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BIM in Project Management-A Review

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Abstract- Project managers can utilize BIM to enhance cooperation, coordination, and communication on projects. They can ultimately promote the usage of a Common Data Environment and BIM Collaboration Format to boost project teams' operational effectiveness in their capacities as "integrators." Development of construction documents/assistance with conceptual design, and pre-project planning services were the three main application areas for BIM. With a similar contract structure, the usage of BIM reduced overall risk. BIM combines data from various disciplines to produce intricate digital renderings that are controlled in an open cloud environment for real-time collaboration. Using BIM improves decision-making, offers more sustainable solutions, and reduces costs for AEC projects. The success of early adopters makes it wise to investigate space management and asset management as places to start when utilizing BIM for the operations and maintenance of a building. In addition, several specialized uses, such as infection control, are being investigated. BIM, which is currently used primarily for making various assessments and analyses, can be defined as a technique that uses a three-dimensional parametric modeling technique to consolidate the information generated during the construction phase into a database in order to facilitate connections between data points. BIM technology can be utilized to dramatically minimize future building maintenance costs during the construction stage, increase construction quality, lower construction expenses, and speed up the construction process. Building information modeling (BIM), which enables us to involve clients, collaborators, and other stakeholders in the design and creation of built environments from the very beginning stages, has grown in importance as a tool for architects. This helps ensure the finished product while also saving time and money. Over the past few years, BIM (Building Information Modeling) has completely changed the AEC sector's technical and financial viability. The field of project management is the one that can most effectively take advantage of the benefits of BIM's long-term implementation. A genuine cradle-to-grave cycle requires processing vast volumes of data, a lot of responsibilities, and other things for which BIM is the one-stop solution. The requirement for asset management is a constant process. For effective project management, project managers must embrace BIM, analyze the BIM data, and capitalize on all of its advantages. BIM application was generally regarded as being between somewhat beneficial and extremely useful in project management knowledge areas. Professionals' resistance to changing long-standing work habits, absence of qualified professionals the price of BIM technology Project managers' lack of awareness, insufficient IT infrastructure, The price of BIM training Uncertain Return on Investment, BIM technology's lack of interoperability, other similarly competitive developments, lack of support from upper management, risks connected to ownership and intellectual property, professionals' lack of IT literacy, risks related to product liability and authenticity lack of customer demand, Absence of supply chain support.

Keywords- Building information modeling, Project management, Functions of Project management

I. INTRODUCTION

Due to these projects' increasingly complicated roles, rising construction volumes, and sophisticated needs for construction technology, the management of current construction engineering projects faces a number of serious problems. BIM stands for building information modelling. Today's definition of a building information model is far larger than it was in the beginning of the development of this technology. The usage of BIM technology spans the whole life cycle of construction projects, beginning with the initial production and management of BIM-3D models and continuing through BIM-4D schedule management, BIM-5D cost management, and finally BIM-6D operation and maintenance management. BIM technology has developed into a framework and method for managing engineering projects as a result. The 1.3 trillion-euro (trillion) construction industry in Europe, which makes over 9% of the continent's GDP, employs more than 18 million people. However, it is one of the least digitalized sectors, with flat or negative productivity rates (EU BIM, 2017). IPD (Integrated Project Delivery) is a tried-and-true method for project management. By uniting many disciplines and efforts and combining project managers, designers, engineers, systems, and procedures under one roof, an integrated project delivery plan delivers a win-win situation for all parties involved. The likelihood that the project will be successfully finished increases when IPD and BIM are combined. A project team's efficiency is increased by using BIM to effectively combine the detailed information that is available from all stakeholders into an intelligent integrated model. Building information modeling contains a number of complex technical features that can make project management easier. which is summarized briefly below:

Clash Detection: The most typical issue in the AEC sector is inconsistencies in the geometric designs of the many disciplines of a structure. Due to overlap between the various plans, this occurs. The only practical answer to this problem would be to use BIM, combine the plans in the cloud, look for any differences, and then make the necessary corrections.

Constructability: A foundation for conducting constructability assessments and monitoring constructability is provided by building information modelling.

BIM allows for better analysis: Clearer decision-making is made possible by BIM, which also gives engineers and designers a better visual representation of a building. By changing the materials and orientation, mass and space, etc. for every problem, starting with the energy consumption details and ideal lighting needs, BIM helps with better problem-solving.

4D/5D modeling: 4D and 5D modelling is one of the distinctive qualities that Building Information Modeling can provide. An engineer can assess the status of a construction project using a 4D model and gain a thorough understanding of the project phases. Using 5D BIM models, it is possible to evaluate a project's costs and find the most affordable solutions. Building information modeling essentially makes it easier to simulate several options for a construction project and aids executives and project managers in accurately foreseeing the outcomes of their choice.

Quantity Take-off: The availability of quantity take-offs in a BIM model can help project teams and management analyze their choices and provide a clear and trustworthy insight into various options during the design process or even throughout the project lifecycle. An accurate estimate can be achieved more quickly since there is a chance of integration between the BIM model and a database that contains cost estimation. The roles and responsibilities of the project manager must be clearly defined for a project to succeed. Simply said, the BIM process highlights the project manager's responsibilities since it combines the skills and knowledge of various people in a way that meets cost, quality, safety, and sustainability goals. The project manager prioritises these goals throughout the whole process cycle. Since BIM is all about integration, the project manager must successfully utilise the team's strengths. Project managers need to support BIM and be the catalyst for others to adopt it if it is to become a standard component of

lab design. For projects to move forward further, it must be understood by people in charge of them. Project managers may assist businesses in adopting BIM in a more comprehensive way by offering strategic counsel as the organisation as a whole begins to transform. A BIM approach involves attributes that are both driven by BIM and serve to drive the BIM approach as the project moves forward, which has a significant impact on the role and responsibilities of the project manager. As a result, the kind, nature, and level of BIM can change throughout the course of the project. It must be made clear from the outset who is acting as the BIM manager. A crucial step in the process is deciding on and defining this role because it establishes from the start who is solely responsible. It is a crucial task that must be tackled first, regardless of who you choose, whether it is by giving the project's lead additional responsibilities or by bringing in a specialist from another area. Failure to perform the necessary planning and analysis nearly always leads to issues along the way, whether an organization decides to stop using BIM altogether or experiences difficulties finishing a specific project. After the strategy has been chosen, a clear implementation plan for BIM must be created. It is important to be clear about the implementation's business-wide goals, how BIM will change the organization, and how this expansion will occur across the short- to medium-term planning horizon. In order to transform them into precise project-based BIM objectives, it also needs to diverge noticeably from the project-level BIM strategy. There needs to be some degree of balance created when discussing BIM and execution. Similarly, individuals at the bottom who make the same suggestion might not have the power to implement it. The process requires a leader who can strike a balance between organizational leadership and BIM leadership. According to experts, three crucial BIM areas need to be addressed moving ahead. If BIM deployment is to become standard practice at both the project and organizational levels, project managers must first adopt a more proactive attitude. This will undoubtedly change as BIM spreads over time; a push for BIM will lead to better collaboration, shared ownership of objectives, and increased synergy between plans and strategies. Second, project managers must become more conscious of the changes brought about by BIM. BIM will lead to People and organizations ought to be able to comprehend new paradigms and technologies that have the potential to alter standards within their respective industries. They can then put this expertise to use by sharing their views and counsel with other businesses they'll be working with. Lastly, project managers need to be in a position where they understand the additional skills and competencies needed of them in a BIM manager role, particularly as BIM becomes more widespread. BIM has been praised for its ability to lower transaction costs and mistake rates. The majority of these advantages were experienced in this study. However, as time passes and problematic technological difficulties are resolved, more might be observed. This article highlights a chance for resourceful project experts in the construction industry by encouraging confidence in BIM before the technology has been fully incorporated.

II. LITERATURE REVIEW

BIM is a digital representation of a project's structural and functional details. Information is created and shared throughout construction projects using BIM tools. Although the idea of BIM has been around since the 1970s [Eastman, C, 2008], it has only lately come to be recognized as a crucial project management tool due to its numerous advantages. These advantages have revolutionized the way construction projects are conducted and represent an important turning point for the discipline. Despite the advantages, the use of BIM as a project management tool is still in its infancy, and there are still numerous difficulties and obstacles that come with using it. The usage of BIM and the techniques that support it as a project management tool will be discussed in this article. We'll also talk about BIM's various application areas and its restrictions. Since the advantages gained from the use of information modelling are particularly applicable to the difficulties of diversified construction projects, the illustration and example will concentrate on construction projects [Building Smart Finland, 2012]. In more recent projects, the use of BIM has been helpful in addressing the fragmentation problems, which have a significant

negative impact on the effectiveness of construction projects. In order to overcome these fragmentation difficulties and create greater integration within construction projects, using BIM as a project management tool has proven to be a promising instrument [Wiig, O. J., 2014]. A BIM manager's primary responsibilities include assigning tasks to all professionals involved in a project, granting permission to each professional to create, modify, or transfer a project component, and indicating and managing the level of information that a BIM model must contain in accordance with the Level of Development or Detail established for each project stage. A company's or office's maturity level is evaluated in part based on how well its processes are integrated, how effectively it uses the BIM platforms at its disposal, and how well the team collaborates on every aspect of the project. Governmental measures, whether required or progressive, enacted by each nation encourage the maturity attained around the world. This study was conducted in Egypt and was only open to participants with expertise using BIM software for project management, including creating drawings and details and estimating quantities and costs. One hundred and six respondents made up the research sample. The implementation of BIM software in project management was found to have the potential to ultimately improve the project management process and evenly cover all management domains. Numerous advantages are listed, including improved cost control, keeping the construction timetable, descriptive information (which is information and an object), and dealing with stakeholders from various backgrounds [E. N. Shaqour, 2022]. This essay aims to examine their experience providing BIM services to a wide range of projects that were done in India's construction industry at the time. The construction industry has always struggled with issues related to controlling productivity in terms of on-time project completion, labor and material management, and upkeep of built assets. At the conclusion of the first decade of this millennium, BIM began to enter the Indian building sector. BIM was greeted with a healthy dose of skepticism by stakeholders, as is typical of the adoption curve of any technology. However, in the past ten years, there has been a sluggish but steady increase in knowledge of its potential advantages, breadth of application in project design, and administration of different aspects [Dhopte, S, and Daga. A, 2022].

Figure1: Bangalore International Airport used the Autodesk BIM 360 for design/planning

Figure 2: Indian Railways Gwalior station

Project management in the construction industry is challenging. It covers a large number of construction project participants as well as their ties with one another. The need for technology in the construction sector is currently growing. AEC professionals can plan, design, build, and manage infrastructure more effectively thanks to BIM, a progressive, intelligent 3D model-based method. The study addresses the topic of BIM use in building project management implementation motives. The primary goal of the paper is to examine and provide a summary of the BIM incentive groups for project management in the construction industry [Peter Mesaros, 2020]. Engineering and construction projects must successfully implement a quality management approach. If projects are to be finished on time and within the project's budget, the management process needs to be successful and efficient. The quality management procedures for many construction projects are paper-based, which makes them labor- and time-intensive. The BIM cloud is the incarnation of BIM to come. A quality management process may be made more successful with the use of the BIM cloud, which can also help an organization save time and money. The Autodesk BIM 360 Field software, mobile devices, and cloud computing are the foundations for the quality management paradigm that is suggested in this

article. This program serves as a platform for gathering, managing, and regulating the management data quality. To confirm the advantages and disadvantages of using the BIM 360 Field for a construction project, the procedure is then implemented in a real project in Vietnam [Phong Thanh Nguyen, et al, 2018].

Construction projects are distinctive since they support business output and satiate the needs of Z. A. Qhumans [P. T. Nguyen et al., 2018]. As a result, the success and consistency of a building and engineering project directly affect the socioeconomic aspects of the national economy [N. T. Phong, et al., 2017]. Additionally, an improvement in management quality has long been regarded as a critical top concern for construction organizations in a fiercely competitive market economy [Y.H. Tsai, et al, 2014]. Every stage of a project, including the survey, design, organization of the construction process, and project maintenance, must follow a quality management process in order to guarantee a high-quality project [L. C. Wang, 2008]. The hardest procedure to complete is construction. This is due to the fact that the quality control procedure is currently cumbersome, making mistakes simple [F. Y. Y. Ling and T. T. D. Bui, 2009]. Contractors who use good project quality management can cut costs on supplies, labour, and equipment. Additionally, it would improve the contractor's standing in the industry. The information must be continuously gathered, accurately processed, and exchanged between project stakeholders in order to guarantee a high-quality management process. Consequently, a vast amount of information is involved in the project management process. Therefore, it is critical and essential creating a system that can access and understand project information quickly, effectively, and properly. The next generation of BIM is the Autodesk BIM 360 Field. The BIM model is combined with iPads, mobile devices, cloud computing, and other technology [A. M. Gaber, et al, 2016]. This study used Autodesk BIM 360 Field to improve the management effectiveness for construction projects in Vietnam. This innovative method is utilized to enhance quality control activities and boost productivity in order to manage construction projects more successfully. A high-quality construction project satisfies all of the project's requirements, including the technical specifications, budget, timeline, stability levels, safety standards, and environmental considerations [A. A. Bubshait and T. H. Al-Atiq, 1999]. According to D. Arditi and H. M. Gunaydin (1997), generating a high-quality product starts with the conception of the construction idea and continues through all phases of construction (planning, project development, surveying, design, construction, acceptance, and delivery). The quality management method must be used at every stage of the project life cycle in order to guarantee good project quality [Y. Leo, 2007]. Among these, the construction phase is regarded as the most challenging because it makes up the majority of the project's cost (70-80%). The most challenging duties at this stage are the control process and quality management [T. A. Nguyen, et al., 2015]. In accordance with Decree No. 15/2013 ND-CP of the Vietnamese Government, construction quality management entails the following actions: I selecting a contract; (ii) reviewing the preliminary work conditions; (iii) constructing, supervising, and accepting the project; (iv) establishing the construction papers and file storage. The supervision, acceptance, and preservation of documents are frequently paper-based processes in conventional approaches to building quality management. A paper-based approach takes a long time and costs money. Additionally, it is challenging to regulate the caliber of [Y. Chen and J. M. Kamara, 2008]. As a result, it is extremely important to use information technology and the BIM 360 Field to organize and supervise building projects, to accept quality, and to create and save documents on a server. For all sorts of projects (apartments, tall buildings, hotels, industrial homes, production, infrastructure works, and transportation projects), the BIM is currently accepted and developed widely in the construction sector [J. Matthews et al, 2015]. A procedure called BIM is used to create an information model. It entails the planning, development, and management of a construction project [S. Azhar, 2011]. The BIM comprises logical relationships about the space, size, quantity, material, and features of the work components as it serves as an overarching database for the whole life cycle of a project. In order to optimize the design,

building, and project management processes, it is increasingly important in the construction industry to be able to combine work division information with information about norms, unit prices, construction progress, operations, and maintenance regime [D. Bryde, et al, 2013]. The BIM Cloud platform created the BIM 360 Field program [B. Mc Guire, et al., 2016]. It combines mobile and cloud computing technologies with a 3D smart model [C. Eastman, et al, 2011]. The implementation phase of a project makes use of the BIM 360 Field. According to A. Sattineni and T. Schmidth (2015), it helps with the collaboration, fusion, and management of work information that is happening swiftly, improving the efficiency of work quality management and saving time and money. According to J. Wong, et al, 2014, we might use the BIM-Cloud throughout a project's entire life cycle, from planning and project formation to survey, design, execution, acceptance, project handover, and work dismount. The project's data would all be uploaded to the cloud. Participants in the project (investors, consulting firms, and contractors) would get readily accessible preset access privileges to quickly access the required data. Cox et al, suggested a method for carrying out the acceptance stage of the construction project utilizing Hand Base on a personal computer. Its advantages include reducing paper-related activities, producing management reports, and efficiently and swiftly disseminating information. A mobile computing technique was suggested by Chen and Kamara (2008) to manage the information on the job site. The information management process in a construction project is performed via mobile devices, wireless networks, and other mobile apps. Chuang, et al, 2018, developed a system using server software and cloud computing strategies. Through the website, this virtual system was utilized to see and control a BIM 3D model without any restrictions on time or space. This system establishes the framework for information sharing and communication among the project participants. In their 2013 proposal, Sawhney and Maheswari suggested using the BIM-Cloud to monitor the data during the design phase. The data of each design engineer that was uploaded to the server may be checked by the project manager. Jiao, et al, 2013 suggested using virtual reality technology called BIM Cloud Augmented Reality to watch and manage data in the field of design and the work execution of projects in Shanghai and China. Through BIM links and social networking services, this model merges the use of a 3D website and cloud technology. In their description of the implementation of "Site BIM" in a hospital project, Davies and Harty. The "BIM-Enable" technologies were created by the major contractor and enable workers to access design data, quality report images, and fieldwork progress using a notebook. The "Site BIM" system is made up of five basic components: a notebook, a data management system, combined 3D BIM models, "Site dBase" application software, and an office project system (including the infrastructure and relevant software). Fernandes suggested a procedure for involved parties in the construction project using the BIM 360 Field (contractors, investors, consultants, project managers). In addition, the author listed three categories of advantages gained from the project's use of the BIM 360 Field, including: (i) information (good collaboration and quick updates of project data), (ii) operation (improved notification systems and process streamlining), (iii) management (better coordination of project participants based on the cloud and the elimination of traditional paper-based tasks), and (iv) quality (reduction of project costs due to the reduction of reworked tasks and the commitment of better quality). A private cloud-based BIM-Service was suggested by Zhang, et al, 2014. On their private servers, the parties involved in the project save all pertinent information here. This methodology helped project stakeholders effectively set, maintain, and transmit BIM data while also protecting the data. Tsai et al. advocated using the BIM model as the foundation of the cloud platform as an efficient technique for accepting building projects. In this approach, the supervisors can swiftly perform the inspection responsibilities by taking images that were made using the BIM model and construction data. Bluebeam, BIM 360 Field, and Latista were the three software programs investigated by Gleason, et al, 2014 to support building projects. The authors came to the conclusion that while BIM 360 Field is the greatest option for businesses performing BIM in large-scale projects, Bluebeam is appropriate for small construction organizations. Latista is a great option

for businesses that don't use BIM but can still handle challenging projects. Regardless of the programme, the main goals are to raise productivity, promote information exchange, decrease redundant work, and shorten construction project timelines. This study also provided a quality assurance procedure using software and mobile devices. BIM is evolving in the construction sector into a thorough collaborative process. Despite having a brief history, BIM has grown steadily during the past ten years. The main reason for this is because of its qualities in construction projects. Through the use of BIM, all project participants and system divisions may speak the same language and work as a cohesive team. BIM's methodology and integrated project delivery technologies go hand in hand extremely well. The responsibilities of a project manager are quite similar to those of a BIM as the system coordinator for a project. BIM combines several disciplines through effective communication, evaluates project systems for constructability, uses quantity takeoffs to estimate the cost and duration of projects at any moment, creates collaborative teams, and draws a large picture of projects. A project manager performs each of these tasks on a varying scale throughout the course of a project [Saeed Rokooei, 2015].

The inefficiency of the Iranian construction sector has long been decried. There are a lot of potential for improvement because 80% of the content in the construction process is allegedly the same for every project. Construction project delivery performance depends on the project manager. The goal of this study is to analyze how project managers might use BIM as a useful tool to mimic project conditions in order to avoid duplicative labour and time and money loss. It was determined that project managers typically lack basic BIM understanding, which makes it challenging for them to understand its applications. According to the report, BIM can aid project managers in completing successful projects. In comparison to traditional projects, BIM offers a superior basis for decisions [Abdulsame Fazli, et al, 2014]. The primary issues with construction technology are explored in this study, including construction layout, construction quality management, construction safety management, and the interaction between talent development and contemporary information demand. There is a quick analysis of the primary causes of these issues. Next, it describes how to use BIM to construction engineering and talent development [Run-Run Dong, 2017]. This paper aims to explain why BIM adoption has been slower than expected by highlighting the key BIM traits, as well as its advantages, disadvantages, and risk management capabilities. This study concludes that BIM has an impact on production efficiency rate based on quantitative data gathered through surveys. According to the study's findings, project managers encountered two main difficulties when integrating BIM into their project management procedures: 1. Lack of software expertise 2. A lack of understanding of the necessary changes to project management roles following the adoption of BIM The results of the quantitative data analysis demonstrate that BIM improved production efficiency rates in the areas where it was used. The research report concludes by making the major claim on the reason project managers in the AEC business should integrate BIM into their project management processes [Kamyab. N, 2018]. Although project management is the area where BIM is most frequently used, this is also where it may have the longest-lasting applications. Because management is required continuously from the beginning to the conclusion of the life cycle of an asset, whether it be a building or another type of construction, it is a real cradle-to-grave process. In contrast, design team employees will vary depending on the stage of an asset's life cycle. To maximize the benefits of BIM, project managers must be able to comprehend and analyze the information [NBS, 2015]. In this paper, a structural methodology is used to examine BIM project management papers published in designated target journals between 2005 and 2017. The main study axes and areas for BIM research in project management are categorized in this review. Furthermore, given the potential for BIM to be used in project management, this paper tries to provide the groundwork for a brand-new project management paradigm called BIM-based project management. According to the preliminary findings, project management BIM research has advanced significantly throughout the course of the study

period. Enabling BIM as a technology in project management, BIM application as a solution for particular project management scopes, integration issues of BIM that have been brought to project management, institutional environment and regulatory governance of BIM in realizing project management strategies, and analysis of effects and strategies of BIM adoption and implementation in projects are some of the research directions of BIM studies. The directions and trends are then studied to build a research route for BIM studies in project management. The relationships between the research directions, as well as the contributions and theoretical ramifications of this review, are all emphasized in the conclusions. Additionally, suggested areas for future investigation [Albert, P. C Chan, et al., 2018]. Today, the building or construction business stands out among the many sectors that are evolving continuously along with China's booming economy. Project costs are just one of the numerous components that make up a building or construction project. This essay provides a fundamental overview of project cost management, the BIM technology, and its significance. The application of BIM to project cost management is examined based on that and real-world examples, and its benefits are enumerated [lina Ha, 2021]. Project management has made extensive use of BIM, but applications have generally been dispersed and BIM models have not been used throughout the entire project life-cycle. There is a significant issue with how to combine this dynamic and fragmented data together because each participant creates their own BIM. This study focuses on BIM-based life-cycle information management and develops a framework for BIM-enabled life-cycle information management to address this issue. The information components and information flow during the project life-cycle are established in order to properly organize the life-cycle information. The use of BIM for life-cycle information management is then examined. This framework will give information management an uniform platform and guarantee data integrity [Xun Xu, et al, 2014].

It gives project managers a perspective on the benefits and prospective applications of BIM in the construction industry. The International Journal of Project Management is where it was taken. 3D BIM will be required for all contracts with the UK government. Project managers working on public sector projects won't be able to escape BIM. BIM is software for modelling and information input, but it also includes methods and tools for project management. Project managers can therefore employ BIM in building projects, for instance, to enhance stakeholder participation [D. Bryde, et al., 2013]. The introduction and widespread use of BIM technologies have brought about significant changes in the information-based management of construction projects in the context of the intense rivalry in China's construction sector. The project's size and the complexity of managing the information data led to the realization of the informatization of construction project management, which was backed by a variety of technologies and increased the effectiveness and benefit of project management. This study investigates the use of BIM in project management in complex systems based on the benefits and values of BIM technology in project information management [Qian Chu, 2020]. BIM technology is developing at a historic time for globalization and information digitization. Its visualization, dynamic, coordination, simulation, and optimization features have had a significant influence on conventional construction project management and resulted in a ground-breaking innovation. Construction engineering project management has expanded in many ways with the development of BIM's digital dimension. The full life cycle informationized delicacy management of construction project design, construction, operation, and maintenance is realized in this paper, which explains the changes brought about by BIM technology to management from 3D to 6D and illustrates the integrated application value of BIM technology and construction project management [Lei Zhang, and Manyun Zhao, 2021]. The implementation of 5D applications of BIM (3D, 4D, and 5D) with fundamental parameters to approach project development, systematic planning, scheduling, and cost estimating to overcome project hurdles were the subjects of the research presented in this paper. It is possible to complete the full process of fulfilling quality standards in the building sector. A model for carrying out the project has been

developed in the current study. Index Terms: Primavera, Revit Architecture, Building Information Modeling, 5D applications K. J. Brahma Chari and Pathan. Md. Rafi, 2019. Construction projects are become a lot more complicated and challenging to oversee. Information and communication technology (ICT) has been advancing quickly in response. The adoption of BIM is the primary change in ICT for the AEC sector [Bryde, Broquetas, and Volm, 2013]. BIM is a system whose primary goal is information management, making it a project management issue as well. Our research was inspired by an understanding of the managerial relationship gap between the project management and BIM realities. This study specifically seeks to close this gap from the viewpoint of stakeholders. Stakeholder management is one of the most crucial project success criteria since the happiness of the stakeholders is crucial to the success of the project. Both academics and practitioners can benefit from the objective. The exploration is mostly conducted through a review of the literature, but it is also firmly backed by the gathering of primary facts. The second source is direct interviews with a variety of AEC industry players (project managers, architects, BIM experts, software resellers, building developer owners, innovation managers). [Mladen Radujkovi and Mauro Mancini, 2014] The findings relate to the categorization of the important stakeholders in BIM adoption and the contextual situation in the various European nations, with a focus on the involvement of the Governments.

The study tries to pinpoint the challenges involved in picking the right idea for the main construction procedure. By using a proper BIM design, the user may be able to eliminate mistakes, speed up the construction process, and spend fewer resources overall. The writers concentrated on a study of the literature and an analysis of the challenges posed by BIM design software in the planning of construction projects. The three stages of the construction process when BIM design has the most errors are: 1) the creation of an investment project for a building and analysis of the current situation; 2) the creation of an execution technology project for a building; and 3) the current standard processing and data gathering during the building's exploitation period. The analysis demonstrates the ongoing need for more in-depth BIM design research to enhance information exchange formats that would guarantee the maximum amount of design information saved with guaranteed feedback. Similar to BIM design, the software products need to be strengthened by adding insufficient tools or program codes. Following an analysis of BIM design software, it was discovered that the architectural, constructional, and MEP programs function best when they are interdependently used together. When the model is built in one location with a variety of tools, these programs perform best and make the fewest errors. Internally stored design software data are translated into IFC or another information exchange format. Fluent information exchange is possible since the data is not lost when the format is changed [Leonas Ustinoviius, et al., 2018]. The AEC sectors have long looked for methods to save project costs, boost output and quality, and speed up project delivery. The capability to accomplish these goals is provided by BIM. BIM stands for the creation and application of computer-generated n-dimensional (n-D) models to simulate facility planning, design, building, and use. It helps designers, engineers, and builders envision the finished product in a virtual setting and spot any potential design, building, or operating problems. It has the potential to greatly increase efficiency while also fostering unity among players who, all too frequently in the past, perceived each other as rivals. The advantages of BIM for the AEC sectors are covered in this essay. According to Gayatri Dhananjay Jadha, et al. (2017), the implementation of BIM in projects sheds light on a variety of dangers and upcoming issues for the AEC sectors. BIM is a software tool that helps AEC professionals efficiently plan, design, build, and maintain infrastructure and buildings. In BIM, the items are represented by both physical and functional properties in object-oriented parametric models. The AEC industry has adopted a variety of BIM systems worldwide for design/modeling, building energy analysis and clash detection, construction scheduling, and cost estimating. These include Autodesk Revit Architecture, ArchiCAD, Bentley Architecture, and others. Diverse BIM systems and techniques have been incorporated in this project, with a focus on cost estimation and

construction scheduling. There have been two methods for 4D scheduling in BIM presented: 1) 4D BIM tools, and 2) using a 4D BIM tool to connect the 3D BIM model with the project schedule. Three different types of available methodologies have been discussed for the cost estimation capability: I link BIM components to estimating software, ii) export the Quantity Takeoff (QTO) list from the BIM tool to the estimating program such as MS Excel, and iii) utilize the QTO tool to extract the QTO list from the model [Srimathi. S and R. N. Uma, 2017]. The physical and functional attributes of a system that links project information databases from all sectors are illustrated by BIM. One of the most cutting-edge methods for managing building projects is the use of BIM technology. The process of managing a construction project is complex and depends on numerous variables. Among them are human resources. The productivity of the human resources affects the project's outcomes. There are certain concerns regarding the managers' and employees' productivity. Employee productivity is influenced by a variety of procedures and variables. Technology advancement is one of them. BIM technology offers a tool that may increase productivity. This study examined the adoption of BIM technology and examined how BIM impacts project management products in the building industry. The primary goal of the study was to examine how BIM technology is used in the building sector and how this impacts productivity [Peter Mesa'ros, 2020]. The construction sector places a high value on BIM technology, which can efficiently address the unit's inadequacies in terms of cost, quality, and schedule when compared to more conventional management methods. Construction units may create appropriate virtual models based on actual conditions, rely on intuitive models to confirm design flaws, and precisely handle communication and coordination of schedule, materials, environment, and funds with the aid of BIM technology. It can help the construction unit prepare the specific construction content in advance to further improve the quality of the construction. It can also help the management staff realize the quick summary analysis of the engineering quantity data and significantly increase the project's quality and cost-management effectiveness. In order to fully utilize BIM technology's significance in the project schedule, quality, and cost management, the construction sector needs to pay more attention to it [Yingying Gu, 2021]. The BIM model can help with building operation management by assessing pertinent information from the construction process. As a result, more businesses are beginning to use the BIM tool, but some of them lack a thorough understanding of how the BIM series functions due to the lack of more useful references. This article's research was based on a review of the literature that included journal and conference articles as well as other sources. This article compares and summarizes pertinent research findings while analyzing BIM application in practice. The outcomes show diverse effects from BIM adoption, including 3D/4D/5D/6D functionality. The article's ultimate goal is to encourage the full implementation of BIM features in construction-related operations [Yin Rui, 2019]. The study's findings indicate that although there is less broad industry knowledge of BIM than previously thought, younger people are nonetheless accepting of the technology. It was found that the most typical applications of BIM are for visualization and simulation and that BIM is also frequently used for tracking planning progress. BIM is not frequently utilized for management, particularly during the construction phase. Enhancing software application interfaces, data transfer, and an effective change management system have all been suggested as ways to further enhance the usage of BIM in project planning and scheduling [Changxin Cynthia Wang, 2014]. This paper seeks to present a comprehensive overview of journal articles that have been written about the use of BIM in infrastructure projects. The review is supported by 239 papers' bibliometric analysis. When compared to traditional literature reviews, the bibliometric analysis technique is employed as the analytical method since it reduces the chance of subjective judgments. The paper covers the assessment of BIM applications in infrastructure projects examined during a 10-year period; the analysis of most recent studies and trends in applying BIM methodology reveals the shortcomings of BIM applications in infrastructure projects and defines future areas of research. The co-occurrence map of terms is presented by a detailed analysis of citation networks [Tatjana Vilutiene, et al., 2020]. As BIM-supported project delivery methods

gain widespread acceptance in the AEC sector, a cutting-edge modeling technique termed 4D BIM is beginning to take shape. This method links 3D BIM components to time and scheduling data. The spatial and temporal, or 4D, components of construction schedules are difficult to show and explain effectively using conventional construction planning programs like bar charts and network diagrams. As a result, they prevent project managers from swiftly producing scheduling options to find the best way to build a specific design. With the use of 4D modeling, the entire span of an executed Sequence of activities by individuals participating in the project can be shown visually. The 4D BIM tools, which have been widely used, are increasingly regarded as one of the core technological sectors under BIM as a result of the growing interest in BIM and the expanded usage of this and other technological advancements in the AEC industry. The goal of this study is to review and highlight the various effects that 4D applications on Integrated Project Delivery (IPD) have had on the AEC sector while also making recommendations for the best way to best utilise the available tools for quick project completion [Usman Aminu Umar, et al., 2015]. BIM is a comprehensive way of expressing project information that is based on 3D digital technology and incorporates all types of visual, digital architectural models of pertinent data. Additionally, it provides a scientific platform for "simulation and analysis" collaboration for designers, architects, engineers, developers, and end users, enabling them to employ 3D digital models for design, construction, and operation management. According to Jianhu Cheng and Hui Wang (2010), the paper espouses the idea of popularizing BIM approaches and processes by providing project management problems that BIM may help solve. In order to improve the functional management of project information, the study intends to provide an efficient BIM-project information management framework (BIM-PIMF) and related assessment model. The study's research strategy is comprised of an explanatory case study methodology and case study data from four BIM construction projects. The study's conclusions will enhance communication channels and make it simpler to incorporate technology advancements into the construction process while raising the technical proficiency of project workers. The study brought to light a variety of useful suggestions and tactics to improve the use of BIM across a project lifecycle. In order to determine which construction businesses should receive subsidies, policymakers and government agencies can use the model to gauge how much BIM is being used in a project [Timothy O. Olawumi and Daniel W. M. Chan, 2019]. This essay tries to diagnose and evaluate the advantages and disadvantages of building information modelling in the management of construction projects. To learn more about the opinions of a variety of Iraqi engineers and to determine the extent of BIM adoption in the country's construction industry, both open and closed questionnaires were employed. According to the survey, there is a respectable level of knowledge of BIM in Iraq, particularly among the younger generation of engineers, which portends the coming in a few years of the BIM's evolutionary stream. Additionally, a survey revealed that the ability to produce precise 2D plans at any stage was the most significant benefit of implementing BIM in the Iraqi construction sector, while the ability to provide careful planning of the site facilities was the least significant benefit, with a relative importance of (82%) and (33%) respectively. Furthermore, according to the questionnaire, the biggest obstacle to its implementation was the lack of clear roles for data content, while the least significant obstacle was the ineffectiveness of the programs for data exchange and internal collaboration, with relative importance of (81%) and (34%) respectively [Faiq M. S. Al-Zwainy, 2017]. BIM is becoming more widely known in the building sector. BIM is the process of designing and managing the building's data throughout its life. BIM is becoming a component of management tools in contemporary building firms. The participants in construction projects are numerous. It denotes a challenging project management process for the building industry and a pressing need to process a vast amount of data, including design, construction, time and cost constraints, economic efficiency, and sustainability. Modern information and communication technologies facilitate construction project management and cost control. Building information modelling is one of them. The purpose of the paper [Peter Mesáro, and Tomá Mandiák, 2017] is to

investigate the effects of BIM exploitation and benefits on construction project management in Slovak companies. This study's objective was to examine how the use of BIM affected conventional building design techniques. With time as the fourth dimension (4D) and cost as the fifth dimension (5D), the BIM is expanding this concept to three-dimensional (3D) drawings in the three major dimensions width, height, and depth (5D). Simulated scheduling using a 4D model can be used to check on the status of a project without physically being there. Monitoring delays in regard to a timetable can also be made easier with its aid. Accurate quantities are generated using 5D model-based estimating for the effective estimation of architectural, structural, and service components. These numbers may be extracted at many times, including the idea stage for budget generation, the end of the design development stage for floating tenders, and the GFC stage for contractor bill verification. The BIM tools are intended to assist in design, in defining the building shape and spaces, and in analyzing costs, time, and energy performance through visualization. It is a tool for construction management that may be used to simulate an actual construction project in real time. BIM is helpful in the case study under consideration for raising overall project quality, offering precise quantity take-offs, and optimizing scheduling timelines, which reduces overall project contingencies and costs. The case study included in this research revealed that a contractual framework for the construction project increased production, improved coordination, decreased mistakes, and reduced the need for rework [Amol A. Metkari, and. A. C. Attar, 2013]. Time costs and high-quality work are the most crucial factors in today's expanding housing sector. The traditional building design was largely hooked into two-dimensional (2D) drawings. One of the first pieces of software for modeling and creating buildings to appear was BIM in the 1970s. BIM provides us with a 3D model of the building, including its length, width, and height. It also provides us with a fourth (4D) model that includes time, as well as a fifth (5D) model that includes cost estimates. This function makes it possible to visualize schedule, plan, monitor, and detect conflicts across the whole pre- and post-construction phases of a structure. This paper presents a transparent look on utilizing the knowledge of all a live project of traditionally built residential building processes of a building, which was remolded using 4D and 5D BIM technique. The purpose of this study was to compare and contrast how 4D and 5D BIM affected the time and cost parameters of a live project. This study also explains applications of diverse software like REVIT, Microsoft Project, Naviswork Manage to construct 5D model [Neha Devendra Sonawane, et al, 2020]. Autodesk Revit software can be used to design the structure. For landscape architects, landscape architects, structural engineers, MEP engineers, and contractors, Autodesk Revit is BIM software. Users of the software can create buildings and its parts in 3D, annotate the model with 2D drafting elements, and access the database of the building model to obtain building information. There are two flats in the residential structure. We have a bottom floor and five floors in our building. You could put a staircase between two apartments. Robot Structure Analysis Professional, which enables you to evaluate the impacts of structural loads and confirm code compliance using cutting-edge BIM technologies, can be used to achieve comparable capabilities. Only the architectural, engineering, and construction collection has the software that connects with BIM workflows [V. Ramesh Babu, et al., 2020]. BIM is a depiction of a digitally built building model that includes the structural and functional elements of a facility. A precise virtual building model and exact geometry of a building are created using BIM, and the finished BIM model contains the data needed for material procurement, building design, component production, and identifying construction activities. Yohannis Fekadu Aynalem and Shakilmiya S. Malek, 2018 chose a real-world case study to demonstrate the potential of BIM in developing an effective project concept in a 5D environment. The results showed that it is very simple and convenient to develop an effective project concept by obtaining the necessary information from the single integrated model without consulting other sources by entering the cost and duration of tasks into the 3D model using Autodesk Navisworks manage. The usage of BIM systems for building design & resource management helps avoid the classic issues such budget overflow, lack of communication, cost overruns, overtime delays, and rework. In this study,

the BIM idea is applied to 3D modelling, which includes the project's cost (5D) and time (4D) dimensions. With the assistance of the commercial programme Autodesk Revit 2019, a case study of a G+5 residential flat is shown for 3D BIM modelling and quantity take-off. Primavera P6's 4D BIM is described along with methodology for a case study. Additionally, Autodesk Navisworks Manage 2019 is employed for 5D BIM, which features a graphical depiction of the construction schedule and cost estimation for the case study [Gaurav S. Narlawar, et al, 2019].

BIM is therefore more than simply a tool for 3D modeling; it is also a methodology that can be used from the planning stages of a building project through its completion. By using the Building Information Methodology in the pre-construction phase, this thesis focuses on the time and cost side of the building project and analyses the benefits and drawbacks of doing so with the aid of a case study. Additionally, it offers a means for building a 5D simulation model by connecting the 3D model of a G+24 home project made with Autodesk Revit 2020 with the construction schedule and cost data. The model and data are combined using Autodesk Navisworks 2020. Cost is regarded as the fifth dimension, whereas Time is regarded as the fourth. Although 5D BIM is a valiant endeavor to change the entire construction process, many stakeholders do not get how practical BIM is. This article examines and summarizes information on BIM and explains the 5D BIM implementation process as well as the advantages of adopting BIM methodology for scheduling and cost estimation in construction projects. It also establishes the advantages of BIM for the entire Architect-Engineers-Contractor-Operator (AECO) industry. It aids the AECO sector in achieving more exact design, fewer conflicts, more accurate cost estimation, and scheduling, integration of the design and construction phases, and efficient cooperation amongst the many construction stakeholders [Suraj Sharad Katke, 2020]. Two-dimensional (2D) drawings were a key component of traditional architectural design. One of the earliest pieces of building modeling and design software to appear was BIM in the 1970s. BIM provides us with a three-dimensional (3D) model of the building (length, width, and height), a fourth-dimensional (4D) model that includes time, as well as a fifth-dimensional (5D) model that includes cost estimation. Recent changes have made it possible to address building flaws and improve the analysis and detailing of structures while also reducing errors. BIM is a type of 3D modeling that provides a precise understanding of the structure as well as the tools needed to plan, design, and construct the infrastructure and administration of the building. With BIM, we may analyze the project and create a virtual version of it. BIM improves accuracy and eliminates or minimizes any errors during the design phase. The project's goal is to investigate or investigate the BIM in relation to 5D (Fifth Dimensional Modelling), which includes time planning and cost estimation. The whole construction project's time and cost were compared using data from both traditional methods and BIM software [Chandrika P. et al., 2018].

III. DISCUSSION ABOUT RESULTS

The American academic Charles M. Eastman published his description of a functional prototype in the AIA Journal in 1975, which served as the foundation for BIM. Information concerning maps, facades, viewpoints, and sections are all gathered in one document in the article's interactive defined elements. BIM software developed into the current methodology over the previous ten years. Autodesk purchased Revit Technology Corporation in 2002. The DWG format, which had served as the foundation for Autodesk's future innovations for 20 years, was replaced in 2003 by Revit. Bentley Systems and Graphisoft are still working on their software. The majority of colleges have modified their curricula to embrace BIM-based engineering and design. This adaptation ensures that the upcoming generation of architects and draughtsman is familiar with difficult software. We have already witnessed numerous intriguing BIM-related projects over the past few years that highlight its potential. These initiatives expand the capabilities of BIM and incorporate it with cutting-edge innovations like 3D printing, prefabricated sections, and AR/VR. For the purposes of this article, it is frequently questioned whether BIM software must be able to represent

both a building's physical and intrinsic qualities as an object-oriented model connected to a database. Additionally, the majority of BIM programs now include rendering engines, an optimized feature-specific taxonomy, and a programming environment for creating model components. The model is available for the user to examine/interact with in orthographic 2D plans, sections, elevation views, and three-dimensional views. All other project designs will be modified in line with the model's development. Although it would be laborious, a building information model may be created in software that is not strictly speaking "parametric" and where all information and geometry are explicitly stated. For example, the height of a horizontal level can be related to the height of a specific set of walls and parametrically altered using a parametric building modeller. This results in a dynamic database model that is tied to geometry. This innovation met a demand in the architecture sector for the ability to modify designs at various scales and across disjointed drawing sheets. BIM has been used in architecture design since the 1970s and it is still expanding today. The market for BIM software will almost triple in size from USD 5.2 billion in 2019 to USD 15 billion by 2027. Even though BIM has been revolutionizing the construction industry for more than 40 years, many architects are only now beginning to realize its full potential, and BIM's history is still young. BIM is "an intelligent 3D model-based approach that enables AEC professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure," according to software industry leader Autodesk. In order to meet the various design requirements of various teams, there will be hundreds of BIM tools accessible by the year 2020.

BIM, or building information modeling, is a technique that enables networked building planning, execution, and administration. It produces a digital representation, or 3D model, that incorporates details on a building's structural and operational components. All parties involved can access the data because it is centralized and kept in one location. The building data model, with all of its data, provides a trustworthy foundation for decision-making throughout the structure's life cycle, from design through demolition. For all parties engaged from various industries, such as the building and real estate sectors or facility management, using this working technique has several benefits. Central data management, which allows for easy access to all information, is one of the BIM method's key benefits. This enables organized and effective labour. On our BIM page, we have gathered additional information on the subject for you. BIM's history is older than some people may realize. Building Information Modeling's beginnings are not entirely apparent and cannot be pinpointed in time. However, it was a lengthy process of ongoing evolution, and that much is evident. BIM has been developed over many years, but despite the amount of understanding, it has not yet become widespread. You may get a general idea of what transpired that led to the adoption of BIM today from our summary of the events. You may get a general idea of what transpired that led to the adoption of BIM today from our summary of the events. BIM was initially developed for the automotive sector. But in this piece, we'll focus just on the building industry. We need to go back to the late 1950s in order to comprehend the development of BIM. Dr. Patrick J. Hanratty, a US-American, created Pronto in 1957. It was the first piece of commercial manufacturing software (CAM). Shortly after, Hanratty switched to computer-generated images, leading to the 1961 release of DAC (Design Automated by Computer). This CAM/CAD system introduced interactive visuals for the first time. The systems' development went on steadily after that. Ivan Sutherland created "Sketchpad," the first computer-aided design (CAD) program featuring a graphical user interface, in 1963. a significant advance in computer graphics that eventually influenced the Building Information Modeling technique. More and more systems were created in the 1980s, some of which were also used for building projects. Gábor Bojár, a computer genius during the Cold War, snuck Apple machines into Hungary to work on software. He began working on ArchiCAD in 1982. Later, ArchiCAD was the first PC software that supported BIM. A 1986 article is the first to use the term "building modeling." Working using CAD in many teams, according to the author Robert Aish, is only efficient if the relevant data can be displayed correctly for

each participant. He thought that the best way to coordinate and gather information was via an integrated CAD system. Building Information Modeling, or BIM, was merely a tiny step from "Building Modelling" in 1992. In an article for the journal "Automation in Construction," G.A. van Nederveen and F. Tolman coined this phrase for the first time. In it, the authors described how many building models are combined by stakeholders to generate a single building model. The BIM concept was revolutionized throughout time by a number of systems, including the Revit programme in 2000. But BIM didn't become widely accepted until the past ten years. This is due to the fact that several nations have recognized the advantages of BIM, leading to the method's partial implementation in European legislation. BIM has already been successfully adopted in numerous nations. We have put together a comparison between Denmark, the USA, and Germany to show precisely how BIM implementation looks here in Germany and other nations.

Figure 3: Comparison of BIM implementation at Different Countries

Denmark: For many years, large-scale projects have been carried out in many European nations using the digital planning method, including Denmark and Great Britain. The robust public sector assistance in these nations is the cause of this. In Denmark, BIM has been required for all public projects since 2007. The rules were widened as of 2011. All regional projects exceeding a specific expenditure volume must employ the BIM methodology. Denmark is one of the most advanced nations in the field of construction digitalization thanks to its extensive expertise.

United States of America: The USA is where BIM was created. Therefore, it makes sense that this is the nation with the most advanced functioning method usage. The American construction sector first learned about the value of BIM in the late 1990s. The working method gradually expanded throughout the various states as a result. Due to Americans' propensity for experimentation, the expansion has been slow. Clients and contractors use different techniques for every project because there aren't national standards for BIM. Due to the divergent standards, issues are resolved more quickly. BIM was initially tried on smaller projects so that lessons could be learned from them and later applied to larger projects. The Disney Concert Hall was regarded as a significant BIM prototype project in the USA in 2003. Results were initially well below projections because it took 7 years and $174 million in additional expenses for the building to be opened. They rapidly realized their errors, and thanks to optimizations that helped the USA firmly establish the method, they are now unable to function without BIM. BIM is becoming an essential component of the US. Large government clients have long demanded that projects be managed using BIM. The usage of BIM in projects is also becoming more and more in demand from private clients. The USA is now the greatest market for BIM as a result.

Germany: Even though it did so somewhat later, the German government has also acknowledged the benefits of BIM. In order to save costs and hazards, it intends to depend more and more on the digital planning technique known as BIM. In order to implement the working strategy for all transportation and infrastructure projects, a staged plan was adopted in 2015. Three phases make up the step-by-step strategy. The preliminary phase, which is the first stage, lasts from 2015 to 2017. This phase saw the beginning of the first BIM pilot projects, the promotion of education and training, and the definition of a successful BIM planning, building, and operating strategy. More pilot programs have been routinely executed starting in 2017. The third phase will likewise be finished by the end of 2020 to allow for widespread implementation. Therefore, using the BIM method for planning new projects in the infrastructure and transportation sectors is required. The National BIM Competence Centre was established in order to compile all outcomes and discoveries from diverse projects. It has been in use since 2019 with the goal of facilitating a standardized and coordinated approach to building

and infrastructure projects. The center also wants to speed up digitization in the building industry. In terms of utilizing BIM, Deutsche Bahn has assumed a leading position in Germany. Before the phased plan was implemented across the board, it began using digital planning in 2011. Beginning in 2020, BIM will be used for the implementation of all Deutsche Bahn construction projects. Additionally, we have previously been able to work with Deutsche Bahn on a project. To build a digital twin, we surveyed an ICE facility. The BIM approach was used to plan the entire project. Building information modeling is not a new concept that only emerged recently. The planning approach has become more sophisticated and is currently utilized in a wide range of contexts because of the ongoing development of technologies and collaborative working. It is challenging to pinpoint the exact date of the creation of BIM due to the complexity of its evolution. The procedure itself is what makes the story so thrilling. For years, BIM has been used successfully in project implementation in some nations. Our study reveals that the use of BIM is well advanced in Denmark and the United States. They have been successful in gaining a great deal of experience and extending the use of BIM to new sectors, like the private sector. Germany lags behind somewhat in comparison. However, the benefits of BIM have also been acknowledged here. For instance, BIM application in infrastructure and transportation projects is practically finished.

France: Despite the lack of any laws or regulations establishing BIM standards in France, 35% of developers there employ it for their real estate projects. In addition, between 50 and 60 percent of the market leaders in French construction have shifted to BIM, with maturity level 2 being the most popular. To encourage those involved in the building industry to incorporate BIM into their workflows, BIM Plan 2022 was introduced at the end of 2018. Although there isn't a single BIM standard that has been approved, building companies have had trouble reaching an understanding.

Russia: The biggest real estate and construction firms in the biggest cities, including Moscow, St. Petersburg, Kazan, Ufa, and Yekaterinburg, use BIM technology. There are currently 15 national standards (GOSTs) and eight sets of rules for information modelling in Russia, which is the undisputed leader in terms of legislation requiring and standardising BIM. All government projects must start using BIM technology by March 2022, and additional legislation is being prepared.

Figure 4: Benefits of BIM in Construction

Netherlands: One of the greatest BIM adoption rates worldwide is also seen in the Netherlands. There are several established protocols and standard practices in this situation. The adoption and expansion of the Dutch BIM push are due to a few significant public clients.

Scandinavian Countries: Finland, Norway, Sweden, and Denmark are examples of Scandinavian nations that have prioritized BIM procedures. Sweden has an unusually high adoption rate. The best practices are already covered in a number of published manuals. Denmark has mandated BIM for state clients, and BIM is being taught in institutions there.

Singapore: One important technology employed in Singapore is BIM. Singapore recognizes the advantages of adopting BIM in building as part of its efforts to become a smart nation. The Building and Construction Authority made submitting BIM designs necessary to obtain regulatory permission in an effort to promote its use.

India: India's construction industry is among the fastest developing in the world, yet BIM adoption has lagged. India has begun to adopt BIM at the design level in recent years as it has come to understand its benefits and affordability.

China: Nevertheless, there is still a lot of space for BIM to develop and become uniform throughout China due to its size. Since 2001, the Ministry of

Housing and Urban-Rural Development (MOHURD) has worked to advance BIM technologies and expand the use of the procedure. China has recognized the benefits and possibilities of BIM; all that is left is for it to begin expanding national adoption. For instance, Hong Kong has a phenomenal rate of BIM adoption and has BIM standards that are on the level with those of the UK.

Figure 5: Disadvantages of BIM in Construction

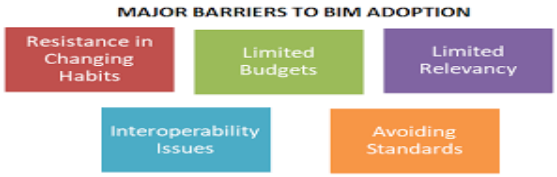

Figure 6: Major barriers to Adoption of BIM

Australia: Australia is definitely interested in the technologically based approach to construction and development. Across the country, there has been a rise in the usage of BIM for infrastructure projects in both the public and private sectors. The absence of a standard methodology or BIM protocols is Australia's main issue. As a result, BIM has been used in various ways across the country. The adoption of BIM is hampered by management challenges such as a lack of senior management support, a lack of consumer demand, cultural mismatches, the fragmented structure of the building process, a time-consuming shift in workflow, and a lack of understanding. A number of enterprises can gain a lot by using cutting-edge technology. The expansive sector of construction can be streamlined and optimized with the help of BIM. This can be used by several specialists who collaborate on particular tasks. It's interesting to see how BIM has been adopted in many parts of the world. Despite a global trend toward higher BIM adoption rates, several countries have distinct policies. But it is clear that the BIM model is spreading quickly over the globe in order to increase construction productivity and cut costs.

IV. CONCLUSION

1. According to research, BIM can be a useful tool for enhancing cost, time, and communications in the project delivery process. Given enough time, knowledge, and money, many of the drawbacks, especially those related to software, can be resolved.
2. To persuade practitioners, a thorough cost/benefit analysis of BIM is required.
3. BIM-3D model management, BIM-4D progress management, BIM-5D cost management, BIM-6D operation and maintenance management also play roles in BIM quality management/BIM safety management.
4. The effective integration, sharing, and interchange of various information and data in construction project management is, in essence, the application of BIM technology. This maximizes the value of information and data. BIM technology is evolving quickly, and it is also getting better at integrating with other technologies like GIS, VR, cloud computing, and the Internet of Things.
5. The study is focused on evolving methods for creating construction project management teams in the context of the construction industry's digitization. The usage of BIM technologies in the execution of construction projects must be expanded.
6. This study's goal was to look into how BIM is being used in project management in the AEC industry. The study specifically aimed to identify the project management knowledge areas for which BIM is used, the level of knowledge and expertise of project management practitioners in BIM in the AEC sector, and the barriers

preventing the adoption of BIM in project management activities in the AEC sector.

7. The survey found that even while most project management professionals in the AEC sector were aware of BIM, their degree of skill in it was generally low. The study also revealed that just three project management knowledge areas had a relatively high BIM adoption rate among project management practitioners in the AEC sector.
8. Finally, the survey found that the top three obstacles to the adoption of BIM in project management in the AEC industry were practitioners' resistance to changing their established working methods, a shortage of educated personnel, and the expense of acquiring the BIM technology.

The goal of the current article was to provide critical analysis of BIM's adoption, difficulties, and advantages in the construction industry. Through a study of the relevant literature that addresses the particular advantages, difficulties, and hazards of BIM implementation, the paper provides an overview of the general state of BIM adoption. The deployment of BIM in the construction sector is considered to be highly dependent on the role of various players. The article comes to the conclusion that implementing BIM on projects is a successful way to address these issues. Despite being widely used, BIM capabilities still require improvement in terms of their efficacy and hierarchy of application to address the problems of total cost and schedule overruns in construction projects.

RECOMMENDATIONS

- The study's findings have provided crucial information about the use of BIM in project management tasks in the AEC sectors.
- Project management professionals will greatly benefit from utilizing the advantages of such technology to ensure the success of their projects. Technological innovations, such as BIM, are moving quickly.
- Therefore, it is advised that project management professionals be motivated and encouraged to accept new and sophisticated techniques in the AEC industry as opposed to rejecting them.
- Regular formal training should be pursued in order to raise the level of knowledge and expertise of project management practitioners in BIM. Players in the sector should also look into creative, economical ways to get BIM technology.

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