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## Potential Use of a Light P AS 1192 2 standard for Local Authorities in Ireland

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# Potential use of a light PAS 1192-2 standard for Local Authorities in Ireland

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**Abstract**– The Irish government has acknowledged the importance of BIM, but the adoption of it is still lower than in other countries. The implementation of more effective information mandates through the life cycle of a project could bring greater barriers, especially for a local authority. Therefore, in this research, which reviewed the obstacles that exist when a company tries to implement BIM, it was found that there are similarities between the barriers to BIM in Ireland and the UK, but studies and life experience when a design team is applying BIM have shown that if clients implement at an early stage the use of an intermediate BIM consultant, this could bring supports and help clients to achieve their goal. In addition, the evaluation of the current practices of a local authority in the UK, namely Hampshire County Council (HCC), that used a variation, or a slim version, of PAS 1192-2 in the implementation of a BIM pilot project (Case Study West of Waterlooville Primary School), was proposed to different stakeholders in Dublin City Council in order to learn from the advances of other jurisdictions and see if this type of practice can be applied in Ireland. Furthermore, as there is a lack of BIM in local authorities in Ireland, in this research, the author developed a workflow of a BIM process for the delivery of a public works project as a key to overcoming the barriers to BIM. The proposed workflow was evaluated using interviews with different stakeholders within Dublin City Council, such as architects, quantity surveyors, councillors, and managers. A mixed methodology was applied in all the objectives of this proposal, as the literature reviewed, with the addition of a fourth-generation evaluation interviews with different stakeholders provided the conclusion of this research. This process produced a better understanding of the workflow BIM process for this LA and final recommendations to DCC for the application of the BIM process in the Capital projects are provided in the following capstone experience.

*Keywords: BIM Barriers; Solution; BIM Level 2; Workflow*

## I INTRODUCTION

Eastman, Teicholz, Sacks and Liston (2011) define BIM as consisting of tools, processes and technologies that facilitate the documentation of performance, planning, construction and the facility management of assets. During the development of this Capstone Experience, the International Standard ISO 19650 Part 1 and Part 2 “Organization and Digitization of Information about Buildings and Civil Engineering Works, Including Building Information Modelling (BIM)” were published. As a result of this, the ISO standard is now being adopted in Ireland instead of the PAS standards but, this work commenced before the ISO standard had been released. Therefore, in the following article the author will be referring to PAS standards.

BIM has been mandatory for local authorities in the UK since April 2016. NBS (2014) defines BIM Level 2 as a process where each discipline

creates separate 3D parametric models with information using software chosen to meet their specific needs. All of the models are combined into one model in a collaborative 3D environment. The information is shared between the design team and all of the parties involved in the project using guidance given in the standards as PAS 1192-2, PAS 1192-3, BS 1192-4, PAS 1192-5, PAS 1192-6, BS 1192. These standards play an important role, as they ensure the adoption of BIM technologies, processes and collaboration to develop a BIM model that is populated with precise and complete information. Hore and West (2016) clearly highlighted how governments around the globe are increasingly recognising the efficiencies that accrue through the use of the standards in the BIM process. Bew (2016) presents how the UK government’s construction strategy, published in May 2016, set a goal to reduce the cost of construction of public sector assets by up to 20% and to improve building performance (or

reduce carbon output) by 50%. The current status of adoption of BIM Level 2 processes in Ireland is explained by the National BIM Council (2017). The NBC has developed The Roadmap to Digital Transition for Ireland's Construction Industry in order to increase the adoption of better information management in Ireland, and this includes local authorities.

In Ireland, the GCCC (2017) (Government Contracts Committee for Construction) explained in a paper titled "A Public Sector BIM Adoption Strategy" the benefits that BIM could bring in the delivery of public works projects and also identified the challenges adoption will bring. The GCCC recommended to government the adoption of BIM across the public capital programme and suggested that the government should mandate this requirement to ensure that consistent standards for delivery are imposed across the public sector, and that public bodies should invest the necessary resources to adopt BIM in line with the strategy. The Department of Public Expenditure and Reform states that BIM will be required in the design, construction and operation of public buildings and infrastructure for public works projects that are funded through the public capital programme over the next four years (Sweeney, 2017). It is in this context that BIM could be mandated for the public sector, and the researcher will be required to implement BIM in capital projects through her employment with a LA.

Therefore, in the literature review of this research you will find obstacles and resistance in local authorities in the UK regarding the implementation of BIM Level 2, in order to understand why resistance exists and whether it is likely to exist in Ireland with the introduction of BIM in local authorities in Ireland.

In addition, you will see a case study in section V of this research, where it will examine a BIM case study in Hampshire County Council and to learn from its practices. Furthermore, this research will critically appraise the barriers and opportunities associated with implementing BIM and will develop a workflow BIM process for a local authority, in order that the final outcome (section VII) could be used in the adoption of digital transition for local authorities in Ireland.

## II & III Research Objectives & Aligned Methodology

- **Objective 1:** To identify barriers and resistance to BIM in UK local authority construction projects that are common in the UK and Ireland, with a review of proposals regarding how to overcome the barriers to BIM via the use of an

intermediate consultant working for the client.

- **Research methodology:** A literature review of currently available research, of the potential use of an internal BIM consultant working for the client (DCC) as an aide to overcoming resistance encountered in the UK.
- **Objective 2:** To identify lessons learned from the existing practices in a local authority in the UK, namely Hampshire County Council (HCC), that has used a variation, or a light version, of PAS 1192-2 in the implementation of a BIM pilot project (case study: West of Waterlooville Primary School).
- **Research methodology:** A combination of review of the existing literature about the Hampshire County Council West of Waterlooville Primary School BIM case study plus an interview with the senior architect and BIM manager of HCC.
- **Objective 3:** To develop a workflow of a BIM process for the delivery of public works project development for a local authority (LA) in Ireland (Dublin City Council).
- **Research methodology:** A critical review of the Local Authority Works Part 8 and governance framework for Capital Projects in Dublin City Council with reference to the BIM level 2 PAS standards.
- **Objective 4:** To critically evaluate the proposed workflow and produce final recommendations to Dublin City Council on the BIM process.
- **Research methodology:** Mixed method research consisting of qualitative interviews with different stakeholders, followed by analysis based on the principles of a 4th Generation Evaluation

## IV REVIEW OF LITERATURE

Mcauley, Hore and West (2017) indicate that the government of Ireland's closest neighbour, the UK, has made the use of BIM mandatory for any new central capital-funded public sector projects since April 2016. The UK made freely available a number of publicly available specifications (PAS) and British standards (BS) which indicate best practice in the implementation of BIM for the capital/delivery and the operational phase of construction projects using BIM. Additionally, the UK government has started to implement the Level 3 BIM programme. Following this, the UK is now a global leader in the adoption of BIM.

The author has selected the construction industry of the UK for analysis in order to identify barriers and resistance that the UK is facing in the implementation of BIM Level 2, due to Ireland and the UK having some similarity as a result of the shared history between both countries, with similar government set-ups and companies working in both jurisdictions.

### 1. UK barriers

Lymath (2016) explains that, in the effort to obey the UK government's mandate in terms of implementing BIM Level 2, construction companies in the UK are facing challenges in the process of implementing BIM, and Lymath outlines the following reasons regarding why resistance against its implementation exists:

- There is no client demand. Whilst the UK government is in the process of enforcing BIM for publicly funded work, clients of smaller organisations do not make similar requests.
- BIM is not always relevant for the application of small projects or for small organisations.
- Cost: A common observation in this study was that the move into BIM does involve considerable investment in software, training and time. However, the costs need to be weighed against the benefits. Those who use BIM have reported that the experience has been better than they had expected.
- Resistance from the staff to implementing changes in the organisation.
- In-house staff might not have the necessary skills concerning BIM, and resources may be required to train staff.

Khosrowshahi and Arayici (2012) explain that the implementation of BIM is a major change management task that involves a diversity of risk areas. A roadmap for the implementation of BIM in the UK construction industry was created, with the related findings suggesting three structures by which to implement BIM in an organisation. The first is to tackle technology, while the second is to introduce a process, and the third involves reviewing the implementation with those who are working with BIM and studying their issues, as well as providing solutions with education, training and information management.

Bain (2019) explains the findings of the National UK BIM Survey 2019. In this survey, it was found that the implementation of BIM requires a

significant change within an organisation. Almost all respondents in this survey agreed that it requires changes to their workflows, practices and procedures. As a result, it can be challenging to find the resources to make the changes possible. The top three barriers to the use of BIM in the UK found in this survey were the lack of client demand 65%, a lack of staff expertise 63% and a lack of training 59%.

### 2. Irish barriers and commonality with UK barriers

Archer (2019), in the article "BIM in Ireland", displayed the results of a recent survey regarding BIM awareness in Ireland. The findings indicate that there is a similarity between the UK and Ireland in regard to the barriers to the implementation of BIM, probably due to the proximity between the two countries. According to 116 responses to the survey, Ireland, like many other countries, is experiencing a digital transformation in its construction sector. The respondents were from a mixture of disciplines, and they included architects, architectural technologists, BIM managers, building service engineers and structural engineers, among others. The following key findings emerged:

- According to Archer (2019), findings on the survey in Ireland using specific design BIM professionals, the outcome shows that there is a similarity in BIM awareness and adoption between the UK and Ireland. All of the respondents to the Irish BIM survey suggested that they are aware of the implementation of BIM.
- As regards to BIM information and initiatives, having access to information and support it is important to ensure the effective adoption of BIM. The following organisations are those that a BIM consultant is most likely to consult when seeking information: NBS, the Construction IT Alliance (CitA) and Building SMART. Furthermore, to help the construction industry in Ireland achieve its digital transformation, the Irish government introduced the BIM Adoption Strategy in late 2017, along with the NBC Roadmap 2018-2021, which explains how the industry can work on this transformation between 2018 and 2021. In the survey, 27% of respondents believed that the Irish government's BIM adoption strategy has been successful, and 44% thought that the NBC Roadmap 2018-2021 has been very successful or quite successful. This is a positive start to the roadmap and strategy

despite the fact that the NBC Roadmap has not yet attracted any government funding.

- Barriers to adopting BIM in both the UK and Ireland include the challenges that design professionals are facing as regards BIM adoption. In Ireland, the top three barriers to BIM adoption are a lack of in-house expertise (74%), a lack of client demand (67%) and a lack of training (67%). However, respondents, especially those who are already using BIM, recognise the advantages that BIM adoption brings, increasing the coordination of construction documents and cost efficiencies.

Barriers and challenges are common in an organisation that is seeking to implement BIM, and it is evident that there are similarities in the barriers to the use of BIM in the UK and Ireland. Therefore, the following section suggests how to overcome the barriers of BIM.

### 3. *Employment of an Intermediary consultant between the LA and the project delivery teams*

BIMireland.ie (2019) explains that the main challenges to BIM adoption in the public sector are mind-set, the experience of procuring a virtual asset, the change from cost to value and the whole life approach; there is still too much emphasis on capital costs.

BIMireland.ie (2017) explains that if clients pursue early engagement with specialists, bringing the right people into the process at the right time, it will enable them to achieve the benefits of BIM. A BIM consultant as an independent and impartial advisor who will help clients with the implementation of the requirements of the standards, as the skill and knowledge to carry out the duties of the BIM process may not be available in the client organisation. This will help to overcome barriers in the organisation and at the end of the project. The lessons learned from the intermediary consultant will result in the up-skilling of client staff representatives, and the knowledge gained will be used in the future.

A master's study report from Turner (2019) has suggested that there are barriers that prevent clients from engaging with BIM processes. One of these is that clients are not clear as regards defining what they need from the process, as there is a lack of understanding of BIM and difficulties in defining their needs at the early stages of the process. Therefore, the Turner study proposed that, in order to overcome these obstacles in the BIM process, the creation of a new role, the client BIM consultant (CBC), directly appointed by the client, working on

behalf of the client and independently from the design team, would help as a solution to these barriers. The role of the CBC involves ensuring that all the information provided by the design team is correct, with the level of definition in accordance at each stage of the process. It will also assist the client in the creation of employers' information requirements (EIR) and will ensure that the client is being represented in all aspects of the BIM process. The CRC will also ensure that information is delivered at the right time and in the correct format. It is essential that the CBC has a deep understanding of the BIM process, ensuring that the correct BIM standards and processes are followed, validating the federated model, with the aim that the client obtains what he/she wants and needs.

Work conducted by Operam (2019) is an example of the use of an educational intermediate consultant. This organisation is focused on creating a management process that achieves business goals for the management of information and establishing a culture of innovation, learning and continuous improvement. The Digital Transformation Framework in a client's organisation is a combination of knowledge and experience in a repeatable approach that will enable the client organisation to achieve sustained success in BIM. The principal objective is to establish a company information management system which defines the client's approach to the management and collaborative production of information. In this regard, it will focus on five capability categories: leadership, people, process, technology and implementation; this collectively enables the client organisation to obtain the benefits of BIM in a smart and sustainable way.

In order to gain feedback and evaluate the suggestions of the above literature review, the author interviewed an engineer from the Roads Design Department in Dublin City Council (DCC) to gauge their opinion on investing in an in-house consultant. This engineer was selected due to

- (1) having a Senior Management position in DCC
- (2) having significant expertise in what is required to implementing BIM within DCC and from the experiences gained on the Clarendon Street Road pilot Project for the Department of Road Design.

The outcome of this interview is detailed below:

The design team of this department tried to implement a BIM process in an infrastructure project in an introductory pilot project using Autodesk Civil 3D for the Clarendon Street Road Project. During the process, it was found that the following obstacles existed as regards completing the project at BIM Level 2 standard:

- The absence of a BIM process in the department or a strategy in the organisation for implementing BIM. In addition, the absence of a national / government BIM mandate made it difficult to progress with the implementation.
- The in-house DCC staff on the Roads Design Department not being trained on the BIM process and not having enough knowledge and experience in the production of the 3D model infrastructure. Furthermore, no other department within DCC could provide them with help and support on queries regarding BIM for infrastructure.
- The lack of support from the Information System Department (IS). The Roads Design Department purchased software (MicroStation 3D) to implement BIM, and a license was bought for a year. The design team could not use this software during this time, as the IS Department would not authorize it to upload documents to the computer system.
- There is fragmented implementation of BIM in the organisation: The quantity surveyors (QS) and architects do not understand the engineering infrastructure work, the system that is in place and how the department works. Therefore, it is difficult to obtain help from those departments due to the nature of the job.
- Contractors are not aware of how to work with BIM, so they are not “on the same page” with the Roads Design Department.

Based on the experience of the failure of the pilot project, the following recommendations to overcome these barriers faced by the design team are proposed by the engineer:

- DCC needs to engage in BIM implementation via a coordinated approach with a Cooperative BIM strategy for all across the organisation.
- It is necessary to create a BIM Office Team in DCC that works only on projects in BIM, as the current backlog of each department makes difficult to concentrate on an extra task such as BIM.
- As the department had a lack of in-house expertise in BIM, it is definitely necessary to employ an in-house client BIM consultant (CBC). This would help the department to deliver the project in BIM, and it would provide guidance at every stage of the BIM process.

Ireland will soon mandate the use of BIM in capital programmes – the author searched for a learning experience (case study) of how local authority in the UK have overcome the barriers to implementing BIM. The following case study is based on a local authority in the UK’s Hampshire County Council (HCC), following PAS 1192-2, and despite the barriers and obstacles that the implementation of BIM brings, this LA overcame these obstacles and chose to implement a successful BIM pilot project in education.

#### V. CASE STUDY: WEST OF WATERLOOVILLE PRIMARY SCHOOL, HAMPSHIRE COUNTY COUNCIL (HCC).

A vast number of projects have been implemented in the UK as per the standard BIM Level 2 (BIM L2) implementation. The reasons why in this Capstone Experience, the author is examining this particular case study is because there are limitations on public works where people are willing to talk about the difficulties in implementing BIM in public bodies. A senior architect BIM manager (SABM) of HCC Property Service spoke with this researcher to explain how the design team of HCC evaluated the requirements of PAS 1192-2 and selected what was needed for the production of a slim version of a BIM pilot project involving £8m capital funding for a primary school facilitating 450 pupils in Waterlooville. During this project, the design team made the standards works for them and produce what they were looking to achieve. Therefore, the following case study shows how HCC produced and utilised a slimmed-down version of the BIM process. A structured one-to-one interview was completed with the senior architect and BIM manager of the project.

##### a) *What is the background?*

The UK government set up a special BIM Task Group to develop a roadmap for the implementation of BIM in the UK in order to facilitate the adoption of different levels of BIM in construction projects, with a mandate that all projects should achieve Level 2 BIM by 2016. Goubau (2017) explains the BIM processes in the form of “levels” from level 1 to 3 as per the UK Government BIM Roadmap.

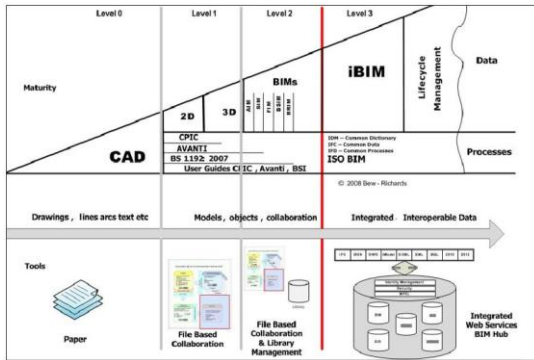


Figure 1 : UK Government BIM Roadmap  
(Government Construction Client Group (2011)  
(Appendix 3, p.16)

The Figure above explains the BIM levels and what they involve (Government Construction Client Group, 2011). This is the minimum BIM level mandated by the government for all public contracts in the UK. BIM Level 3 is an open process involving the use of IFC/IFD standards, using a collaborative environment. The user will have information on the project regarding how to safely and cost-effectively demolish or regenerate the building.

HCC, in response to the PAS 1192-2, tested a BIM process for a new primary school building for 420 pupils in Hampshire. During this pilot project, the council sought to improve productivity by applying a BIM workflow that consisted of an increased collaboration process and avoided the duplication of information, increasing the speed of delivery of the project achieving one of the goals of Lean: better value for the client. Dovetail (2015) explains that the purpose of lean construction is to approach a building project with a solid plan of the project from the beginning to the end, in order that the design team can produce its best work in the shortest time possible. Lean construction has two main goals to serve during the construction process: the first is to keep waste of material, time, and travel to a minimum via clever planning of the project and to avoiding building errors, while the second is to improve the value generation for the client.

b) *“How did the HCC design team successfully implement BIM in the Primary School for Waterlooville”:*

Setting the level of BIM required by the project: The (SABM) explained that, from his experience, once his boss told him “I need a BIM project produced in the Architecture Department of HCC”, his first thought was that the most important issue was to clarify that BIM does not involve the use of Revit software, that BIM involves better information

management. The Architecture Department in HCC starting using Revit, and the team set about determining how to share the information in compliance with PAS 1192-2. As it was limited with regard to in-house expertise in MEP, an external consultant for the model’s MEP and Structural Model was required.

A BIM execution plan was set up as part of how information is shared. As BIM Level 2 involves complex requirements that the design team of HCC was not able to deliver, HCC decided to implement the BIM process in simple steps. Firstly, it started with BIM Level 1, addressing the basics, and from there, it moved forward to facilitate better information management that required knowledge of how to control the process and how to share information between the designers. Secondly, it produced projects with the right name of the scheme. Having BIM Level 1 in place was the key success factor for the delivery of this project, and once Level 1 was achieved, the design team progressed to partial Level 2 implementation with a clash detection modelling 3D view. Autodesk Navisworks was used for design coordination and clash detection. The software used for sharing the federated model in the cloud was Autodesk 360, which served as the common data environment.

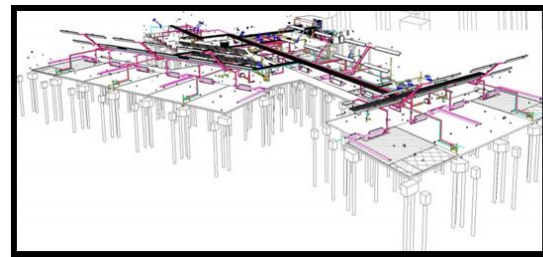


Fig 2: Mechanical, electrical and above-ground drainage are all linked (Lewis, 2016)

a) *Changes in the internal workflow process:*

As no one in the team had much experience of working with BIM, the design team explored the process of working in a collaborative way, as a result the traditional design process change from a linear and traditional process design to a dynamic interaction between the parties involved in order to avoid the duplication of work and progress with the principal of collaboration. (Please see below diagram for details of the BIM implementation process in HCC.)

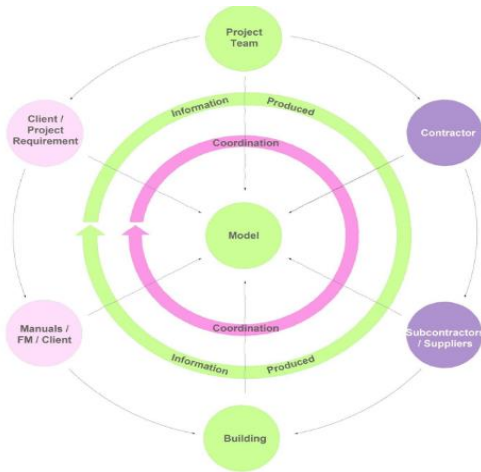


Fig. 3: Comparison between a traditional workflow of HCC and the new workflow with the implementation of BIM (Lewis, 2016)

*b) Simplifying the BIM execution plan*

HCC produced a Light version of what a BIM Execution Plan (BEP) involves, with a four-page summary which included basic features such as the following: who is included in the team; what the design team were doing; and how the design team would share clash detection information. This is important, as it establishes in writing how the design team will work together, and it simplifies the whole process.

*c) What are advantages and challenges of implementing BIM in HCC?*

**Advantages**

- Improved productivity due to easy retrieval of information.
- Increased coordination of construction documents.
- Team management communication is increased.
- Increased speed of delivery and improved visualisation.
- Greater understanding of construction information.

**Challenges**

- ITS support: The design team found a problem regarding Revit licence sharing, the virtual desktop infrastructure (VDI), lower virtualisation memory and difficulties with IT capacity.
- Training the staff caused a delay at the beginning of the project, along with

resistance from the management and senior staff.

*d) Lessons learned from trying to implementing BIM in HCC*

According to Cousins (2016), HCC could not achieve the full target of a 10% net construction cost saving, due to the fact that it could not model the landscaping and underground drainage. In addition, “a large volume of soil was removed from site that was expensive, if that element was modelled more accurately HCC could have reduced that cost”. However, the council is currently working to incorporate the standards for BIM Level 2 into its workflows to ensure compliance. BIM learning from the Berewood project is being taken forward and rolled out for future primary school projects.

Furthermore, (SABM) explained that one of the barriers to the UK BIM Level 2 mandate at the moment is that BIM was necessary for project funding in London, and as regards small projects in the UK, BIM is not mandated, and this is the biggest failing for local authorities in the UK, as they tend not to implement the BIM process in small projects.

Overall, HCC gained substantial benefits from the implementation of BIM in this pilot project. Comparing the cost of 10 projects involving Revit and 10 projects involving AutoCAD, the projects involving Revit were associated with more collaboration and a 50% reduction in costs, as well as fewer mistakes. However, in reality, if HCC works collaboratively with Revit, the design team experienced increased productivity and reduced cost. HCC found BIM to be more effective, requiring less time and lower costs: Better Management.

*e) What advice was given by the Architecture Department of HCC for local authorities in Ireland?*

According to (SABM) the following advice was given for future practice:

- Having BIM manager support during the process will facilitate the implementation of the process.
- Providing continual training to the staff will help to get people on board.
- Keep the BIM process simple.
- Use different software to obtain better results.
- The final project file must be an IFC file.

HCC tried something different. It was not that it did not follow the standards; it looked for the standards that worked for its needs. Local authorities



have limitations in resources and time scales, but in this particular case study, by defining what part of the standardisation would work for the job that the Architectural Department had to carry out and by setting a simple BIM Execution Plan (BEP), it achieved project delivery faster and more efficiently.

We can observe that this pilot project produced a collaborative approach in the architectural department of HCC and created a connection with one of the lean goals increase efficacy. According to (Bhargav, Kiviniemi, Koskela, & Tzortzopoulos (2013), lean is connecting with BIM, as lean construction makes the application of BIM technologies easier and increases efficacy, because it focuses on being able to predict, as well as working together, with innovation and discipline.

This is very important at the early stages when a new technology is being incorporated. In this, local authorities in Ireland should apply and adopt a lean philosophy Lean Construction Ireland (2019) as the slogan of the lean construction (“better faster together”).

In the next part of this paper, a workflow of a BIM process for the implementation of BIM in a Local authority will be presented, and an evaluation of the proposed Workflow with a discussion of whether DCC should take on this type of approach for the delivery of a capital project will be presented.

## VI. A BIM WORKFLOW OF A BIM PROCESS FOR DCC:

NBS (2014) defines BIM Level 2 as a process where each discipline creates in collaboration a federate model with information using software chosen to meet their specific needs. The information is shared between the design team and all of the parties involved in the project using guidance given in PAS 1192-2, “Specification for information management for the capital/delivery phase of construction projects using building information modelling”, and PAS 1192-3, “Specification for information management for the operational phase of construction projects using building information modelling”, where the information is exchanged using a common data environment (CDE). These standards play an important role, as they ensure the adoption of BIM technologies, processes and collaboration to develop a BIM model that is populated with precise and complete information. In order to create a BIM Level 2 process for DCC, it is necessary to define the following: What a capital project is? How are such projects currently produced? Under what type of legislation they are regulated.

The Capital Project Support Office (2019) defines a capital project (CP) as “a project that results in the creation of an asset beyond the year in

which the asset is provided. Capital projects also include renovation or refurbishment of capital assets”. CP in DCC are subject to review and approval by the Corporate Project Governance Board (CPGB). The members of the CPGB are senior management, and they oversee and monitor the City Council’s capital accounts. Every three months, they evaluate the current stages of all the projects and provide approval for them to continue (Figure 4: DCC governance structure).

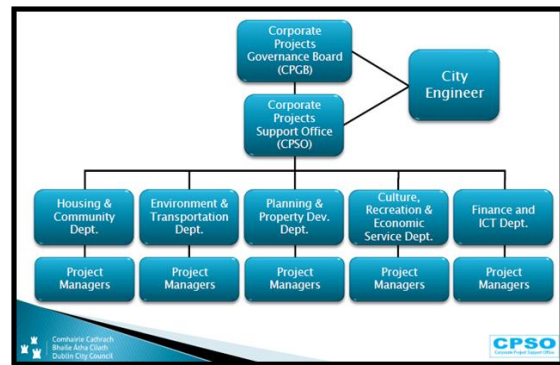


Fig. 4: DCC governance structure (Glynn, O’Farrell, & Balfe, 2017, p.10)

If a CP requires planning permission, the design team needs to apply for it via a Work – Part 8 Procedure, which also involves a pre-planning submission process. The Planning & Property Development Department (2018) explains that a local authority cannot implement any developments or works as their own, as the project must firstly undergo a planning procedure as set out in Part 8 of the Planning and Development Regulations 2001. The benefits of these planning procedures are that DCC will be perceived as open and transparent in its business, and the public will have the opportunity to raise their concerns, while the elected members (councillors) will have the final say in the decision. Article 80(1) of the Planning and Development Regulations 2001 explains which types of works (civil infrastructure) are under the jurisdiction of the Part 8 Planning Procedure. The Planning & Property Development Department (2018) has clarified that, if a project that is to be undertaken by DCC requires the production of an Environmental Impact Assessment Report (E.I.A.R), the procedure under Part 8 does not apply, as this type of project (with an E.I.A.R.) must be dealt with in accordance with the requirements of Section 175 of the Planning and Development Act 2000, as amended\*, and this will require a Part 10 procedure.

In this research, the author will focus on the Part 8 procedure for the creation of the BIM roadmap, as it relates to the majority of the projects that the council produces. The Planning & Property Development Department (2018) explains that there

is a pre-planning submission process that projects which are under the Part 8 procedure are obliged to undergo. This involves the design team needing to firstly obtain the approval of the design proposal, in writing, from all of the in-house stakeholders, and then, with the approval of the senior planner, the project will receive/require written approval of the executive manager, who is given permission for the project to proceed and take part in the Formal Part 8 procedure. (See Appendix 1 with all the information regarding the Formal Part 8 Procedure that takes place for a period of 20 weeks, in compliance with section 179 of Planning and Development Act 2000).

The Department of Public Expenditure and Reform (2011) gives details on the four major stages in the life cycle of public work management: 1. Appraisal, 2. Planning, 3. Implementation, and 4. Project Review. These guidelines provide a governance framework focused on achieving maximum value for money in line with the Public Spending Code.

The DCC Standard Project has stages according to Capital Project Support Office (2019) and, to achieve a consistent approach, all DCC projects are subject to seven stages which are: Stage 0 Concept, Stage 1 Preliminary Design, Stage 2 Planning and Statutory, Stage 3 Detail Design, Stage 4 Procurement, Stage 5 Construction/Implementation, Stage 6 Testing/Commissioning and Stage 7 Project Competition.

All project departments in DCC need to report to the Corporate Project Support Office (CPSO), which is responsible for assessing appraisal reports on projects and making recommendations as appropriate for the CPGB to assist in its consideration of project proposals. In addition, the CPSO is in charge of monitoring the progress of the projects and determining whether they are in compliance with the Public Spending Code (PBC).

The PBC is the set of rules and procedures that apply to ensure that these standards are upheld across the Irish public service sector. The code brings together in one place all of the elements of the “value for money” framework that has been enforced up to now by the Government Accounting Unit of the Department of Public Expenditure and Reform.

In order to map the workflow of a BIM process in the DCC governance process, it is important to clarify that the current status of the adoption of BIM Level 2 processes in Ireland is expecting to be mandated by the government for public capital projects. According with The Department of Public Expenditure and Reform states that BIM will be required in the design, construction and operation of public buildings and infrastructure for public works projects that are funded through the Public Capital Programme over the next four years (Sweeney,

2017). Turner (2019) expressed concerns that the Public Works Contracts documents do not make reference to BIM in the actual contracts. The last update that was posted on the website of Construction Procurement Reform (2019), on 21st March 2019, explained that a review of procurement policy for public works projects will take place in the oncoming 18 months in order to engage with industry stakeholders and with public bodies. These changes are required for the introduction of BIM in the delivery of public works projects.

The following BIM workflow (Fig.5) has been prepared in compliance with the combination of the Standard DCC Project Stages, the Planning Permission Work – Part 8 Procedure and the Information Delivery Cycle set in PAS 1192. During the research for this proposal, ISO 19650 was published as an international standard. It is required that, in future, research regarding the proposed BIM workflow will align with the ISO standards and the oncoming Construction Procurement Reform for Public Works Contracts using BIM.

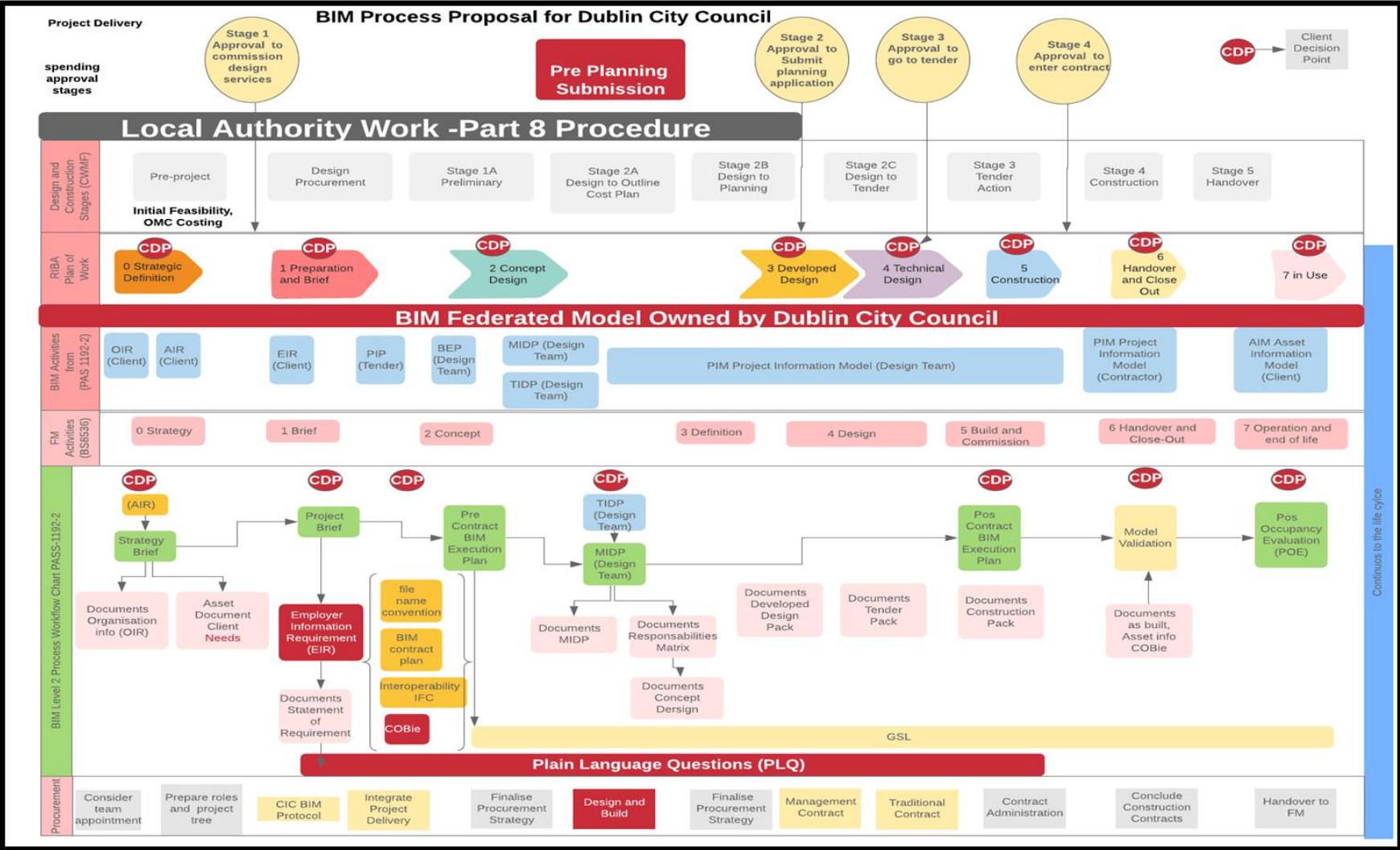


Figure 5: Proposed workflow of a BIM process for DCC

The workflow of a BIM process for LA was evaluated using interviews and questionnaires with different stakeholders within Dublin City Council, This will enable a better understanding of the BIM workflow for the LA.

## VII QUALITATIVE ANALYSIS AND SYNTHESIS OF INTERVIEW FINDINGS

In order to obtain feedback from the proposed workflow and to have a better understanding of BIM practices in a real-world local authority situation, a number of structured one-to-one interviews were completed. These interviews included different stakeholders in DCC: technical staff from different disciplines who have been exposed to pilot trial projects with BIM in DCC (a quantity surveyor, an architect, a civil engineer and three senior managers without BIM knowledge) and a public representative (a councillor) from the Green Party. All interviewees were provided with anonymity in order to protect both their identity and confidentiality. The author produced two types of questionnaires (one for the managers and the other for the BIM technical staff of DCC), connected with the objectives of this research. These questionnaires are attached in Appendix 2 and 3 of this paper. The proposed workflow of a BIM process for DCC was also provided in advance of the interviews to allow the interviewees to prepare for the process. A fourth-generation analysis as per a study conducted by Lay and Papadopoulos (2007) was also employed, with all interviewees asked to comment on pertinent findings from previous interviews. The interviewees included the following:

- A. *Managers of Dublin City Council*
  - Assistant Chief Executive, Environment and Transportation
  - Executive Manager, Environment & Transportation Department
  - Senior Transportation Officer
  - Councillor for Kimmage Rathmines
  
- B. *Technical staff DCC*
  - Senior Executive Roads and Design Engineer, DCC.
  - Chartered Surveyor Manager, Land Surveying and Mapping, DCC.
  - Senior Executive Quantity Surveyor, DCC.
  - Project Information Manager from Housing & Community, DCC

### 1. *Analysis of interviews of the Management prospective view*

#### a) *BIM terminology – definition and the importance for the organisation*

The majority of managerial staff expressed the idea that BIM is the use of a digital technology which allows design teams to collaborate and that will help to avoid conflicts, with everybody working towards the same agenda. This system will reduce conflicts for DCC in contracts and in the future, to be used for maintenance and improving DCC efficiencies and long-term management development. All of the managers were aware of the implementation of BIM across the organisation as a pilot trial. However, a councillor from the Green Party noted that BIM has not been mentioned in the corporate plan or development plan of DCC.

One manager expressed the idea that DCC should implement BIM faster, as the private sector is using BIM to scope DCC failures and consultants are determining how they can gain financial returns for extras added. Another reason for the adoption of BIM in the organisation is to obtain faster deliver and efficiency in projects with the better management of assets.

#### b) *In-house consultant*

All managers agreed that an internal consultant should be used in the short term but that it is necessary to up-skill our staff, which should be the goal as an organisation. The industry experts should train DCC staff and hand over supervision to internal staff for sustainable long-term use of BIM. The combination of both is necessary, and it will help DCC to embed BIM within the system, while, in turn, the staff will receive training, and in the future, DCC will manage BIM effectively.

#### c) *Policy and resources are required to implement BIM in local authorities (LAs)*

The senior managers suggested that, if the current structure within DCC for construction projects will enable it to deliver on requirements related to such projects as housing, infrastructure and water, DCC will have staff and expertise with the ability to deliver, but DCC has a barrier for delivering faster and is down to the lack of resources. Furthermore, if BIM becomes mandatory in Ireland for LAs, one concern as managers is that the Government declare BIM is mandated in Ireland for LAs, and the other concern is whether the LAs have the capability to implement. Policy direction is

important, but filtering this down to LAs requires more resources. The executive manager stated the following: “We don’t have enough resources to deliver our capital projects, and we need more resource to undertake BIM”. Meanwhile, the councillor from the Green Party asserted, “Central government and local government say something, and they don’t give us the resources; then this BIM will fail. It is a requirement that staff need training, and extra staff will be required”.

d) *Other findings from the managers interviews*

Ireland requires a system for distributing risk in construction. The senior managers expressed the following: “Can or could BIM help after the action reports, and to avoid ending up in court with legal proceedings? Also, the risk avoidance [would] help reduce overruns by using BIM.”

2. *Analysis of interviews of Technical staff prospective view*

a) *Barriers to the implementation of the proposed BIM Roadmap*

The following barriers for the implementation of the workflow of a BIM process for LA were founded through the analysis of the interview process:

- The current structure of DCC is fragmented; it needs Corporate Standardisation.
- The absence of the mandated BIM standards and protocol for Ireland
- DCC staff have their own preferences for software.
- The organization operates in silos, which highlights the lack of IS support and of communication between departments.
- Due to the improved economic conditions in Ireland and globally, there are difficulties in getting BIM staff and keeping them within the organization.
- There is no BIM process across the organization.
- No in-house BIM experience at the Roads and design department.
- Increase of the cost of the project due to the additional request for contractor and consultant to produce a project in BIM.



Fig.5: BIM barriers resulting from the interview analysis, that the author produced using Pro Word Cloud.

b) *COBie*

Hamil (2018) defines COBie as information exchange for an asset’s life-cycle, capturing and delivering the information needed by facility managers. The Architectural Department and surveyors recognised that, although it has been difficult in the organisation to obtain the benefits of COBie in the pilot projects that were carried out using BIM, they would prefer to keep COBie requirements, due to the benefits that this will bring for building maintenance. The Architectural Department expressed the idea that BIM is suited to facility management (FM) and that there is no point in engaging in BIM without COBie. At present, DCC is considering modernising the FM system with the use of COBie. A suggestion from the Architectural Department is that TU Dublin should provide a training course in relation to COBie.

c) *The BIM model*

In general, the tech staff expressed concern that some risk is insufficiently managed within the organization. The belief is that DCC staff will be exposed in the tender process if a mistake is found in the BIM design. It is therefore better to pass the risk directly to the contractor or consultant. In regard to the ownership of the model, at present, the quantity surveyors and architects with the Law Department of DCC are seeking to incorporate within their contracts a copyright notice indicating that the interaction of the model belongs to DCC, as the model is in its CDE, and DCC staff should have full access to this at all times.

d) *Internal consultant reviewed*

The technical staff of DCC expressed their concerns and suggested that a BIM office in charge of these projects would be beneficial for the smooth implementation of BIM in the organisation. In the

Roads and Design Department, it was indicated that, with the use of an intermediate consultant, there was the potential of obtaining training regarding the transition from traditional methods to a collaborative method. "People with experience in-house in DCC, they are busy with their own work that they have no time to share their knowledge. You have to create a meeting schedule, and if they are not available, then there is no one to help us to answer our queries" (BIM staff in DCC). However, in the Architectural Department, there are BIM staff with level 9 degrees, and they felt that intermediate consultants are not required. If DCC uses an intermediate consultant for BIM, the consultant needs to adapt to a local authority mentality, and choosing such a person would be difficult, because every department in DCC would seek a specific consultant on its subject area. As a result, if there is no corporate vision, this could lead to having numerous consultants on the project.

e) *A light version or full BIM level 2 for DCC*

Different opinions were received on this subject, but it was concluded that, if the project is large, a complete BIM level 2 process is required. However, if it is a small in-house project, the proposed workflow of a BIM process would be excessive, and therefore a light version would be required. Using a light version of the BIM process would help in the learning experience regarding the full BIM process (upgrading the experience in a step-up approach)

## VIII RECOMMENDATIONS

### 1. *Author Recommendations*

- The local authority should have a standardised BIM process. A strategy is needed for the whole corporation, rather than every department implementing BIM separately.
- The author understands that, although DCC BIM staff believe in the implementation of the full version of BIM Level 2, they are actually making it too rigid, and a light version will help to advance this LA in the implementation of BIM.
- For an intermediate consultant, money is required, and such a consultant must feel part of the overall project team. I have found that, within the Architectural Office, it has become more competitive and more successful at implementing BIM in DCC. In addition, BIM was implemented to a lesser degree in the Roads and Design Department. Therefore, there should be a BIM working group in DCC across the organisation to share expertise and to support each other's projects.
- The majority of the interviewees stated that they wanted to apply BIM level 2. The organisation should pick a small project and introduce a light BIM version, as per Hampshire County Council, where the collaboration approach can be trialled.
- An action plan to avoid the silo barriers includes:
  - a. Create a BIM working group; this is not expensive to establish. Rotating the chairman from different departments within the local authority and meet every 2 weeks at the beginning of the projects and once a month when the staff become more knowledgeable and become experts.
  - b. Create a BIM page in the internal Dub-net website of DCC, where staff can determine how problems happen and how to overcome them, and also they can share ideas regarding how to fix the problems and determine how the designer resolved the problem and what the solution was.
- To use the proposed workflow BIM process for LA in each internal department of DCC, and each team should to create their own light version on the proposed BIM workflow process to align with its requirements as they implement in future BIM projects. Furthermore, these departmental or their own versions are each validated and co-ordinated against each other, to create coherence across the organization in order to federate the workflows.
- It is required that the forthcoming BIM mandate for Ireland comes with additional resources for LAs in order for BIM to be successfully implemented. If resources are not provided, BIM will fail.
- No process was found to fit all of the departments in DCC. It needs corporate standardisation and inclusion of BIM on Dublin City Council corporate development plan.

## 2. *Managers' Recommendations:*

- If BIM is mandated in Ireland by the Irish Government, it should be delivered via a process indicating how BIM should be used, and with adequate resources being approved.
- By implementing BIM technology and contrasting it with our traditional project management, this could demonstrate what the advantages of BIM are for the organisation.
- To share our knowledge with other LAs in Ireland.

## 3. *BIM Staff Recommendations:*

- Do the proposed workflow of a BIM process for LA with the international standard ISO 19650.
- Implement a QA/QC quality assurance within the BIM workflow of a BIM process. Autodesk (2019) describes QA and QC as checks required for each milestone. It is important to exchange the model to the contractor to measure and ensure the quality of a product.
- A suggestion from the Architectural Department is that TU Dublin should provide a training course about COBie.
- There should be a dedicated BIM unit for each department, and these BIM units should collaborate to improve BIM processes and work exclusively for capital works projects using BIM

## XI CONCLUSION

Following the critical appraisal of the Potential use of a light PAS 1192-2 standard for Local Authorities in Ireland, please see follows:

- ***Objective 1:***

The author found in the literature review that the top three barriers for the use of BIM in the UK were the lack of client demand 65%, a lack of staff expertise 63% and a lack of training 59%. In Ireland, the top three barriers to BIM adoption are a lack of in-house expertise (74%), a lack of client demand (67%) and a lack of training (67%), we can see that Irish barriers have a commonality with the UK barriers. The literature review showed that the use of an intermediate consultant is a way to overcoming barriers to implement BIM in an organization and it will enable them to achieve the benefits of BIM.

Furthermore, interviews and questionnaires were arranged with BIM engineers from the Roads & Design Department of DCC and the outcome showed that the department had a lack of in-house expertise in BIM, it is definitely necessary to employ an in-house client BIM consultant (CBC) for DCC. This would help the department to deliver projects in BIM, and it would provide guidance at every stage of the BIM process. Also, during an interview process with the managers of DCC, the overall consensus on this was that managers agree to have an intermediate consultant but only for the short term until the relevant staff in DCC obtain the adequate knowledge and expertise in the BIM process.

- ***Objective 2:***

The result of the mix methodology applied in this objective from the reviewing of the existing literature of the case study of Hampshire County Council West of Waterlooville Primary School BIM and the interview with the Senior Architect BIM manager (SABM) of HCC showed that, the lessons learned from this existing practices in a local authority in the UK (HCC), is that that they used a light version, of PAS 1192-2 in the project. We can observe that this BIM pilot project produced in the architectural department of HCC a change in the internal workflow from linear traditional to a collaborative approach. HCC used the standards and made it to work for them. Local authorities have limitations in resources and time scales, but in this particular case study, by defining what part of the standardisation would work for the job that the Architectural Department had to carry out and by setting a simple BIM Execution Plan (BEP) was the key to achieved project delivery faster and more efficiently.

- ***Objective 3:***

The literature review of Local Authority Works Part 8, governance framework for Capital Projects in Dublin City Council of this objective showed that the current spending approval stage for local authorities does not mention the BIM process. It is required that the Department for Public Expenditure and Reform dictates that the adequate amendment of the public work contract for the use of BIM process on it. This will encourage the local authorities to implement BIM in future capital works projects. In addition, in this objective the author created a proposed workflow of a BIM process for the delivery of a public works project as a key to overcoming the barriers to implement BIM for DCC. The proposed workflow BIM process went through different iterations of the design process and the final workflow of a BIM

process for the delivery of public works project for DCC was produced in this capstone experience. Furthermore, the BIM workflow complies with the reviewed literature review

- **Objective 4:**

The author evaluated the proposed BIM workflow for the delivery of public works projects with a 4th Generation Evaluation process interviews. The author interviewed different stakeholders such as BIM technical staff from different disciplines within DCC who have been exposed to pilot projects with BIM. The author also interviewed Senior Managers from DCC without BIM knowledge and a public representative (a councillor) from the Green Party. The Author produced suggestions and proposals for the best course of action as the above is based on the finding of the interviews and to make sure that the proposed workflow could be implemented successfully in futures BIM pilot projects.

Overall it seems that the implementation of the BIM process with international standard ISO 19650 part (1 and 2) will improve the usage of BIM in Capital Works Management Project in local authorities.

## XII FURTHER RESEARCH.

It is required that the proposed workflow BIM process for the delivery of a public works project for a Local Authority be done with the new international standard ISO 19650 parts (1 and 2) which were only mandated internationally in December 2018. Further research should be investigated to see if BIM consultants are required and necessary for BIM projects within local authorities when local authority staff have been trained and completed the full BIM Process.

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**APPENDIX 1**  
**IMPORTANT STATUTORY TIMELINES –**  
**FORMAL PART 8 PROCEDURE**

*Section 179 of Planning and Development Act 2000 (As amended)*

<b>Day 1 - Part 8 Submission</b>	Part 8 application formally submitted with Planning Registry Section and application put on public display by Proposing Dept. (if applicable).
<b>Day 1/Week 1</b>	Application will be available for viewing at Public Counter, Planning Registry Section once submitted.
<b>End of Week 4</b>	<b>Public inspection/purchase period expires.</b> <i>(Please note that this period may be extended if any public/bank holidays fall within the relevant period)</i>
<b>End of Week 6</b>	<b>Observation/Submission period expires.</b> <i>(Please note that this period may be extended if any public/bank holidays fall within the relevant period)</i>
<b>End of Week 8</b>	<b>Planners Report</b> prepared by Planning and Property Development Dept.
<b>End of Week 10</b>	<b>Draft Chief Executive's Report</b> Prepared by Planning and Property Development Dept. and forwarded to Proposing Dept.
<b>Weeks 10-14</b>	Before any project is presented to Council, the relevant <b>Local Area Committee</b> shall be given an update in relation to the Part 8 and advised of the intention to submit the Chief Executive's Report to the City Council. Please note – if the next scheduled Area Committee meeting is due to take place after the next sitting of the City Council, an information Area Committee meeting shall be scheduled.
<b>End of Week 14</b>	Finalised <b>Chief Executive's Report</b> and other relevant documents to be forwarded to the Planning and Property Development Department.  The Planning and Property Development Dept. will forward the Chief Executive's Report to the Chief Executive's office for inclusion on the <b><u>Agenda of the next City Council Meeting.</u></b>
<b>End of Week 20</b>	Part 8 must be decided by <b><u>City Council.</u></b>

**Important Note:**

**There is no City Council Meeting held in August.** Please take this into consideration when calculating timelines for Part 8 applications.

**APPENDIX 2**

*Questionnaire for BIM staff Dublin City Council.*

1. What is your experience of BIM?
2. If BIM had been implemented in your offices, what type of processes were used?
3. Please see my roadmap, in relation to this proposal what do you think are the main barrier for implementing BIM in Dublin City Council?
  - Cost of Software
  - Cost of Hardware
  - Cost of Staff Training
  - Lack of Client Demand
  - Lack of knowledge within Design Team (Engineers, Quantity Surveyors etc.)
  - The absent of the mandated BIM standards for Ireland.
  - Other: please explains
4. What do you think about Cobie which I am proposing to taking out from the BIM process?
5. The model holds equal status to the drawings and must be owned by DCC after each stage (concept, detailed, construction). Model and drawings must be fully aligned and synchronized, as well as having defined accuracy, detail and development (LOI, LOD,) from the EIR & BEP. Can we tender the model and in order to avoid that the consultant re-doing the model again?
6. Looking at the roadmap proposal, is there anything that you think is a non-value adding element of the BIM process?
7. What do you think that could be removed from roadmap without having a negative impact on the final project?
8. Research that has been done, has suggested that public sector projects would benefit from the employment of an internal BIM Consultant working for the client (DCC) to assist in the design process for the information requirements and to ensure that the client is represented throughout the BIM process. What is your opinion?
9. What problems or challenges could you foresee with having an intermediate consultant?
10. Do you think we need to implement and do a completed BIM level 2 process and then we do a slim down version of the process?
11. Could and should DCC try to implement a slim down version of BIM process as per HCC case study?

*Thank you for your time and co-operation.*

**APPENDIX 3**

*Question for Management of DCC*

1. What is your understanding of Building Information Modelling (BIM)?
2. What is your understanding of how BIM is used in DCC?
3. Do you think it would be worthwhile investing in the BIM process (technology, training and pilot trial) for DCC?
 

Yes	No
3.1 Why?	
4. Good practice is showing that it is best practice of implementing BIM process you needs to have an in-house consultant working with the client DCC, Do you think DCC will need support from internal consultant to enable this implementation or would it be better to up-skill DCC staff to introduce the BIM process?
5. Do you believe that the current structure within DCC for construction projects will enable you to deliver on requirement such as housing projects, infrastructure projects, and water projects?
6. Do you think the forthcoming BIM mandate from Government will help or hinder this to deliver better projects?
7. Do you think that DCC could and should introduce a slimmed down version of the UK Level 2 BIM process similar to this case study? <http://www.bimplus.co.uk/projects/bim-p5ilot-pass7es-te8st/>

*Thank you for your time and co-operation.*