an EIR, he further outlines many of the EIR's he has seen have not been prepared by the client & have been prepared by the design team with little or no reference to the clients needs and requirements. Consultant B outlines that this leads to the client receiving something that doesn't meet his needs at the end of a project, leading to frustration as the client has now paid for something which is of little or no use to them. In relation to the client role within a project Consultant B outlines that many clients don't want to know their role within a project unless they have some experience or FM team in place. Consultant B goes on to state this is due to the fact that the client has a business to run and that's where his focus is or on just getting the building built and has no desire in BIM. Consultant B also outlines that he has procured the services of professional thinking that is there role. Consultant B outlines that unless it is someone who is a multi-national or a repeat client or someone who has a current system in place they worst get involved in the process.	Touched on within Question 2	Consultant B states that yes there are benefits, highlighting the transfer and storage of data required by clients to operate their assets. Consultant B also highlights the benefits of 3D modelling from the ability to pull information they require quickly rather than read drawings. Although does highlight that this is dependent on designers and contractors. Consultant B also highlights the benefits of integrating a 3D model with a digital safety file, this allows the client to virtually understand their assets and components prior to receiving the asset, also allows them to see whether they have the required documentation.	Consultant B outlines that the mandate shouldn't cause an issue, although does outline that this is very dependent on what the Irish government does in relation to standard and the change from PAS 1192 to ISO 19650. Consultant B outlines that the annexes associated with ISO 19650 are not being adopted within Ireland, this then means that the new standards would not have all the clauses and requirements. Consultant B outlines this as a skeleton without it's flesh. This means that if a client stipulates that you comply with the ISO 19650 they may not get the type of services they envisaged as the annexes have not been included. Consultant B see this as a big issues although does hope it will be dealt with by the middle to end of this year.	Consultant B has outlined that there is a growing demand of clients approaching him outlining their need to write and have their own EIR. Consultant B outlines that PAS 1192 states that the information manager can be a member of the design team however many client prefer to have a separate person sit in on the design team, as they feel they get a better service.	Consultant B outlines that there is a lot of talk around how the government needs to do this and provide that but he feels that if the benefits are shown to clients they will learn and adopt BIM willingly. Highlight that they shouldn't need a mandate forcing them to use BIM on public projects. Consultant B states that he feels that there is enough awareness and training out there it is dependent on whether the clients wishes to learn. Again Consultant B highlight clients will only be willingly if there is a benefit to them. Consultant B states that he has seen saving during the design and construction phases through the use of BIM although not directly benefitting the client, he is get to see benefits to clients in how BIM is being provided to them, such as in revit or 3D modelling rather than as the information data.	Consultant B outlines that he does not see any barriers to the implementation and adoption of BIM other than the client willingness to use BIM. Highlighting that it is still a new technology and process and will be adapted to the industry as CAD was. Consultant B also highlights that we need to focus on where significant saving are.	Consultant B outlines that this is dependent on the type of contract and project. Highlighting ownership of model as an important factor. Consultant B highlight a project in which the client has hired a BIM producer to produce their 3D model throughout the design and construction stages. Consultant B outlines that at handover stage the model was handed over but had the drawings removed from the file on the basis that the client had bought and paid for the model but not the drawings. This was due to the schedules were no smart elements produced from the model. Consultant B outlines that if people adopt and use the contracts that are there it is more than enough (Steven Lyman)	
3	Consultant C outlines that clients is one of their key targets within the Irish construction industry, outlining her experience prior to setting up the BIM consultancy is the lack of information within client tender documents as to the use / output of BIM. She outlines that this lead to increased frustration around the lack of understanding and knowledge on the clients side. She outlines that many clients still don't see the need to get involved within the decision making, outline many clients still expect design teams to tell them what they will get.	Consultant C outlines similar to response 1 that many clients she feels don't have an understanding of the capabilities of BIM and their role within a project. However she goes on to state that she has worked with international and multinational companies who have a BIM strategy but outlines when this is put into practice it appears to fall between the cracks.	Consultant C outlines that she couldn't make a sweeping statement for all clients in relation to the implementation of BIM within the Irish construction industry. However she goes on to state that she was recently approached by residential clients who were looking at implementing BIM on upcoming housing project, although she outlines that this has been a hard sell to get them to fully commit. She outlines that this is one sector within the Irish market who is start to think about the use of BIM. She outlines that the commercial sector (shopping centres) within the Irish industry are starting to integrate BIM tech and software into their FM systems.	Consultant C outlines that she is a big believer in BIM and states that there are benefits throughout the entire lifecycle of the project. Outlining the ability to the sharing of the model between the design team and the contractor as a sticking point therefore leading to additional re-work for the contractor or the model received isnt suitable for construction. Consultant C states that one of the biggest draw back is many projects not having an EIR or no document stating the clients requirements meaning the project starts on the wrong foot.	Consultant C outlines she has created these documents for a client but not for a live document but as a standard set of specs which they would use on their projects globally. She outlines though that the client had not requested an EIR Consultant C and her company had to suggest this to them while they created a standard suite of documents.	Consultant C suggests that there is enough training within the market in relation to the technology side of BIM. However she goes on to suggest that there is lack of training around the process and responsibilities. She states that it is one thing to send employees on a 3 day revit course but if they don't understand the process this will be wasted. BK outlines the importance of this similar to me prior to the masters in which I thought BIM was only a technology rather than a process.	Consultant C states that she does see barriers within the implementation and adoption. Consultant C states that smaller organizations are afraid to adopt and implement BIM where as larger organizations don't look at changing their process or spending time and money on research and development. She outlines that there will be a need for additional support for both of the above scenarios.	Consultant C states that this will be essential as she outlines that the current government procurement contracts do not support a BIM process. This is due to the current contract forms do not allow for the IPD or more collaborative forms of work. She outlines that the current contract forms of design, bid, construct leads to conflict between tenderer and client over price	Consultant C goes back to the fundamentals of BIM - people, process and technology. She outlines that the importance of a process and technology is important but having people and defined roles and responsibilities is of great importance. Consultant C outlines that enterprise Ireland have 2 schemes called BIM implement and BIM Enable to help clients and organisations to implement and adopt BIM and processes. Although Consultant C outlines that this is something that would need to be rolled out over more of the industry.	
FINDINGS	Majority of Consultants have outlined that they have been approached by clients to assist them within their BIM journey.	All consultants have outlined that the clients that have approached them have little or no understanding of BIM process or the capabilities.	Majority of consultants interviewed stated that clients are not committed to BIM and don't want BIM. With the consultants stating that they just wish for projects to go much smooth and more efficiently. One consultant also highlighted that these clients have their own business to run and therefore don't wish to get involved in an additional process and this is why they higher professionals.	All the consultants highlight numerous benefits such as increased visibility, reduced clashes and re-work. Along with the bonus of document and data transfer and storage throughout all phases of the project.	The majority of the consultants interviewed stated that yes they do envisage issues arising with a potential mandate. With the main focus being that of Standards and how these are implemented within the industry.	Yes all consultants stated that they had been approached by clients in order to prepare certain BIM documentation such as the OIR, AIR & EIR	Consultants were very split on this question with mixed responses. One consultants stated that there is no training out there for clients cause clients don't wish to have training. However he states this is wrong as clients must have an understanding of the capabilities and their role prior to beginning a project.	The consultants again where split on this question with some suggesting the only barrier is clients willingness to use BIM. Whereas the other suggests that professional may not be able to fully provide BIM in it's correct form to allow clients to adapt it fully.	The majority of the consultants highlighted that there would need to be changes to the currently Irish contract forms in order to allow for effective BIM implementation.	Review this column when writing as interesting comments from Consultant C and Consultant A.
	The majority of the consultants outline that they feel their role is to educate and teach clients as they feel they are still lacking in their understanding of BIM and their role.	Majority of consultants state that they are trying to inform clients of the capabilities and their roles but is a slow process. One consultant has outlined that he see's more and more clients attending industry talks which will assist in this process.	The minority of consultants highlighted that different types of clients have recently looked at implementing BIM so therefore states that maybe they are more willing to adapt and implement BIM.	The majority of the consultants highlighted the lack of professional skills as a drawback to the implementation of BIM within the industry.	The other elements which were also mentioned as issues which would need to be addressed are the leadership roles and understanding of roles within the process. The training and education aspect within the industry in particular the industry resistance against moving digital, Lastly procurement was stated as a potential issue with one of the consultants stating that traditional contract forms don't stop the implementation of BIM but they certainly don't help.		On the other hand one consultant stated that clients shouldn't need a mandate to want BIM they should want it for the benefits. They also stated that there is adequate training out there but again clients are not willing to learn.	This was also highlighted within Question 5	The majority of consultants suggested a IPD form of contract as a potential contract form which may assist the implementation of BIM.	
		One of the consultants has stated that he feel the industry is putting too much expectation on clients to have a full understanding of BIM and it's process. Highlighting that many industry professionals are hiding behind this statement. Suggesting the design teams are the professionals and should be providing a professional service.		The minority of the consultants interviewed stated that the lack of Client EIR's is a draw back on the project stating this starts the project off on the wrong foot.			Where as the other consultant stated that there is adequate training on the technology side of BIM to help clients but not on their roles, responsibilities and the process.			
		The majority of consultants stated that they feel many professional are only providing clients with the service that they want to rather than what the clients require. Highlighting many professionals are writing EIR's on behalf of clients to suit themselves.								