CPM Research Proposal

Mitigating Health and Safety Risks Through BIM in Construction

Name of Institute

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# Introduction

Construction is considered one of the deadliest jobs around the world; too many people are either die or get injured in the UK industry every year, even when the best practices are adopted throughout the project (pbctoday.co.uk, 2017). Safety of workers in distress for the employers, and they have to set some most effective approaches to deal with such issues or else they can face quite horrible consequences either in terms of legal allegations or in terms of financial BIM is an active process of that allows developing features of a building digitally, this information and the model of the building which is created is used throughout the lifecycle of the building (Leslie, et al., 2020).

BIM is a quite descriptive term involving technological advancement, operations in construction, collaborative, and information-based procedures that help in designing and constructing. It is used in the entire lifecycle of some building, with the help of creativity, collation, and 3D models or some AI, which is used to define the structured data. One should not mistake it with some simple tool as this system has led to some marvelous development in the field of innovation creativity and design. With the time and on-going technological advancement, the BIM designs are turning out more effective, benefiting the collaborators, owners, and the clients.

There are different levels of BIM that includes;

*Level 0: Unmanaged CAD*

*Level 1: Managed CAD (either 2D or 3D)*

*Level 2: Managed 3D along with the environment data – developed in different discipline models*

*Level 3: Online project model with the sequencing in construction, information related to cost, and insights about lifestyle management.*

UK government’s aspirations to adopt BIM in all the public projects were recognized in 2016; for promoting the use of this approach, different health and safety standards are associated with that (Ruikar, 2016). Various software is used to implement BIM, such as Revit, ArchiCAD, or other BIM-specific-software. For the approval of some building ideas, the government is a requirement collaborative BIM along with the information regarding the project information, asset, and documentation as electronic data. Specifically, in the level 2 projects of the government. They are using this legislation to aware of the contractors about the effectiveness of this approach.

## Rationale:

OH&S in the construction industry of the UK is notorious, and this business requires some operational measures should be adopted to reduce such cases. One touted benefit of this approach is, it helps to make the construction process a lot safer. The question here is why this system gets so much hype, how it works, and ensures the safety of the people involved in the project. This research will help in highlighting those aspects that are making this process this important for the construction companies. This research will identify client organizations’ roles in the BIM implementation process; that are developing information validation and requirements, along with BIM implementation processes across their supply chain to ensure safety of the people working in the construction industry. Twenty-one potential areas have been identified in which BIM can be used throughout project lifecycle. Each area demands different types of requirements that clients need to provide in order to achieve the desired benefits of BIM.

It will highlight the advantages associated with BIM, along with examining how is works more appropriately. This study would be quite useful for the people who are studying building or construction and those who are related to technological advancement in this sector. It will provide them some specific information related to BIM along with highlighting the areas in which this approach is helping out organizations. Moreover, this study could be beneficial for the business persons associated with this industry, who are finding some precise information about the role of BIM in managing the H&S of the staff working for them.

## Research Question:

*To investigate the impact of using BIM to alleviate the risk related to H&S in construction*

# Literature Review:

Building Information Modelling; known as the collaborative way of learning and working along with digital technologies. That allows unlocking the more effective and efficient manner of creating designing and managing the assets. It is said to be a game-changer in the industry (gov.uk, 2012). The building or construction division of HSE is entirely focused on researching that how the advance systems like BIM are helping in setting standards of H&S, and the results show that now only the most significant projects and the biggest contractors can get benefited from that, but the people who are working at small level in the industry can get benefited to that as well. This system effectively helps in unlocking the H&S information, which is reusable and can be used in future projects as well (hse.gov.uk, 2015). Thus, this report can be used in this research, and it has a lot of information related to H&S under the law.

Mark & Zulu (2019) stated the benefits and barriers that are associated with adoption of 4D BIM in order to ensure workplace health and safety. The use of technology in construction indutrsy is growing rapidly, its application to the H&S department of industry and the benefits from that cannot be denied. The study highlighted the barriers as well that includes, the cost of training staff regarding BIM and some cultural issues in model adoption. Study concludes there is need to teach people about the BIM and health and safety management, moreover evidence based studies can help in promoting BIM (Mark & Zulu, 2019)

Mohammed Muzafar (2020) stated that the building industry is continually developing; this filed must integrate some technologies into different design aspects, construction as well as maintenance in the construction projects. He effectively explores how approaches like BIM are helping the employers to ensure worker’s protection along with complying the safety standards set by the government (Mohammed, 2020)

Yang et al. (2017) highlight the importance of risk management in construction, engineering, and architecture. They stated it is a global issue to reduce the injuries and risks associated with construction projects. In the results of the rapid adoption of BIM and the other relevant technologies, few organizations are effectively handling the H&S issues of the organizations. However, this research concludes that BIM still has some limitations that need to be resolved for better outcomes (Yang, et al., 2017).

David & Ilozor (2019) provides a quantitative study on different project outcomes and using BIM in these projects of the construction industry. The researchers analyzed effectively how BIM is helping out the contractors to develop a more sustained atmosphere at work. The results of this research show that projects that used BIM experienced higher growth levels in the project in comparison to those who did not use this approach (David & Ilozor, 2019).

David et al. (2019) deliberated about the safety of employees in the construction field, which is the most crucial aim for the construction companies. The migrant movement increased due to globalization, so the construction developments are becoming diverse. Language barriers are one common reason that leads to health and safety concerns. This research shows that companies faced a lot of challenges in terms of translation issues, workload, and crucial operations that are unimportant to complete without proper equipment. Sometimes, complexities become a hurdle in implementing health and safety communication strategies (David, et al., 2019).

Mark & Zulu (2019) discussed the effectiveness and advantages associated with BIM, along with assuring the health and safety of the workers. They stated that the educational sector plays a vital part in the development of the construction industry’s future. Teaching the importance of BIM and such other approaches can be beneficial for the students as well as it will play a part in assuring the health and safety of the workers without any specialized training (Mark & Zulu, 2019).

Ambark & Chen (2019) discuss in this paper about the role of SNA in the development of a framework that allows using different models of information or management in regards to buildings. The research method used in this paper enables focusing on different models and means to extract the required results. The conclusion from this research shows that BIM is playing quite an active role in sustaining the business, along with protecting the people working in dangerous places (Ambark & Chen, 2019).

Khaled et al. (2020) talk about the second level of BIM development in the construction business of the UK. In the last decade, this business shows some significant improvement in the procedures used in this business. There are now different effective technologies that are leading to better results with every passing day. The study focusses on the success factors associated with implementation factors of BIM in the specific SME’s. The outcomes of this research highlight 15 crucial factors that play a significant role in the implementation process of BIM (Khaled, et al., 2020).

Leslie et al. (2020) deliberated about the management of different aspects that plays a vital role in the building sector. This study identifies the power BIM invested in various projects and ensures success, along with assuring that people involved in this process are safe and sound. The resulting state that BIM is frequently used in the concerned field in the UK. Although, due to the lack of strategies for ICSCL, this approach (BIM) is not used yet; also, it may cost a lot for managing IT and other training utensils for that. The primary benefit of BIM highlighted in this paper is, it may play a vital role in developing some trusted SC (Leslie, et al., 2020).

António et al. (2019) state that working in the construction or building industry is one of the riskiest professions due to the massive number of reported demises and injuries. The use of Scaffolds is one of the most common concerns in the sector as this leads to falls from height. The researcher suggested using the advanced approaches that may positively influence the lives of people that work in this deadly industry. There is a need for training the staff about the essential technological advancement, the solutions, and methods of using these approaches (António, et al., 2019).

Pérez et al. (2020) said that proposal management is as essential as any other approach in the building sector. It outlines the H&S requirements that need to be used throughout the process. However, the EU is focusing on promotions of BIM in the local and private projects. The government is developing different roadmaps so that they could integrate BIM in the projects in order to ensure OH&S. This study examines the design stage of BIM and how it operates in the natural working environment (Pérez, et al., 2020).

## Knowledge Gap:

After analyzing the literature, a range of studies is read for gaining information related to the research question. There were papers related to BIM development, different phases that need to be completed for successful implementation, and some approaches that need to ensure the success of this technological advancement, but apart from that, it is investigated that some information is not available regarding BIM. For example, there is so much information about BIM and how this system was developed in the region how companies are paying so much attention to that.

In general there is a sort of knowledge gap regarding use of BIM software, a lot of people do not know how to use this software appropriately. Gap that will be identified is, in terms of development of maturity competencies and how to use this software more appropriately. This study will also recommend some approaches that may help in making BIM more efficient for the construction industry. Moreover, the literature provides information about the communication gap and BIM as well. Yet, there is no information regarding the implementation methods of BIM. There are very few articles that may guide companies to collide traditional health and safety management with advanced technological systems. Other than that, the support and development process of BIM is not much discussed by researchers as well.

# Research Aim and Objectives:

## Aim:

The major aim behind of conducting this research is to create, authorize and yield a final assessment conceptual framework to explain the relationship between BIM and H&S along with the user benefits from perspective of the UK construction clients’. It goal also includes an explanation as to how UK construction clients can use the BIM into H&S on a practical basis.

## Objective:

After reviewing the literature, it is essential to set some roadmap to conduct research; developing objectives helps in completing research effectively within a given timeline. The following are objectives related to the project.

* To authorize the proposed BIM maturity model and identify the relationship between client roles
* To understand how BIM works in the construction industry and how it helps in maintaining safety standards.
* To recognize the probable areas where BIM can be used and the equivalent benefits and necessities for each BIM use from a clients’ perspective
* To discuss the stages and phases of BIM development in the construction industry of the UK
* To demonstrate the benefits of BIM
* To inspect how BIM plays a part in assuring the H&S of the workers.

# Research Method:

The approach that will be used to conduct this research is the ***secondary research method***. It is the approach which allows the researcher to collect data from the secondary sources rather than gathering information directly from the people (Christina, et al., 2019). In this specific approach, most of the information is gathered from the aviate literature. Thus, data is collected through peer-reviewed articles. As there could be a lot more information about this topic, it is essential to specify the timeline or the platforms from which the information will be collected analyzed. For that, purpose, most of the data is obtained from the articles from the year 2015 to 2020, and those articles are chosen that were mainly published in the *Journal of Construction, Journal of Construction in Developing Countries, International Journal of Construction Education and Research, Journal of Construction Engineering and Management.* The key terms that are used to identify the related journal articles are *Construction*, *UK industry*, *BIM*, *Safety*, *Information Modelling,* and *Building Sector*. Other than that, some information will be gathered from government websites that are serving the industry and holds essential information about BIM or standards related to that.

The methodology used to collect the qualitative data will be the traditional literature review approach that will be used to understand the progress of BIM in the industry up to the present situation. This approach focusses on the thematic investigation of research works. This method would help in setting relevant themes that are affecting the implementation of this approach, along with some themes related to the benefits of this approach (David, 2019).

For selected themes, the contemporary and classic theory that underpin each theme is investigated that helps in undertaking the literature review and couching that with the theoretical framework. The literature review starts with defining the BIM approach, its different levels in the UK construction industry with specific reference to health and safety on the construction sites. Themes that are associated with the literature include; health and safety, BIM innovation, implementation of BIM, benefits of BIM. The three different themes analyzed together to understand the crucial factors or the barriers of health and safety and BIM at the construction sites.

Thematic analysis is the whole process, and different phases have to be completed in order to ensure that relevant data is extracted from the collected resources, the following are some approaches that will be used while data analysis of this research;

***Familiarization:*** This is the first stage in which the researcher gets familiar with the data he has gathered from the articles. It is a critical phase as it allows the reader to know about the vital information regarding the research question, and it makes the further steps way easier for him.

***Coding:*** In this phase, the researcher has to code collected information; this may refer to highlighting some significant points from the whole document. It allows converting the long lines in the shorter sentences that sum-up the complete data. Different codes include; acknowledgment of BIM development, changing the tradition, uncertainty, perception of builders, shift in H&S standards.

***Generating themes:*** After developing some themes, the most crucial part in developing the themes that would be the primary focus of the research (Moira & Delahunt, 2017).

***Reviewing the selected themes:*** Reviewing themes helps in removing unnecessary themes or extracting the repeated themes.

***Defining name of themes:*** After having the final list of themes, the title or headings will be established for each of them. This phase allows coming up with the concise or most natural names that suit well with the codes written in that theme.

***Write-up:*** This is the last stage of thematic analysis; this stage involves writing up the information extracted under each theme. One thing that should be kept in mind is, each theme is written at its turn as decided during the coding process (Virginia, et al., 2019).

## Justification:

The reason behind choosing the secondary data collection approach is, the information is already gathered from the other sources and used in the previous research that makes it easier to get answers to further questions. This research method is quite time-saving and cost-efficient, as well as the information, is not first-hand, and the researcher does not have to collect it. Looking for the information online is advantageous, breadth of this research type is awe-inspiring, as most of the information used in this approach is gathered and provided by the experts who have much more information than a first-time researcher has (Quinlan, et al., 2019). Other than these benefits, there are a lot of drawbacks of this approach, for example sometimes secondary information is not specified with the needs of researcher, . Quality of research can be questioned as well. secondary research is derived from the conclusion of primary research. If the originator concerned about the organizations, in this situation the reliability on other’s data prevents it. Incomplete information is another drawback, as the researcher is not able to get complete information which sometimes they are unable to know where the procedure went wrong.

# Timetable:

To complete the research on time, a Gantt Chart is developed that would help in checking the progress of the project.

|  |  |
| --- | --- |
| **Activity** | **Timeline** |
|  | Week 1 |  Week 2  | Week 3  |  Week 4 | Week 5  |
| Project background  |  |  |  |  |  |
| Literature review |  |  |  |  |  |
| Proposal submission  |  |  |  |  |  |
| Data collection  |  |  |  |  |  |
| Detailed literature review  |  |  |  |  |  |
| Data analysis |  |  |  |  |  |
| Organizational and finalization of the project  |  |  |  |  |  |
| Technical report writing  |  |  |  |  |  |
| Compilation/ submission  |  |  |  |  |  |

# Possible problems and potential solutions:

Conducting this research could be a little difficult, it may encounter some difficulties which are discussed below along with some approaches to overcome these issues;

* One major issue which could be encountered is, the official information may reflect some bias, as BIM is entirely concerned with the government regulations. It may impact the full results of the research in order to ensure that such things do not impact the project; only reliable resources will be used to collect data. The information about the publisher will be gathered that either he is using the fair means for checking the journal article or not.
* Another important thing that can negatively impact the research results is, the information could be outdated. The data can be too old to match the current situation of the industry. To mitigate this issue, the date in which the article is published would be prioritized. Articles from the previous five years will be chosen to include in the paper.
* Ignoring ethical considerations could be another thing that may raise some concerns in research, in case a person is not credited for his work used in the paper. It may lead to many issues. In order to resolve this issue, ethical approaches will be used throughout the research. All information included in the paper will be cited appropriately.

# Findings and discussion:

This segment of the research will converse about the gathered information, and a thorough examination of the results will be done using the relevant theories. Each theme will be discussed separately to focus on each aspect at a time. As mentioned in the thematic analysis process, different codes and themes will decide the flow of information during the write-up.

# Conclusion:

The conclusion of the research paper will highlight the critical elements of the paper, how the secondary data collection and thematic analysis method is used to line-up the research results. From the introduction to the results, a summary and critical points of the project will be discussed in this segment so that reader could get maximum information about the research after going through the conclusion only.

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