# Cultural Impact of Implementing Building Information Modelling (BIM) in the UK Construction Industry

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## Abstract

The implementation of Building Information Modelling (BIM) is a consequence of the mounting pressure for improving efficiency in the construction project lifecycle. It captures versatile benefits, such as extensive use of information in building the asset, improvement in efficiency in the project delivery process, and better management of the a project during both the delivery and operation phases. A number of issues are raised during the implementation and adoption of BIM, which range from technical complexity, legal concerns and cultural and training barriers. These issues have a significant impact on the success of the implementation of BIM. Implementation also has a significant effects on the culture of the construction project-based organisations and supply chain.

The aim of this research is to investigate the relationship between the culture of the project-based organisations in the United Kingdom (UK) construction industry and the implementation and adoption of BIM, and the interactions that take place among the participants within the project supply chain.

A qualitative methodology approach using the Grounded Theory Method (GTM) was used for this research using interviews, questionnaires, industry attachment and engagement with the BIM sector and community.

In this study, it was found that leadership and management in a BIM project has an obvious influence on the integral parts of BIM. It also revealed that the culture in a BIM project can be perceived in terms of the coordination's and integrations within the project delivery process performed by the people and the interactions between themselves through patterns of attitudes, values, beliefs, and behaviours shared. Collaboration is not only needed within the organisation, but in the supply chain as communication and sharing will reduce rework, and improve efficiency and productivity whilst adding value. There is going to be significant changes incorporating the new processes, so leaders/managers need to empower their teams and encourage and welcome the change

The findings in the research allowed the author to concentrate on the top implementation and adoption barriers, and the outcome was the remainder of the barriers were merged or discarded.

The study proposes that clients, organisations and the supply chain all need to have a better understanding of BIM to assist them when implementing and adopting. A BIM business transformation strategy plan is required as this will determine the current position, assist in developing the strategy, build the plan and finally manage the performance. Training will play a significant role in the transformation with long-term objectives decided along with the budget. The research shows that BIM training is required across both the organisation and supply chain. Dependant on the level of training required will determine how much time is required. It will be the responsibility of the BIM manager to manage, drive and motivate the training and changes.

The overall results of the study propose an understanding on the various elements of BIM and their associations with the project outcomes which are achieved through the implementation of BIM. This will provide necessary guidelines to implement BIM successfully in a UK construction project.

## Declaration

I, the undersigned declare that the work contained within this dissertation is entirely my own. Any material that has not originated by me has been marked, and creator identified.

The word count of this dissertation is: 9.897

**Name of student:** Andrew Johnson

**Signature:** 

**Date:** 31st March 2019

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# The Cultural Impact of Implementing Building Information Modelling (BIM) in the UK Construction Industry

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## 1. INTRODUCTION

Building Information Modelling (BIM) can be defined as modelling technology and the associated set of processes to produce, communicate and analyse building models [1]. The design and project processes in the Architecture, Engineering and Construction industry (AEC) have evolved significantly in the last decade. Primitive techniques evolved into technical drawing with the use of paper. More recently, the use of computers accelerated the process going from 2 Dimensional (2D) Computer-aided Design (CAD) systems to 3 Dimensional (3D) modelling and nowadays reaching BIM systems.

BIM is an approach that aids project delivery by improving efficiency for the client over the entire lifecycle of the project. It reduces waste in the construction which leads to increased productivity and profitability. BIM also provides better flexibility for designers. However, the most significant benefits of BIM are realised during the operations and Facility Management (FM) stage [2].

The UK Government has acknowledged the benefits of working in this fully collaborative 3D environment and has stated that they "*require fully collaborative BIM level 2* (with all project and asset information, documentation and data being electronic) *as a minimum by 2016*" [3]. This thesis began with the problem that currently the United Kingdom (UK) construction industry display substantial shortcoming in meeting both BIM level.

1 and 2. This mandate prompted the author to investigate to determine what the cultural impacts are for implementing BIM in the construction industry.

One of the key focuses of this investigation was to establish what is the primary driver.

These adoption barriers for BIM are in three categories: leadership and management, cultural and training barriers. Among the training barriers, literature highlights that BIM was not often taught in universities, so young engineers and architects were not aware of the new technologies.

This thesis will use the findings from Subject Matter Experts (SMEs) interviews combined with analysis of various commercial 'best practice' experiences to suggest solutions to the challenges identified.

### 1.1. Aim

This dissertation aims to analyse the cultural impact and challenges by adopting and implementing Building Information Modelling (BIM) in the construction industry. It shall discuss if these challenges can be overcome and how.

### 1.2. Objectives

- Identify why the construction industry is adopting BIM.
- Research the impact and cultural challenges implementing BIM in the construction industry.
- Analyse the challenges identified by companies in adopting BIM.
- Identify the potential impact based on industry opinions and various commercial experiences.
- Suggest solutions to these challenges where possible to industry professionals.

## 2. LITERATURE REVIEW

This literature review explains vital areas relating to the objectives that support the aim of this thesis. These areas include why the construction industry needs to adopt BIM, the impacts and cultural challenges of implementing BIM, the construction industries vision, and foreseen challenges to adopting BIM.

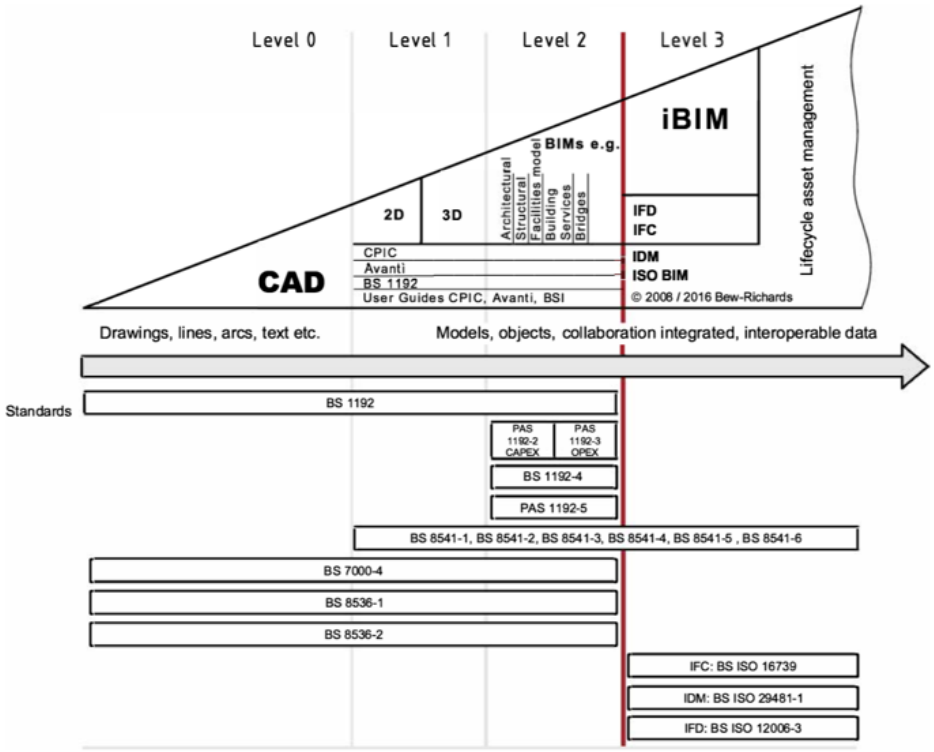
### 2.1. Why is the Construction Industry adopting BIM?

There are numerous advantages of BIM across all stages of the project lifecycle from delivery to operational phases. The UK Government has acknowledged the benefits of BIM and has stated that they *'require fully collaborative BIM Level 2with all project and asset information, documentation and data being electronic as a minimum by 2016"*[4]. Papers published by the Cabinet Office state that all publicly funded government projects must have collaborative 3D BIM by 2016 [3].

BIM is becoming a global language for the infrastructure and construction sector, enabling greater collaboration and movement across borders.

In May 2011, the UK Government published the Construction Strategy aimed at reducing the cost of public sector assets by up to 20% by 2016 [3]. Fundamental problems exist with procuring public assets, which have been known for achieved in resolving them. The Construction Strategy defines several strategic objectives, which collectively will overcome these problems.

The widely accepted concept of BIM maturity levels has been defined by the Bew-Richards maturity model shown in Figure 1.




**BIM Maturity Model**

**Figure 1** - Bew-Richards Maturity Model [1].

The BIM Level 2 maturity is a series of domain and collaborative federated models. The models consisting of both 3-Dimensional (3D) geographical and non-graphical data are prepared by different parties during the projects life-cycle within the context of a Common Data Environment (CDE) [5]. The requirement has been introduced to drive the adoption of BIM processes throughout the public and private sector to encourage the benefits.

The adoption of BIM Level 2 by the construction and asset management industry requires organisations and individuals to embrace change and accept that traditional roles within the supply chain and client organisation may need to be redefined to successfully implement the new processes and information management requirements [6].

### 2.2. Standards and Guidance

The role of standards and guidance is essential. The 1192 suite of standards to support industry in the adoption of BIM Level 2 outline the processes and information management practices required to perform at the Level 2 maturity level. The BIM Level 2 suite of documents are made up of British Standards (BS) and Publicly Available Specifications (PAS) [7]. Through government and industry sponsorship the documents were free to download helping the construction industry on their way to effectively implementing and achieving BIM Level 2. Figure 2 shows the BIM advisory documents journey since 2010.

It was recognised that BIM would become a disruptive and "game changing" way of working which would have a profound effect on the global construction, further, that BIM technologies and processes transcended national or geographic borders [8]. Therefore, during the development of the UK BIM Programme, there was a growing consensus that BIM-globalisation would inevitably push towards international norms and standards.

#### 2.2.1. ISO 19650

In Q1 2019 the first two international standards of the ISO 19650 series were published. It contains all the same principles and high-level requirements at BIM Level 2 and is closely aligned with the current UK 1192 standards [9].

These two standards are founded in the UK's standards for information management using BIM, namely BS 1192:2007 + A2:2016 and PAS 1192-2:2013 [7]. The principles remain as per these standards and the terminology changes being preserved via the UK National Forewords and National Annex [10].

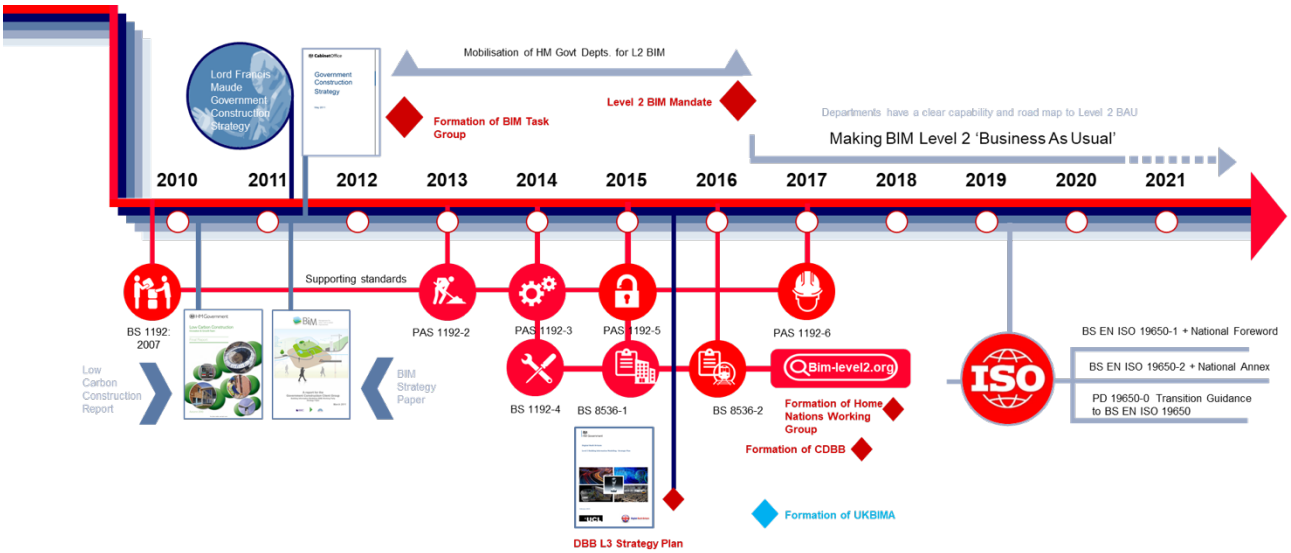



**Figure 2** – The BIM Advisory Documents Journey [11]

### 2.3. Growth through BIM

The UK Construction sector has considerable growth opportunities with the global construction sector forecast to grow by up to 70% by 2015 [3]. The UK has seen the global reaction to the BIM Level 2 program successfully delivering significant cost savings which are greatly assisted the construction cost savings of £840 million in 2013/4, with several major EU nations including France and Germany who announced similar BIM programs [3].

BIM is changing the UK construction industry- a vitally important sector that employs more than 3 million people and in 2010 delivered £107 Billion to the UK economy [12]. Over the next decade, this technology will combine the Internet of Things (IoT), advanced data analytics and the digital economy to enable us to plan new infrastructure more effectively, build it at lower costs and operate and maintain it more efficiently.

### 2.4. The Impact and Cultural Challenges Implementing BIM

The meaning of '*Culture*' varies according to the diverse disciplines and level of perception; sometimes these are controversial [13]. The definition from states that culture refers to the characteristic patterns of attitudes, values, beliefs, and behaviours shared by members of society, population or organisation [14]. Members of a cultural group share characteristics that distinguish them from other groups. Cultural differences will affect the receptivity of an individual to individual education and willingness to accept information and incorporate it into his or her lifestyles. Culture in a traditional construction project-based organisation is compromised by different organisational culture, where cultural conflicts often create a confrontational environment. This situation ultimately leads to an adversarial culture in a construction project.

Process fragmentations and functional adversaries reinforce the adversarial culture by overlapping the construction phases and enabling effective collaboration in the projects [15]. Such a revolutionary move involves a fundamental change in working style, which is a massive cultural shift, from an adversarial culture to a collaborative culture . However, numerous SMEs argue that besides applying the latest technology like the implementation of BIM requires the combined effort of all the participants throughout the process [16]. The development of a model depends on the contribution of the participants from diverse disciplines within a project.

#### 2.4.1. Do you need a High Performing Culture?

A high-performance culture is a set of behaviours and norms that leads an organisation to achieve superior results by setting clear business goals, define an employee's responsibilities, creating a trusted environment, and encouraging employees to grow and reinvent themselves continuously.

In other words, it is a culture that drives a high-performance organization/company that achieves better financial and non-financial results, such as customer satisfaction and employee's retention.

An example of a high-performance culture is the British Army as they create a strong company culture. The British Army recognises six measurable qualities of high-performance cultures to achieve improved outcomes (in no particular order) as shown in Table 1 [17].

**Table 1**- British Army High-Performance Framework [17]

| | |
|---|---|
| **Vision & Strategy** | Communicates a shared vision and organisational strategy |
| **Processes & Support** | Optimises processes and supporting information-technology systems |
| **Goals** | Organised to achieve goals |
| **Decision Making** | Tracks costs and makes resourced and risk-informed decisions |
| **Promote Culture** | Promotes a culture that fosters excellent leadership and management |
| **Benchmark** | Routinely asses and benchmark performance |

#### 2.4.2. The behaviour of the People within A Project

Numerous SMEs within the BIM community agree that each construction project is composed of people from different socio-economic background and culture, where people have a different understanding of self, of others, or the interdependent parties [15]. Also, individuals'

behaviour is driven by certain factors in certain situations.

To try and define and create a great culture within an organisation or project a set of values and standards must be created so employees can believe in them and live by them. Values are the things that people believe are important in the way we live and work. Although everyone has their values, an organisation can also have values. This will define what is expected of the employees and assist them to work as a team.

The British Army has six core values that it requires soldiers to live by [17]. A soldier's job is difficult, dangerous and demanding; so, in order to do it, the Army needs all their soldiers to have high standards of behaviour at all times. The values help guide and develop soldiers and the standards explain how they should behave. The values are shown at Table 2.

### 2.5. Main Internal and External Barriers to Implementing BIM in the Construction Industry

The annual National BIM Report from the National Building Specification (NBS) is now recognised as one of the industry's most comprehensive reviews into the use of BIM. In the eighth report dated 2018 [18], it gleans insight into the achievements and challenges of the industry two years on from the BIM Mandate. This report was vital to analysing the challenges of the construction industry in adopting and implementing BIM.

To understand and confirm the current BIM cultural climate the author conducted his survey and several key stakeholder interviews[1]Concerning BIM. These stakeholders have deemed a good representation within the UK BIM community. The findings were aggregated with the top four taken from each group. The main barriers to using BIM taken from [18] are shown in Figure 3. It is evident that there is a lack of education and training required from the results, with companies worried about no client demand and implementation costs.

**Table 2** - A British Soldier's Values [17]

| | |
|---|---|
| **Courage** | Both physical and moral courage. Moral courage is doing the right thing, not looking the other way when you know or see something wrong. |
| **Discipline** | All teams need discipline. It means that work will be carried out and everyone is confident that they will not be let down by their teammates. |
| **Respect for Others** | Individual come in all shapes and sizes and deserve to be treated fairly. There is no place for any harassment or discrimination. |
| **Integrity** | Means being honest, not lying, cheating or stealing. If you lack integrity, your teammates cannot trust what you say or do; they cannot rely on you and your team will suffer. It takes a long time to earn trust back, if ever. |
| **Loyalty** | It's about supporting your teammates, looking after and helping them, putting their needs before your own, not letting them down, even when the going gets tough. In return, they will do the same for you. |
| **Selfless Commitment** | None of us work on our own, we always work in a team. Teams can only be effective if we all play our part in full, putting the team before our needs, trusting each other. |

[1] Conducted with SMEs from various industry organisations.


**Figure 3** - What are the Main Barriers to Using BIM [18].

The author asked BIM professionals and SMEs what barriers they foresee to BIM Implementation as shown in Figure 4. Like the National BIM Report there was a pattern where there is a lack of education and training required, but working in silos[2] Was scored high, again with companies worried about implementation costs.

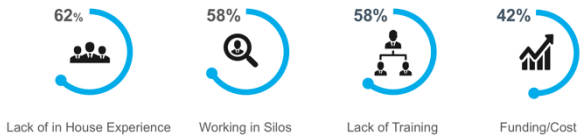



**Figure 4** - What Barriers do you Foresee to BIM Implementation [16]

### 2.5.1. Lack of in-House Experience and Training

The top reason was a lack of in house experience 71% [18]and 62% [16] and a lack of training 61% [18] and 58% [16]. Traditionally and depending on the size of the company, in-house training is the obvious choice by most companies or outsourcing it to third-party providers. Since the BIM Mandate [3] e-learning via online has become a trendy choice as this allows global companies to cascade training easing the geographic barrier.

Emerging additions/alternatives to in-house or external training are online training courses. These courses have gained in popularity, for those aspects of BIM that focus predominantly on learning the features inherent to BIM authoring and coordination software. The training now focused more on the project delivery or procurement route Online courses make much sense if they can be effectively monitored using a Learning Management System (LMS) for participation and assessing performance.

### 2.5.2. No Client Demand

The evolution of BIM depends on the external factor of client demand or just on the skill level of operators. As shown in Figure 3, a total of 69% of BIM users said that there was no client demand [18]. Client demand is one of the most motivating factors for the BIM uptake, and greater awareness is the first step to adoption. Taken from the [18] 77% agree that clients do not understand the benefits of BIM. The need for greater client education, perhaps led by all kinds of government clients, has gone away. Clients still do not understand what they are asking for or what BIM is. The majority do not have any idea and see BIM as a cost. This is a massive issue for the construction industry [6].

### 2.5.3. Working in Silos

In today's world information is king. As shown in Figure 4, a total of 58% of BIM users foresee working in silos as an implementation barrier to BIM. BIM represents a realisation that information cannot be produced in silos whose contents rarely pay attention to their neighbour. Breaking down discipline silos and enabling collaborative working, especially between those who create and those who maintain built assets [19]. Without addressing these new attitudes and including the many players involved in the built environment, the HM Governments BIM level 2 programme would have been set for failure.

### 2.5.4. Funding and Cost

Both surveys showed 50% [18] and 42% [16] retrospectively that financial cost and funding was one of the challenges to adopt and implement BIM. This is due to the initial capital investment for an organisation to get set-up with all the necessary equipment, infrastructure/hardware, software (including license subscriptions) [20], maintenance and associated training. When the question was asked *"Do organisations only see expense incorporating BIM?"*, 46.2% said yes, with 30.8%

[2] Silo mentality is an attitude that is found in some organisations; not sharing information or knowledge with another individual in the same organisation.

saying no [16] as shown in Figure 5. The industry still sees funding and cost as a primary barrier.

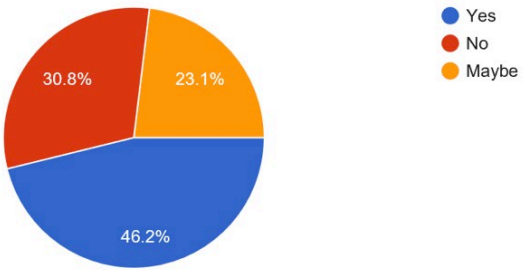



**Figure 5 –** Do Organisations only see Expense Incorporating BIM? [16].

### 2.6. BIM Adoption Barriers

BIM adoption barriers by organisations can be divided into two main categories; industry related and academic. Most adoption barriers are related to project management and the lack of knowledge, although some SMEs say it is related to the technology and the difficulties procuring and implementing it. Analysing the results data from all sources the author chose the top four BIM adoption barriers, they are as follows:

#### 2.6.1. Leadership and Management

The term 'leadership is viewed diversely, ranges by behaviour, characteristics, and outcomes or results. To meet the appropriate leadership approach for diverse settings in our modern era, different authors prescribe a range of leadership approaches such as 'situational leadership,' 'adaptive leadership' and 'creative leadership.' In the modern globalised construction industry, it is necessary to apply different kinds of skills, knowledge, and styles of leadership; which indicates a new breed of leadership style, i.e. 'authentic leadership' [13]

Authentic leaders demonstrate behaviours which enable people to trust in them all the time. They take ownership when they make a mistake and share responsibility for any mistake. They also show the necessary courage to push further up the leadership chain, question the current status quo or defined their people and processes [21].

#### 2.6.2. Lack of Motivation

When the goal of implementation of BIM has attained a certain level of collaboration facilitated by technological application, motivation is an important issue. Nevertheless, in the process of BIM, there is a lack of motivation embraced by asymmetrical distribution of risks and rewards and invisible financial return of benefit for the initiators.

Besides the barriers discussed above, there are also several factors which hinder teamwork in construction projects [22]. These are attitudes to working together in a shared platform including lack of trust, silo thinking, and recognition of rewards. A construction project comprises of teams from different organisational cultures along with individuals having different social needs. The combined team may include experienced and young players, and both are essential for a project [23]. In such a situation, the absence of cultural empathy promotes a confrontational environment which hinders effective teamwork.

In a new process with leading-edge technology, team players' feeling unvalued or dispensable is very likely to exist. Thus, social loafing can easily take place which causes a knock-on effect on the team's effectiveness. These critical attributes of teamwork often hinder collaboration and innovation within the process.

Physical barriers from an organisation that produces the work itself can cause isolation. Personal contacts can make a significant contribution to work satisfaction; such physical hindrances can make for an often-unnecessary disturbance of work satisfaction and motivation [13].

#### 2.6.3. Lack of Skill, Education, and Training

Many authors argue that the implementation of BIM requires a fundamental change in the traditional design and procurement process to get the benefits of modern technology. It is not the learning of new software; it's the changes in the way of design coordination, resetting the workflow, training and reassuring responsibilities [24]. This will require change management and shifting the culture while building mutual trust and cultural empathy. Human resistance is ubiquitous in this situation.

[25] argues that although modern tools help to increase productivity in construction, it demands initial investment to replace the existing technology. The initial efforts to organise training for the employees, hiring new employees, and buying software are significant. All these activities involve additional cost to organisations, but not fee is allocated for the professionals. Many authors that there is no immediate return visible in the current state of BIM adopted projects, and most of the

SMEs are not capable of undertaking required training.

There is less opportunity and cross skilled professionals to provide types of training. Academic courses also do not cover the required curriculum to facilitate fresh graduates on participating in BIM activities. The3 hesitation of experienced professionals is one of the pragmatic barriers to BIM implementation. Nevertheless, it is essential to utilise the skills of experienced professionals in the modelling process to avoid robotic judgment.

#### 2.6.4. Return on Investment (ROI)/Cost

The transition from CAD to BIM and onwards to a wholly digital environment has reached a tipping point. There is no way back. The same ROI augments exist, and productivity gains are being stifled [26]. With new digital approaches, data is increasingly being used for the life cycle of a project for new and different topics, such as helping to determine the need for building in the first instance or to reduce the costs of operating it once it has been constructed.

There are simplified formulas and even "online tools" to measure BIM ROI. The benefits depend on a large number of factors, and they differ throughout the various trades, markets, and maturity levels of BIM uptake.

There are also third-party requirements such as BIM mandates or specific BIM related policies. Implementation costs for software, hardware, training, or content creation can represent a significant hurdle that prevents some from going for BIM in the first place [27].

Latent training happens by culture, being handed down from employee to employee, in which case there is a hidden cost when the trainer takes time to explain to the trainee, or where there is an absence of any form of training, which leads to problems and inefficiencies which have cost implications in themselves.

Those who choose to implement have a steep learning curve and ongoing costs for managing the change.

### 2.7. Managing Change when adopting BIM

Organisational change requires a change in culture. Social science describes organisational culture as “the constellation of values, beliefs, assumptions, and expectations that underlie and organise the organisation’s behaviour as a group” [28]. Cultural change, therefore, has a profound impact not only on an organisation as a whole but also on its members as it is asking them to alter their perception and behaviour.

Fear plays a role that feeds into resistance to change, fear of the unknown, ear related to financial loss or fear of becoming redundant. In the construction industry, there exists a tendency to approach a project with the same methods that have worked in the past; successful delivery often depends on pre-established “formulas” and workflows that have been proven to be efficient and effective for those involved[29]. Due to traditionally poor knowledge-capture in the construction industry, many of these formulas sit within individual project leaders’ heads.

#### 2.7.1. Leadership and Management

Managers usually learn to focus on outcomes and tangible results very early on in their careers. Although outcomes are significant, the leader must pay attention to underlying emotions, and the world of power and influence, in order to sustain change and achieve continued success in the long term [28]. Leaders of change need to balance their efforts across all three dimensions of an organisational change; Outcomes, interests, and emotions as shown in Figure 6. Leaders are at the centre of all three. They shape, direct and juggle them. One dimension may seem central at any time, for example, developing a strategy.

Every single project has a person assigned to it and is responsible for the BIM. That person does not necessarily have to be a capable BIM person; that person must be a capable manager.


**Figure 6** - Three Dimensions of Leadership [28].

### 2.7.2. Individual Change

Managers and others experiencing or implementing the change need to have an understanding of the change process and how it impacts individuals while using strategies to use when helping people through the change to ensure results are achieved [28].

To demonstrate this there are four approaches to change as shown in Figure 7. These are the behavioural, the cognitive, the psychodynamic and the humanistic approaches.

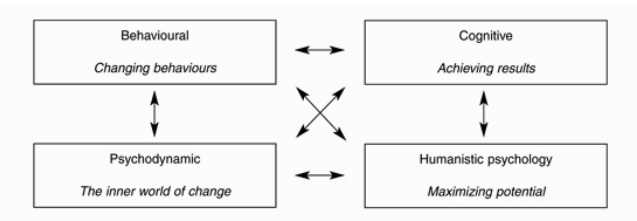



**Figure 7** – Four Approaches to Individual Change [28].

Focusing on behavioural approach to change, as the name implies, it very much focuses on how one individual can change another individual's behaviour using the reward and punishment, to achieve intended results. Rewards and punishments operate in all organisations, but how effective are they in bringing about change [13]?

To help an organisation with individuals going through change, there are some steps required which will assist with reinforcement strategies [28]:

- **Step 1**: The identification of the behaviours that impact performance.
- **Step 2**: The measurement of those behaviours. How much are these behaviours currently in use?
- **Step 3**: A functional analysis of the behaviours – that is, the identification of the parts that make up each behaviour.
- **Step 4**: The generation of a strategy of intervention – what rewards and punishments should be linked to the behaviours that impact performance.
- **Step 5**: An evaluation of the effectiveness of the intervention strategy.

### 2.7.3. Reinforcement Strategies

There are two types of reinforcement strategies; financial and non-financial reinforcement. Traditionally financial reinforcement is the most explicit of the reinforcement mechanisms used in organisations today [13]. The use of bonus payments, prizes, and other tangible rewards is common. To be effective, the financial reinforcement needs to be clearly, closely and visibly linked to the behaviours and performance that the organisation requires.

Non-financial reinforcement is becoming more popular. It takes the form of feedback given to an individual about their performance on specific tasks. The more specific the feedback is, the more impactful the reinforcement can be. This can be either positive or negative [13]. Social reinforcement takes the form of interpersonal actions; praise compliments general recognition. An ineffective social reinforcement is "naming and shaming," so stay clear of that.

### 2.7.4. BIM Managers: Facilitators of Change

During the process of facilitating change, BIM managers train, mentor, and build communities in order to align traditional workflows with new approaches that respond to the strategic BIM and technology-driven identified earlier [30]. This is the period where those affected are likely to be taken out of their comfort zone, the period where BIM Managers empower them to cope with and embrace the change that affects them.

When looking at existing and desired skills across an organisation, the BIM manager should map out different levels of BIM related to knowledge to them to determine each staff members desired pathway for change.

### 2.7.5. Communication is Key

It is well known that successful change occurs when there is clear leadership. It also needs to be supported by clear and timely communication with all staff. Everyone in the organisation will have to know at least something about BIM [31]. People respond best when they are directly involved in the delivery of a change process. Not only that, they are more likely to support the change when they feel supported in their roles. The simple analysis of the skills and training needs around BIM will help to identify who needs to what and what training they will require.

### 2.7.6. Training and Development

Latent training happens by culture, being handed down from employee to employee, in which case there is a hidden cost when the trainer takes time to explain to the trainee, or where there is an absence of any form of training, which leads to problems and

inefficiencies which have cost implications in themselves [32].

### 2.8. Digital Empowerment

Achieving digital empowerment is taking control of your digital agenda rather than being controlled by the outside digital world. It is developing digital mastery in your sector. It is, in practice, Digital Transformation.

Digital empowerment falls under the culture engagement of people of an organisation [33]. It is creating an organisational environment in which digital transformation flourishes rather than an organisation led and controlled by outside the digital world. It can assist organisations in opening knowledge, experience, and values that people already have, it is about discovering and releasing the power of your people in a controlled and focused way [34].

A considerable part if digital empowerment is creating a culture that supports and strives rapid innovation. The construction industry needs to be able to innovate and test assumptions quickly and to do so without fear of failure but with learnings and improvements.

#### 2.8.1. What is Digital Transformation?

Throughout the history of British architecture, technology has repeatedly transformed what, and how, architects can create. Since the digital revolution, the profession has experienced rapid change, starting with the adoption of 2D, then 3D CAD, moving to BIM and, soon, the Internet of Things (IoT) [34].

Digital transformation describes how digital technology allows the industry to create what could not be created before, to design new kinds of buildings, to transform towns and cities to meet the challenges of urbanisation and sustainability. It will help create better-built assets, and improve client outcome; 56% of the survey [18] respondents recognise this as one of its benefits. It is more than the adoption of a set of technologies. Instead, it is a fundamental shift in culture, supported and facilitated by technology.

#### 2.8.2. What are Digital Transformation Challenges?

Below the surface, we see cultural barriers: slow decision-making, a lack of radical thinking and an unwillingness or inability to change the culture. This underscores the importance of a digitally literate leadership, ready and able to create a professional culture of digital transformation [35].

It is not all bad, 43% explicitly agreed they were challenging organisational culture. Almost half (49%) had assigned senior staff with formal responsibility for digital technologies, while 38% were creating teams to experiment with digital technologies and 34% were appointing dedicated digital specialists [36].

#### 2.8.3. Digital Transformation – The Future

While the future possibilities of digital transformation are exciting, it is essential that the benefits of all parts of the industry and society. While 43% believe that digital transformation will mainly be a force for good, 60% believe that it will raise concerns about privacy and security [35].

### 2.9. Literature Review Conclusion

This research review is the current cultural impacts of implementing BIM in the UK construction industry. Since the release of the Construction Strategy in 2011 and the BIM Level 2 mandate in 2016, many academics have researched why there have been adoption problems implementing BIM which is still changing. This research has focussed more on the business culture and best practice within the construction industry and other sectors, i.e. the military. No academics have researched this area before, and it will assist future research to assist the ever-changing UK construction industry in adopting BIM.

## 3. METHODOLOGY

### 3.1. Approach

Qualitative methods generally aim to understand the ‘what,' ‘how' or ‘why' of a subject. This thesis aims to establish what the challenges are when adopting and implementing BIM and how they can be overcome and therefore would be best supported by a qualitative approach. Also, as there has been very little research into the implementation of BIM within a military context, it is recommended that this form of research be adopted.

### 3.2. Methods of Data Collection

The methods of data collection will largely depend on the limitations and nature of the research question [37]. In order to strengthen the findings of this thesis, a Triangulation Methodology will be used [37] by combining two different methods of data collection:

formal interviews, e-mail interviews, questionnaire, and industry attachment.

The Grounded Theory Method (GTM) was chosen to generate new understandings/theory about the field of study and allowed both data collection and analysis to proceed simultaneously. The GTM was used as it involves the comparison of people, places, events, conditions, and settings. This allowed the GTM to analyse the qualitative data collected from interviews, questionnaires, and literature.

#### 3.2.1. Formal Interviews

The first method of data collection was formal interviews with Subject Matter Experts (SMEs). Interviews are most appropriate when little is known about the area of research as they involve an in-depth insight into an individual's experiences and opinions. They provide a greater understanding of phenomena that may not be obtained through purely quantitative methods [38]. Although the use of in-depth e-mail interviewing is rapidly becoming more popular as an essential tool for qualitative research [39] and offers the researcher the ability to consult with individuals in varying geographical locations [40] the author decided to use the formal approach of face to face conversations. The interviews consisted of a series of semi-structured questions which varied depending on the area of expertise of the individual with transcripts shown in Appendix B. These questions were specifically structured to ensure that all of the relevant cultural impacts were addressed concerning challenges of BIM operational implementation.

#### 3.2.2. Online Questionnaire

The second method of data collection was via an online questionnaire using Google forms. This method was chosen as the respondents' data is presented visually graphical. A total of 29 recipients responded to the questionnaire that made available on social media like LinkedIn and Twitter. There are considerable advantages to using these methods of social media; this allowed the author the ability to consult with individuals in varying geographical locations and specific sectors within the construction industry. An important advantage to using this method is that the researcher can make an immediate response to any entry and so can encourage a more detailed explanation by those contributing. The researcher's ability to 'supervise' the data adds authenticity to the data produced

The questionnaire is a vital means of data collection as it is currently the best form of gathering knowledge and understanding of the challenges of adopting BIM in such a busy environment. The questionnaire is shown in Appendix A.

#### 3.2.3. Industry Engagement

The third method of data collection was a six-week industry attachment with a BIM advisory and educational company called Operam. The company is owned and managed by Paul Shillcock who co-authored BS 1192, PAS 1192-2 and the recent ISO 19650 parts 1 and 2. The author attended a BIM Level 2 fundamentals course in April 2018 to further his knowledge in BIM. The company introduced an E-learning platform called Operam Academy, and for the past eight months the author has had access through distance learning. This also led to a 6-week attachment with the company between November and December 2019.

### 3.3. Analysis of Results

The results obtained from interviews were analysed using the six-step thematic analysis prescribed by. The six steps are as follows:

#### 3.3.1. Familiarising yourself with your data

This assisted in identifying patterns of themes from the interviewed data. The author had to familiarise himself with the data and made preliminary ideas for codes that can transcribe the data.

#### 3.3.2. Generating Initial Codes

The codes are only a description, not an interpretation. The data were coded and organised into meaningful groups as this was the best way to identify interesting information in the data.

#### 3.3.3. Searching for Themes

The codes were then analysed looking for themes using sticky notes to help visualize the relationship between the different codes and themes allowing for a thematic 'map' to be generated. Some themes were subthemes to others.

#### 3.3.4. Reviewing Themes

In the words of "*Data within themes should be cohered together meaningfully, while there should be clear and identifiable distinctions between themes."* A more in-depth review of the identified themes helped to combine, refine, separate, or discard original themes.

3.3.5. Defining and Naming Themes

The ongoing analysis was required to enhance the identified themes further. At this point, a unified story of the data emerged from the themes.

3.3.6. Producing the Report

The analysis was transformed into a questionnaire, relating to the themes, research question, and literature.

The results obtained from the questionnaire were displaying in graphical format using Google forms. The data was analysed to ensure the validity of the results.

**3.4. Participant Selection**

Sample selection has a significant effect on the overall validity of the research so choosing the correct method was important. The five types of sampling; random, systematic, convenience, cluster, and Stratified were identified. As the BIM sector is very niche, the stratified sampling approach was chosen, mainly so the sector could be divided into groups based on roles, experience, and level of responsibility.

**3.5. Limitations**

The method of research did display some inherent limitations, which are discussed below.

3.5.1. Limit Before Research

The absence of previous research into the cultural challenges of BIM implementation within the UK construction industry. It has resulted in heavily engaging with the UK BIM community when analysing and discussing the findings.

3.5.2. Data Collection Methods

Due to interviewees being busy it was difficult to arrange specific dates and times, sometimes there would be lapses between communication with the possibility of the interviewee losing interest. It was a constant challenge, but persistence was vital to limit this problem.

**3.6. Ethical Considerations**

As qualitative researchers seeking to acquire knowledge, awareness of how that research may be read, reinterpreted and used it is vital to consider the important ethical implications of the research. In every aspect of this research, the author maintained complete honesty, professionalism, and transparency ensuring that all findings were robust and reliable. The contribution of other parties has been explicitly and honestly acknowledged and all findings were appropriately documented and analysed.

3.6.1. Informed Consent

Ethical obligations insist that the researcher gain informed consent from all participants before beginning any form of research. All contributors to this thesis were made fully aware of what agreement would entail, and verbal/written consent was obtained before any research was undertaken.

3.6.2. Anonymity

Qualitative research should aim to ensure anonymity for all participants. Transcripts used pseudonyms rather than individual names and identifying details were altered where possible.

3.6.3. Confidentiality

It is a responsibility of the researcher that any information obtained remains confidential. All interview transcripts, research notes and any other documentation either electronic or handwritten were always securely stored.

3.6.4. Information Security

The information within the thesis is neither sensitive or commercial confidential and therefore should be treated as such.

3.6.5. Data Interpretation

All data was carefully analysed to ensure a fair representation of what was seen and heard.

**3.7. Industry Engagement**

3.7.1. Company Attachment

To have a greater understanding of BIM within the construction industry, the author was seconded for six weeks to a BIM advisory and training delivery company called Operam. For the six weeks, the author was introduced to the digital transformation framework and attended many BIM related forums and networking conferences meeting BIM SMEs and champions within the UK construction industry.

3.7.2. BIM Show Live 2019 Presentation

While seconded to Operam and working on this thesis, the author decided to apply to present at BIM Show Live 2019 on the Cultural Impact of Implementing BIM from a Soldiers Point of View (POV). Having witnessed the cultural impacts of implementing BIM in the military and analysing the impacts within the UK construction industry, it

would be an excellent opportunity to brief both the military and the construction industry on the results. The topic was accepted, and the author presented to an international audience on the 28 February 2019, and it was well received. The presentation can be found in Appendix C.

### 3.7.3. UK BIM Alliance Roadshow

Since BIM Show Live the author has presented on numerous occasions to the UK construction industry nationally for the UK BIM Alliance. The industry was very interest in the Army's values, and standards and on the authors change management process. The author now fully engages with the UK BIM Alliance and is supporting them were possible.

## 4. RESULTS

The results of this thesis were obtained through a fundamental principle of GTM study, data collection through SME interviews, a questionnaire and industry engagement. They identified the cultural challenges and proposed solutions to the adoption and implementation of BIM within the UK construction industry. The results were analysed using six steps thematic analysis prescribed by and prior academic research including 'best practice' evidence from the construction industry and BIM community.

### 4.1. The 'Big Five' Implementation Barriers

As discussed a questionnaire was generated and sent to 62 people within the BIM sector and a total of 29 participant replied. The question was asked "*what barriers do you foresee to BIM Implementation*". From a list of 13 reasons the top five were chosen and can be seen below in Figure 8.

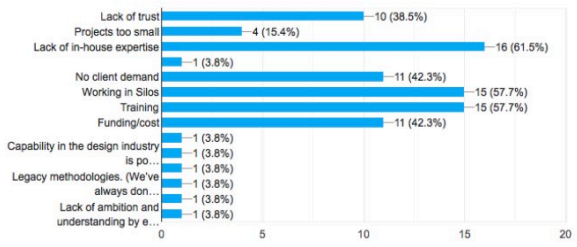



**Figure 8** – What Barriers do you Foresee to BIM Implementation [16].

The author created 13 questions relating to the BIM implementation barriers, but chose the 'Big Five' to discuss in more detail.

### 4.1.1. Lack of in-house Experience

As shown in Figure 9, the participants stated that 32% of their organisations were accredited from a BIM Level 2 course, with 16% having a MSc in AEC. The chart shows that within the organisations there are people qualified from the basic to PhD level, so the experience and knowledge is there.

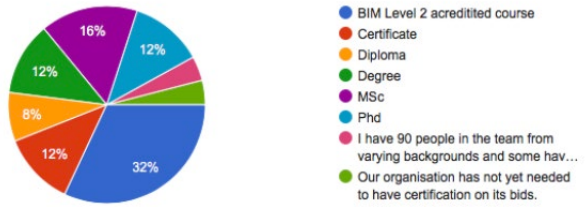



**Figure 9 –** What is the Highest Relevant BIM Qualification within your Organisation? [16].

### 4.1.2. Working in Silos

As discussed organisations need to be more collaborative, especially when there are geographic or cultural barriers. The pie chart below at Figure 10 shows nearly 41% of participants collaborate via a CDE, with 37% using emails. Face to face and Online platforms are the minority, this will probably improve as technology advances.

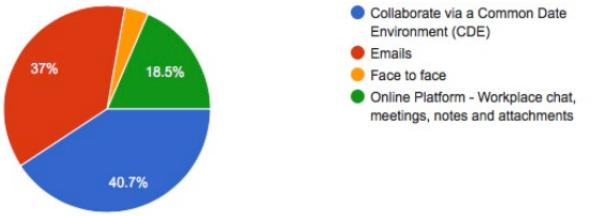



**Figure 10** – Please tell me the Primary method of Collaboration within your Organisation? [16]

### 4.1.3. Training

To ensure the teams have the relevant knowledge and capabilities to achieve best practice and the continued drive all employees must have some training in BIM. As shown in Figure 11, nearly 58% of participants stated they would benefit from formal education, with nearly 39% unsure.

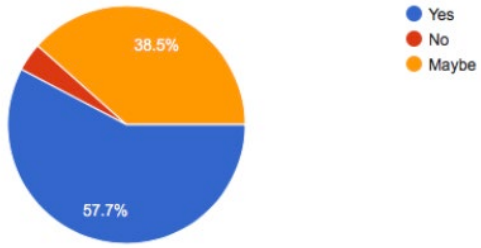



**Figure 11 –** Would your Organisation Benefit from Formal Education on Adopting a BIM Approach? [16].

#### 4.1.4. No Client Demand

A high proportion of public sector clients are failing to adopt BIM on their projects. As discussed clients still do not understand what they are asking for or what BIM is. As shown in Figure 12, 37% of participants state they are almost at BIM Level 2 and realising the benefits, with 33% realising the benefits, and 22% not.

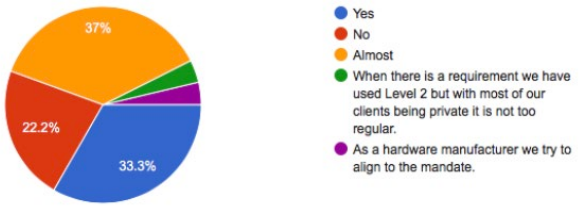



**Figure 12 –** As per the Government Construction Strategy 2016-2020 has your Organisation embedded BIM Level 2 and Realised the Benefits? [16].

#### 4.1.5. Cost/Funding

As shown in Figure 13, 46% of the participants stated that organisations only see expense incorporating BIM, with nearly 31% saying no and 23% maybe. There is expense implementing, especially in training, hiring, equipment and software, but as discussed the benefits are realised once implemented on a project where it makes it more efficient, lowers their risks and gives better value and better outcome to the client, a great ROI.

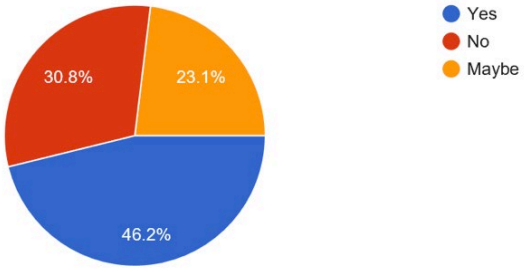



**Figure 13 –** Do Organisations only see Expense Incorporating BIM? i.e., Training and Hiring new Employees, Buying new Software? [16]

### 4.2. The 'Big Four' Adoption Barriers

During the data collection and analysis process some concepts emerged. The concepts were grouped into various categories. Following are the categories that emerged throughout the research shown in Table 3.

**Table 3 –** Categories and their Interpretations from the Questionnaire [16]

| Categories | Merged with | Compared | Discarded |
|---|---|---|---|
| Leadership & Management | 9 | 9 | 5 |
| Lack of Motivation | 4 | 13 | 7 |
| Lack of Skill, Education & Training | 14 | 15 | 4 |
| Cost | 7 | 5 | 3 |

### 4.3. Training is the Way Forward

As shown in Figure 14 "*Do you know who requires BIM education in your organisation?"* a high majority of participants stated that training was needed across their organisations and supply chain, ranging from the board of directors to contractors. Human Resources (HR) was the exception, with participants stating they do not require training, even though they are specialists in recruiting, screening, interviewing and placing workers.

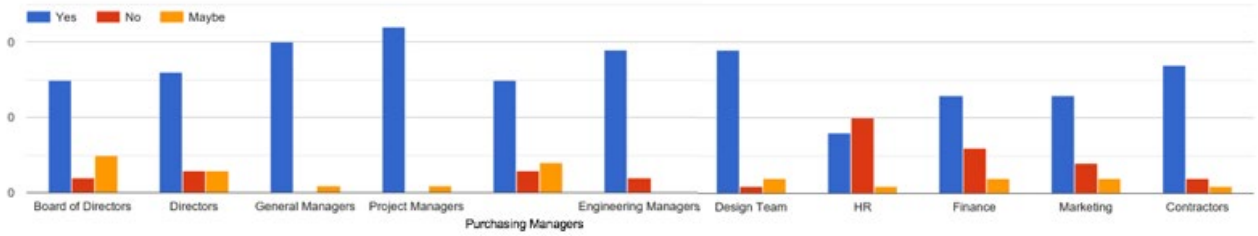



**Figure 14** – Do you Know who Requires BIM Education in your Organisation? [16].

What is evident having analysed all the results is there needs to be either formal or informal training in BIM across the whole organisation and supply chain, either as formal classroom training or E-learning to either be more flexible or assist geographic restrictions.

For BIM to be a success within an organisation, senior managers and managers need to have formal training in Change Management and Leadership Management, as the change will only be successful if the whole company really wants it and it is lead in the right direction.

## 5. DISCUSSION

The greatest challenge posed by the implementation of BIM on projects is the 3 P's: people, processes, and policies [41].

Understanding the context of the organisation is a process. This process determines factors which influence the organisations purpose, objectives and sustainability. It considers internal factors such as values, culture, knowledge, and performance of the organisation. It also considers the external factors such as legal, technological, competitive, market, cultural, social and economic environments. Examples of how an organisation's purpose can be expressed include its vision, mission, policies, and objectives [42].

**Organisational Culture**

In many cases, organisational change is seen as a direct result of external changes. Among these external forces are: political, technological, cultural, demographic, economic and the market [13].

**Table 4 -** External and Internal Triggers for change [13].

| | |
|---|---|
| **Political** | Deregulation or liberalisation of the legislation in the international trade of consumer products and services. |
| **Technological** | Information and communication technology facilitates new working practices like working from home or distance work. |
| **Cultural** | Societal and cultural norms about what is politically and morally appropriate to pressure organisations in specific directions. |
| **Demographic** | These forces impact an organisation's recruitment possibilities and the competence profile of the labour force. |
| **Economic** | These factors include the causes and effects of business cycles and what an international world leads to growth and stagnation. |
| **Market** | Market orientated cultures are results orientated, with a focus on completion, achievement and "getting the job done." |

### 5.1.1. Cultural Environments

The construction industry is very much integrated into local environments. Even the largest construction companies working in international markets act locally. On the other hand, locality is necessary because of problems with logistics or integration into local context is needed because of the differences in legislation and locally applied standards and procedures. The consequences of the

locality are more profound assimilation into the cultural characteristics and habits of the specific environment.

In a series of six surveys conducted between 1939 to 1996, several traits have changed in importance [43]. First came ambition and industriousness has decreased in the importance of women, while it has stayed stable for men. Second, came good financial prospects have increased in importance for men while it remained relatively stable for women. Nevertheless, over the span from 1939 to 1996 both traits were still considered more important for women.

#### 5.1.2. Tired of the old ways of working

There is a growing feeling that the old combative workers are guilty of being the producers of the highest proportion of waste in the UK construction industry [32]. This is a result of different and complicated contracts, non-collaboration, claim to chase and blame culture; all are examples of activities that generate waste and are a costly effort.

Groups such as BIM2050 which represents the younger generation and the Government BIM initiative display a fantastic refreshing attitude towards an integrated approach and adequately represent the future generation who can work together in better ways [32].

Collaboration is getting everyone in the office or project to enter the same state of mind. A willingness to adapt to a BIM way of working and thinking is essential if a new way of doing business is to generate qualitative and quantitative benefits.

### 5.2. Standards and Guidance

Focusing on policies, BIM works best when all those involved in the construction project can share information freely and collaborate. Contracts usually forbid information sharing under the clause of confidentiality, liability and litigation concerns. It is imperative to understand that design solutions are required to not only protect the companies but also encourage them to collaborate.

Organisations can further protect themselves by applying filters to the information they share. By collaborating with stakeholders, all parties can agree upon definitions, processes and policies, and parameters at the start of every project. Doing so will reduce risk while streamlining the workflows that BIM relies on for best practice.

#### 5.2.1. Best Practice from the UK 1192 Series

BS 1192 was published 12 years, and PAS 1192-2 was published six years later in 2013. Many lessons have been learned says [11]. This has resulted in the emergence of best practice for essential activities such as establishing requirements for information, preparing an invitation to tender and information delivery planning. The lessons learned and best practices since the release of the BS 1192 series have been included with the new ISO 19650 series.

#### 5.2.2. ISO 19650 Series Best Practice

The ISO 19650 series represents the attest standards and best practice and provides a unified approach that enables delivery teams to collaborate around an internationally agreed set of standards. [11] quotes "*Asset owners and construction clients are recommended to switch from UK BS 1192 series sooner, rather than later*".

#### 5.2.3. ISO 19650-2 National Annex

When standardised and codification is an issue internationally, it became apparent that region-specific requirements were required as a National Annex. ISO 19650-2 defines the requirements, and the National Annexes define the standards which must be used to meet the requirements in a region.

### 5.3. Making Sense of Change Management

#### 5.3.1. Overcoming Change Resistance and Managing Expectations

Middle management, and in particular project team leaders require lots of attention when it comes to learning BIM [44]. When a BIM manager is looking at the existing and desired skills across an organisation, they should map out different levels of BIM related knowledge to then determine each staff members desired pathway for change.

BIM managers need to take on a coaching and mentoring role; easing the burden of transition for those who struggle while empowering them to become part of the BIM implementation process. Well-formulated people skills area prerequisite for BIM managers who provide support to others. They need to provide vision and guidance that cuts across the professional boundaries, thereby embracing the whole-of-life dimension of BIM.

### 5.4. BIM Business Transformation Strategy

We know that implementing BIM starts with vision and leadership, this has been discussed at length in the barriers of adopting BIM, but ultimately the driving force is through the individuals who will apply BIM in their day-to-day execution of projects.

Many BIM implementations start on the shop floor in the IT department delivering mediocre results or even fail. These implementations were often opportunistic, taking advantage of project budgets and project stakeholders' eagerness to "do BIM"; however, they missed out on the most valuable benefits BIM has to offer [45].

#### 5.4.1. BIM Framework for Implementation

Many BIM implementations start on the shop floor or in the IT department deliver mediocre results or even fail. These implementations are either opportunistic, taking advantage of project budgets and project stakeholders' eagerness to "do BIM"; however, they issued out on the most valuable benefits BIM has to offer [45].

The business transformation is required to start with the executive vision and sponsorship but is carried out by an organisation's leaders and project work-force. It is a framework based on three essential strategies, each integral to the performance of others. These three strategies are shown in Figure 15.

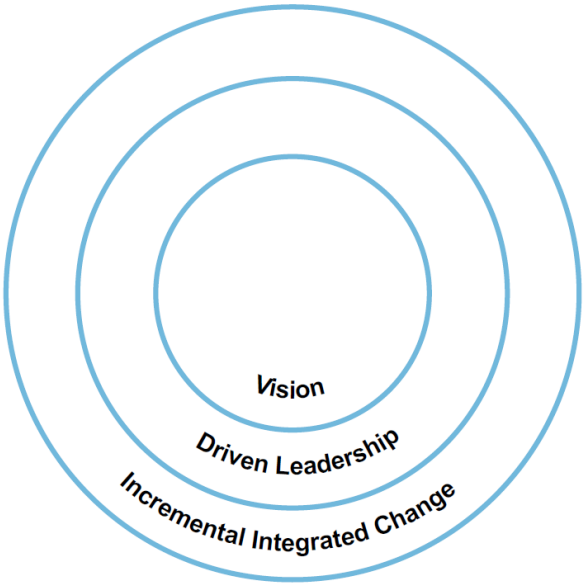



**Figure 15** – BIM Framework Strategy [45]

## 6. CONCLUSION

By addressing each of the impacts discussed this chapter will summarise all the perceived challenges and solutions for implementing BIM that has been explored throughout this thesis.

### 6.1. Leadership and Management

Leadership in any BIM project is an essential element of culture and has influences on the culture in the BIM-enabled project-based organisation within the UK construction industry. The leader must have a high level of understanding on project delivery in BIM so they can control power, actions and drive a project team to success in the various activities.

A project leader is defined as the identifiable person who designs the implementation of BIM for delivering the project using the whole supply chain. The characteristics of leadership and management regardless of the styles of leadership can drive the successful implementation of BIM while influencing the culture in projects.

The leader/manager must have high values and standards which are essential within an organisation. These define what the leader/manager is and what is expected from the employees in a professional and disciplined manner. The values will guide and develop the people within the organisation, and the standards will explain how people should behave.

### 6.2. Motivation

Valued optimisation drives successful BIM-enabled projects as it motivates the participants towards the objectives of the project team. Achievable value planning embracing everybody's interest motivates the employees from various organisations and the supply chain to participate in the collaboration.

### 6.3. BIM Business Transformation Strategy

Organisations must develop a BIM business transformation strategy using the findings in this thesis and industry 'best practice' principles. This will allow organisations to develop their own BIM policy and processes. These should be taken from standards and should comply with the government mandate, including an established information process offering full interoperability.

### 6.4. Training

In order to ensure the highest standards of training a training delivery programme must be implemented

as it changes the way of working. The results from both the NBS BIM Survey 2018 and the authors' questionnaire show that BIM training is required by a whole organisation as the implementation of BIM-changes the way of working and daily vocabulary of construction projects as discussed.

Skills need to be harnessed and the training gaps filled by capacity building programmes in line with the value proposition for projects.

### 6.5. Organisation and Supply Chain

The whole organisation and supply chain will require educating on information management, roles. The implementation of BIM has a notable impact that builds and holds the culture of BIM-enabled projects.

The activities participated by the supply chain drives coordination, integration, and interactions while representing the collaborative working in a construction project.

### 6.6. Financial Implications

Cost is a fundamental element of any capability development programme, and the challenge is resourcing the necessary funding. Other financial implications outweigh the cost challenges of implementing a BIM capability. The impact of not being BIM compliant and the savings associated with an established BIM capability makes it evident that organisations must become BIM compliant.

## 7. FUTURE WORK

After discussing the pragmatic, mythological, and practical implications along with the limitations, the following recommendations have been drawn for future research.

### 7.1. Styles of Leadership

The research focused on leadership and management and how leaders/managers can motivate their teams and increase efficiency and productivity. Further study using a wide range of literature could focus on the types of styles of leadership within BIM projects and organisations.

### 7.2. BIM Adoption Internationally

This study has solely focused on the implementation of BIM within the UK construction industry. Since the recent release of ISO 19650 in January 2019 other countries are now looking to incorporate BIM-enabled projects. Although the purpose of the implementation of BIM in the UK is different to other countries, further studies can be carried out creating value and best practice from the BS EN ISO 19650 UK National Annex.

### 7.3. BS 1192 to ISO 19650

Since the release of BS EN ISO 19650 parts 1 and 2, there has been some resistance from professionals in the UK. Maybe people expected the BS EN ISO 19650 series to be the UK 1192 series but with a different name. The key concepts and principles of the UK 1192 series, and it is recognised that there is a need to support people transitioning from the UK 1192 series to navigate their way around the new documents. Further study on the success of the new documents, especially the transition.

### 7.4. Future Study

Future study can be carried out in a wide range based on the integral parts of BIM and the relationships identified in this study.

## 8. ACKNOWLEDGMENT

I want to express my sincere appreciation to my thesis supervisor Mr Grahame Baker who steered me with his in-depth knowledge and encouraged me during the individual project term. The most important pillar for the success of the project has been achieved through his leadership, guidance, and support.

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Lastly, I express my most profound and most sincere love and gratitude to all the family members who have given me endless support and have always believed in me and trusted me.

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## Appendices

Appendix A: Questionnaire Questions and Results

Appendix B: BIM Show Live 2019 Questions

Appendix C: BIM Show Live Presentations

# The Cultural Impact of Building Information Modelling (BIM) in the UK Construction Industry

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## Appendix A: Questionnaire Questions and Results

# Questions

## Introduction

My name is Andrew Johnson and I am writing my final dissertation for my MSc in Engineering/Industrial Management with the University of Greenwich.

I was asked by an industry professional to research the cultural impact of implementing BIM in the construction industry, focusing on the drivers and barriers.

I am leaving the British Army in April 2019 after serving 24 years in the Royal Engineers as a civil/military engineer. I have chosen to transition into the world of Information Management and Digital Transformation aka BIM, to broaden my construction/leadership experience.

## Aim and Objectives

Aim

The aim of my dissertation is to analyse the cultural impact and challenges by adopting and implementing Building Information Modelling (BIM) in the construction industry. It shall discuss if these challenges can be overcome and how.

Objectives

- Identify the current fundamentals of BIM.
- Research the impact and cultural challenges implementing BIM in the construction industry.
- Analyse the challenges identified by companies in adopting BIM.
- Identify the potential impact based on industry opinions and various commercial experiences.
- Suggest solutions to these challenges where possible to industry professionals.

## Definition of BIM

For the purposes of this survey, the term 'BIM' relates to the collaborative approach to the management, production and exchange of information between the receivers and providers of digital information relating to built assets. This is based upon the information management processes defined within the documents which form BIM Level 2 in the UK, namely BS 1192 and BS EN ISO 19650. It does not relate to the production of a 3D model or the use of a particular software.

## Permission and Confidentiality

Your answers will be recorded with your permission and confidentiality will be maintained accordingly. All the questions can be given verbally if preferred. This is an open questionnaire to answer verbally or in writing.

All qualitative research will ensure anonymity for all participants. Transcripts will use pseudonyms rather than individual names and identifying details will be altered.

## 1. General

This section is aimed at both construction organisations and consultation company's. Please only answer the questions if they are applicable.

### Q1. What is your primary role in your organisation?

- ○ Director
- ○ Design Team Project Manager
- ○ Construction BIM Manager
- ○ BIM Technical Manager
- ○ BIM Technician
- ○ BIM Coordinator
- ○ BIM Consultant
- ○ BIM Advisor
- ○ Project Estimator
- ○ Building Manager
- ○ Model Manager
- ○ Other...

### Q2. How many employees are there in your construction organisation?

- ○ Less than 100
- ○ 101 - 500
- ○ 501 - 1000
- ○ 1001+
- ○ Other...

Q3. Do you have dedicated team responsible for implementing BIM in your organisation?

- ○ Yes
- ○ No

Q4. Is this team integrated with other functions in your organisation?

- ○ Not integrated
- ○ Fully Integrated
- ○ Partially Integrated

Q5. As per the Government Construction Strategy 2016-2020 has your organisation embedded BIM Level 2 and realised the Benefits?

- ○ Yes
- ○ No
- ○ Almost
- ○ Other...

Q6. Please tell me the primary method of colloboration within your organisation?

- ○ Collaborate via a Common Date Environment (CDE)
- ○ Emails
- ○ Face to face
- ○ Online Platform - Workplace chat, meetings, notes and attachments
- ○ Other...

## Q7. How does your organisation use BIM to manage risk?

- [ ] Clash detection and avoidance
- [ ] Measuring BoQ's
- [ ] 4D Sequencing
- [ ] Versioning
- [ ] Model upload/download
- [ ] Multiple data model formats
- [ ] Model merging
- [ ] Audit trail
- [ ] Workflow management
- [ ] Data publishing
- [ ] User profiling
- [ ] Access control
- [ ] Security
- [ ] Data archiving

## Q8. How integrated are your project teams?

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| 1 - Not Integrated | ○ | ○ | ○ | ○ | ○ | 5 - Very Integrated |

## 2. Project – Communication

This section is for organisations and consultation company's. Please only answer the questions which are applicable.

### Q9. Is your organisation responsible for leading the BIM process? Is this managed internally or outsourced?

- [ ] Yes
- [ ] No
- [ ] Internally
- [ ] Outsourced
- [ ] Other...

### Q10. In your opinion, do Information Managers have a significant role in the implementation of BIM?

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| 1 - Not significant | ○ | ○ | ○ | ○ | ○ | 5 - Very significant |

### Q11. What barriers do you foresee to BIM Implementation

- [ ] Lack of trust
- [ ] Projects too small
- [ ] Lack of in-house expertise
- [ ] Not relevant to projects worked on
- [ ] No client demand
- [ ] Working in Silos
- [ ] Training
- [ ] Funding/cost
- [ ] Other...

## Q12. What percentage of experienced and young team members do you have?

- ○ 80/20 -Experienced/Young
- ○ 50/50 -Experienced/Young
- ○ 20/80 -Experienced/Young
- ○ Other...

## Q13. What has been the primary drivers for BIM implementation in your organisation?

- ☐ Competition
- ☐ Government pressure
- ☐ Client/competitive pressure
- ☐ Innovation to remain competitive
- ☐ Provide whole life value to client
- ☐ Accurate construction sequencing and clash detection
- ☐ Streamlining design activities
- ☐ Improving design quality
- ☐ Design Health & Safety into the construction process
- ☐ Improving communication to operatives
- ☐ Cost saving and monitoring
- ☐ Time savings
- ☐ Improving build output quality
- ☐ Marketing
- ☐ Teamwork
- ☐ Other...

Q14. At what level of the organisation is there an emphasis on mutual trust, openness, new ideas/opportunities and target achievements?

- ○ Director
- ○ Senior Management
- ○ Middle Management
- ○ Project Management
- ○ Technical
- ○ Other...

### 3. Relationships

This section is for organisations and consultation company's. Please only answer the questions which are applicable.

Q15. In your opinion, would you agree that BIM forges closer working relationships between all parties – architects, structural engineers, mechanical and electrical consultants and contractors – right from the start?

- ○ Yes
- ○ No
- ○ Uncertain
- ○ Other...

## Q16. Did you encounter any interoperability or other technical issues?

- [ ] Rework
- [ ] Abortive work
- [ ] Data loss
- [ ] Software
- [ ] Standards
- [ ] Data extraction
- [ ] Evolving technologies
- [ ] Other...

## Q17. How do you evaluate the success of the implementation of BIM?

- [ ] Assessing your current capabilities - Analysing your existing capability
- [ ] Determining your goals and ambitions - Long-term goals
- [ ] Shaping a process that's right for the organisation - Steps taken to reach goals
- [ ] Implementing and monitor the adoption - Parallel adoption, single project adoption or implementation
- [ ] Other...

## Q17a. How significant is the impact?

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| 1 - Low | ○ | ○ | ○ | ○ | ○ | 5 - High |

## 4. Cultural Barriers

This section is for organisations and consultation company's based on personal opinions and experiences.

### Q18. Do you agree that the following are influential factors in BIM adoption?

| | Yes | No | Uncertain |
|---|---|---|---|
| Adoption Motivation | ☐ | ☐ | ☐ |
| Ease of Implementation | ☐ | ☐ | ☐ |
| Technology | ☐ | ☐ | ☐ |
| Organisation competency | ☐ | ☐ | ☐ |

### Q19. Do you agree modern technologies are a barrier?

- ○ Yes
- ○ No
- ○ Maybe
- ○ Other...

### Q20. Do you feel that the BIM process provides excessive amounts of useless data?

- ○ Yes
- ○ No
- ○ Maybe

### Q21. Do you agree new design technologies increase productivity in construction?

- ○ Yes
- ○ No
- ○ Maybe

Q22. Do organisations only see expense incorporating BIM? i.e. training and hiring new employees, buying new software?

- ○ Yes
- ○ No
- ○ Maybe

## 5. Education

This section is for organisations only.

Q23. To what degree are employees educated on the BIM approach within your organisation?

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Low level | ○ | ○ | ○ | ○ | ○ | High level |

Q24. Is it just the Information Management team who are trained in BIM?

- ○ Yes
- ○ No
- ○ Partly
- ○ Other...

Q25. Was the BIM training/education delivered by an external provider or were internal experts used?

- ○ Internally
- ○ Externally
- ○ Both
- ○ Other...

## Q26. What is the highest relevant BIM qualification within your organisation?

- ○ BIM Level 2 acreditited course
- ○ Certificate
- ○ Diploma
- ○ Degree
- ○ MSc
- ○ Phd
- ○ Other...

## Q27. Would your organisation benefit from formal education on adopting a BIM approach?

- ○ Yes
- ○ No
- ○ Maybe
- ○ Other...

## Q28. What educational products does your organisation currently utilise?

| | Yes | No | Uncertain |
|---|---|---|---|
| In-house training | ○ | ○ | ○ |
| External training provider | ○ | ○ | ○ |
| Online training | ○ | ○ | ○ |

## Q29. Do you know what education/courses is needed within your organisation?

- [ ] BIM Fundamentals
- [ ] BIM Awareness
- [ ] BIM Level 2
- [ ] BIM Level 3
- [ ] BIM Strategic Implementation
- [ ] Security aspects of BIM and Information Management
- [ ] Data Management for Digital Assets
- [ ] Financing Digital Built Assets
- [ ] Project Management essentials in BIM
- [ ] Benchmarking the Supply Chain for BIM
- [ ] FM Essentials in BIM
- [ ] Handing over a Digital Delivery
- [ ] Understanding ISO 19650
- [ ] Collaboration for Digital Delivery
- [ ] Legal considerations for Digital Delivery
- [ ] Asset Breakdown Structure (impacts and relationships)
- [ ] Defining Asset Function, Duty and Risk (asset tagging)
- [ ] Asset Information Requirements
- [ ] 7 Questions for Capable Clients (writing an aligned EIR)
- [ ] 7 Questions for Delivery Partners (writing your BEP and MIDP)
- [ ] 7 Questions for Supply Chain partners
- [ ] Managing Assets for Digital Delivery
- [ ] Productivity improvements with BIM
- [ ] Making BIM work for Maintainers
- [ ] Planning and Scheduling best practice for Digital Asset Delivery

- [ ] Improving Safety through the Digital Asset
- [ ] Insuring Digital Assets
- [ ] Work packaging for digital
- [ ] Strategic Understanding of BIM
- [ ] BIM Asset Management
- [ ] CDM2015 and BIM
- [ ] Digital Transformation
- [ ] BIM for Product Manufactures
- [ ] COBie and IFC Fundamentals
- [ ] BIM for Project and Construction Professionals
- [ ] BIM - An Introduction to Project Collaboration
- [ ] BIM for Decision Makers (Corporate Training)
- [ ] Zero to BIM

## Q31. Do you know who requires BIM education within your organisation?

| | Yes | No | Maybe |
|---|---|---|---|
| Board of Directors | ○ | ○ | ○ |
| Directors | ○ | ○ | ○ |
| General Managers | ○ | ○ | ○ |
| Project Managers | ○ | ○ | ○ |
| Purchasing Managers | ○ | ○ | ○ |
| Engineering Managers | ○ | ○ | ○ |
| Design Team | ○ | ○ | ○ |
| HR | ○ | ○ | ○ |
| Finance | ○ | ○ | ○ |
| Marketing | ○ | ○ | ○ |
| Contractors | ○ | ○ | ○ |

## Q32. How would the education be delivered to the greatest effect?

- ○ Classroom
- ○ Online
- ○ Team event
- ○ Other...

## Q33. Does your use organisation currently use online learning resources?

- ○ Yes
- ○ No
- ○ Maybe

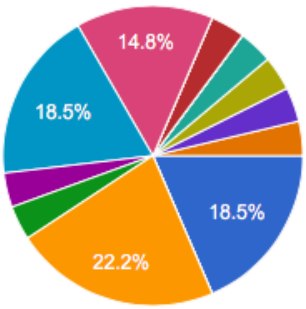
Thank you for completing my questionnaire. If you would like to provide further feedback please email me at %%%%%@%%%%.com

# Results

## 6. General

### Q1. What is your primary role in your organisation?

27 responses




- Director
- Design Team Project Manager
- Construction BIM Manager
- BIM Technical Manager
- BIM Technician
- BIM Coordinator
- BIM Consultant
- BIM Advisor

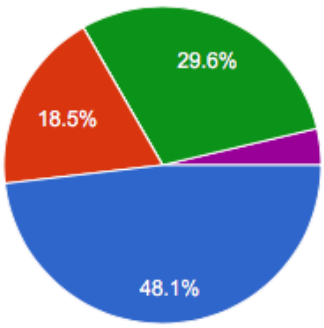
▲ 1/2 ▼

- Project Estimator
- Building Manager
- Model Manager
- Project Manager- not specifically Design Team, also for contract etc
- Product Manager
- Design Manager
- Architect

▲ 2/2 ▼

### Q2. How many employees are there in your construction organisation?

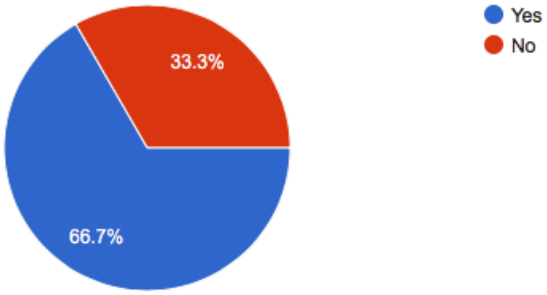
27 responses




- Less than 100
- 101 - 500
- 501 - 1000
- 1001+
- 5800

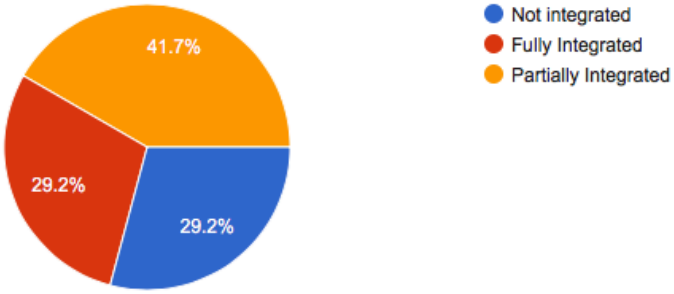
## Q3. Do you have dedicated team responsible for implementing BIM in your organisation?

27 responses



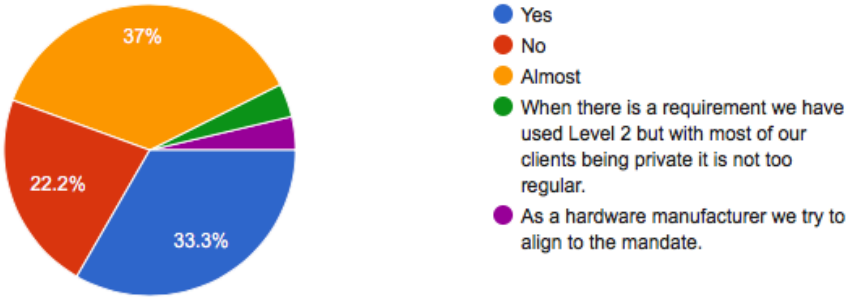

## Q4. Is this team integrated with other functions in your organisation?

24 responses



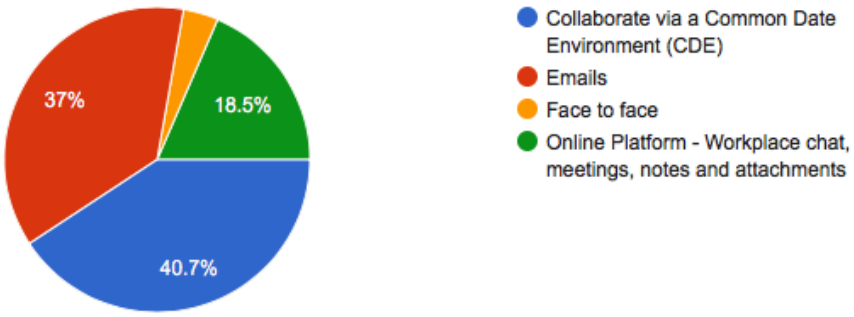
## Q5. As per the Government Construction Strategy 2016-2020 has your organisation embedded BIM Level 2 and realised the Benefits?

27 responses



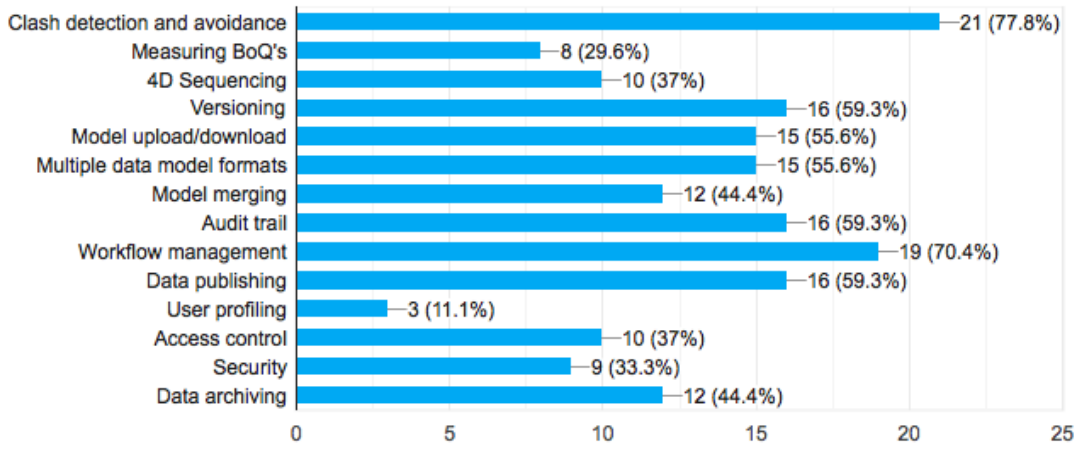
## Q6. Please tell me the primary method of colloboration within your organisation?

27 responses



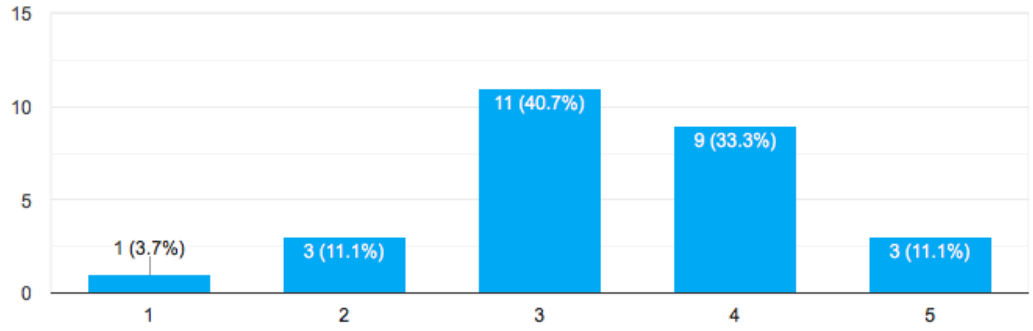

## Q7. How does your organisation use BIM to manage risk?

27 responses



## Q8. How integrated are your project teams?

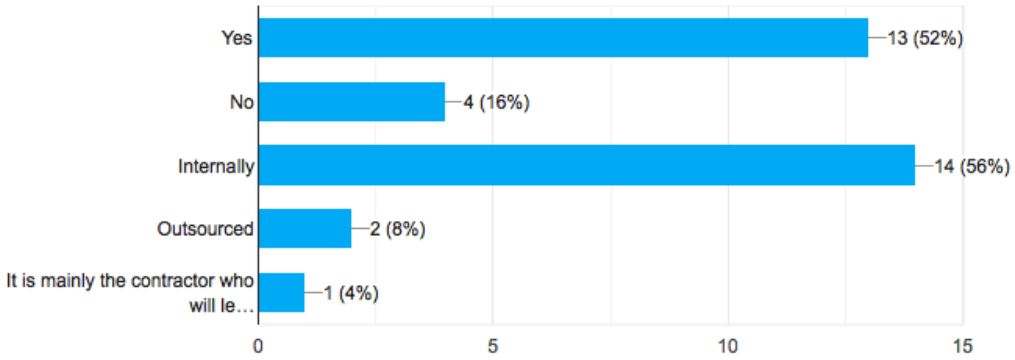
27 responses




**7. Project – Communication**

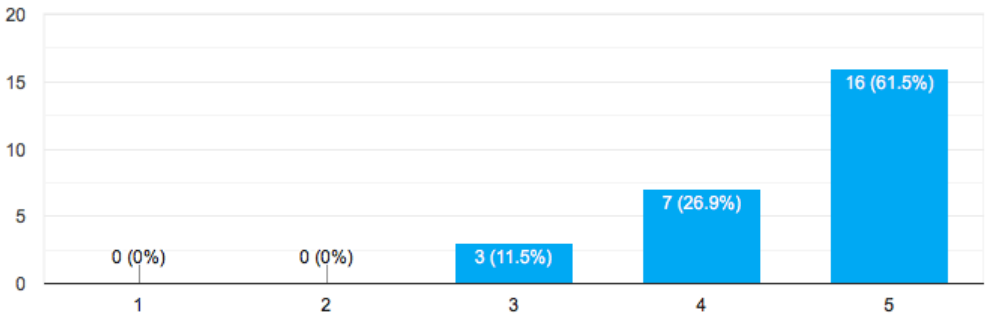
## Q9. Is your organisation responsible for leading the BIM process? Is this managed internally or outsourced?

25 responses



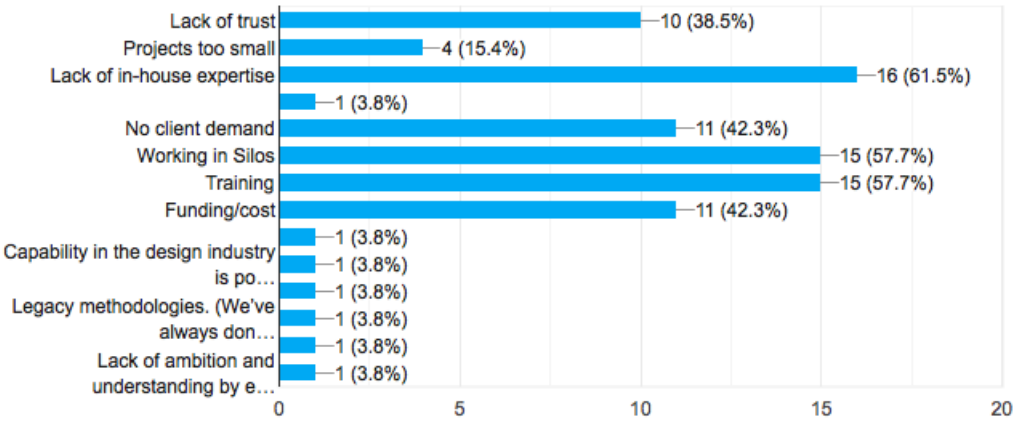

## Q10. In your opinion, do Information Managers have a significant role in the implementation of BIM?

26 responses



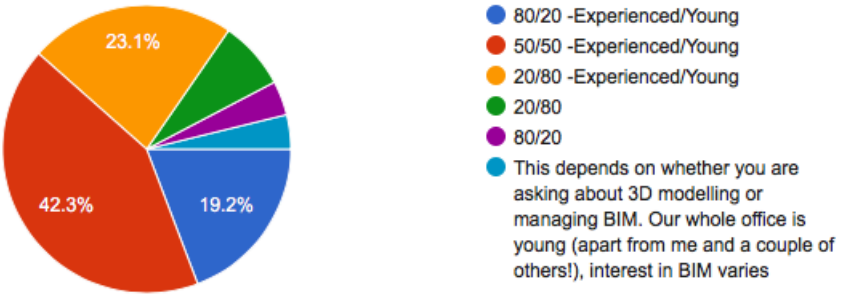
## Q11. What barriers do you foresee to BIM Implementation

26 responses



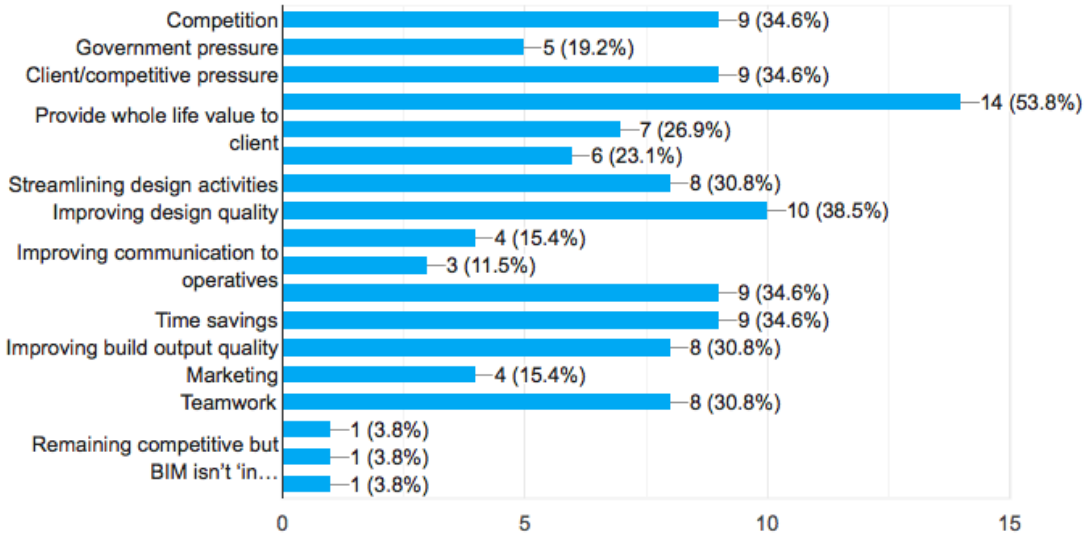

## Q12. What percentage of experienced and young team members do you have?

26 responses



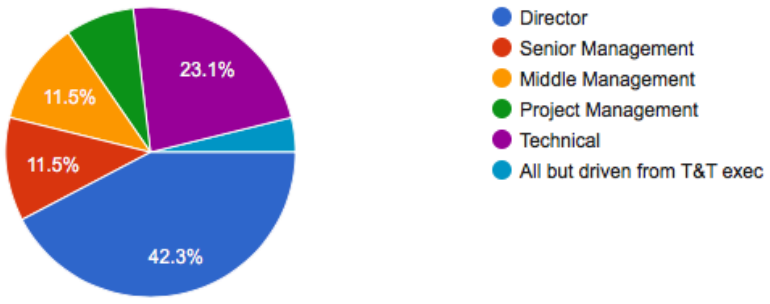
## Q13. What has been the primary drivers for BIM implementation in your organisation?

26 responses




## Q14. At what level of the organisation is there an emphasis on mutual trust, openness, new ideas/opportunities and target achievements?

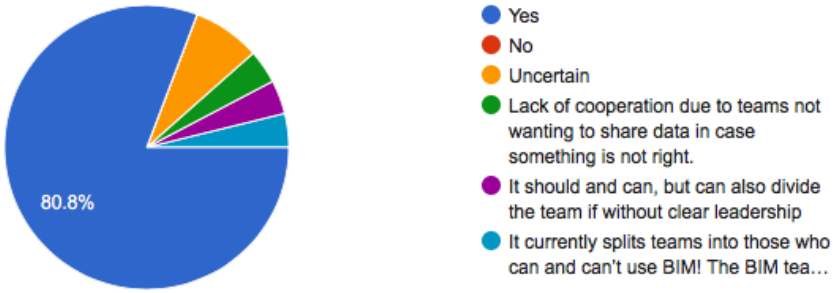
26 responses



## 8. Relationships

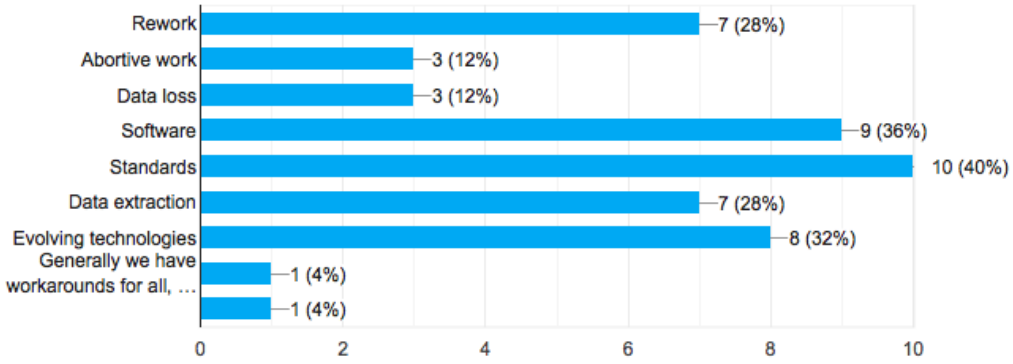
### Q15. In your opinion, would you agree that BIM forges closer working relationships between all parties – architects, structural engineers, mechanical and electrical consultants and contractors – right from the start?

26 responses



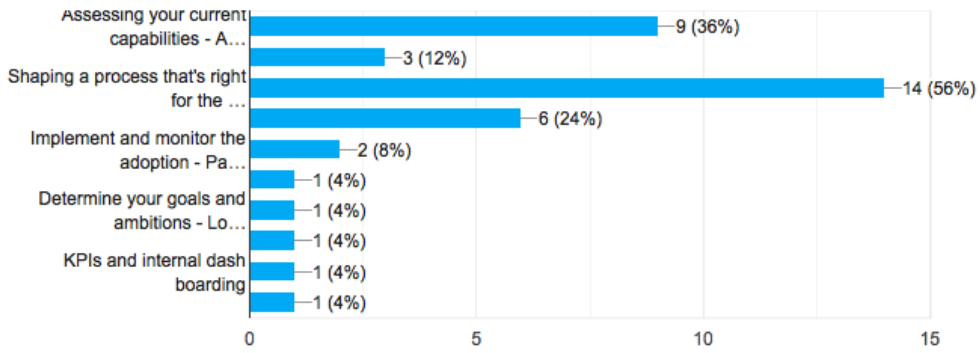

### Q16. Did you encounter any interoperability or other technical issues?

25 responses



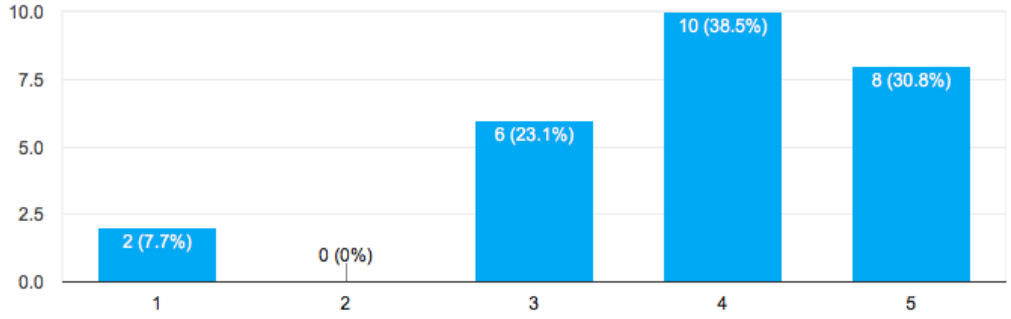
## Q17. How do you evaluate the success of the implementation of BIM?

25 responses



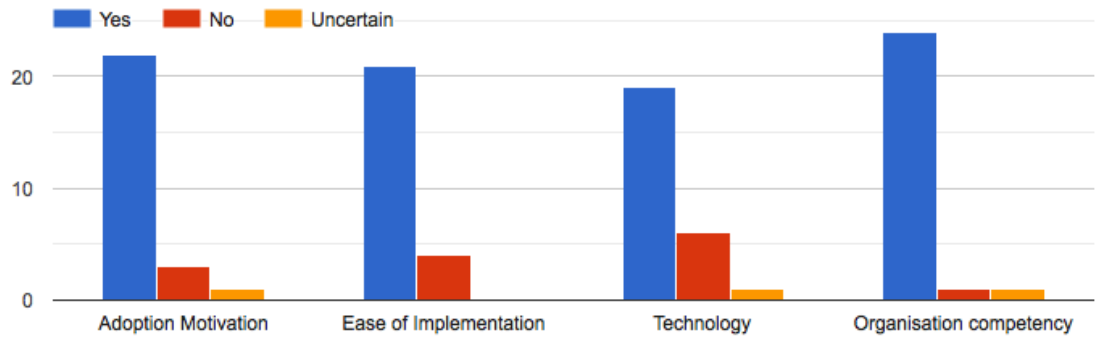

## Q17a. How significant is the impact?

26 responses



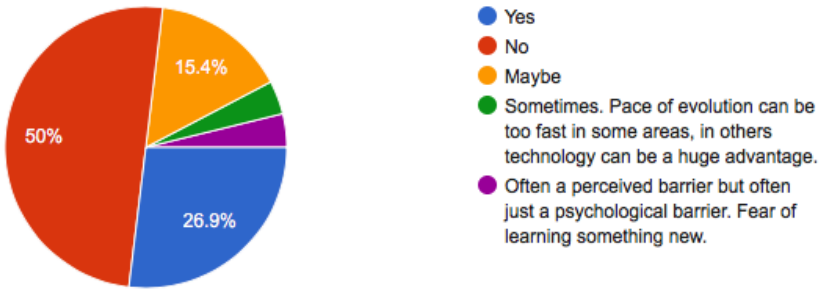
**9. Cultural Barriers**

Q18. Do you agree that the following are influential factors in BIM adoption?



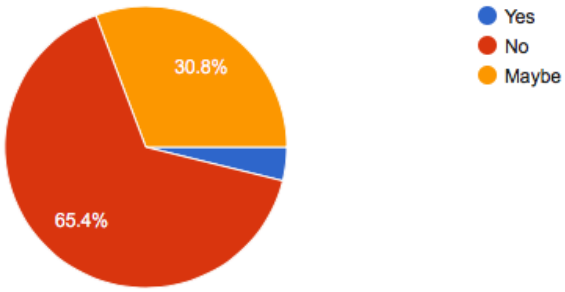
## Q19. Do you agree modern technologies are a barrier?

26 responses



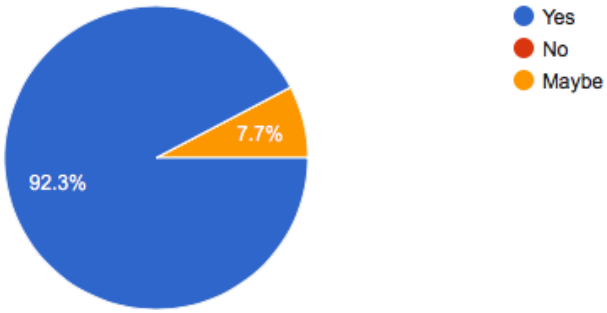

## Q20. Do you feel that the BIM process provides excessive amounts of useless data?

26 responses



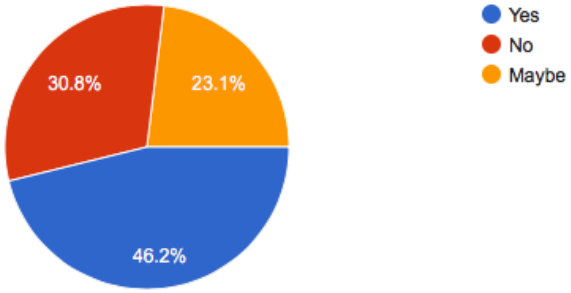

## Q21. Do you agree new design technologies increase productivity in construction?

26 responses



Q22. Do organisations only see expense incorporating BIM? i.e. training and hiring new employees, buying new software?

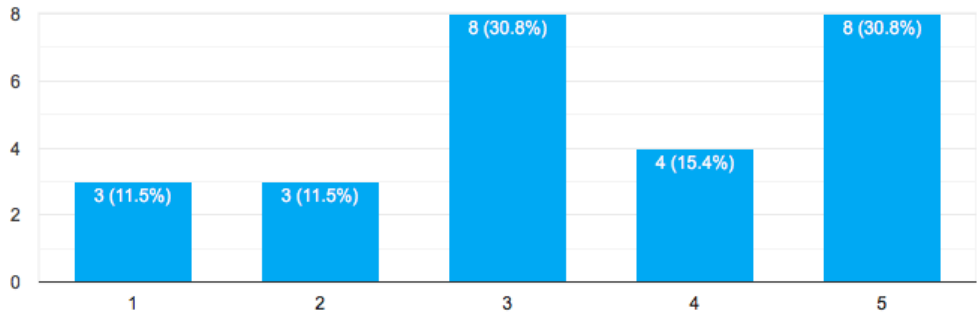
26 responses



**10. Education**

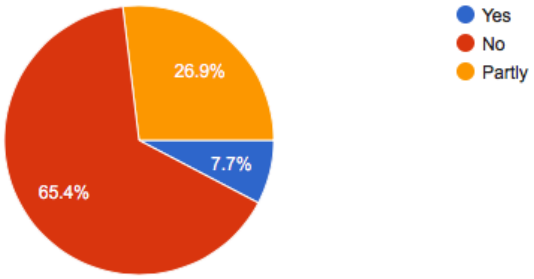
Q23. To what degree are employees educated on the BIM approach within your organisation?

26 responses



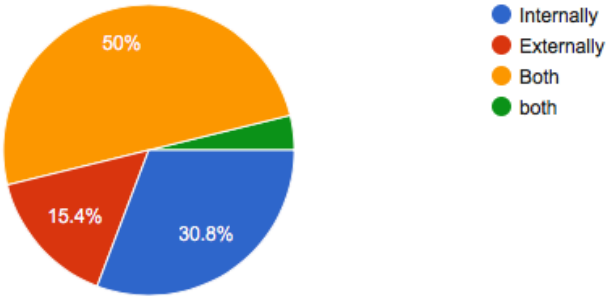

Q24. Is it just the Information Management team who are trained in BIM?

26 responses



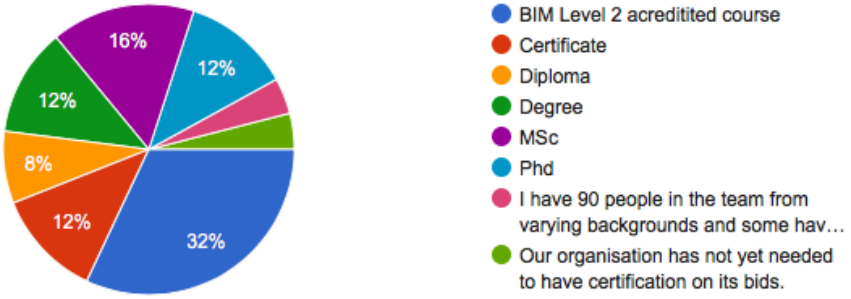
## Q25. Was the BIM training/education delivered by an external provider or were internal experts used?

26 responses



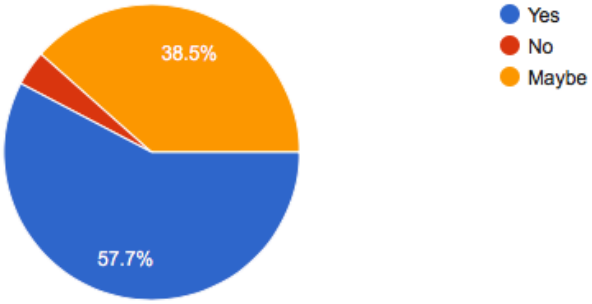

## Q26. What is the highest relevant BIM qualification within your organisation?

25 responses

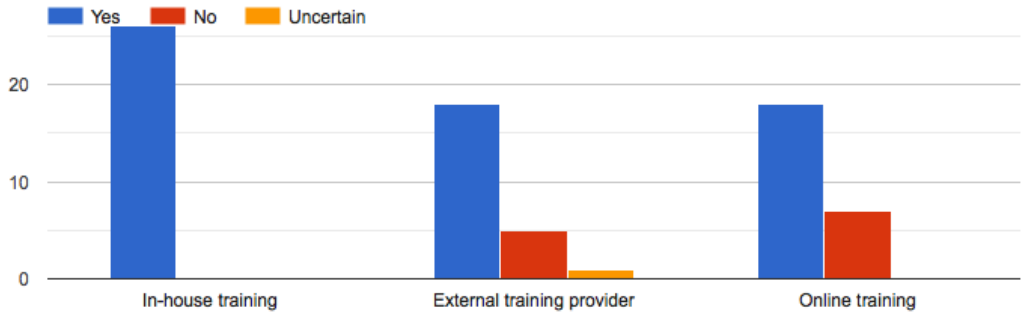



## Q27. Would your organisation benefit from formal education on adopting a BIM approach?

26 responses

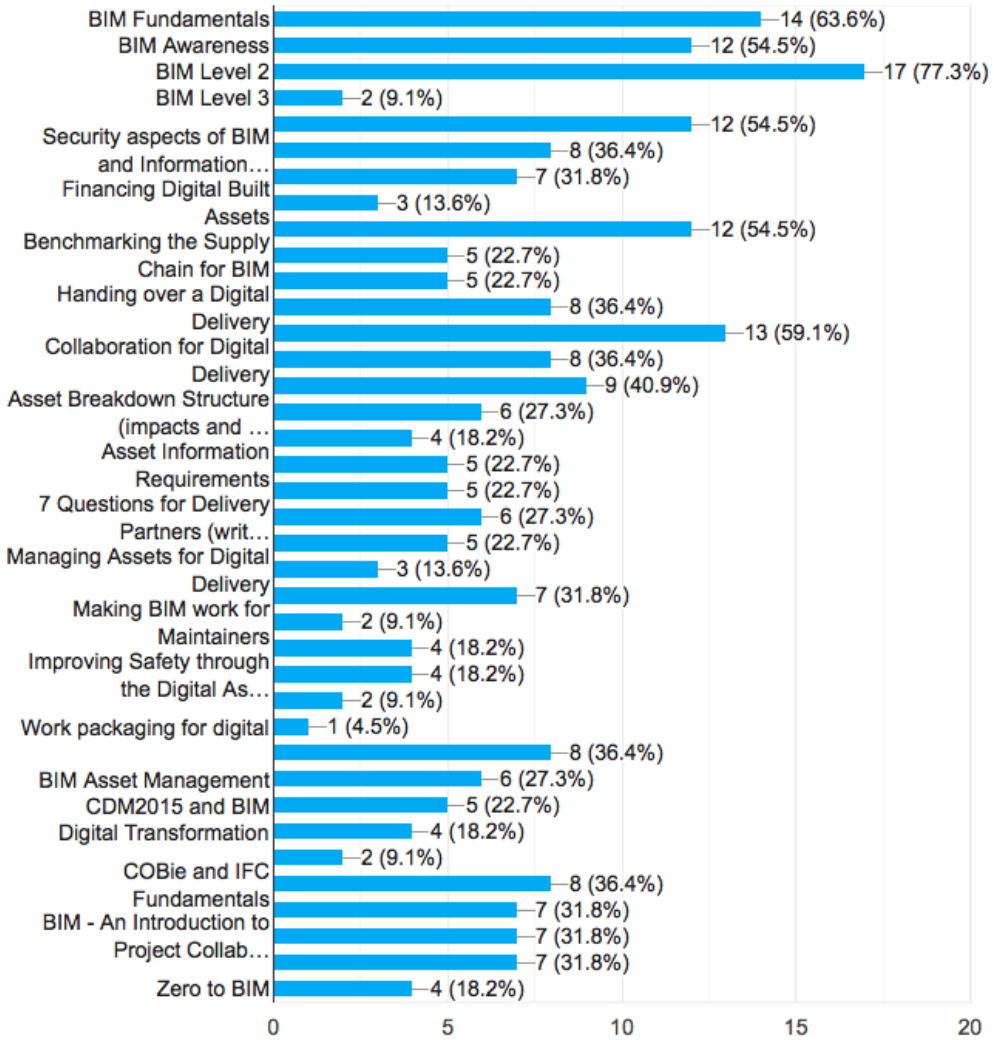


## Q28. What educational products does your organisation currently utilise?

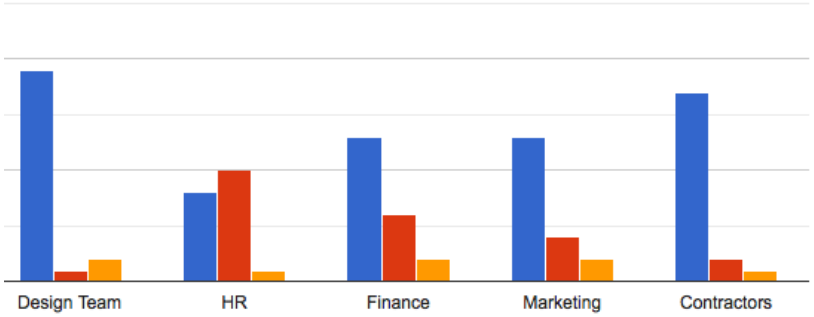



## Q29. Do you know what education/courses is needed within your organisation?

22 responses

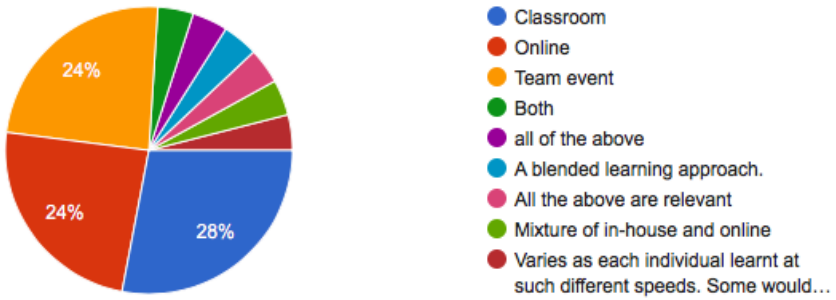


## Q31. Do you know who requires BIM education within your organisation?

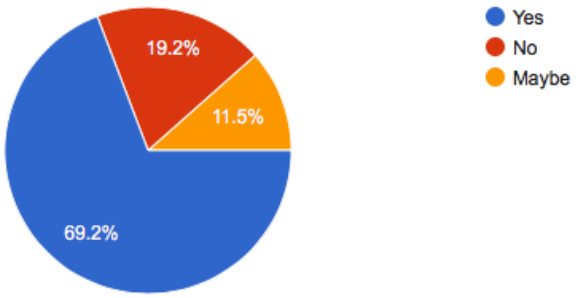

## Q32. How would the education be delivered to the greatest effect?

25 responses



## Q33. Does your use organisation currently use online learning resources?

26 responses



# The Cultural Impact of Building Information Modelling (BIM) in the Construction Industry

A.D.Johnson, 000975631

MSc Engineering/Industrial Management

Faculty of Engineering and Science, University of Greenwich

(aj6216u@greenwich.ac.uk)

## Appendix B: BIM Show Live 2019 Questions

COSTELLO PALMER
Communications

# bimshow live: Pre-show speaker interview 2019

Please answer the following questions and return by Friday 4 January 2019.

Max 250 words per answer.

Name: Andrew Johnson

Position: Warrant Officer Class One – Sergeant Major Instructor (SMI)

Company name: Royal Engineers

1. What is your current role?

   I am leaving the military in April 2019 after 24 years of service. I am currently on termination leave researching and learning digital transformation. Prior to this, I was the Sergeant Major Instructor (SMI) for the Military Plant Foreman (MPF) course which was taught at the Professional Engineering Wing, Royal School of Military, Kent. Although it is a military course the students finish with a Foundation Degree in Civil Engineering on behalf of the University of Greenwich.

2. What does BIM mean to you and how do you use/implement digital construction methodology on your projects.

   Up until January 2017, I had limited knowledge of BIM as it is not practised in the military. It was not until I began studying for my MSc in Engineering Management I began to research and be very interested in the management of digital information and Big Data. With my knowledge of earthmoving construction equipment I wrote a published paper on the "*Impact of Big Data on Construction Equipment Supply Chain*". In November 2017 I was challenged to write my final dissertation on the "*Cultural Impact of BIM in the UK Construction Industry*".

   As a Military Plant Foreman, we cover all the roles of the whole life cycle from concept to disposal which is slightly different to the construction industry as these roles are shared between various managers. We implement digital construction where we can but this can sometimes be limited as we work in austere environments with little infrastructure. We do use digital tools to improve the process of delivering and operating the built environment but this can be limited, so where possible we use the reach back approach to the UK.

3. When did you first start working with BIM?

   In March 2018 I realised I wanted to transition into BIM and digital transformation world so I engaged with my LinkedIn network and I was introduced to Paul Shillcock at Operam Ltd. Paul an Ex-Royal Engineer offered to support me throughout my transition from the military. I attended courses, online training and work attachments with Operam for 8 months. He must have seen potential as he has offered me the role as advisor and I am due to start with Operam in April 2019.

4. Why should BIM Show Live visitors attend your talk?

   I am by far no expert in BIM or digital construction, but what I do have is lots of cultural experiences working in construction in challenging environments worldwide. This has tested my leadership and management skills in such a highly collaborative culture similar to BIM. I will discuss some experiences where digital tools could have made a huge difference in military operations, not only saving cost and time but also lives.

   I was challenged by an industry professional to research the cultural impacts of BIM as it was an area not many researchers have delved in. I accepted the challenge and have thoroughly researched the topic for 12 months engaging with SME's, professionals and the BIM community. I will deliver my findings from a senior soldiers point of view focusing on the barriers and drivers.

5. What technologies in the AEC industry currently impress you the most?

   I have been blown away with the wearable reality capture sensor platforms available. They are making progressive professional BIM documentation a reality mapping indoors, outdoors, underground….actually anywhere! These would be perfect on military construction reconnaissance's on foot as they would gather 3D data much faster to make better-informed decisions that may increase the chances of survival and save lives.

6. What do you think will be the next big thing in BIM and digital construction?

   Personally, for me, I hope the military adopt BIM in their projects and move forward in digital construction. With the new ISO EN 19650 being released there is a standard that can assist the military to manage information over the whole life cycle of build assets using BIM worldwide. The military is experts at concepts, strategy and principles, so with this guidance, they can be more productive in the delivery phase of their assets.

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www.costellopalmer.com

@costello_palmer

# The Cultural Impact of Building Information Modelling (BIM) in the Construction Industry

A.D.Johnson, 000975631

MSc Engineering/Industrial Management

Faculty of Engineering and Science, University of Greenwich

(aj6216u@greenwich.ac.uk)

## Appendix C: BIM Show Live Presentation


# Cultural Impact of Implementing BIM from a Soldiers POV

Andrew Johnson

AndrewJ556


# WO1(SMI) Andrew Johnson
# Military Plant Foreman
# Royal Engineers

STEM AMBASSADORS

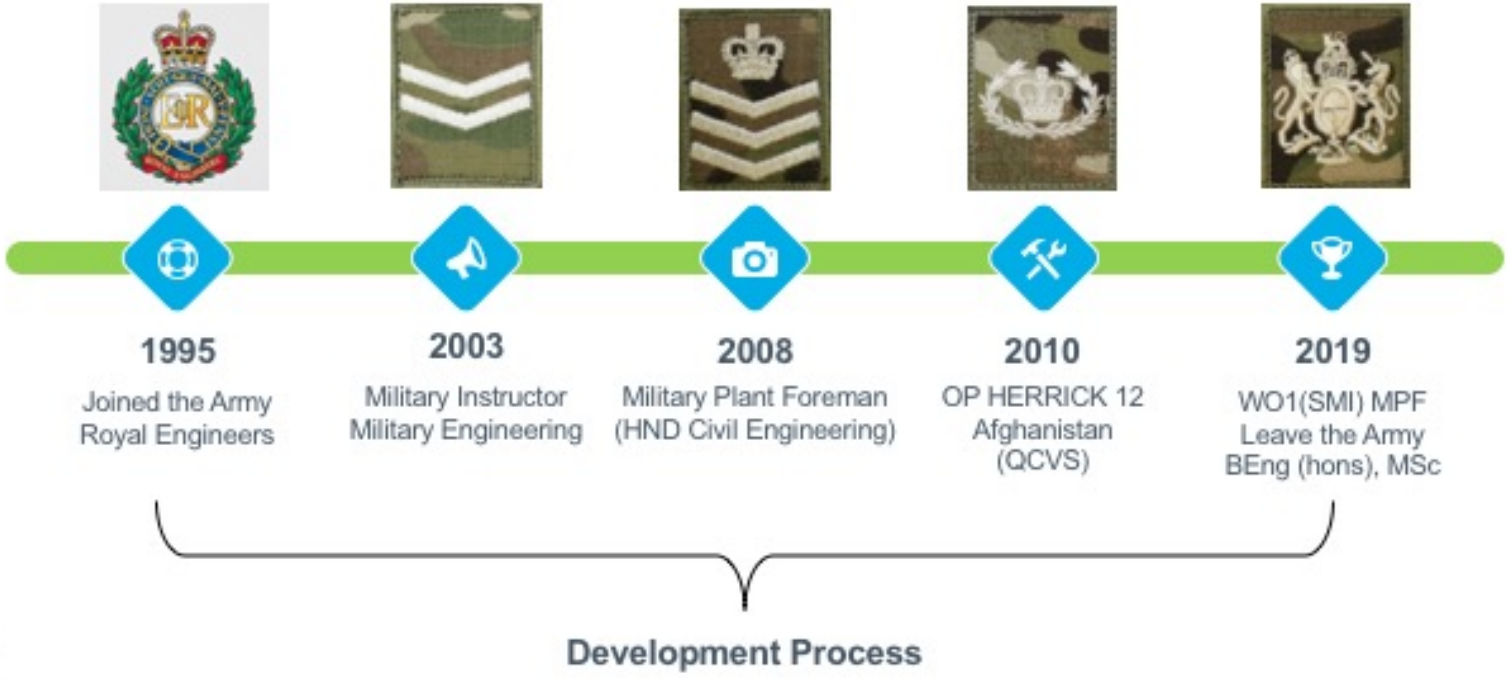

# Background

**Royal Engineer Motto**

**Ubique and Quo Fas et Gloria Ducunt**

**"Everywhere" and "Where Right and Glory Lead"**

# Key Points to my 24 Year Army Career



# My BIM Journey

**Feb 2018**

Career Advice
Caroline Livesey
(Ex-Royal Engineers)

**Mar 2018**

Chris Senior
Infinite BIM
(BIM Handbook)

**Apr 2018**

LinkedIn
Paul Shillcock
Operam
(Ex-Royal Engineers)

**May 2018**

Military Network
Iain Miskimmin
Bentley
Asset Management

**Jun - Present**

Operam
Operam Academy
MSc Thesis
Operam Advisor

**Development Process**

# What is a Military Plant Forman (MPF)?


MPF Moto "***Proestare et Prodesse***"

"***To be Outstanding and Advance***"

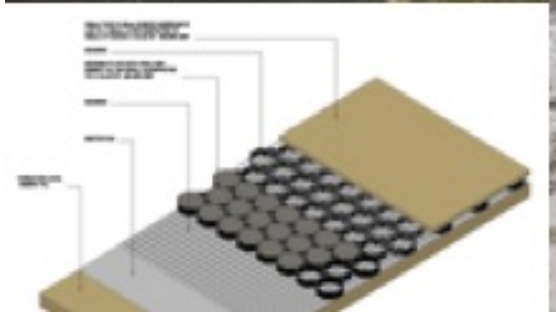
- Highly Regarded in the Corps and Construction Industry all throughout History
- 2 year intensive course
- Independent Trade: SSgt – WO1
- Foundation Degree - Civil Engineer
- Employable in and out of the Army.
- Accredited within Industry

Military Plant Foreman









**Cumbria Floods – November 2009**
Workington Bridge, Cockermouth

## Rapid Deployment:

- Bulk Rock Excavation
- Flooding
- Technical Pavement Assessments
- Landslip Assessments
- Asset Management & Control

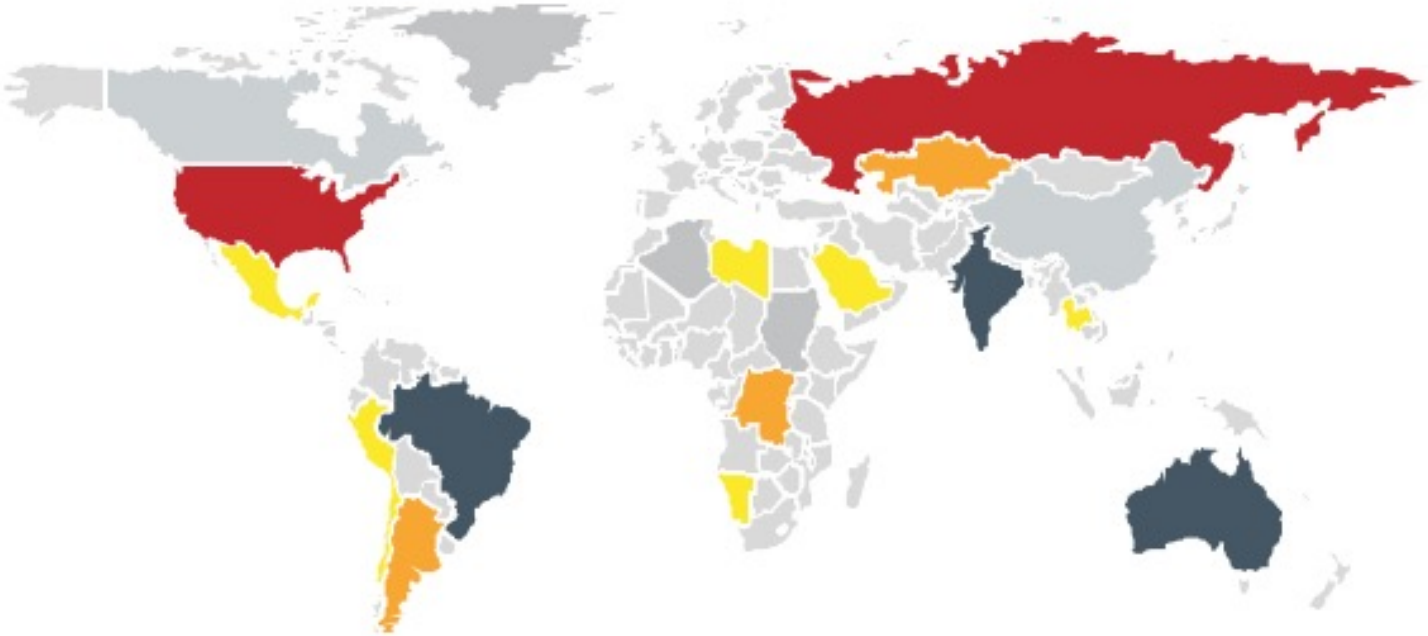
Military Plant Foreman


If the
Royal Engineers
did BIM...
Carlsberg
COPENHAGEN
1847

- Culture
- Core Values & Standards
- Barriers Implementing BIM
- Cultural Barriers
- Change Management
- The Way Forward
- Q&A

Contents

# What is Culture?



"Culture refers to characteristic patterns of **attitudes**, **values**, **beliefs**, and **behaviours** shared by members of a **society**, **population** or **organisation**"

Culture

"BIM is more about **Culture**, less about **Technology**."

"BIM is all about **Collaboration**."

"BIM is **10% Technology**, **90% Sociology**"


Culture

# Does your Organisation have a High-Performing Culture?

## What is a High-Performing Culture

A high-performing culture is a set of **behaviours** and **norms** that leads an organization to **achieve superior results** by setting clear business **goals**, defining employees' **responsibilities**, creating a **trusting environment**, and encouraging employees to continuously **grow** and **reinvent** themselves.


Culture

# Does the British Army Have a High-Performing Culture?

01 Communicates a Shared Vision & Strategy

02 Optimises Processes & Support

03 Organised to Achieve Goals

04 Decision Making

05 Promote Culture

06 Routinely Assess & Benchmark Performance

Improved Outcomes

Culture

# What are the Main Barriers to Implementing BIM in the Construction Industry?

# What are the Main Barriers to Using BIM?



Lack of in House Experience


No Client Demand


Lack of Training


Cost

Barriers Implementing BIM

# What Barriers do you Foresee to BIM Implementation?


Barriers Implementing BIM

## Industry Related and Academic Barriers

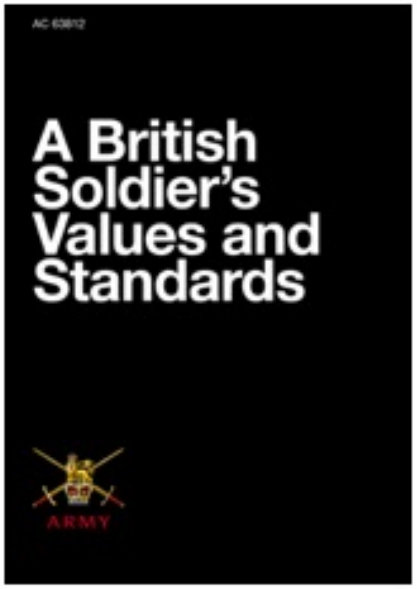
- Leadership and Management
- Lack of motivation
- Lack of Skill, Education and Training
- Cost

# Is Leadership & Management Key?

# Core Values and Standards


Core Values and Standards

## Army Values




Loyalty

Respect for others

Courage

Selfless Commitment

Integrity

Discipline

MPF

Core Values and Standards

## Army Standards


"Have your actions or behaviour badly affected, or are they likely to affect the operational effectiveness of your business"

### Lawful

### Appropriate Behaviour

### Total Professionalism

Core Values and Standards

# OPERATION HERRICK 12

## Helmand Province, Afghanistan

March – October 2010

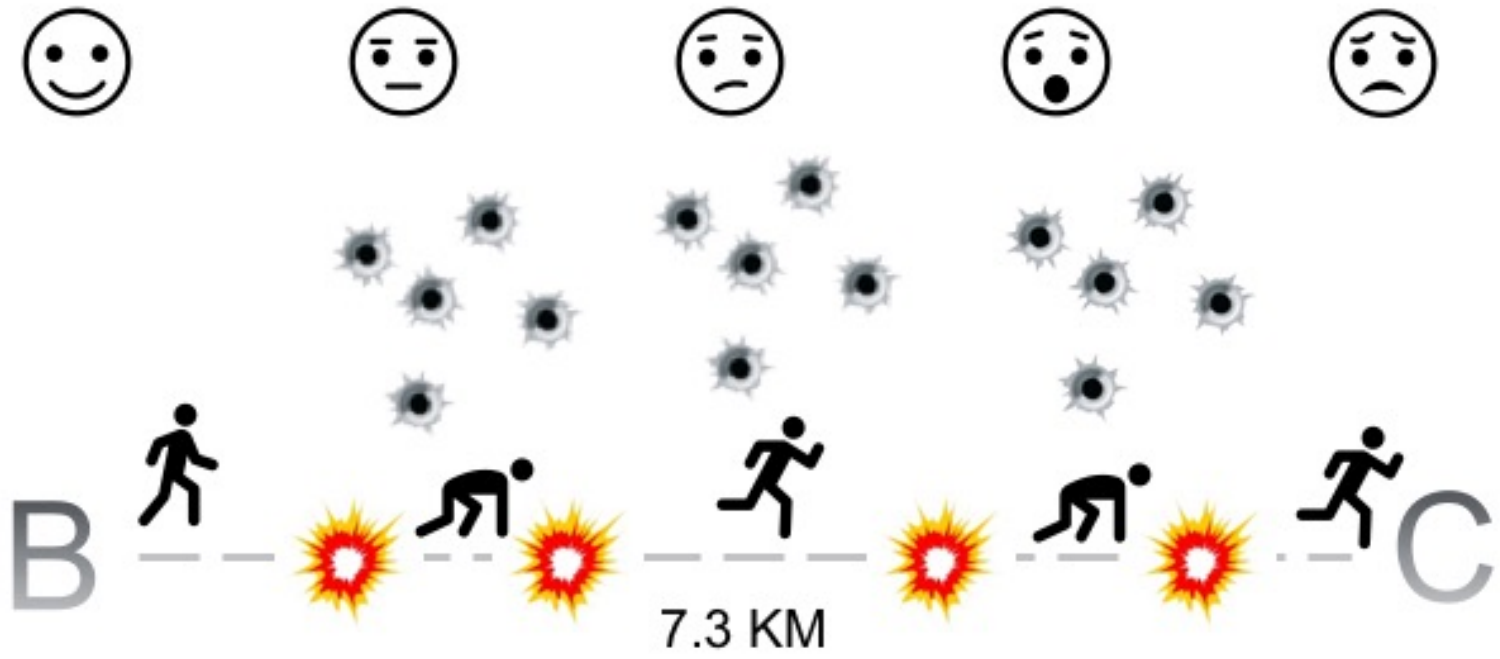
# Route Trident

## Phase 2

## Detailed Reconnaissance

- 27 Mar 2010
- Myself, Plant Reconnaissance Sergeant & Surveyor
- 7.3 KM – Over arable farmland
- Force Protection

Leadership & Management

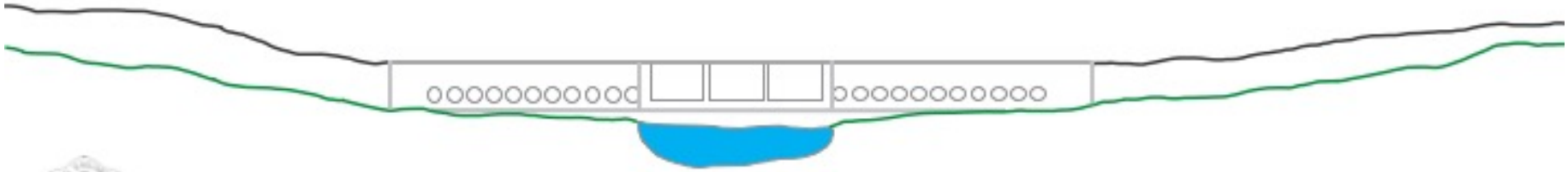



Leadership & Management

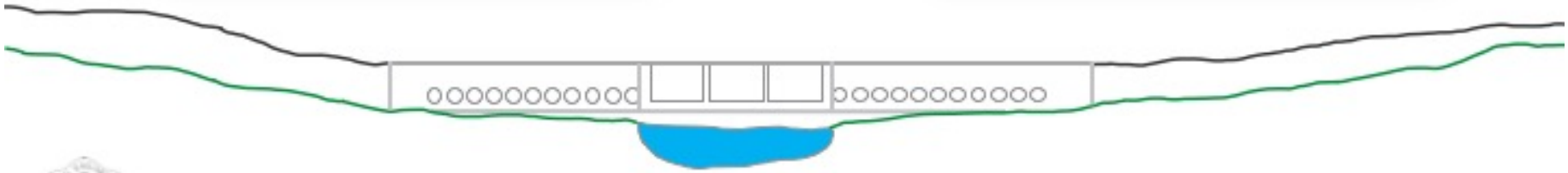

DAEWOO

# Yellow 14

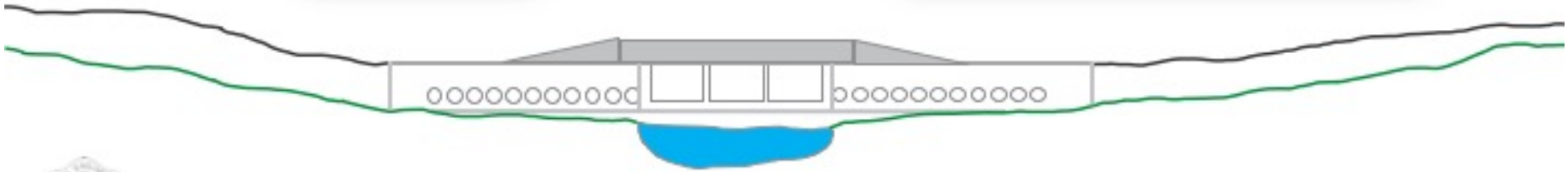
## Wadi Crossing



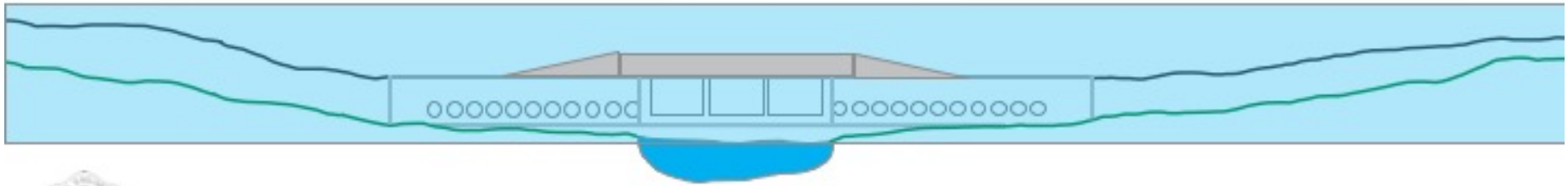
Leadership & Management



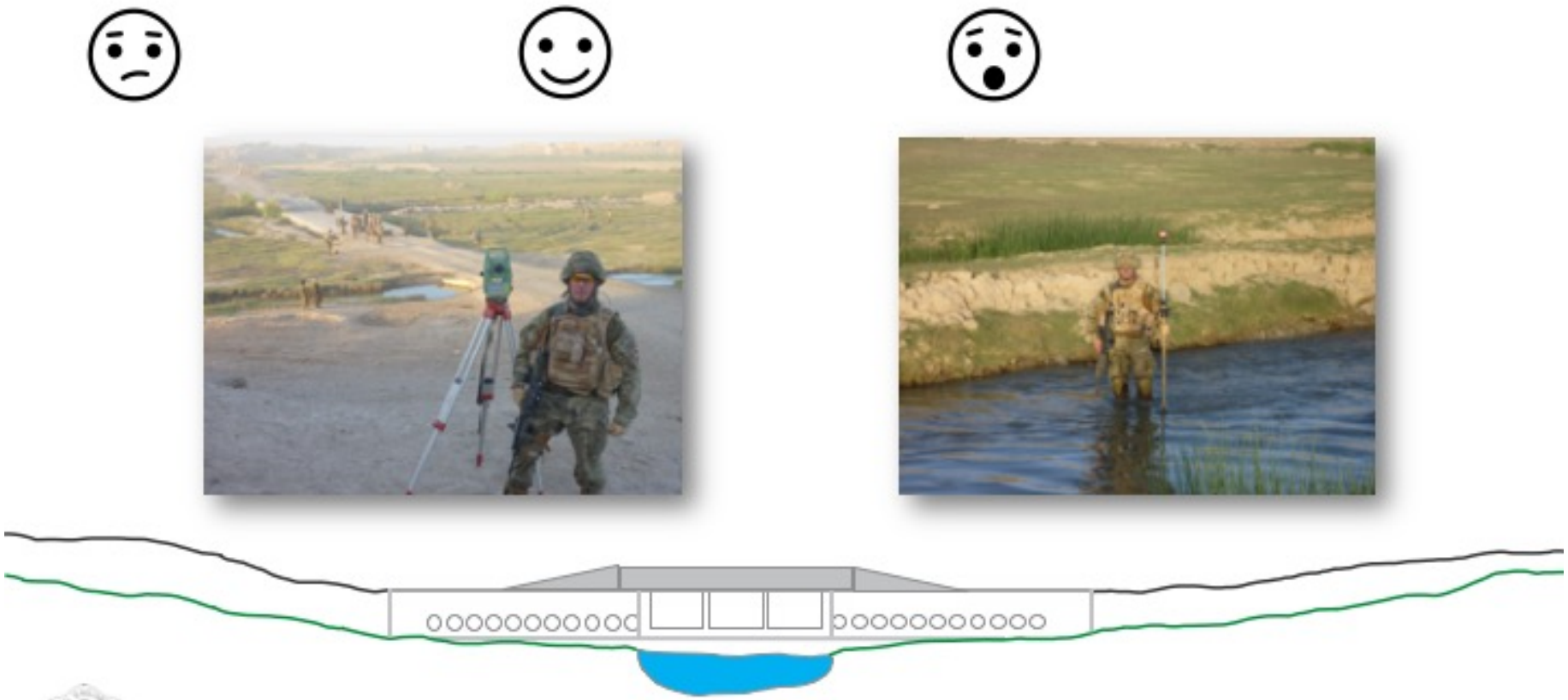
Integrity



Discipline

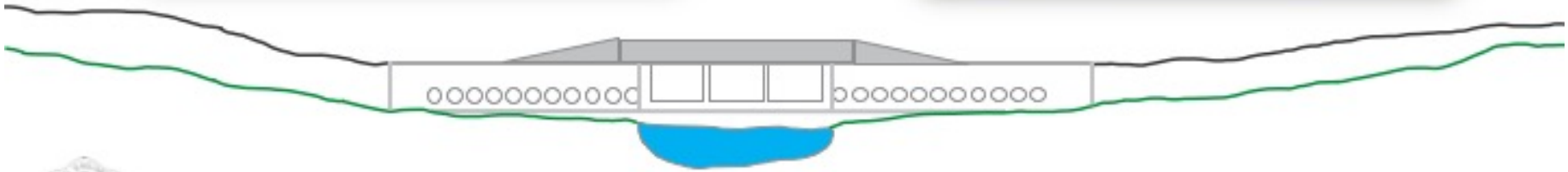


Courage



Selfless Commitment



Respect for Others

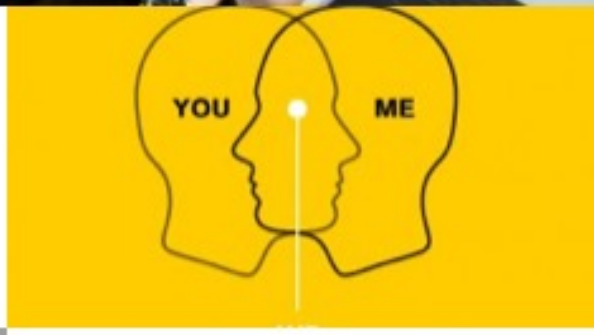

Loyalty

Welcome the Change

# Lack of Motivation in Industry?

Lack of Motivation

Trust



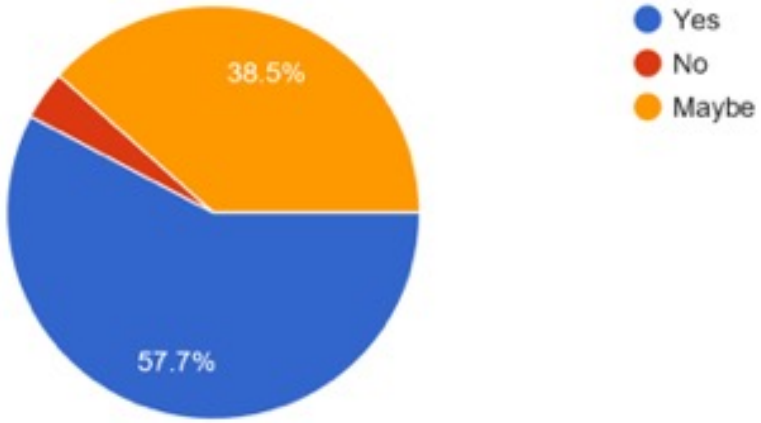

Silo Thinking


Working Together

# Lack of Skill, Education and Training in BIM?

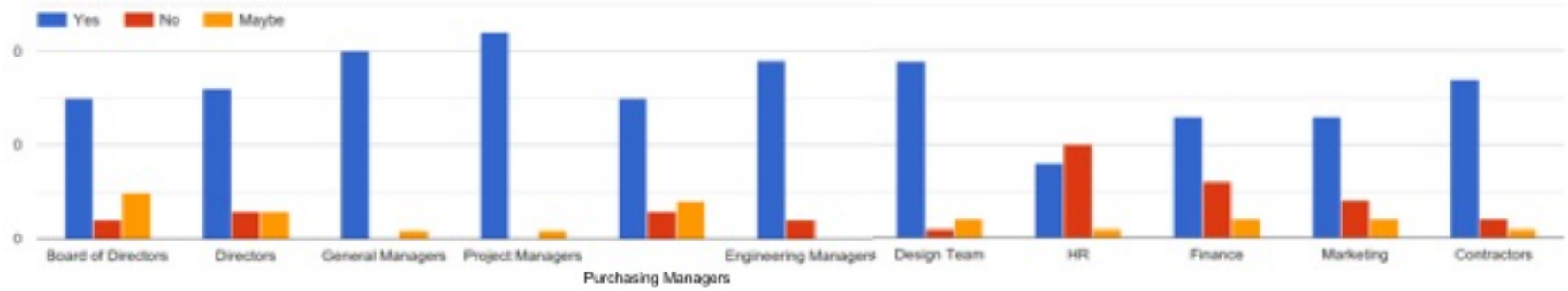

## Lack of Skill, Education and Training

## Would your Organisation Benefit from Formal Education on Adopting a BIM Approach?




Lack of Skill, Education and Training

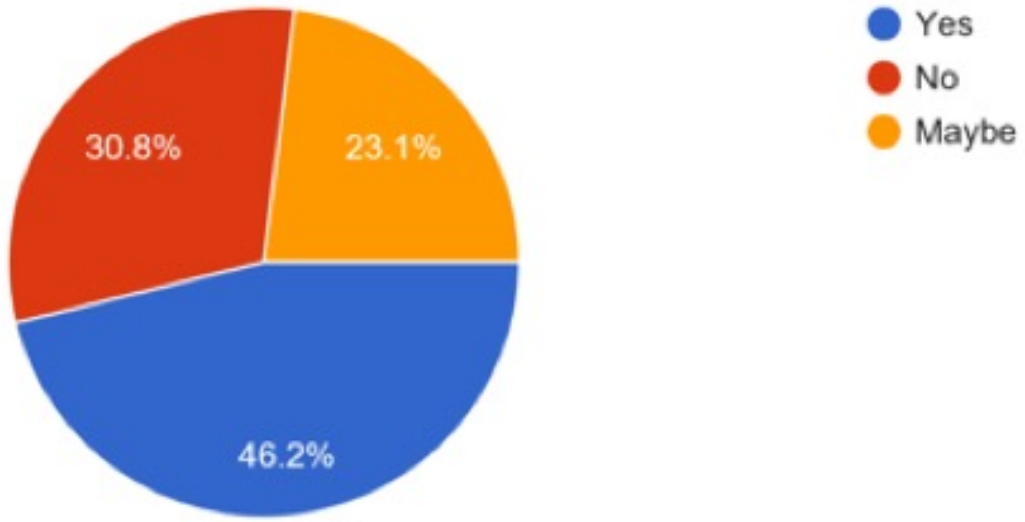
# Do you Know who Requires BIM Education in your Organisation?




Lack of Skill, Education and Training

# Cost/Funding

# Do Organisations only see Expense Incorporating BIM?




Cost

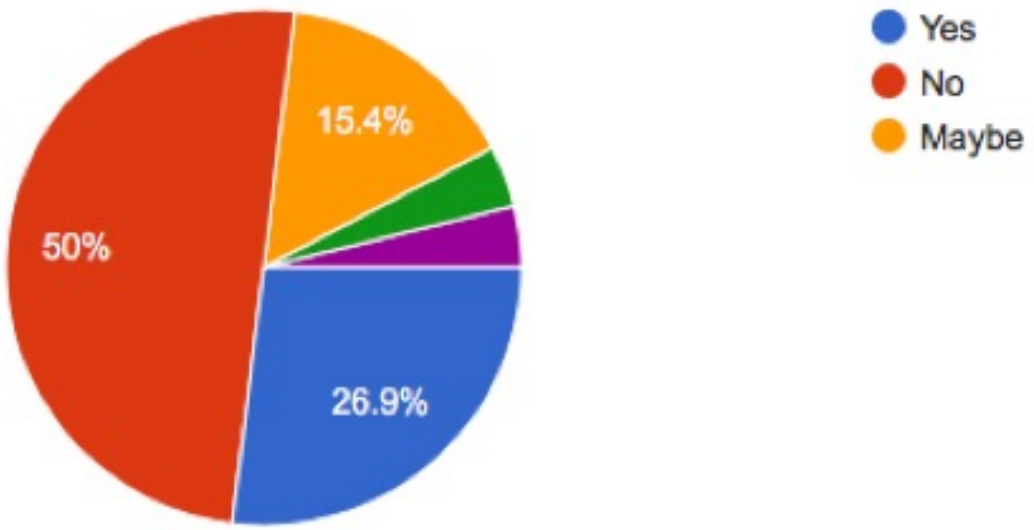
# Expenses

Cost


DATA CAPTURE
Building in Cloud
DATA MANAGEMENT
ideate explorer
ideate sticky
COLLABORATION
KUKA|prc
ideate BIMLink
FABRICATION
DESIGN AUTHORING
I/O
FLUX
ENVIRONMENTAL
CONCEPTUAL MODELLING
PARAMETRIC MODELLING
CLASH DETECTION
VISUALIZATION/ VR
SOLIBRI
EleFront
@it
MAX

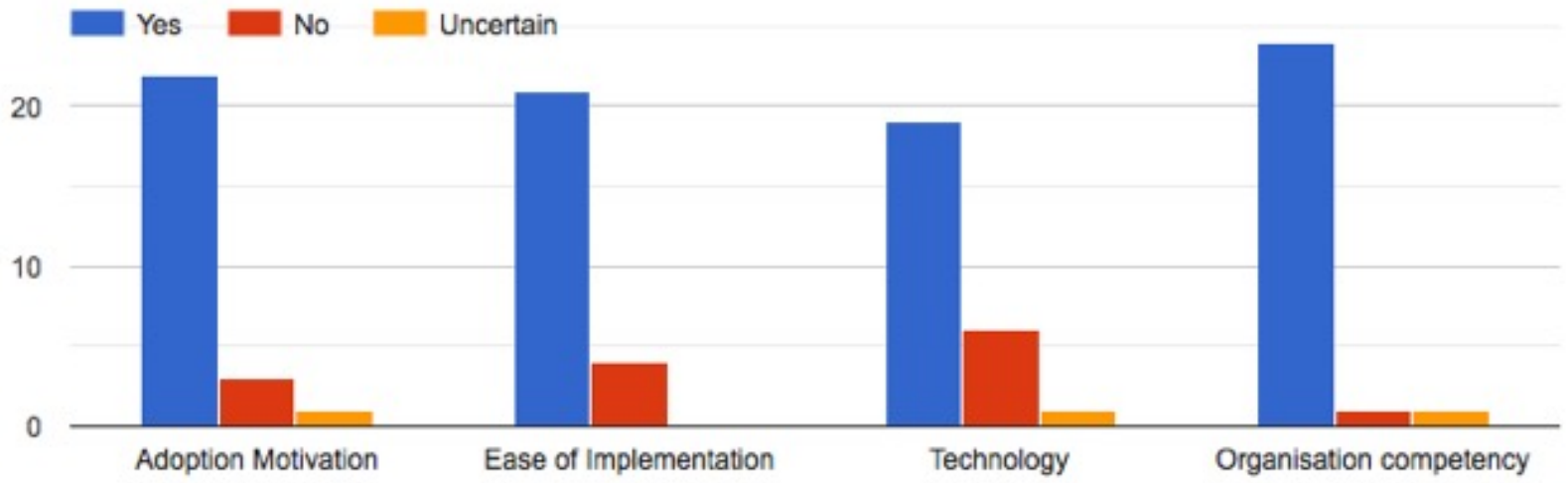
# What are the Cultural Barriers to Implementing BIM?

# Do you Agree Modern Technologies are a Barrier?




Cultural Barriers

## Do you Agree that the Following are Influential Factors in BIM Adoption?




Cultural Barriers

# What can Affect the way we do Business?

## National Culture

- Norms
- Behaviours
- Beliefs
- Customs
- Values

## Customs

Cultural Barriers

# Do we Manage Change well?

Change Guru John Kotter "*70% of Major Changes Either Don't Get Started or Fail*"


Change Management

## Comparison

### Construction Industry

- Leadership and Management
- Lack of motivation
- Lack of Skill, education and training
- Funding/Cost

ARMY

### British Army

- Continuity
- Lack of in House Experience
- Lack of Ambition and Understanding by Employer
- Funding/Cost

Change Management

# The Way Forward

*"Best collaboration behaviours and agility to solve problems"*

## Changing Organisational Culture

- Physical Barriers
- Leadership
- Project Management Barriers
- Training Barriers
- Build a Team Earlier
- Educate Supply Chain
- Change your Behaviours
- Longstanding Relationships that enable Continuous Improvement

The Way Forward

## My Change Methodology:

1. Create Ownership
2. Start at the Top Tier
3. Subject Empowerment
4. Create a Steering Group
5. Line of Communication
6. Assess the Cultural Impact
7. Address the Culture
8. Prepare for the Unexpected
9. Address the team
10. Welcome the Change

Change Management

## Why Take Advice from a Royal Engineer?

- Over 900 years of unbroken service to the crown.
  - Tower of London & Rochester Cathedral– Designed by Bishop Gundulf "Father of the Corps of Royal Engineers in 1080s.
  - Royal Albert Hall 1867-1871 – Designed by Captain Francis Fowke and Major-General Henry Y.D.Scott of the Royal Engineers.


BIM
DON'T STRESS
ABOUT IT
LEARN
TO MANAGE IT
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## Thank You

## Any Questions?