Vaasan yliopisto
UNIVERSITY OF VAASA

Ram Krishna Regmi

Identifying Barriers and Challenges in the Adoption of Building Information Modeling (BIM) Data for Project Portfolio Management (PPM) for Decision-Making

School of Technology and Innovations
Master’s thesis in Strategic Project Management

Vaasa 2026

UNIVERSITY OF VAASA	
School of Technology and Innovations	
Author:	Ram Krishna Regmi
Title of the thesis:	Identifying Barriers and Challenges in the Adoption of Building Information Modeling (BIM) Data for Project Portfolio Management (PPM) for Decision-Making
Degree:	Master of Science in Technology
Degree Programme:	Strategic Project Management
Supervisor:	Jari Ruokolainen
Year:	2026 **Pages:** 76

ABSTRACT:

Building Information Modelling (BIM) is a digital tool, which has gained popularity in the construction sector for enhancing design coordination, visualization and efficiencies at the project level. But it is still not widely used in Project Portfolio Management (PPM) or in decision making for strategic planning. The barriers affecting the effective use of BIM information in PPM with emphasis on the decision-making process, specifically, in infrastructure related organizations are analysed in this thesis. The qualitative approach was used with semi-structured interviews with four industry practitioners, Project Director, BIM practitioner, Infrastructure and construction Project Managers from Finland and Nepal. Thematic analysis method was used to analyse the data based on the categories of technical, organizational and managerial barriers that have been identified in the previous research. The findings show that there are interrelated barriers in three dimensions that cause BIM to be underutilized when making portfolio decisions. Interoperability problems, the absence of common data formats, and the integration of several software systems present technical challenges. Organizational barriers include the lack of formal BIM data handover processes, silo mentality among the teams, and unwillingness to change among the highly experienced professionals. Managerial barriers are poor awareness of the strategic benefits of BIM among managers, uncertainty about the potential ROI and lack of skills to utilize BIM for strategic analysis instead of operational work. The results indicate that BIM is not used primarily as a strategic decision support system but rather as a design and a coordination tool. This leads to poor quality of portfolio decisions, limited learning across projects and poor strategic fit. The results reveal that BIM underutilization is not just a technical problem but a systemic problem that is related to the organizational structure and managerial practices. A contribution is made by this study through the provision of a structured barrier framework and the relationships between BIM adoption barriers and the loss of strategic value and the quality of decision making. It also offers actionable guidance to industry stakeholders, BIM specialists, portfolio managers and leaders to enhance the BIM-PPM relationship and foster data-driven PPM.

KEYWORDS: construction projects, construction management and economics, decision making, digital support, data systems, project management.

Contents

Figures

Tables

Abbreviations

3D = Three Dimensional
4D = Four Dimensional
AEC = Architecture, Engineering, and Construction
BIM = Building Information Modeling
CDE = Common Data Environment
DOI = Diffusion of Innovation Theory
ISO = International Organization for Standardization
PPM = Project Portfolio Management
ROI = Return of Investment
SMEs = Small to medium size enterprises
TAM = Technology Acceptance Model

1 Introduction

Building Information modeling (BIM) is a revolutionary digital technology that has taken centre stage in the construction and infrastructural industry. It is the process of creating and controlling of 3D digital representations that bring together extensive data during the complete lifecycle of a project (Khattra & Jain, 2024). BIM also improves collaboration as it enables the stakeholders to have a central platform of information, in terms of cost estimates, schedules, risks, and performance metrics. BIM will assist in minimizing the number of mistakes and errors, streamlining the processes, and improving decision-making because it allows updating the project in real-time and gives a full picture of the project (Sajjad et al., 2024). Although it has been successful in project level, its implementation in portfolio management level is very low and hence organizations cannot enjoy the complete benefits of BIM.

On the other hand, Project Portfolio Management (PPM) is an important practice that is concerned with overseeing a portfolio of projects care of an organization in respect to strategic objectives. PPM entails the selection, prioritization, and allocation of resources to various projects in a manner that they can add up to the overall success of the organization (Suvvari, 2023). It gives a top-down view, which assists firms in controlling risks, resource optimization and informed decision making. The conventional approaches to PPM will, however, likely be based on aggregate data about single projects, including financial reports and previous performance, which might lack the real-time and detailed awareness that BIM can offer.

The portfolio level is the area in which BIM takes place where PPM has a major challenge. Whereas BIM has been demonstrated as useful in the management of single projects, more detailed studies of its use in maximizing the decision in portfolios, like resource management, risk management, and long-term planning, are understudied (Erzaij et al., 2020). The proposed research aims at exploring the obstacles that exist to the integration of BIM into the processes of PPM and finding out how the information available in BIM can enhance strategic decision-making in management of multiple projects at the same time.

1.1 Research Problem

Building Information modeling (BIM) is a revolutionary digital technology that has taken centre stage The fundamental problem of the research is the poor incorporation of Building Information Modeling (BIM) in the Project Portfolio Management (PPM) level (Hatem et al., 2018). Although BIM has been as popular as an individual project, the use of the method on a portfolio level has not been fully exploited. PPM has traditionally been based on consolidated information, e.g. financial summaries and past performance which may not be as detailed and up-to-date as the real-time information available in BIM (Franz & Messner, 2019). With the increased complexity of portfolios, lack of BIM integration will result in lack of efficiency in decision making, allocation of resources and risk management. This is a difference that limits the possibility of making fully informed and data-driven decisions that will maximize performance in various initiatives.

The necessity of the current study is related to the enormous potential of the improvement of the decision-making process in PPM with the involvement of BIM. By examining the obstacles that do not allow BIM to fully be adopted in portfolio management, the study will also seek to offer information on how the BIM data can be used to enhance strategic decision making (Aamri et al., 2025). The proposed research will also help to address the gap related to the application of BIM since it will explore how the specifics of the data provided throughout this process might enhance the process of project selection and risk evaluation, as well as resource optimization on a portfolio level. Finally, the study will indicate the significance of incorporating BIM in PPM to enhance efficiency and effectiveness of managing various projects.

1.2 Research Questions

Main Research Question: What are the key barriers and challenges hindering the adoption of Building Information Modeling (BIM) data in Project Portfolio Management (PPM) for decision-making?

Sub-questions:

1. What are the technical barriers preventing BIM data integration into PPM?
2. How do organizational culture and structure influence the adoption of BIM in PPM?
3. What managerial challenges exist in using BIM data for strategic portfolio decisions?

1.3 Research Aim and Objectives

The aim of the research is to find out the challenges that pose the most critical challenges to development of Building information modeling (BIM) data in Project Portfolio Management (PPM) and formulate ways in which these challenges can be addressed (Kineber, 2023).

The specific research objective of this study is to identify the key barriers hindering the adoption of Building Information Modeling (BIM) data in Project Portfolio Management (PPM) and to propose strategies for overcoming these barriers to improve decision-making and portfolio (Kineber, 2023)

General Objectives:

1. Analyse scholarly sources on BIM adoption and PPM to identify barriers.
2. Examine industry professionals' perceptions of BIM data in portfolio decision-making.
3. Categorize barriers into technical, organizational, and managerial dimensions.
4. Assess the impact of these barriers on portfolio decision quality and strategic value.
5. Provide recommendations for better integrating BIM into PPM processes.

1.4 Significance of the Study

The study being reviewed enhances connection of Building Information Modeling (BIM) with Project Portfolio Management (PPM) by filling one of the most crucial research and practice gaps. This study reveals essential information regarding the obstacles that prevent the use of BIM on the portfolio level, which, in turn, can also be defined as a powerful source of the insights identifying the challenges to make the management of numerous projects more data-driven and strategic. The presented results will add to the academic community and practice by providing a thorough insight into the possibility of using BIM to enhance the portfolio decision-making process, resource optimization, and risk management.

Moreover, the research will deliver practical recommendations that can assist the organizations to overcome the barriers with the identified problems, thus being more able to integrate BIM in the work of PPM. (Abdullah Alghuried, 2023) The integration has the potential to result in improved alignment of project portfolios with organizational objectives, improved project performance and the entire process of strategic planning in the construction industry.

1.5 Limitations of the Study

The research has a few limitations that can be used in understanding the findings. These limitations relate to the nature of the investigation, locally oriented focus, method of data collection and time limits.

1. The study is restricted to BIM implementation in construction PPM, and the results might not be applicable to other sectors and industries.
2. The research will be majorly founded on practitioners within limited region implying that the findings might be biased by the practice and policies of the region.
3. The sample size used in primary data is small and involves a sample of a few professionals which might not be representative of the general population in terms of results.
4. Limitation on time prevents having to explore all possible obstacles to BIM adoption, so it concentrates on the most critical obstacles.

1.6 Structure of the Study

The research has been divided into six chapters. Chapter 1: Introduction gives a background on the research problem and identifies the research questions and objectives, limitations of the study and gives an outline of how the study is organized. Chapter 2:

Literature Review provides literature review about the relevant literature on Building Information Model (BIM), Project Portfolio Management (PPM) and barriers to BIM adoption in PPM, pointing at theory and past studies. Chapter 3: Methodology involve the research design and how data was to be collected (through interviews) and how it was to be analysed. Chapter 4: Results and Analysis contain the presentation of the primary data gathered among the industry professionals, expounding the challenges that impede the introduction of BIM in PPM. Chapter 5: Discussion provide a profound analysis of the findings comparing it to the existing literature and theoretical frameworks. Lastly, Chapter 6: Conclusion summarize the study findings and gives recommendations on how the barriers to the adoption of BIM in PPM can be overcome.

2 Literature Review

Building Information Modeling (BIM) refers to the digital technology employed in the construction sector to design and control the 3D models of the physical and functional features of the project. It combines all features (which are cost, schedule, risk, performance, and sustainability) into a single model which can be obtained by the entire project stakeholders in real time (Paolini & Rank, 2019). BIM is no longer just another simple design tool but developed to advanced systems that facilitate the communication process, minimize errors, and enhance decision-making (Małgorzata Kurcjusz et al., 2024).

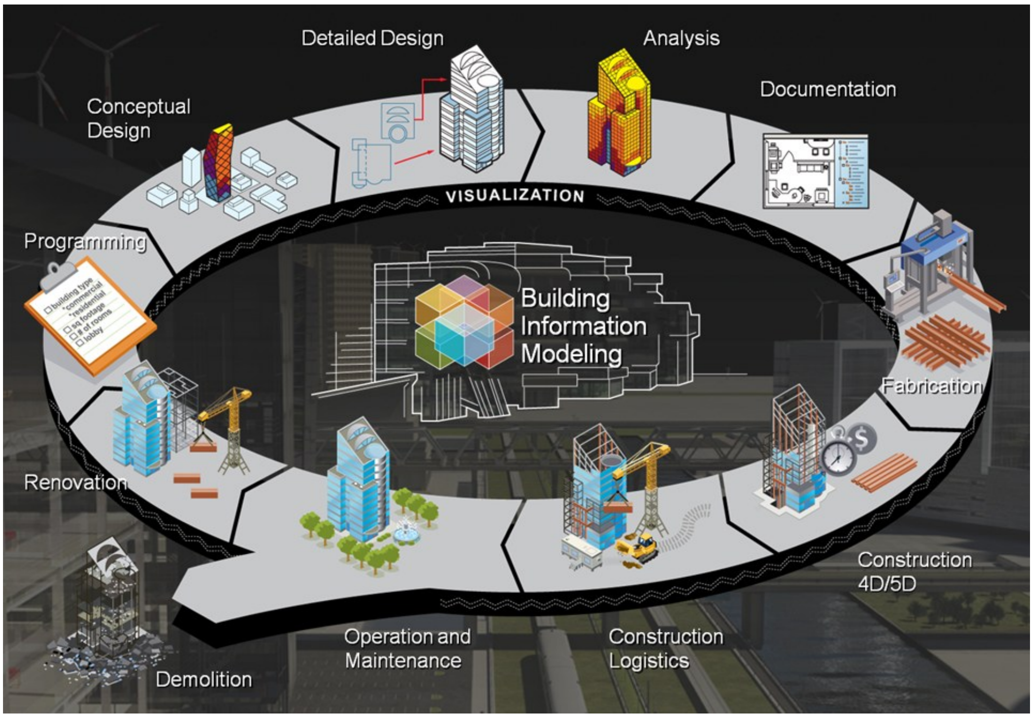

Figure 1. Building Information Modeling (BIM) (Aproplan, 2025).

2.1 BIM as a Data-Drive Approach for Integration

The core competence of BIM is that it allows the combination of various sources of data into a centralized version, as it connects the price estimates, schedule, quantities of materials, and risks (Raza et al., 2023). This combination facilitates proximate decisions, in which the stakeholders can be able to readjust in real-time on the basis of enhanced information (Jin, 2024). BIM also facilitates predictive analysis, assisting the teams in dealing with possible delays or costs that are expected to occur before they happen. This strategy creates the more precise image of a project lifecycle and ensures effective resource utilisation and enhances project control.

2.1.1 BIM at the Project Level

BIM has been extensively used at the project level in estimates and schedule and risk management. It enables one to calculate the costs with accuracy, as the data is obtained out of the model itself, whereas the 3D simulations can determine the possible bottlenecks and resource conflicts (Nguyen et al., 2024). Besides, BIM capacity to simulate risk, including material deficit or a security concern, assists in creating mitigation approaches previously to their interference in the project.

2.1.2 BIM's Potential for PPM

Although BIM has also demonstrated its effectiveness on the project level, there is a great amount of potential on Project Portfolio Management (PPM). The capability of BIM to deliver real-time data on the various projects allows in maximization of resource allocation, better management of projects risks, and effective strategic decisions (Namlı et al., 2019). Organizations can use BIM at the portfolio level to plan projects and ensure their alignment with the long-term objectives positively influencing the performance of the entire portfolio.

2.2 Project Portfolio Management (PPM)

Project Portfolio Management (PPM) is the process of choosing, ranking, and controlling several projects to make sure that they have been aligned to the strategic objectives of an organization. Project Portfolio Management plays an important role in ensuring that the projects undertaken by an organization are aligned with its long-term strategic objectives while optimizing the use of available resources (Suvvari, 2023). Through a well-managed portfolio of projects, organizations can streamline the performance, reduce risks, and have strategic alignment of all projects. The main objectives of PPM include strategic alignment, performance measurement, financial management, risk management and decision-making support, as illustrated in Figure 2 (Suvvari, 2023). Lack of good PPM will make organizations dangerous as they will invest in projects that might not be on strategic directions hence inefficiencies and wastage.

Figure 2. Objectives of Project Portfolio Management.

2.2.1 Traditional PPM Challenges

Traditional Project Portfolio Management processes usually depend on distilled financial records, past performance, and arbitrary decision-making in terms of project selection and prioritization (Saiyad, 2024). Such approaches tend to concentrate on the analysis of cost benefits or other financial measures; however, they might not reflect the real-time project information or the unstable interdependence of projects. This may lead to sub-optimal choices since the dynamics of project relationships as well as real time position of projects are not considered. Moreover, the conventional PPM also lacks the dynamism of the nature of the projects, and this implies that risks and challenges can only be detected when it is too late to intervene to put them back on track. These delays in decision-making cause the project environment to use outdated data or reports to make decisions that are not always relevant due to the rapid change (Dempsey et al., 2022). This means that organizations might find it hard to adapt to the surfacing challenges or opportunities in good time.

2.2.2 Need for Data Integration in PPM

The growing complexity of project portfolios is driving the growing demand of an integrated real-time data to facilitate the making of informed decisions in PPM. The real-time data can be used to monitor and evaluate project in the portfolio in real-time, which can enable faster decision-making processes and project managers to efficiently allocate resources and determine risks at an early stage (Zahaib Nabeel, 2024). In this regard, Building Information model (BIM) can be instrumental in that it can offer real-time information about the project, which is systematically similar among all projects within a portfolio. BIM can be used to combine cost estimates, schedules, risk evaluation, and performance metrics and place them into a centralized model that could be utilized to determine the well-being of the whole portfolio (Ahmed Shehab & Abdelalim, 2023). Through the integration of BIM, the organizations may circumvent the constraints of the conventional PPM, make better decisions, and provide high levels of strategic alignment throughout their project portfolios.

2.3 Theoretical Framework

2.3.1 Technology-Organization-Environment (TOE) Framework

Technology-Organization-Environment (TOE) model is a popular model to explain about the factors involved in technology adoption. It is especially helpful in investigating the impediments of Building Information Modeling (BIM) implementation in Project Portfolio Management (PPM) (Qin et al., 2020). The TOE framework identifies the barriers based on three major dimensions, namely, technological, organizational, and environmental factors.

1. Technological Factors: These can be related to the inability to interoperate BIM software with other project management systems, the complexity of BIM tools, and lack of standardisation in BIM data formats (Faisal Shehzad et al., 2022). There is also a lack of smooth integration between various software systems, which is also a critical problem because organizations are unable to develop a single BIM platform that can be applicable across a portfolio of projects.

2. Organizational Factors: These factors include the nature of the organizational culture, leadership, and resources, which are important in BIM adoption. BIM can be prevented by resistance to change, lack of skill and training programs (Manzanares et al., 2020). Furthermore, the organizational readiness, the ability to support the digital transformation needed to integrate BIM, may also become an obstacle to the adoption process especially in large and complex organizations.

3. Environmental Factors: There are also external influences that include regulatory requirements, industry standards as well as market pressures on BIM adoption (Jing & Alias, 2024). As an example, government requirements on BIM application in government projects may drive its adoption and absence of any in the private sector may decelerate the process.

2.3.2 Diffusion of Innovation Theory (DOI)

Diffusion of Innovation Theory (DOI) is a theory that is developed by Rogers (2003) and describes the process through which new technology diffuses in organizations and societies (Sahin, 2006). The relative advantage, compatibility, complexity, trialability, as well as observability are the factors that DOI says affect the adoption of an innovation like BIM. Relative advantage in the case of BIM adoption in PPM is the advantages that BIM has over traditional project management approaches, as the ability to better estimate costs, schedule, and address risks. Compatibility is the degree to which compatibility between BIM and the current processes and values in an organization exist. Although BIM might be easy to adapt in certain organizations, others can have difficulties integrating it because of workflow that is not updated or the unwillingness to adopt new technology.

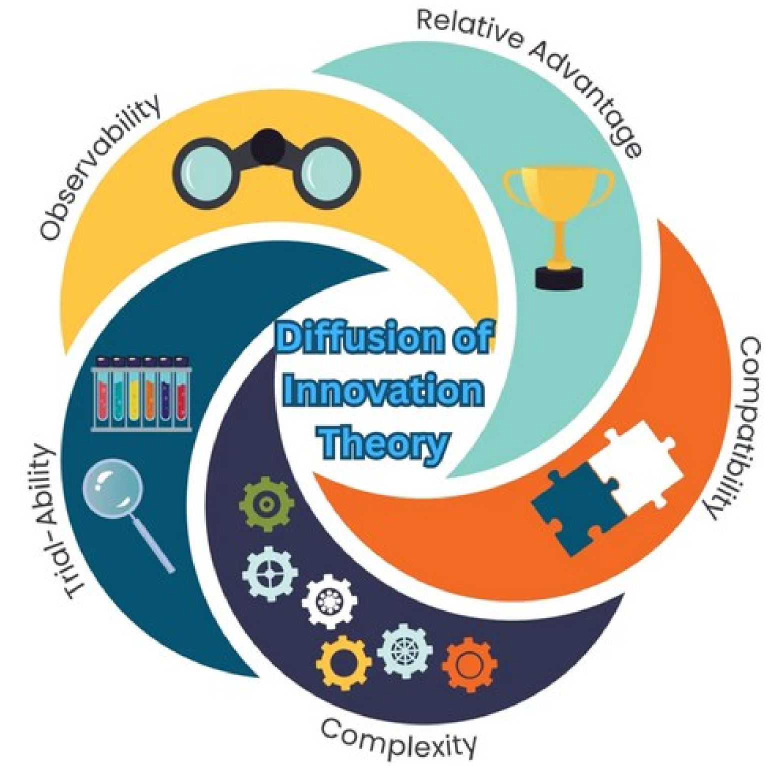

Figure 3. Diffusion of Innovation Theory (Strategic Management Insight, 2025).

Another critical consideration is complexity, because the BIM perceived complexity causes the disheartenment of the adoption of BIM in organizations (Van Tam et al., 2021). Finally, trialability and observability are the terms that describe the ease with which organizations may test BIM on smaller projects or notice its advantages before implementing it to large-scale projects. The reasons are also crucial in explaining why other organizations might be reluctant to implement BIM into their portfolios, particularly when they lack a passionate internal advocate or a successful case of implementation to inspire its usage.

2.3.3 ISO 19650 and Common Data Environment (CDE)

ISO 19650 is a BIM data management international standard that establishes procedures and principles of structuring and sustaining digital information through the project lifecycle (Tang et al., 2019). The aim of this standard is to make sure that every stakeholder in a project can work together efficiently hence, share information. It is critical in the process of ensuring the popularization of BIM in PPM as it forms guidelines on how Common Data Environments (CDE) should be managed which defines the central point where project data is stored and accessed by all the parties who will be involved (Technostructacademy, 2024).

CDEs play an important role in PPM, as they facilitate the smooth interchange of the BIM data in the portfolio of projects that facilitates data consistency, collaboration, and transparency (Seyis & Özkan, 2024). A well-designed CDE can enable organizations to be able to make data-driven choices on a portfolio level and enhance resource allocation, risk evaluation, and project strategic fit.

2.3.4 Adoption Models

Various models have been developed to explain the process of technology adoption in an organization and one of the most evident models is the Technology Acceptance Model (TAM). TAM allows assuming that perceived ease of use and perceived usefulness have served as the main driving force behind the decision to use a technology by an individual (Schorr, 2023). Perceived usefulness in the scenario of BIM adoption in PPM would be the degree to which BIM assists in meeting portfolio-level objectives like the efficiency in resource allocation or the optimization of the efficiency of decision-making. Perceived ease of use, conversely, displays the ease with which BIM tools can fit the current PPP workflows without the necessity of any significant changes and multifaceted training (Işıkdağ et al., 2025). These variables define both the adoption of BIM on the portfolio level because organizations will need to perceive additional advantages in terms of efficiency and ROI to make the investment.

2.4 Conceptual Framework

2.4.1 Integration of BIM in PPM

A Conceptual Framework of integrating Building Information Modeling (BIM) into Project Portfolio Management (PPM) is based on the concept of utilizing the rich, real-time project details provided by BIM to enhance decision-making within the project portfolio (Wang & Chen, 2023). On the portfolio level, PPM is interested in ensuring that various projects are aligned towards meeting strategic objectives of an organization (Suvvari, 2023). The conventional use of PPM has been based on financial summaries, historical information, and subjective evaluations to make decisions (Dempsey et al., 2022). With BIM, organizations can have real-time and data visibility of what is being done in projects, and therefore, make more data-driven decisions that respond to the strategic goals (Raza et al., 2023; Sajjad et al., 2024).

Within this model, the BIM data is adapted to the portfolio selection process as it damages detailed performance indicators, costs approximate, schedules, and resources demands between projects. It also enables portfolio managers to compare the projects with objective, real-time information instead of using only historical information. Moreover, since BIM is incorporated in the budgetary allocation of resources, resources (labour and material) are path-optimal in all the projects, which eliminates the conflict and maximizes effectiveness (Mi & Li, 2024). Lastly, BIM offers predictive capabilities in risk management whereby portfolio managers can detect possible risks at the project level (delays or cost overruns) and proactively respond to it on the entire portfolio.

2.4.2 Factors Affecting BIM Adoption in PPM

An adoption of Building Information Modeling (BIM) to Project Portfolio Management (PPM) is determined by several factors, such as technological, organizational, and managerial factors. Interoperability is also essential as far as technology is concerned unless BIM is integrated with other PPM tools seamlessly, its potential can only be highly constrained (Noor et al., 2018). Data format standardization is another important factor because the absence of universal standards between BIM systems may become a barrier to its widespread adoption. Organizational factors include organization readiness which are also important. Successful BIM adoption requires having the right infrastructure, qualified staff, and leadership. Also, cultural resistance to new technology and processes may be the significant barrier especially in the organization that is used to such traditional method. On the side of management, leadership plays a major role in the progress of BIM integration (Mishra et al., 2024). In the absence of a well-defined strategic vision and advocacy of the BIM adoption, there is a high likelihood of the process to fail. In addition, training to establish the required skills proves to be crucial in the ensuring success of BIM application on the portfolio.

2.4.3 Interrelation of BIM and PPM

The interface between PPM processes and BIM data is the key factor in enhancing decision-making. The functionality of BIM to feed real-time information can enable a lively feedback loop in PPM whereby project level information can be translated into portfolio level decisions instantly. For example, the idea of achieving strategic alignment between projects and organizational goals is achieved with the help of the BIM capacity to give all-encompassing information-driven picture of the contribution made by each project to the larger goals (Cavka et al., 2015). Portfolio managers can determine the fit of each project to the organization strategy and make changes in priorities where needed.

Moreover, BIM increases the risk assessment through elaborate visualizations of risks in the portfolio. The 3D modeling and integration of data allows managers to build scenarios in various scenarios to determine the effect of such a situation on several projects, including delays or lack of resources. Another benefit of BIM is that it can improve resource management by providing an overview of how the resources are used throughout the projects and ensuring their efficient allocation and eliminating conflicts between the projects. This evidence-based method results in more effective, proactive decision-making and this fact makes the whole process of PPM more efficient and strategic-oriented.

2.5 Empirical Review of Past Studies

Building Information Modeling (BIM) has been a popular topic of research among the construction industry, and there has been several research conducted to explore the use of the tool, its advantages and challenges. The project level adoption of BIM has been identified as one of the areas of focus. note that BIM has greatly enhanced efficiency of construction projects by facilitating improved cost estimation process and management and identification of risks. Their analysis of BIM adoption in the AEC (Architecture, Engineering, and Construction) industry has found out the fact that BIM enables more efficient cost prediction since it connects the specific details of materials quantities and labour estimations to 3D models. Nevertheless, these improvements notwithstanding, BIM as an approach at the project level is not smooth sailing. The research indicates that the expensive upfront expenses and training involved in using the BIM software is a significant obstacle especially when it comes to small organizations.

Additional researchers like (Zavaleta, 2025) explore further the issue of BIM implementation and reveal interoperability and organizational opposition to adoption as the main obstacles. In their study, they established that although BIM is usually viewed as the tool of enhancing the project outcomes, the lack of software compatibility and the absence of the standardisation of various BIM tools makes their implementation difficult. The technology barriers do not allow an organization to integrate BIM on its project workflows completely. Besides, organizational culture is an important part in adoption.

According to (Zavaleta, 2025), regardless of the technological advantages, most companies undergo resistance because of the conventional forms and fears towards investing in the new digital systems.

The use of BIM in managing projects at the project level has also been extensively analysed especially under the cost estimation, project schedules, and project risk management aspects. (Datta et al., 2023) state that visualization and simulation of the lifecycle of a project is the primary benefit of BIM in terms of cost and schedule management. It is through the course of their study that BIM with 4D simulations that combine time with project models enable the clearer realization of the construction sequences and assist project managers in finding out probable bottlenecks or delays in the constructions early in the process. Likewise, the use of BIM in cost management is important. It enables to do quantification of materials more accurately, which, in turn, will result in more accurate estimates of costs and distribution of resources. Irrespective of these advantages, the authors observe that BIM has little influence at the portfolio level in that the influence of traditional project management systems has continued to dominate bigger project portfolios.

(Tiza, 2024) build upon how the implementation of BIM can be applied in Project Portfolio Management (PPM). They claim that BIM has been doing fine on a project-level, but it is not well-developed on a portfolio level. The investigation implies that the real-time information of BIM can substantially contribute to the portfolio-level decision-making in the sense that the information would offer managers with an integrated perspective of several projects in a portfolio. This integration would allow optimal resource allocation, better use of risks and allow projects to be strategized based on organizational interests. There is however as the study indicates that a significant proportion of the currently available research has been directed towards BIM in PPM as opposed to portfolio wide management of current projects. This gap implies the necessity of conducting more studies on the potential BIM data to use in making portfolios, especially in project selection and prioritisation.

When analysing the obstacles to BIM adoption in PPM, a few critical problems have been outlined, which are closely connected to the presence of technical, organizational, and financial complications. According to (Ahmed, 2018), the technical barriers, including the problem of interoperability and the absence of standardized data format, play a major role. Based on their study, although BIM is predominant at the project level, integration of BIM data across multiple projects in a portfolio is still a problem because of the differences in software platforms and file formats. They claim that effective integration of BIM in PPM would require standardization of the software and the type of data stored which would ensure smooth data exchange between projects.

Another major consideration about BIM adoption is organizational barriers especially when considering PPM. According to (Munir, 2025), change resistance and skilled professional's shortage are enormous obstacles. Their research concludes that the cultural resistance to the implementation of new technologies like BIM occurs frequently within the organizations. Employees might be used to the old ways of managing the projects and reaching the final decision, they might be reluctant to use a new technology-based style. Also, absence of in-house training programs and expertise may block the successful implementation of BIM. The workforce might not be able to make the most out of the potential of BIM when it comes to portfolio management without having proper skills or training.

Financial issues also dominate the BIM adoption, most notably at the portfolio management level. The initial expenses of deploying BIM include software purchase, training, and infrastructure which are prohibitive to many organisations, especially those with small to medium size enterprises (SMEs). According to (Kocakaya et al., 2025), uncertain return on investment (ROI) of BIM to PPM is still a serious deterrent. Most organizations do not want to risk spending at the portfolio level with BIM because it is expensive and does not come with immediate returns. Even though the long-term reward of BIM, i.e., the better performance of the project and the resource optimization, is generally accepted, the initial financial investment cost can be called a challenge of many companies.

Another study conducted by (Ozorhon & Karahan, 2017) provides insight into the organizational culture and leadership commitment as a critical factor in BIM adoption. Their study demonstrates that the organizations with the high level of leadership support and active attitude to change management are more likely to be able to implement BIM successfully in several projects. They reiterate that the top management should be very critical in breaking the resistance towards new technology and developing an organizational culture that embraces the digital transformation. Their results point to the fact that cultural preparedness and training packages can play a critical role in reducing the obstructions to BIM adoption, especially in the portfolio of the large-scale projects.

Lastly, research by (Liu, 2023) is aimed at financial barriers to BIM implementation, specifically, addressing the difficulty in justifying BIM investment on a portfolio management level. Their research shows that most organizations do not have a way of quantifying the ROI of BIM when used in managing the portfolio because the ROI is usually long-term and is challenging to quantify. Although the impact of cost savings and efficiency improvement on the project level is well-reported, most decision-makers still have no financial reasoning to adopt BIM regarding a project portfolio. The research indicates that cost-benefit studies that presume the long-term portfolio performance is possibly needed to showcase the worth of BIM to PPM particularly in companies where financial measures prevail in decision-making procedures.

2.6 Barriers to BIM Adoption in PPM

2.6.1 Technical Barriers

Embracing Building Information Modeling (BIM) within Project Portfolio Management (PPM) has a huge technical impediment. The interoperability of BIM tools and the current PPM systems is one of the major challenges. BIM software does not always fit harmoniously with the use of other project management software which complicates the data transfer between various platforms and makes it challenging to pull information at the portfolio level (Tchouanguem Djuedja et al., 2019). Besides, when dealing with large amounts of BIM data in many projects, the problem of data management also occurs. BIM models may require a lot of data that may be difficult to analyse, and the data generated in these models is complex and often excessive, and unless a good system of data management is in place the sharing of such data between stakeholders may have no meaning. Lack of standardisation of BIM data formats and implementation of Common Data environment (CDEs) is yet another major obstacle. Lack of standardization of the BIM data formats presents organizations with challenges in maintaining uniformities across projects and integrating of BIM information into the existing project planning and control systems is complex and inefficient (Shawky et al., 2024).

2.6.2 Organizational Barriers

Organizational barriers are also a key aspect that prevents the adoption of BIM in PPM other than technical barriers. Resistance to change is one of the biggest challenges (Nast & Rekve, 2022). There is a strong entrenchment of organizations in the old procedures of project management and reluctance to move towards BIM-based processes, which necessitates the alteration of the well-developed workflows and attitudes. The leadership and governance are also important aspects of successful implementation of BIM. Without a serious leadership backing or effective governance structure, adoption of BIM may not proceed as there is no sense of direction as well as commitment by the top management. Moreover, shortage of trained staff is a critical impediment. The successful application of BIM in PPM needs a certain expertise in the creation of the BIM program, as well as integrating it into the process of project management (Politi et al., 2018). Organizations usually have employees who are not knowledgeable to effectively use BIM tools, and therefore, the processes are slowed down, and BIM technologies are not effectively utilized.

2.6.3 Financial Barriers

Another barrier to BIM enforcement which is mostly cited is financial barriers particularly at the portfolio management level. One of the most urgent eyes is the high initial cost of BIM adoption. These expenses encompass the acquisition of BIM software and investment in the personnel training process as well as the establishment of the required infrastructure. There is also the problem of uncertain return on investment (ROI). Most of the organizations face challenges in measuring long-term authorizations of BIM implementation especially at the portfolio level where the positive impacts are less obvious than project-based BIM applications (Giel & Issa, 2013). This uncertainty has a tendency of resulting in unwillingness to invest heavily on the BIM in a portfolio management level on account of the financial investment being too large given the uncertainties on the short-term benefits.

2.7 Research Gaps in the Literature

2.7.1 Lack of BIM Adoption at the Portfolio Level

One of the main gaps in the literature is the minimal integration of Building Information Modeling (BIM) at the portfolio stage of project management. Although an extensive body of research is dedicated to the advantages of BIM in terms of their individual project, little has been carried out to investigate the application of BIM on a multi-project portfolio basis. The potential of BIM on how to enhance decision-making at the portfolio level or project selection, project prioritization, risk management, and the allocation of resources has not been well researched. Majority of the studies done have focused on project level management neglecting how BIM can result in strategic decision making when dealing with a set of projects that are congruent to the organizational objectives (Ottaviani et al., 2025). The expanding use of BIM by organizations at the individual project level poses an increasing requirement of studies linking the opportunities of BIM with the larger context of portfolio management. The knowledge concerning the improvement of the project portfolio performance and the long-term planning using BIM data will be instrumental in the development of the digital transformation or project portfolio management.

2.7.2 Limited Empirical Studies on BIM in PPM

The other major gap is the absence of empirical studies that capture practical applications of BIM in Project Portfolio Management (PPM). Although the literature has many theoretical studies, there are extremely few of the works that explore the application and implementation of BIM in PPM practices (Alam et al., 2023). The information about how BIM data could directly influence such portfolios decisions as resource allocation, project prioritization, and strategic alignment is lacking. The lack of both case studies and empirical studies proves the knowledge gap in comprehending the way in which organizational to offer the implementation of BIM on a portfolio level, and the practical challenges they may encounter in doing so. The gap also demonstrates the necessity of the research that would measure the influence of BIM on the overall portfolio performance of the project complex environment, in terms of long-term benefits, and ROI of organizations that implement BIM in the context of their PPM.

2.8 Conclusion of the Literature Review

The literature identifies some barriers to the adoption of the BIM in Project Portfolio Management (PPM) such as technical constraints such as interoperability and data management, organizational resistance to new technology and financial constraints such as high initial cost and uncertain ROI. Also, the literature on the application of BIM to PPM decision-making processes is a definite gap, and existing research does not cover the aspect of its utilization in enhancing the decision-making at the portfolio level, including selection of project, allocation of resources, and risk management. Moreover, the absence of empirical case studies on a portfolio level contributes to the necessity of having practical information on how BIM may be implemented in a variety of projects. This study will address these gaps by dwelling on the question of the incorporation of BIM into PPM and examining how it can be utilized to improve strategic decisions contributing significantly to the adoption of BIM in the construction industry at the portfolio level.

3 Methodology

This chapter describes the way the research was conducted. It provides the research design, selection of the participants, the data collection procedure, the method used to analyse data, ethical considerations, and actions that were undertaken to enhance the excellence of the study. The chapter is composed to conform to the purpose of the study, which is to establish the obstacles and issues that inhibit the application of Building Information Modelling (BIM) data in Project Portfolio Management (PPM) to make decisions.

The research design was a qualitative one, as the research problem demanded an insight into perceptions, experiences, and work practices, and not testing numerically. The qualitative research comes in handy where the researcher requires a detailed explanation and context of how individuals perceive a process, as well as why things keep going on, as concerns issues in reality (Michelen et al., 2024). The use of BIM in PPM is a topic that is yet to be developed at the portfolio level, and this is why the most appropriate method was an exploratory method.

The guidance of the supervisor is also answered in this chapter. Specifically, it describes the reason why the study did not concentrate on a single type of project. Rather, it reviewed infrastructure organisations, which can manage mixed portfolios, i.e., buildings, bridges, highways, and energy-related works. This was not meant to give a comparison of technical BIM information across sectors, but it came up with some mutual organisational, managerial, and decision-making impediments.

3.1 Research Design

A qualitative and exploratory research design was embraced in the study. A qualitative design was applicable since the questions that needed to be answered were what the barriers are, how the barriers are realized, and what prevents the use of BIM data from becoming completely implemented in portfolio decision-making (Agwa & Celik, 2025). These are questions that need detailed descriptions by professionals who deal with BIM, project delivery, design, or management.

The design was exploratory as the literature demonstrates that BIM has been researched extensively as concerns project level, but there is less direct data on how BIM is used when making decisions at the portfolio level. Semi-structured interviews appear to be suitable in such situations, as it strikes the right balance between having a clear interview guide and providing the flexibility necessary to allow the participants to elaborate on problems in their own words and to provide examples of the practice (Tahir, 2024).

This research was primarily based on primary data. The primary evidence was the results of the interviews and written answers by the professionals in the industry. The reason is that the interview guide was developed using only the secondary sources to support the analysis and relate the findings to the overall literature. This implies that the chapter adheres to a leading methodology as demanded in the thesis.

3.2 Research approach and justification of scope

The study was interpretive by nature. This implies that the research was interested in knowing how professionals came to a sense of the use of BIM, integration of data, and decision-making in their respective work environments. The experiment had no attempt to demonstrate a universal cause law. Rather, it attempted to comprehend trends of meaning among participants.

There was a conscious choice of including participants representing various infrastructure-related scenarios instead of being limited to one sector (Valentin et al., 2018). This was done due to the primary concern of the study being organisational and managerial constraints, including poor integration, poor leadership support, lack of skills, silo working, and ineffective utilisation of digital data in strategic decisions. These are the barriers

that should be expected to be present in a wide range of infrastructure portfolios, even when the technical BIM tools may vary, sector to sector.
This expanded orientation is also appropriate to the actual character of project portfolios. Several organisations do not deal with a single type of project. They frequently have to work on multiple classes of projects and still have to make resource, risk, and priority choices at the portfolio level. That is why the research needed to refer to the cross-cutting barriers that could be moved over to the analogous infrastructure organisations.

Simultaneously, this option was identified as a constraint. The analysis failed to compare the differences between types of projects minutely. The future studies can thus target just a single sector, like the bridges or the highways, to find out whether there are some barriers that are more powerful in one setting than in the other.

3.3 Selection of participants

Purposive sampling was used to select the participants (Tajik et al., 2024). This implies that respondents were selected on the basis that they would be able to offer good information on BIM practice, project delivery, digital workflows, and management decisions. Purposive sampling does not involve the selection of participants based on random choice; however, the selection is based on the participants' suitability to the objectives of the study, and the participants are capable of speaking directly to the research question (Memon et al., 2025).

The research targeted professionals with field experience in one or more of the following divisions: BIM application, design coordination, project management, portfolio administration, digital data processing, or organisational decision-making. The sample was thus composed of individuals involved in jobs that had a relation to BIM, design, technical coordination, and management. This mattered since the subject falls between the strategy and practice of the technical side of the task.

The sample was small since it was a master's thesis that had limited time and resources. The concept of sample adequacy relating to qualitative work is not determined by a numerical measure of sample adequacy. The criteria used to judge it are the topicality of participants, the breadth of their response, and the volume of information they can help with. Recent methodology also demonstrates that the sample size of a qualitative work is to be justified with reference to purpose, depth, and analytic fit instead of some numerical rule (Lim, 2025).

The ultimate sample was thus meant to favour depth as opposed to breadth. It was not the statistical generalisation. It was aimed to collect knowledge-based testimony of professionals who will be able to articulate how BIM is utilised, why it is not inextricably linked with PPM, and under what circumstances its implementation can be enhanced.

3.4 Data collection methods

3.4.1 Semi-structured interviews

The main method of data collection was semi-structured interviewing (Ruslin Ruslin et al., 2022). The reason behind this method is that the researcher could pose the same fundamental questions to all the participants and give them a chance to clarify, provide follow-up questions, and examples. The approach was quite appropriate to this research, as some of the respondents were more knowledgeable in BIM, whereas others were more knowledgeable in management or coordination. The interview was conducted using a flexible format to enable the discussion to follow up on the participant's area of experience of the participant without straying from the key research questions.
The interviews covered five major areas:

1. modern application of BIM in organisations,
2. technical barriers,
3. organisational barriers,
4. finances and management obstacles, and

5. strategies of improved adoption.

The questions were not a surprise, yet the arrangement and phrasing were made appropriately as the discussion progressed. This assisted the researcher in demystifying vague responses and gathering examples in actual working conditions.

3.4.2 Interview setting and mode

They were gathered using the online interview via Microsoft Teams and e-mail responses. The pragmatic aspect of this mixed interview mode was that the participants had free schedules, location, and availability, which varied. It also enabled the researcher to incorporate professionals who would have been very hard to get face-to-face during the live interview yet would complement the same in the written form.

A pilot test on friends was conducted before the actual data collection to enhance the wording, sequencing, and timing of the interview guide. This pilot step aided the researcher in finding out the questions that were overly broad, repetitive, or challenging to comprehend. It was also useful in enhancing confidence in follow-up questions.

Live and written responses made use of diverse primary data. Wealthy conversational content was achieved in live interviews, whereas additional time to answer was provided to the participants through email responses. This was helpful as not all participants had it in the scope of their daily tasks, like the BIM integration and portfolio decisions.

3.4.3 Recording, transcription, and data handling

Live interviews were recorded when permission was given and then transcribed for analysis. Written answers were saved in the form of text files. All the materials were tabulated into one set to be coded. After reading the transcripts and written answers, the researcher obtained them sometimes, and then formal coding commenced.

The data collected in the interview was taken with a lot of care since, usually, qualitative interview data consists of work-based opinions, personal judgment, and context-related data. Consent is also not supposed to be a one-handed deal in qualitative interviewing; it is to be understood as an agreement that is continued and explicit regarding its purpose, participation, and subsequent utilization of the data (McGrath et al., 2026). Table 1 below lists the total number of respondents that took part in this study, their expertise as well as years of experience in their respective fields. The data collected in the interview was handled with care. Table 1 below lists the total number of respondents, their expertise and years of experience in their respective fields.

Table 1. Interview study respondents.

Respondents	Expertise	Organization	Experience	Venue
Respondent 1	Project Director	Ramboll (Finland)	10 + Years	Teams (45 Min)
Respondent 2	Project Manager	Not disclosed	8 years	Email response
Respondent 3	Project Manager	Not disclosed	4 Years	Email response
Respondent 4	BIM Specialist	Trimble (Finland)	5 Years	Teams (40 Min)

3.5 Data analysis

The thematic analysis was employed to analyse the data collected. Thematic analysis is an adequate approach in situations where the goal is to discover recurring patterns of meaning in a set of data in an organized yet versatile manner (Ahmed et al., 2025). This study applied it to establish the descriptions of the participants about barriers to adopting BIM in PPM and the influence of these barriers on the process of decision-making.
It was analysed using six steps. To begin with, the researcher became conversant with the data through numerous readings of the interview transcripts and written responses. Second, key statements, recurring issues, and powerful instances were then used to generate the first codes. Third, comparable codes were combined into general themes. Fourth, the themes were checked concerning the entire data to identify whether they indeed represented the accounts of the participants. Fifth, the definitions of each theme

were clear, and the themes were also connected with the research questions. Sixth, the last themes were written in an understandable analytical form.
Coding was also predominantly inductive as the researcher left the response to bring out themes. It was, however, also directed by the study framework, namely the differentiation between the technical, organisational, financial, and managerial barriers. Latest directions of thematic analysis emphasize that researchers must describe concisely how their strategy fits the research condition and must show the trace of data into a theme (Haan & Venema, 2025).

The interoperability, differences in software and data formats, skill shortage, leadership support, resistance to change, cost, and the poor use of BIM data to make strategic decisions were among the final themes to be expected. These themes were subsequently compared against the literature review with a view to enhancing interpretation.

3.6 Triangulation

Even though the main basis of the study was the primary data, at the level of interpretation, the study was triangulated. The results of the interview were contrasted with the literature that was reviewed in Chapter 2 and with the conceptual framing of the study. This did not make the study a mixed-method design. Instead, it assisted the researcher in verifying the hypothesis of whether the matters that were expressed by participants were individual comments or reflected broader trends that have already been noticed in the published studies.

Credibility was also supported through triangulation. Credibility is enhanced in qualitative research as the results are verified against various types of evidence and not favored by one statement only (Ahmed, 2024). The convergence was considered in this research in terms of live interviews, written responses, and the available literature on BIM barriers.

3.7 Ethical considerations

The study allowed ethics to play a role since the research participants were human beings, and the work-related experiences. The participants got to know the objective of the study, the voluntary nature of the participation, and how their responses would support the thesis. They were also informed that they could refuse to give any answer and they could quit the whole exercise at their own will.

The level of confidentiality and anonymity was maintained as much as possible. Finally, names and sensitive identifiers were eliminated or minimized during the publication of results. This was imperative since there might be information in the interview material that includes the nature of organisations, internal practices, and personal opinions. Recent literature on responsible sharing of qualitative data indicates that the research using interview methods must be handled with caution due to the need to balance openness with confidentiality, context, and sensitivity of personal testimonies (Walsh et al., 2025).

The researcher was conscious as well that a few of the answers could represent boundaries in the position of the participant as opposed to a full depiction of the entire organisation. That is why the analysis did not consider each answer as an ultimate fact about the organisation. Instead, it considered all answers professional but influenced by role, experience, and access.

3.8 Reliability, validity, and trustworthiness

In qualitative research, it is customary to talk about the quality of a study in the context of trustworthiness and not statistical reliability. Credibility, transferability, dependability, and confirmability are parts of trustworthiness (Ahmed, 2024).

Supporting credibility through the appropriate use of participants with pertinent professional experience, the use of follow-up questions, and the ability to compare themes by more than one response source were used. This issue was addressed by providing concise descriptions of the research context, type, and sample of the study participants, and the extent to which the results can be relevant to other infrastructure organisations. Reliability has been ensured through maintaining a good record of the research process, which includes the design of the interview, data handling, and coding. Reliability, since findings were closely related to the response of the participants and did not depend on their subjective views.

Reflexive practice was also employed in the study. Reflexivity implies that the researcher is cognizant that certain biases, like his or her assumptions, background, and expectations, might affect the way the researcher poses questions and interprets information. The recent qualitative advice proposes that reflexivity must be dynamic and active, rather than a brief declaration written at the conclusion of the research (Trundle et al., 2025). It was a thesis whereby reflexivity was integrated in the design of questions, taking notes, coding, and review of the themes.

The concept of respondent validation was also considered in that the interpretation remained to what the participants stated, particularly in cases where there are participants who openly indicated that they were not directly involved at the portfolio level of making decisions. According to recent guidance, strengthening qualitative rigour by ensuring themes are a fair representation of participant views can be done (Noble & Smith, 2025).

3.9 Use of AI in this thesis

The application of AI tools was utilized in the creation of this thesis only in a limited support role, such as ChatGPT. They were limited to language assistance, judgmental structuring, and preliminary drafting. The interview data, references that were invented, and the researcher's analysis have not been generated using AI.

Such a restrictive application is in line with the existing academic discourse, which acknowledges that AI can be used to assist in the organisation of ideas, textual improvement, and writing assistance, yet emphasises that it should be used ethically and transparently. The existing instruction is also that AI tools are not accountable for scholarly material and that human authors will be wholly responsible in terms of correctness, judgment, and notification of usage (Cleland et al., 2026).

Due to that fact, all final interpretations, methodological choices, theme development, and checking the sources were the duty of the researcher. The researcher had to go through every citation, claim, and conclusion in the thesis before including them.

3.10 Chapter summary

The methodology of the study has been explained in this chapter. The study used a qualitative and exploratory research design and predominantly used primary data obtained through semi-structured interviews and written feedback from industry players. Participants were selected through a purposive sample that would give first-hand information on the use of BIM, project delivery, and decision-making. The information was analysed using thematic analysis, backed by a literature comparison. Other aspects that involved ethical principles, trustworthiness, and restricted transparent use of AI were discussed as well.

Generally, the selected methodology was appropriate to the study as it enabled the research to not only investigate the presence of barriers, but also to explain how and why these barriers inhibit the application of BIM data in decision-making in project portfolios across the infrastructure-related setting.

4 Results and Analysis

The findings from semi-structured interviews conducted with four professionals of BIM and project management, such as one Project Director (Finland) and two Project Managers (Nepal and foreign construction sites), are presented and analysed in this chapter. Technical barriers, organizational barriers and managerial barriers are the three categories that have been considered for the analysis. The results are analysed and explained in the perspective of their influence on Project Portfolio Management (PPM) decision making process. The chapter has also tried to evaluate the current level BIM maturity and future desired maturity in the use of BIM of the project. Considering the current state and expectation in the future desired maturity of the BIM has been given in the following figure. All the dimensions are expected to be improved as compared to the current situation.

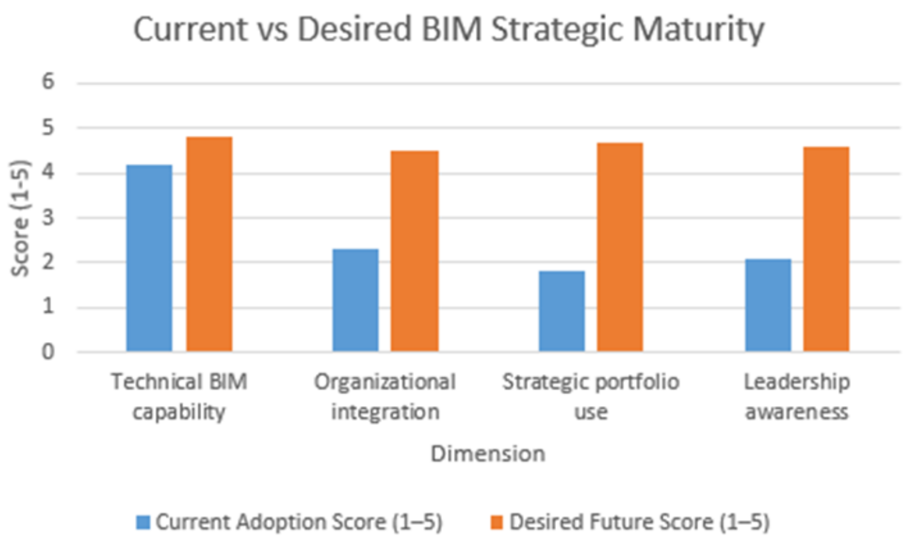

Figure 4. Current versus desired BIM strategic maturity levels across key dimensions, based on participant perceptions (1 = very low, 5 = very high).

4.1 Technical Barriers

4.1.1 Interoperability and Data Sharing Issues

One of the top technical challenges revealed in the interviews is the challenge of interoperability between BIM data from various software applications and disciplines. The Project Director noted that there were some major issues in the coordination of infrastructure and building models (Takyi-Annan & Zhang, 2023).

"Models always have to be turned to the right coordination and size in order to be shared between these two systems, so it is complicated." (Project Director, Finland)
Likewise, users mention that they use various data formats (IFC, LandXML and proprietary BIM systems), which can cause inconsistencies when exchanging models. A Nepalese Project Manager said: "Not all project management platforms support BIM use, and it can be challenging to incorporate BIM Schedules, cost information and performance metrics." These differences hinder cross-platform collaboration and make BIM less useful at portfolio level.

The results indicate that BIM is a widespread tool in organisations, but it is primarily used on the project level. The participants described that BIM assists in enhancing design coordination, minimizing errors, and aiding in planning activities (Teo et al., 2022). It enables teams to collaborate in a better manner and gives a visual representation of the project.

But in the case of Project Portfolio Management BIM is not utilized exhaustively. Most organisations continue to rely on traditional tools like reports, spreadsheets and previous data to run various projects (Jha et al., 2020). Although the BIM offers precise and real-time information, this information is not utilized well in making strategic decisions across projects.

Participants also emphasized that availability of BIM data and its actual use in decision-making have a definite gap. This gap indicates that organisations are yet to come up with systems and processes to apply BIM at the portfolio level (Zhou et al., 2024).

4.1.2 Data Standardization and Volume Issues

One of the other challenges is a lack of uniformity of BIM data between projects. One respondent pointed out that although BIM provides detailed project information, that is not necessarily organized for comparative analysis of projects: Some of the challenges here are that "Portfolio managers may not always have the technical skills to interpret BIM data". (PM, written)

Also, while BIM tools help create huge data sets, organizations have difficulties to get strategic insights: "There is no portfolio-wide data lake – we store data in cloud platforms such as Autodesk Construction Cloud." (Project Director)

4.2 Organizational Barriers

4.2.1 Lack of Formal Data Handover Systems

One of the key organizational challenges is the absence of formal systems of data transfer between the execution of projects and decisions at the portfolio level. The interviews showed that BIM can be used to provide information, but these are not routinely passed on or used again once a project has finished (Wang & Chen, 2023). One Project Manager said that "Lessons learnt from a BIM model are not captured systematically for future decisions on the portfolio." This results in a substantial loss of knowledge; valuable project data is not used for strategic planning. As a result, organizations are unable to take advantage of evidence-based portfolio management and continuous learning to optimize project selection, efficiency and performance in the future.

4.2.2 Siloed Work Culture

One of the biggest organizational barriers identified was the silo mentalities within the culture of the work organizations, where the BIM technical teams and the decision makers for the portfolios work separately. The BIM specialist said that “BIM managers are responsible for design coordination, but not BIM managers are in BIM workflows. This distinction results in a definite disconnect between operations and strategy. This has a negative impact on communication, on transferring valuable BIM data to decision makers, on the integration of project execution and the portfolio strategy, and on the overall level of integration and efficiency within the organization.

4.2.3 Resistance to Change

Some resistance towards change was found primarily in more experienced professionals who have a more traditional way of working. As mentioned by the Project Director, “Older designer(s) will say ‘we've always done it this way. This is indicative of a lack of openness to new technologies such as BIM although it has advantages. While this resistance is slowly fading with younger engineers entering the workforce and more people getting introduced to digital, it's still a problem and a drag on general digitalization in the organization (Biswas et al., 2024).

4.3 Managerial Barriers

4.3.1 Limited Strategic Awareness

One of the primary challenges in management is the lack of strategic understanding among the leader(s) in place about the value of BIM in decision making for the portfolio. The Project Director experienced that “Leadership understand that BIM is important for design, but not how it can support project selection.” This suggests that BIM is not considered a strategic asset but is mostly used as an operating design tool. This means that its ability to assist in the selection, prioritization and optimization of projects over the long-term is underutilized (Mishra et al., 2024).

4.3.2 Financial Constraints and ROI Uncertainty

BIM is an investment conscious process with initial investment in software, training, and infrastructure. But there were barriers when it came to measuring the ROI of the portfolio, as respondents indicated. This is a particular problem for smaller companies because of cost issues.

4.3.3 Skills Gap

There is a large gap in the skills of BIM application for strategic use. While the presence of BIM managers in advanced organizations is undeniable, what they are trained on are primarily technical. The BIM specialist said, “Training is not a time for clash detection, it's not a time for portfolio analytics.” This further limit professional being able to use BIM data to inform higher level portfolio decision making, thereby further reducing the strategic value of BIM in organizations.

4.3.4 Summary of Findings

The results showed that BIM is very useful for executing projects at the project level and not well accepted for the portfolio level decisions. Technical limitations, organizational problems and managerial constraints are all obstacles to the strategic use of BIM in PPM. In general, the results indicate that BIM is used rather on the level of projects and has not been yet advanced to Project Portfolio Management. Even though BIM offers in-depth and real-time data, this information is not well utilized in managing multiple projects.

The research found that there are a few obstacles that restrain the use of BIM in PPM. These are technical problems that involve the absence of integration, complexity of data and standardisation. Other organisational issues like resistance to change, skills deficiency and poor leadership contribute significantly.

The findings clarify the reason behind the low adoption rates of BIM at the portfolio level and why advancements in the field of technology and organisational practices are necessary.

5 Discussion

The empirical results are interpreted in the context of the literature surrounding Building Information Modelling (BIM), Project Portfolio Management (PPM) and Digital transformation within the construction industry. It offers an important analysis of the effect of the identified technical, organizational and managerial barriers on the low use of BIM data in strategic portfolio decision making. In the literature BIM has been recognized as an effective tool to enhance the design coordination and its ability to estimate costs and to improve project-level effectiveness, but it has not been widely explored at the portfolio level. The results provided from the study indicate that the discrepancy between theory and practice is mainly due to non-technical issues, such as non-functioning of inter-departmental communication, lack of leadership awareness and organizational structure (Mishra et al., 2024). This chapter, therefore, compares the results obtained from the interviews and previous studies to see the points of convergence and divergence. It also shows how the lack of integrated data systems and strategic governance restricts the use of BIM from an operational tool to a tool to support decisions for a portfolio. The overall goal of this discussion is to gain a better understanding of the why of the underutilization of BIM for strategic decision making despite its apparent technology and uptake in the industry.

5.1 Technical Barriers and Literature Alignment

The results of this study effectively reinforce the literature which has so far identified interoperability as one of the most astounding technical challenges in the implementation of Building Information Modelling (BIM) (Chatsuwan et al., 2025). The finding of the interviews was that participants faced numerous difficulties in interoperability of BIM data, especially between the domains of infrastructure and buildings. These challenges were not just that software incompatibility, but they involved modelling conventions, data structures and disciplinary workflows as well.

One of the main challenges mentioned by the Project Director was the issue of scale discrepancies when it comes to infrastructure and building models, such as using meters for infrastructure and millimetres for building design. As can be seen in this issue, interoperability is not just a technical limitation, it's a representational one, too. The scale mismatch is due to fundamental differences in the ways that disciplines think about and create digital models. In such a way, BIM data exchange is more of a translation process than a mere transfer, and plenty of manual adjustments and interpretations are needed to translate the data.

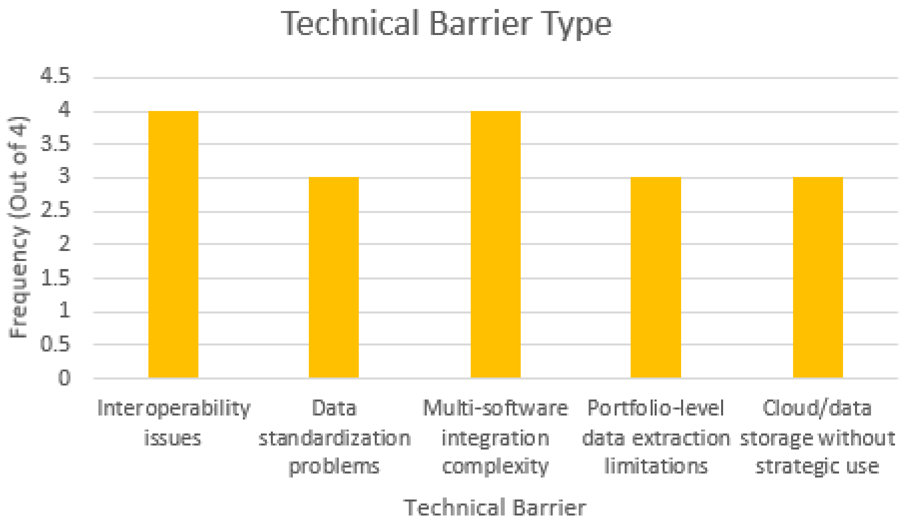

Figure 5. Technical barriers to BIM adoption in project portfolio management identified from interview findings.

This observation is like findings of work (S. Wang et al., 2024), which suggests that successful knowledge exchange requires various types of proximity: technological proximity, cognitive proximity, organisational proximity and institutional proximity. Technological proximity is the level of compatibility of BIM systems and software platforms in the scope of this research, and cognitive proximity is the level of shared understanding of the design logic, modelling conventions and project requirements of the different disciplines. The results indicate that, despite the introduction of some technological solutions, as outlined in the standards, including IFC (Industry Foundation Classes), cognitive and semantic gaps are still affecting the data integration process.

Other issues participants noted include the fact that software ecosystems for infrastructure (Infra-modeling tools) and building projects (IFC-based systems) result in disjointed data environments. Today, most BIM platforms can handle a variety of files, such as IFC and LandXML, but the conversion and fusion of those models require a lot of work and are prone to errors. This further supports existing research that has contended that interoperability is still a “last mile” issue in the adoption of BIM, referring to the technical capacity for interoperability but the lack of usability.

This study, however, builds on the current literature by showing that interoperability issues are not limited to the data exchange. Rather, a more critical problem is the lack of utilization of BIM data that have been integrated successfully. Despite efforts to exchange models and get them "technically in sync," participants indicated that the data is not used much beyond the project-level coordination level. For instance, BIM deliverables like clash detection reports, quantity take-off and scheduling are usually only shared among project teams and not across the portfolio for analysis.

This finding moves the interoperability as a technical exchange issue out of BIM literature and places BIM as a strategic utilisation issue. That is, the issue isn't just about the need for BIM systems to communicate, it's about the need for information to be actionable for the organisation's decision-making process. This distinction is significant as it emphasises a difference between implementation of BIM in operations and incorporation of BIM into the strategic management process of PPPs that is typically not considered in technical studies.

Moreover, participants noted that standards like IFC help at a structural level to achieve interoperability, but not in terms of data interpretation and decision relevance. For example, although models can be exported to other platforms, data from the models are rarely in context with the other indicators at the portfolio level, such as cost efficiency, sustainability indicators, and risk profiles. Therefore, portfolio managers cannot make clear and direct comparisons between projects, using BIM outputs as they would like.

It is good evidence of the fact that the interoperability of BIM can be considered as a socio-technical issue, and a technical one. Even when files are compatible, that is not enough to ensure that they become meaningful in decision-making processes. Rather, it is the organization's workflow, data management, and analytical skills that can make or break the ability to convert BIM data into usable information.

The results also indicate that data environments are not pooled due to tools being siloed across disciplines in BIM. A lack of a common data language is a result of designers from various disciplines working in their own software ecosystems, such as infrastructure designers, structural engineers, and architectural teams. This further supports previous research that indicates that not only is technology not a barrier to BIM adoption alone, but that a fragmented digital ecosystem is also a factor.

In conclusion, this research contributes to the literature by taking a step beyond the technical limitations of BIM interoperability to the data usability and strategic integration aspects of BIM interoperability. Previous studies have concentrated mainly on enhancing the compatibility of files and software integration, but the results of this study indicate that a very big challenge exists in the transformation of interoperable data to decision relevant information at the portfolio level. This means that further research is required to move the focus of BIM data exchange mechanisms to BIM data governance, analytics and strategic use within PPM.

5.2 Organizational Barriers and Knowledge Silos

This study largely validates previous organizational learning research findings that one of the key challenges of applying BIM within Project Portfolio Management (PPM) is the lack of a systematic process for transferring the knowledge gained in the project execution process into the strategic decision-making process. Organizations are competitive in the long term when they can effectively capture, retain and transfer knowledge across projects (Xu et al., 2024). In the same way, the work by (Teymour Zadeh & Nakazawa,

2025) points out that the value of data-driven transformation is lost when the data stays locked in within operational units. The interview in this research clearly shows this issue, with participant's multiple times describing the use of data generated by BIM for the purposes of design coordination, clash detection and scheduling at the project-level, while the data is rarely shared within the organization for broader learning.

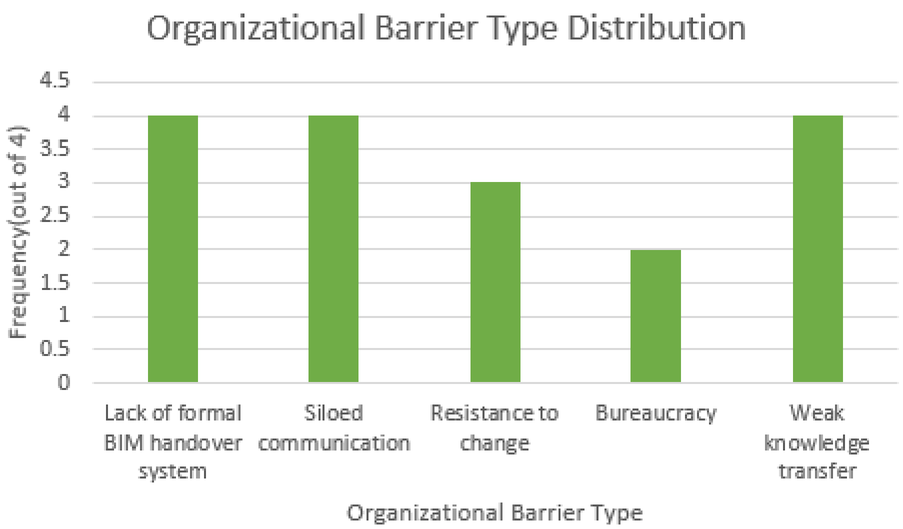

Figure 6. Organizational barriers to BIM adoption in project portfolio management identified from interview findings.

One theme that emerged from the participants was that BIM information is not formally shared or aggregated across projects or generally shared with any high-level purpose. It is typically kept in project folders, cloud-based platforms or software-specific databases. This validates the existence of a classic knowledge silo issue: in which valuable operational knowledge is produced but not transferred between organizations. The best that can be said is that all those things that were learned from the previous projects, such as cost performance, constructability issues, scheduling accuracy or reduction in material waste, are not systematically considered in the next project in the portfolio. This means that organizations are regularly losing out on the use of their past BIM knowledge for project selection, prioritization of resources and strategic project planning.

This silo mentality is indicative of a general feeling of organizational dismemberment. BIM specialists and technical teams are more likely to be working in a project delivery setting, whereas portfolio managers and executives are working at a strategic level and don't have access to detailed BIM information. The same goes for the BIM specialist, who said that portfolio managers do not commonly participate in BIM activities, which reflects a structural division between the operations and the strategy. This disconnection promotes the idea of organizational decoupling, where formal digital systems could be in place, but functional integration among departments is still weak. That is, organizations can spend a significant number of resources on implementing BIM within their operations but not link these to governance that can affect strategic decision making on portfolio selection.

Organizational decoupling holds special importance because it implies that the problem is not lack of BIM capability, but lack of institutional processes to connect BIM technical products with institutional goals. Although BIM teams can create rich and valuable data, if there are no cross-functional forums, common key performance indicators (KPIs) or formal handover systems, that data will stay operationally siloed. This study builds on previous BIM research that demonstrated that BIM under-use is not entirely the fault of software or technical issues, but also organizationally.

The interviews also identified a lack of a common language between BIM, and the portfolio managers adds to this divide. Your technical teams will be solely concerned with the accuracy of your models, coordination and project implementation, whereas your strategic managers will be concerned with your investment decisions, business cases and optimizing your portfolio. These groups have different priorities and frameworks because there are no systems or training that convert BIM outputs into metrics. This has a negative impact on the effectiveness of communication and diminishes BIM's strategic potential.

Another key organizational obstacle found in the interviews was resistance to change. Senior professionals were referred to as more likely to embrace traditional approaches, suspecting the need of new digital approaches when existing approaches have been the success they've known in the past. This was in line with Status Quo Bias theory (Klein et al., 2022) which stated that individuals and institutions tend to favour familiar systems rather than an alternative even though the alternative system might be superior, primarily because of some feelings of uncertainty, effort or disruption. In the BIM adoption sense resistance is not only technological hesitation, but it's a behavioural tendency that originates from organizational culture.

But this study provides much depth to the theory of Status Quo Bias, revealing resistance is not one-size-fits-all. Participants indicated a progressive loss of this resistance, as the industry is changing, more people are being exposed to digital tools and as generations change. There seems to be a willingness to take up BIM and other innovations among younger engineers and digitally trained professionals, suggesting that over time, as digital literacy spreads, the resistance to BIM might be less. This indicates that resistance is a challenge, but as a first step it is becoming more of a transition challenge.

Overall, the results show that organizational barriers have a very strong link with knowledge management problems, organization silo mentality and cultural resistance. The study strengthens the opinion that it is not just about the technological implementation but also the organizational redesign and the introduction of a greater knowledge transfer, integration and adaptive culture. If such internal structural challenges are not tackled, BIM is only going to be strategically underutilized but continue to be useful as an operational tool.

5.3 Managerial Barriers and Strategic Misalignment

Another key finding of this research is that leadership has limited influence on the adoption of BIM in the higher level of decision making: the portfolio level, which shows that there is a substantial managerial hurdle that goes beyond technical competence that needs to be addressed. This result is very consistent with the literature on Project Portfolio Management (PPM) as discussed by (Al-Shamayleh et al., 2025), which agreed that proper governance of PPM is based on a systematic, data-driven assessment of projects using relevant strategic project criteria, including resource allocation, risk, value creation, and organizational strategic goals. There is potential in theory that BIM can help to support that governance by providing a wealth of information about cost, time, sustainability, constructability and lifecycle performance. But the empirical results indicate that this potential is not fully implemented in practice.

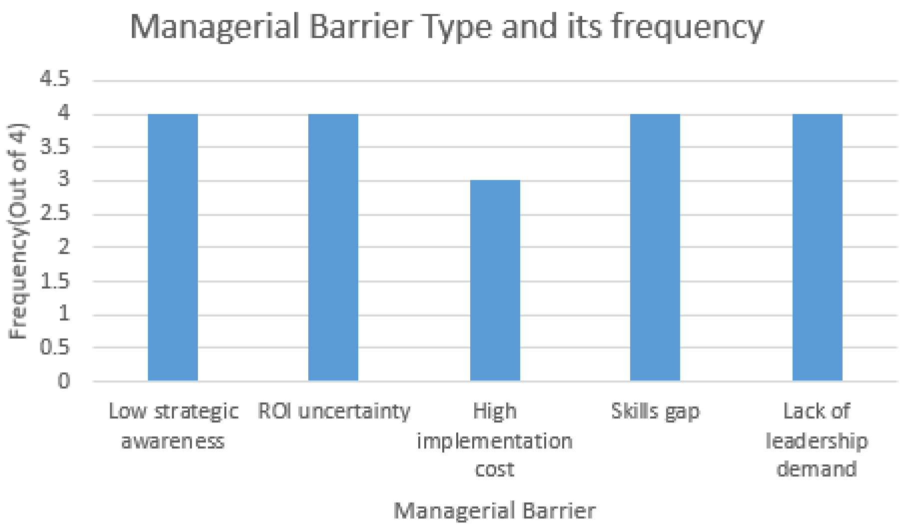

Figure 7. Managerial barriers to BIM adoption in project portfolio management identified from interview findings.

Throughout the interviews, BIM was reported as a tool that is mainly utilized for design coordination, clash detection, technical communication and project execution. These functions are of operational value but are just a part of BIM's wider strategic possibilities. Again, participants highlighted that leadership seldom ask questions relating to how BIM data can help them make higher-level decisions in the project portfolio, including decisions on which project to go for, how to maximize the long-term investment strategy, or how to analyses projects for sustainability and/or financial criteria. This means that BIM is perceived as an engineering or design tool and not as a strategic management tool.

This gap in the strategy of governance is apparent. A governance gap is when digital systems are technically put in place but not formalized as part of an organization's decision-making processes. This study found that although BIM systems are present and sometimes very powerful, the information they generate is not communicated to the top-level management in a form they can use for strategic purposes, i.e. decision support metrics. For instance, BIM could be funded with licenses, software updates and training, but without having agreed upon portfolio-level BIM indicators (such as lifecycle cost, carbon impact, resource efficiency etc.) BIM could be a standalone tool without any relation to strategic governance.

This discovery builds on the current PPM theory by proposing that the more data that is available in the system, the more valuable the PPM system is, but only when it is led and strategically utilized in the system. That is, the issue is not that there's a lack of BIM data, but that there's a lack of managerial structures that enable BIM information to become BIM intelligence for governance. This fits in with the study of strategic management that organizational tools can be used to create competitive advantage only when backed by the strategic intent (Liu et al., 2023).

Moreover, this research emphasizes conceptual deficiency in leadership and the managerial barriers are in close connection with this. Leaders might recognize how vital BIM is to the operation of their business, but not its potential to improve the selection of their portfolios, strategic forecasts and enterprise-wide learning. Consequently, BIM use is still not widespread, with high level of BIM use in projects, but low level of strategic integration in the projects. This means that organizations are digitally mature, but digitally immature in terms of digital governance.

Another major managerial constraint identified was financial issues, which is a constraint that was also found in other research on technology adoption; however, the results tend to complicate the picture more than traditional technology adoption literature. As per the work (Omar & Mohd Fateh, 2023) in suggests that uncertainty and cost are two typical factors that hinder the uptake of innovations, especially in terms of the initial investment, training and infrastructure. These issues were very apparent in responses from participants, particularly as they compared the software licensing, hardware upgrade and implementation costs for smaller organizations. This study indicates, however, that financial constraints are not just about price but the concept of value that organizations have.

Participants stated that the project level benefits of BIM – such as reduced rework, fewer clashes and better scheduling – are relatively known, whereas ROI in the portfolio level is seldom considered or calculated. This is an important difference to make. BIM is not thought of as a portfolio decision support system, so organizations do not typically assess whether BIM can help them improve the strategic project selection, portfolio balancing and long-term capital efficiency. As a result of this, there is a lack of strategic returns in conventional investment logic.

This makes it clear that the financial barriers are not only economic but cognitive and managerial as well. Lack of a portfolio level ROI analysis is a lack of thinking of BIM as an investment and not a cost. If executives don't make this mental leap, they might still consider the costs of BIM as part of their day-to-day running costs rather than as an asset for more effective strategic governance.

Overall, the results show that there is a strategic misalignment between the digital capability and the governance of the organization that provides the basis for managerial barriers. The lack of BIM in PPM is not just about technology or funding, it is about the lack of leadership vision, governance and strategic frameworks that help put BIM in the competencies and portfolios toolbox to deliver competitive and portfolio intelligence (Del Savio et al., 2022). To maximize BIM's benefits, organizations need to go beyond implementing BIM to the strategic institutionalization of BIM, in which leaders put BIM metrics into good use when managing their portfolios and making investment decisions, and in long-range strategic planning.

5.4 BIM and Decision-Making Quality

The results of this study indicate that portfolio decision-making in many organisations is still largely based on the managers' experience, intuition and simplistic management solutions rather than on intelligence gained from data. This is a very similar to Simon's (1957) notion of "bounded rationality," the idea that people making decisions, face limitations in both information they have and the systems they use, as well as limited analytical ability (Giarlotta & Petralia, 2024). Managers do not make decisions that are totally rational and based on all the evidence available, but on the information, they have and then make the best decision (Vittori et al., 2025). Although in the context of BIM and Project Portfolio Management (PPM), the study shows that this is not due to the lack of data but to the lack of integration of BIM generated data into the decision-making systems.

The need to continue using Excel sheets, traditional reporting forms and personal judgment in decision making about portfolios were mentioned repeatedly. Although familiar and readily available, these tools are limited in depth, dynamic analytics and predictive capacity which BIM data may have to offer. This means that there is a big gap between the data produced by operations and that required for strategic decision-making. While BIM systems can deliver detailed information about design performance, resource use, scheduling efficiency, quantity of resources and their life cycle implications, these are seldom presented in a format that enables the executives to make portfolio comparisons. Not having a standardised BIM data for projects also exacerbates this problem. If there are no metrics, common frameworks, or interoperable portfolio dashboards, then organizations cannot make systematic comparisons across projects on such criteria as cost efficiency, sustainability, constructability, and/or risk exposure. This makes it difficult for managers to make a judgment for projects based on empirical facts, and they might need to make their decision based on their past experiences or assumption. This results in inconsistent decisions and lack of transparency in decision making within the organization.

Depending on subjective assessment adds to the strategic risk as the decisions can be swayed by bias, lack of memory, inconsistent assessment methods and not on objective measures of the portfolio. Particularly it reduces accountability because decisions based on intuition are harder to explain and will be less easy to measure, review and assess in hindsight. Finally, the results suggest that the inefficiency of BIM use in portfolio management greatly influences the quality of decisions made, keeping the bounded rationality conditions. If BIM is going to help improve strategic decision making, then there needs to be a link between creation of the data and its use by the executive through standardisation, analytics and integration with governance.

5.5 Strategic Value and Organizational Learning

One of the key implications of the results is the potential for organizational learning that is lost because of the lack of systematic use of BIM information from past projects. The information generated during a BIM process is massive and is often the same project-specific information as found in traditional design, resource consumption, scheduling and operational data, but this information is seldom transferred to a wider organizational system where it can be of strategic value to the next project. This means that important lessons learned are only captured at project level and are not used to support the development of useful feedback loops to enhance subsequent portfolio decisions. This finding directly challenges as per the findings in the work (Wijayarathne et al., 2024) “dynamic capabilities theory” which states that sustainable competitive advantage is gained through the integration, development, and reorganization of internal and external competencies in response to a changing environment. Learning from experience, adapting systems and knowledge in a strategic way are key elements of dynamic capabilities. Without structured BIM data reuse, organizations aren't utilizing the BIM data from previous projects to maximize strategic adaptability in their BIM and PPM projects.

In addition, participants noted the lack of a means to compare sustainability indicators, resource efficiency, or outcomes of various projects across projects, which negatively impact strategic alignment. Without data common across projects, it is difficult to see whether projects are an effective instrument for achieving wider goals like reducing carbon or optimizing costs or minimizing risks. This restricts the ability of BIM technologies to contribute to strategic governance and organizational future.

As a result, BIM is mostly used for operational tasks like design coordination and project delivery but not used as a tool for organizational learning and optimizing portfolios. This is limiting BIM's ability to contribute to competitive advantage, since organizations are making the same mistakes, are missing out on lessons learnt, and are making decisions based on less-than-optimal information about the project's intelligence. BIM has the potential to deliver its benefits; it is important to realize that this does not stop with the mere use of BIM as a project tool but is truly realized when it becomes a learning infrastructure to adapt, improve and strategically build resilience.

5.6 Integrated Barrier Framework

The synthesis of the results of the interviews and the literature review presented in this study establishes the integrated three-layer barrier framework to explain why BIM data is not currently being leveraged in Project Portfolio Management (PPM) for strategic decision-making. The framework offers a broader perspective of the use of BIM, showing that barriers are not just technical issues but also relate to technical, organizational and managerial dimensions.

On the technical side, challenges include barriers to interoperability, mismatch between software ecosystems, mismatches in data standards, and scalability problems. Issues with the seamless integration of BIM output into infrastructure and building systems were discussed, especially when dealing with several file formats like IFC, LandXML or proprietary software environments. This will make it harder to compare data and make it more difficult to convert project-level BIM information to "Portfolio-level intelligence".

Organizational barriers arise from teams that operate in isolation, inadequate data governance frameworks, lack of formal handover processes and reluctance to change procedures. BIM professionals, project teams, and project managers are often working in silos. Consequently, BIM information is created but not transferred or standardized, not reused strategically. Organizational structures thus serve as filters, capturing BIM knowledge in project objects (Bringas, 2026). Barriers at the managerial level are more strategic: lack of awareness of executive management, lack of return on investment (ROI) and lack of strategic skills. The technical and business benefits of BIM are often recognized by the leadership but not connected with the other business or portfolio governance goals, including prioritization, sustainability analysis or strategic resource allocation (Brazauskas et al., 2021). Significantly, these 3 layers are mutually dependent. When data doesn't flow well, technical issues can exacerbate organizational silos; similarly, when management issues, they create a disincentive to address technical and organizational gaps. The integrated framework implies that instead of a single thing like software upgrades, multiple parts need to be addressed to achieve success with BIM-PPM implementation.

5.7 Implications for Theory and Practice

The results of this study have significant implications for academic research and industry practice as it shows that BIM barriers in PPM are not only technical barriers. Interoperability, software capability and technical implementation have been identified as the key challenges in the adoption of BIM in the existing literature. The results of this research, however, also show that the technical problems are just one part of a much larger systemic problem. A lack of organizational cohesion, governance issues, organizational leadership, and limited strategic awareness all contribute to stalling the transformation of BIM data into a resource to support portfolio-level decision making. This builds upon the

BIM and PPM scholarship by capturing the use of BIM as a cross-level governance issue, not solely a software issue.

Theoretically, the paper contributes as it connects the barriers to the adoption of BIM in the construction industry with concepts like bounded rationality, dynamic capabilities and organizational learning, which goes beyond construction technology to strategic management. The results indicate that it is time for organizations to shift their perspective of BIM away from a design coordination or clash-detection tool to practice. Rather, BIM must be transformed to become a system of decision intelligence, which can provide information for project selection, sustainability analysis, lifecycle forecasting and strategic resource allocation on portfolios (Fang et al., 2025). To make this transition, a paradigm shifts in governance, cross-functional collaboration and leadership commitment are essential.

5.8 Summary

This chapter has shown that while there are some technical issues identified with BIM in Project Portfolio Management (PPM), the root cause is more structural, organizational, and managerial mismatches. Although BIM systems can provide vast amounts of project intelligence, they lack strategic value due to poor interoperability practices, fragmented data governance, siloes organizational culture and lack of leadership vision. The discussion revealed that BIM is still largely adopted for operational design functions, as organizations don't have processes, strategic frameworks, and managerial capabilities to transform project-level data into a decision intelligence of the entire portfolio. The challenge is less that of the improvement of BIM software tools and more about the awareness and learning systems of executives, the governance frameworks, and the systems of learning that enable BIM to become a strategic resource for long-term portfolio planning and competitive advantage.

6 Conclusions

This chapter gives the conclusion of the study by summarizing the key findings obtained from the analysis and discussion of barriers related to the adoption of BIM data in Project Portfolio Management (PPM) for decision making. It briefly reviews the research's main technical, organizational, and managerial problems, provides a research answer to the primary research question and emphasizes the theoretical and practical value of the study. Furthermore, this chapter proposes some recommendations for industry stakeholders, recognizes the scope of the research, and suggests some future research paths to further develop the field of integrating BIM in the strategic level of portfolio governance.

6.1 Summary of Key Findings

This study explored the challenges to using Building Information Modeling (BIM) data in Project Portfolio Management (PPM) for strategic decision making. Following an analysis of the four interviews with industry experts from BIM, project management and leadership roles, three broad categories of interconnected barriers have emerged that can all be summed up as contributing to the lack of BIM transitioning from a project-level operational tool to a portfolio-level strategic asset.

6.1.1 Technical Barriers

According to the study, there is still a significant challenge due to technical limitations in the integration of BIM-PPM. Some of the most important challenges were the interoperability issues with BIM software and with other project and portfolio software that are already in use, especially when combining a BIM software with other software ecosystems like IFC, LandXML, Tekla and other proprietary software. In addition, the lack of standard data structures in the different projects limited the level of comparability, and the integration of multi-software posed problems for the exchange of data. While a lot of data is produced during a BIM project, there is a challenge for organisations to extract and combine the data into a higher level of intelligence for strategic purposes at a portfolio level as well.

6.1.2 Organizational Barriers

The research also identified that many organizations do not have an established knowledge transfer process that can be adopted to transfer the BIM work completed for a project to the portfolio governance process. BIM data tends to stay within project teams, leading to silo mentality for communication on technical and strategic level. But both resistances to change, particularly from the more established professionals who are used to more traditional workflows, and the fear of losing out on jobs, continues to hamper the digital transformation. Furthermore, the lack of strong knowledge transfer systems only allows lessons learned to be used in a sporadic way in future projects.

6.1.3 Managerial Barriers

There was a lack of a general approach by managers to the full potential of BIM in the broader strategic context. Often, senior decision makers only see BIM as a design coordination tool, not as a system for managing a portfolio of designs. High up-front investment costs and lack of clarity about the ROI for the portfolio level further slow adoption momentum. Finally, there is a great lack of skills; most BIM training is in relation to the technical aspects of execution, not strategic aspects.

All these obstacles limit BIM's ability to be embedded in the overall decision making and governance process.

6.2 Answer to Research Question

Main Research Question: What are the key barriers hindering the adoption of BIM data in Project Portfolio Management (PPM) for decision-making?

Answer:

The study shows that the use of Building Information Modeling (BIM) in a Project Portfolio Management (PPM) is limited due to intertwined technical, organizational and managerial challenges. Technology-wise, many problems with interoperability arise as well, such as different software ecosystems, and non-standardized data structures, making BIM data transfer between projects and portfolio systems difficult. The lack of organization and weak or non-existent data transfer mechanisms, as well as silo mentality between BIM specialists and strategic managers, severely hinder valuable project intelligence from flowing. Limited management understanding of BIM's strategic potential, uncertainty about financial investment and difficult to answer questions about the ROI at the portfolio level, and a shortage of strategic skills further hinder the use of BIM as a decision support tool at the management level. It is important to note that these barriers are not mutually exclusive and serve to reinforce each other on a few organizational layers. Therefore, BIM underutilization in PPM must be considered as more than a technological problem, but also as a system of governance problem.

6.3 Theoretical Contributions

This study adds to the knowledge on the following three points. Firstly, it builds on BIM–PPM integration theory by showing that the lack of full integration of BIM for portfolio-level decision-making is not so much a technical issue but rather is a result of a more fundamental mismatch between the organization and strategy. This moves away from the focus on technology-based explanations to governance and managerial practice. Second, it creates a taxonomical framework of barriers which reflects the challenges on a structured level, with a technical, an organizational and a managerial dimension, with a view to the future, in which research and practical assessment can be carried out. Third, it suggests a model of the impact of the underutilization of BIM data on the quality of decisions made in the BIM portfolio, the lack of evidence-based decision making and loss of strategic value. These contributions collectively provide a better understanding of the factors behind lack of effective integration of BIM in PPM environments.

6.4 Practical Implications

The study offers a number of important recommendations to improve the integration of BIM in Project Portfolio Management (PPM).

For Leadership

1. Understand BIM as a strategic portfolio decision tool and not limited to a design tool.
2. Use BIM metrics to inform project selection and approval process.

For Portfolio Managers

1. Establish common guidelines for BIM data transfer from the project to the project portfolio level
2. Create a centralized BIM data repository for consistent access and re-use of BIM data

For BIM Managers

1. Develop dashboards that help understand detailed BIM information into decision-making KPIs
2. Implement and refine BIM techniques and technology to achieve organizational goals

For Industry

1. Increase the interoperability standards among BIM platforms and systems.
2. Encourage cross-function training to build cross-functional working relationships between technical and managerial positions.

These steps will all contribute to the better data-driven portfolio decision-making, and better strategic value of BIM.

6.5 Limitations of the Study

The present study has a few limitations that need to be noted when interpreting the results of this study. First, the number of subjects was relatively small (only four) and this reduced the extent to which the results could be generalised. Secondly, the geographical scope was limited to Finland and Nepal, which may not be representative of other geographic areas and other more diverse construction markets. Third, little attention was paid to the presence of senior (portfolio level) decisionmakers, which might have limited their capacity to provide greater depth to governance related views. Lastly, the study used questionnaires for the answers to the questions, this was not as detailed as live interviews. Although there are some restrictions, the study provides interesting qualitative information to the challenges in the integration of BIM–PPM.

6.6 Future Research Directions

Further studies are needed in several important areas to build on the results of this study. First, the identified BIM–PPM barriers need to be validated and generalized in larger scales in the industry environment. Second, researchers need to create structured BIM based portfolio decision frameworks to make it possible to implement in practice in organizations. Third, use of artificial intelligence (AI) and machine learning (ML) with BIM should be considered to further increase predictive decision-support capabilities. Fourth, longitudinal studies are needed to obtain the long-term return on investment (ROI) of BIM in BIM portfolio management. Finally, comparisons between industries and countries would help to gain general knowledge about industry and country-specific variations and adoption.

References

Aamri, A. M. S. Al, Evdorides, H., & Baniotopoulos, C. (2025). *Barriers and opportunities for the adoption of building information modelling in the design of buildings: Case study of Oman*. https://doi.org/10.3390/su17083510

Alghuried, A. (2023). Measuring the benefits and barriers of the mplementation of BIM in sustainable practice in the construction industry of Saudi Arabia. *Mdpi*. https://doi.org/10.3390/su151914323

Agwa, T. C., & Celik, T. (2025). From barriers to breakthroughs: A deep dive into BIM integration challenges. *Buildings*, *15*(7), 1116. https://doi.org/10.3390/buildings15071116

Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health*, *2*, 100051. https://doi.org/10.1016/j.glmedi.2024.100051

Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., M. Ameen, B. M., & Khdhir, R. M. (2025). Using thematic analysis in qualitative research. *Journal of Medicine, Surgery, and Public Health*, *6*, 100198. https://doi.org/10.1016/j.glmedi.2025.100198

Ahmed, S. (2018). Barriers to implementation of building information modeling (BIM) to the construction industry: A critical review. *Journal of Civil Engineering and Construction*, *7*(2), 107–113. https://doi.org/10.32732/jcec.2018.7.2.107

Ajayi, T. O., Daramola, O. T., & Adhuze, O. O. (2024). Cost management evolution in building projects: A review of innovations and challenges. *International Journal of Research and Innovation in Applied Science*, *IX*(IX), 80–95. https://doi.org/10.51584/IJRIAS.2024.909009

Al-Ashmori, Y. Y., Othman, I., Al-Aidrous, A.-H. M. H., Alashwal, A., Ibrahim, M., & Kineber, A. F. (2026). Identifying and assessing BIM implementation challenges and success factors in sustainable building projects among Malaysian SMEs. *Scientific Reports*, *16*(1), 9177. https://doi.org/10.1038/s41598-026-39021-5

Alam, F., Ali, J., Hamid, S., Madni, H., & Husnain, H. A. (2023). Identifying barriers to effective BIM adoption in the re-engineering of construction business practices in developing countries. *Preprints 2023, 2023051378*, *May*, 1–29. https://doi.org/10.20944/preprints202305.1378.v1

Al-Shamayleh, A., Zakaria, S., & Rahim, N. (2025). BIM in PPP projects comprehensive performance evaluation framework: A literature-based analysis. *Sigma Journal of Engineering and Natural Sciences*, *43*(3), 705–713. https://doi.org/10.14744/sigma.2025.00065

Alshibani, A., Aldossary, M. S., Hassanain, M. A., Hamida, H., Aldabbagh, H., & Ouis, D. (2024). Investigation of the driving power of the barriers affecting BIM adoption in construction management through ISM. *Results in Engineering*, *24*, 102987. https://doi.org/10.1016/j.rineng.2024.102987

Andersson, R., & Eidenskog, M. (2023). Beyond barriers – exploring resistance towards BIM through a knowledge infrastructure framework. *Construction Management and Economics*, *41*(11–12), 926–941. https://doi.org/10.1080/01446193.2023.2218498

Aproplan. (2025). *Building information modeling (BIM)* [Image]. https://www.aproplan.com/blog/bim-software-guide

Baker, J. (2012). *The Technology–Organization–Environment Framework* (pp. 231–245). https://doi.org/10.1007/978-1-4419-6108-2_12

Biswas, H. K., Sim, T. Y., & Lau, S. L. (2024). Impact of building information modelling and advanced technologies in the AEC industry: A contemporary review and future directions. *Journal of Building Engineering*, *82*, 108165. https://doi.org/10.1016/j.jobe.2023.108165

Brazauskas, J., Verma, R., Safronov, V., Danish, M., Merino, J., Xie, X., Lewis, I., & Mortier, R. (2021). Data management for building information modelling in a real-time adaptive city platform. *Arxiv*. https://arxiv.org/abs/2103.04924

Bringas, E. N. (2026). Leveraging knowledge graphs in facilities management: A scoping review. *Journal of Building Design and Environment, 4*(2), Article 2025120. https://doi.org/10.70401/jbde.2026.0033

Burgess, M., Wilson, C., & Fan, Y. V. (2026). Adoption drivers and barriers of building information modelling (BIM) in Europe. *Energy and Buildings, 355*, 116953. https://doi.org/10.1016/j.enbuild.2026.116953

Cavka, H., Staub-French, S., & Pottinger, R. (2015). Evaluating the alignment of organizational and project contexts for BIM adoption: A case study of a large owner organization. *Buildings*, *5*(4), 1265–1300. https://doi.org/10.3390/buildings5041265

Chatsuwan, M., Ichinose, M., & Alkhalaf, H. (2025). Enhancing facility management with a BIM and IOT integration tool and framework in an open standard environment. *Buildings*, *15*(11), 1928. https://doi.org/10.3390/buildings15111928

Cleland, J., Driessen, E., Masters, K., Lingard, L., & Maggio, L. A. (2026). When and how to disclose AI use in academic publishing: AMEE Guide No.192. *Medical Teacher*, *48*(4), 542–553. https://doi.org/10.1080/0142159X.2025.2607513

Datta, S. D., Tayeh, B. A., Hakeem, I. Y., & Abu Aisheh, Y. I. (2023). Benefits and barriers of implementing building information modeling techniques for sustainable practices in the construction industry: A comprehensive review. *Sustainability*, *15*(16), 12466. https://doi.org/10.3390/su151612466

Del Savio, A. A., Vidal Quincot, J. F., Bazán Montalto, A. D., Rischmoller Delgado, L. A., & Fischer, M. (2022). Virtual design and construction (VDC) framework: A current review, update and discussion. *Applied Sciences, 12*(23), 12178. https://doi.org/10.3390/app122312178

Dempsey, M., Brennan, A., Holzberger, A., & McAvoy, J. (2022). A review of the most significant challenges impacting conventional project management success. *IEEE Engineering Management Review*, *50*(3), 193–199. https://doi.org/10.1109/EMR.2022.3187168

Erzaij, K. R., Hatem, W. A., & Maula, B. H. (2020). Applying intelligent portfolio management to the evaluation of stalled construction projects. *Open Engineering*, *10*(1), 552–562. https://doi.org/10.1515/eng-2020-0064

Faisal Shehzad, H. M., Binti Ibrahim, R., Yusof, A. F., Mohamed khaidzir, K. A., Shawkat, S., & Ahmad, S. (2022). Recent developments of BIM adoption based on categorization, identification and factors: a systematic literature review. *International Journal of Construction Management*, *22*(15), 3001–3013. https://doi.org/10.1080/15623599.2020.1837719

Fang, Z., Teng, X., Shen, Z., Yang, D., & Lin, X. (2025). Standardizing design-stage digital-twin assets in a smart home for building data management: Workflow design and validation based on IfcGUID compliance. *Buildings, 15*(22), 4096. https://doi.org/10.3390/buildings15224096

Franz, B., & Messner, J. (2019). Evaluating the impact of building information modeling on project performance. *Journal of Computing in Civil Engineering*, *33*(3). https://doi.org/10.1061/(ASCE)CP.1943-5487.0000832

Giel, B. K., & Issa, R. R. A. (2013). Return on investment analysis of using building information modeling in construction. *Journal of Computing in Civil Engineering*, *27*(5), 511–521. https://doi.org/10.1061/(ASCE)CP.1943-5487.0000164

Giarlotta, A., & Petralia, A. (2024). Simon's bounded rationality. *Decisions in Economics and Finance*, *47*(1), 327–346. https://doi.org/10.1007/s10203-024-00436-2

Green, C. A., Duan, N., Gibbons, R. D., Hoagwood, K. E., Palinkas, L. A., & Wisdom, J. P. (2015). Approaches to mixed methods dissemination and implementation research: Methods, strengths, caveats, and opportunities. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*(5), 508–523. https://doi.org/10.1007/s10488-014-0552-6

Haan, M., & Venema, S. D. (2025). Using a blended approach to thematic analysis: A case study on fatherhood and imprisonment. *Public Opinion Quarterly*, *89*(SI), 716–733. https://doi.org/10.1093/poq/nfaf033

Hatem, W. A., Abd, A. M., & Abbas, N. N. (2018). Barriers of adoption building information modeling (BIM) in construction projects of Iraq. *Engineering Journal*, *22*(2), 59–81. https://doi.org/10.4186/ej.2018.22.2.59

Işıkdağ, Ü., Aydın, Y., Bekdaş, G., & Underwood, J. (2025). Factors influencing perceived ease of use and usefulness of BIM tools. *Buildings*, *16*(1), 106. https://doi.org/10.3390/buildings16010106

Jalo, H., & Pirkkalainen, H. (2024). Effect of user resistance on the organizational adoption of extended reality technologies: A mixed methods study. *International Journal of Information Management*, *75*, 102731. https://doi.org/10.1016/j.ijinfomgt.2023.102731

Jin, S. (2024). Integrating BIM to enhance stakeholder collaboration and economic efficiency in architecture and construction projects. *E3S Web of Conferences, 565*, 03014. https://doi.org/10.1051/e3sconf/202456503014

Jing, W., & Alias, A. H. (2024). Key factors for building information modelling implementation in the context of environmental, social, and governance and sustainable development goals integration: A systematic literature review. *Sustainability, 16*(21), 9504. https://www.mdpi.com/2071-1050/16/21/9504

Karim, I. (2018). *Influence of Implementing BIM in a construction project on Building lifecycle management.* 1–107. https://www.theseus.fi/bitstream/handle/10024/267799/BIM-Building information modeling-Mater Thesis-Imtiaz Karim.pdf?sequence=2

Khattra, S. K., & Jain, R. (2024). Building information modeling: A comprehensive overview of concepts and applications. *Advances in Research*, *25*(5), 140–149. https://doi.org/10.9734/air/2024/v25i51145

Kineber, A. F. (2023). Challenges to the implementation of building information modeling (BIM) for sustainable construction projects. *ResearchGate*. https://www.researchgate.net/publication/369067083_Challenges_to_the_Implementation_of_Building_Information_Modeling_BIM_for_Sustainable_Construction_Projects

Klein, H. C., Stelter, A., Oschinsky, F. M., & Niehaves, B. (2022). A status quo bias perspective on user resistance in building information modeling adoption – Towards a taxonomy. *Computers in Industry*, *143*, 103760. https://doi.org/10.1016/j.compind.2022.103760

Lim, W. M. (2025). Sample size in qualitative research: Moving from data saturation to theoretical saturation. *Journal of Global Marketing*, 1–11.

McGrath, C., Palmgren, P. J., & Liljedahl, M. (2026). When I say … informed consent. *Medical Education*, *60*(2), 104–105. https://doi.org/10.1111/medu.70008

Memon, M. A., Thurasamy, R., Ting, H., & Cheah, J. H. (2025). Purposive sampling: A review and guidelines for quantitative research. *Journal of Applied Structural Equation Modeling*, *9*(1), 1–23. https://doi.org/10.47263/JASEM.9(1)01

Michelen, M., Phan, M., Zimmer, A., Coury, N., Morey, B., Montiel Hernandez, G., Cantero, P., Zarate, S., Foo, M. A., Tanjasiri, S., Billimek, J., & LeBrón, A. M. W. (2024). Practical qualitative data analysis for public health research: A guide to a team-based approach with flexible coding. *International Journal of Qualitative Methods*, *23*. https://doi.org/10.1177/16094069241289279

Mishra, A., Hasan, A., & Jha, K. N. (2024). A holistic evaluation of bim implementation barriers in the Indian construction industry: Pre- and post-adoption perspectives. *International Journal of Construction Education and Research*, *20*(3), 358–380. https://doi.org/10.1080/15578771.2024.2320108

Noble, H., & Smith, J. (2025). Ensuring validity and reliability in qualitative research. *Evidence Based Nursing*, *28*(4), 206–208. https://doi.org/10.1136/ebnurs-2024-104232

Ottaviani, F. M., Zenezini, G., Saba, F., De Marco, A., & Gavinelli, L. (2025). System-level critical success factors for BIM implementation in construction management: An AHP approach. *Systems*, *13*(2), 94. https://doi.org/10.3390/systems13020094

Ozorhon, B., & Karahan, U. (2017). Critical success factors of building information modeling implementation. *Journal of Management in Engineering*, *33*(3). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000505

Qin, X., Shi, Y., Lyu, K., & Mo, Y. (2020). Using a TAM-TOE model to explore factors of building information modelling (BIM) adoption in the construction industry. *Journal of Civil Engineering and Management, 26*(3), 259–277. https://doi.org/10.3846/jcem.2020.12176

Radzi, A. R., Azmi, N. F., Kamaruzzaman, S. N., Algahtany, M., & Rahman, R. A. (2025).

Challenges in construction readiness for BIM-based building projects. *Journal of Asian Architecture and Building Engineering*, *24*(3), 1689–1704. https://doi.org/10.1080/13467581.2024.2343803

Raza, M. S., Tayeh, B. A., Abu Aisheh, Y. I., & Maglad, A. M. (2023). Potential features of building information modeling (BIM) for application of project management knowledge areas in the construction industry. *Heliyon*, *9*(9), e19697. https://doi.org/10.1016/j.heliyon.2023.e19697

Saghafian, M., Laumann, K., & Skogstad, M. R. (2021). Stagewise overview of issues influencing organizational technology adoption and use. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.630145

Sahin, I. (2006). Detailed review of Rogers' diffusion of innovations theory and educational technology-related studies based on Rogers' theory. *Researchgate*. https://www.researchgate.net/publication/284675572_Detailed_review_of_Rogers%27_diffusion_of_innovations_theory_and_educational_technology-related_studies_based_on_Rogers%27_theory

Sajjad, M., Hu, A., Radu, D., Waqar, A., Almujibah, H. R., & Mateen, A. (2024). BIM implementation in project management practices for sustainable development: Partial least square approach. *Ain Shams Engineering Journal*, *15*(11), 103048. https://doi.org/10.1016/j.asej.2024.103048

Schorr, A. (2023). The technology acceptance model (TAM) and its importance for digitalization research: A review. In *International Symposium on Technikpsychologie (TecPsy) 2023* (pp. 55–65). Sciendo. https://doi.org/10.2478/9788366675896-005

Semaan, J., Underwood, J., & Hyde, J. (2021). An investigation of work-based education and training needs for effective BIM adoption and implementation: An organisational upskilling model. *Applied Sciences*, *11*(18), 8646. https://doi.org/10.3390/app11188646

Shehab, A., & Abdelalim, A. M. (2023). Utilization BIM for integrating cost estimation and cost control in construction projects. *Researchgate*. https://www.researchgate.net/publication/370682454_Utilization_BIM_For_

Integrating_Cost_Estimation_And_Cost_Control_In_Construction_Projects

Sriyolja, Z., Harwin, N., & Yahya, K. (2021). Barriers to implement building information modeling (bim) in construction industry: A critical review. *IOP Conference Series: Earth and Environmental Science*, *738*(1), 012021. https://doi.org/10.1088/1755-1315/738/1/012021

Strategic Management Insight. (2025). *Diffusion of innovation theory* [Image]. https://strategicmanagementinsight.com/tools/diffusion-of-innovation-theory/

Suvvari, S. K. (2023). Project portfolio management: Best practices for strategic alignment. *International Journal of Professional Business Review*, *8*(12), e04987. https://doi.org/10.26668/businessreview/2023.v8i12.4987

Tahir, S. (2024). Using Semi-structured Interviews in Qualitative Research: A Case of the maintenance of social order in the linguistic landscape of Islamabad, Pakistan. *Qlantic Journal of Social Sciences and Humanities*, *5*(4), 158–168. https://doi.org/10.55737/qjssh.v-iv(CP).24139

Tang, L., Bew, M., Lee, Y. S., & Wen, Y. (2019). ISO 19650 – An international approach to the journey of industry integration, digitalization, and innovation. *Researchgate*. https://www.researchgate.net/publication/390107011_ISO_19650_-_An_International_Approach_to_the_Journey_of_Industry_Integration_Digitalization_and_Innovation

Trundle, C., Araújo, N., Khan, S., & Phillips, T. (2025). Beyond the mirror: Challenging the common assumptions of reflexivity in qualitative research. *International Journal of Qualitative Methods*, *24*. https://doi.org/10.1177/16094069251369311

Turk, Ž. (2020). Interoperability in construction – Mission impossible? *Developments in the Built Environment*, *4*, 100018. https://doi.org/10.1016/j.dibe.2020.100018

Valentin, V., Naderpajouh, N., & Abraham, D. (2018). Impact of characteristics of infrastructure projects on public opinion. *Journal of Management in*

Engineering, *34*(1). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000576

Van Tam, N., Diep, T. N., Quoc Toan, N., & Le Dinh Quy, N. (2021). Factors affecting adoption of building information modeling in construction projects: A case of Vietnam. *Cogent Business & Management*, *8*(1). https://doi.org/10.1080/23311975.2021.1918848

Walsh, H. A., Parsons, M. V., Mozersky, J., Gupta, A., Lai, A. M., Friedrich, A. B., & DuBois, J. M. (2025). Responsible sharing of qualitative research data: Insights from a pioneering project in the United States. *International Journal of Qualitative Methods*, *24*. https://doi.org/10.1177/16094069251329607

Wang, S., Chong, H.-Y., & Zhang, W. (2024). The impact of BIM-based integration management on megaproject performance in China. *Alexandria Engineering Journal*, *94*, 34–43. https://doi.org/10.1016/j.aej.2024.03.036

Wang, T., & Chen, H.-M. (2023). Integration of building information modeling and project management in construction project life cycle. *Automation in Construction*, *150*, 104832. https://doi.org/10.1016/j.autcon.2023.104832

Wijayarathne, N., Gunawan, I., & Schultmann, F. (2024). Dynamic capabilities in digital transformation: A systematic review of their role in the construction industry. *Journal of Construction Engineering and Management*, *150*(11). https://doi.org/10.1061/JCEMD4.COENG-15055

Xu, K., Chen, Z., Xiao, F., Zhang, J., Zhang, H., & Ma, T. (2024). Semantic model-based large-scale deployment of AI-driven building management applications. *Automation in Construction*, *165*, 105579. https://doi.org/10.1016/j.autcon.2024.105579

Zierz, O. I. S., & Lordsleem Junior, A. C. (2026). Business intelligence tools in organizations with a focus on Power BI applications in civil construction: A systematic literature review. *Buildings*, *16*(4), 869. https://doi.org/10.3390/buildings16040869

Zavaleta, J. P. A. (2025). Challenges in the adoption of bim by construction professionals over 50 years of age cognitive, technical and pedagogical barriers. *Papers.Ssrn.Com*.

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5133987

Appendices

Appendix 1. Interview Questions

A. Understanding BIM in PPM

1. What is the role of Building Information Modeling (BIM) in Project Portfolio Management (PPM) in your organization?
2. What is your experience with BIM and its role in decision-making in specific projects? Please can you provide some specific examples?
3. What do you suppose would be the advantages of using BIM on managing an entire portfolio of projects as compared to managing individual projects?

B. Challenges to Adopting BIM in PPM

B1. Technical Challenges

1. What are some technical challenges that you have faced in attempting to connect BIM with organization project management tools which are already being used?
2. Is there an incompatibility or data sharing between BIM and other systems that have complicated the wider application of BIM in other projects?
3. BIM is able to generate substantial data. How would your organization deal with all that data?
4. How can BIM tools be improved or changed to be more useful in managing portfolios of the project?

B2. Organizational Challenges

1. What is the attitude of your organization to the implementation of new technologies, such as BIM? Have you experienced any resistance or difficulties with buy-in?
2. How does leadership contribute to the adoption of BIM with regard to the adoption of the system to support portfolio management?
3. Do you believe that your team possesses the appropriate skills to apply BIM to manage a portfolio? What sort of training or assistance would assist in that?

B3. Financial Challenges

1. In relation to BIM as a portfolio management tool, what is your assessment of the financial investment required? Do you sense the rewards are balanced with the expenses?
2. What are some of the financial issues that you've encountered with regard to having BIM adoption approved on various projects within the portfolio?
3. In smaller companies, would you consider the initial investment in BIM to be such a detriment to implementing it in managing a portfolio?

C. Strategic and Managerial Challenges

1. What are the obstacles that you encounter whenever attempting to apply BIM data to assist strategic decision-making in managing a portfolio?
2. Does BIM assist in aligning personal projects to the overall objectives of the organization? What is your experience of this process?
3. How can the portfolio managers integrate BIM into decision making? What are the challenges of their BIM usage in this purpose?

D. Overcoming Barriers and Recommendations

1. What are the things that you believe the organizations should do in order to successfully place BIM under their portfolio management practice?
2. Do you believe that BIM can be fully integrated in PPM in order to enhance long-term planning and decision-making?
3. In the future, do you believe there will be any new advancements or innovations in BIM that will further enhance its utility in terms of project portfolio management?