Ultimart: Visual Communication Journal
Vol 19 No. 1, June 2026
ISSN: 1979 - 0716, e-ISSN 2615-8124
Faculty of Art and Design
Universitas Multimedia Nusantara

ULTIMART

ART OF VISUALIZATION IN BUILDING CONSTRUCTION: DRAFTING AS COMMUNICATION, COORDINATION, REGULATION, AND BUDGETING

Wendy I. Hakim[1]
Anggi Rahmad Zulfikar[2]
Feriza Nadiar[3]
Fajar Indra Kusuma[4]
Desy Ratna Arthaningtyas[5]

Received Apr. 26, 2026; Revised May. 15, 2026; Accepted May. 25, 2026.

Abstract: *This study investigate the importance of drafting in AEC (architecture, engineering, and construction) industry. The article goes beyond seeing drafting as a technical task of producing drawings, but as a visual art, as it transform abstract ideas into visual construction knowledge. It is interpretive as drafting requires judgment to select, organise, and to communicate technical, legal, spatial, and financial information. At the same time, drafting is also a synthesis as it brings those four different forms of knowledge altogether to become a unity of coordinated visual medium. Construction industry becomes multifaceted and more dependent on digital tools. Thus, this study brings literatures review from several fields to look at how drafting works in four significant areas. Firstly, it helps diverse professionals communicate. Second, it solves coordination problems. Third, it shows legal compliance. Last, it also supports budgeting. While each of these areas has been studied on its own, few studies connect them all through the role of drafting. This study suggests that drafting is not merely a technical task, but also shapes how construction projects happen. Because of this, the paper argues that professionals in the AEC field need to better understand how drafting affects teamwork, legal processes, and financial planning. The model shown in this paper can be a platform for new research, policy, and training to understand the influence of graphical representations, such as drafting, on the physical construction of buildings.*

Keywords: *drafting; AEC; visual instrument; building construction*

[1]Wendy I. Hakim is a lecturer at The Faculty of Vocational Studies Universitas Negeri Surabaya (Unesa). *e-mail: wendyhakim@unesa.ac.id*

[2]Anggi Rahmad Zulfikar is a lecturer at The Faculty of Vocational Studies Universitas Negeri Surabaya (Unesa). *e-mail: anggizulfikar@unesa.ac.id*

[3]Feriza Nadiar is a lecturer at The Faculty of Vocational Studies Universitas Negeri Surabaya (Unesa). *email: ferizanadiar@unesa.ac.id*

[4]Fajar Indra Kusuma is a lecturer at The Faculty of Vocational Studies Universitas Negeri Surabaya (Unesa). *email: fajarkusuma@unesa.ac.id*

[5]Desy Ratna Arthaningtyas is a lecturer at The Faculty of Engineering Universitas Negeri Surabaya (Unesa). *email: fajarkusuma@unesa.ac.id*

Introduction

Drafting play a variety of central roles in the AEC (architecture, engineering, and construction) industry. We propose that drafting be understood as a means of visualizing ideas as well as something that shapes team communication, coordination, regulatory navigation, and budget management. As AEC work has become increasingly complex and dependent on digital information, drawings have shifted from static drawings to more integrated, systems-based practices (Succar, 2009; Becerik-Gerber & Kensek, 2010). Tools like Building Information Modeling (BIM) have essentially turned engineering drawings into a common platform linking people, decisions, and data in real time (Bryde, Broquetas, & Volm, 2013). Increasingly these drawings have been a part of nearly every key decision in the building life cycle (Eastman et al., 2008).

Visual documents really help communication between parties from different backgrounds by clarifying things and bringing teams closer together (Whyte, 2011). This is a key point especially in projects where there are a lot of changes coming from different people the architects, engineers, contractors, and regulators who all have to work together and combine their diverse points of view (Sebastian, 2011). Drafting is one of the ways that best supports communication among different groups of people and prevents the problems of misunderstanding (Porwal & Hewage, 2012). Digital tools like BIM are capable of merging the shape of a building (geometry), the information related to it (metadata), simulations of how the building will perform, and the way in which its construction will be done, all in one single model (Azhar, Khalfan, & Maqsood, 2012). Apart from that, these tools make it easier to find areas where the different building elements clash with each other; they can also do automatically checking whether the building is up to code and get the cost of the building in real-time (Sacks, Eastman, Lee, & Teicholz, 2018). Therefore, making technical drawings is not just making a piece of paper but it is actually a way of helping the design process (Cao, Li, & Wang, 2017).

Many countries have gradually started using performance-based codes. (Foliente, 2000). This means a more thorough visual demonstration of safety, environmental friendliness, and accessibilities is needed (Foliente, 2000). Besides a technical purpose, drawings have become a legal reference as well (Ding, 2008). This double function is a source of both opportunities and difficulties for those working in the construction industry. Drawings in planning and heritage conservation work like records showing where a person has come from, what a person has done, and where a person is going (Rodwell, 2003; Tiesdell, Oc, & Heath, 2012). Drawings are policy as well as design tools (Imrie & Street, 2009; Alwan, Jones, & Holgate, 2017).

The integration of cost data with design models enables accurate pricing at early project stages, thereby reducing financial risk (Monteiro & Martins, 2013). The relationship between visual data and economic outcomes constitutes a central focus of Building Information Modeling (BIM)-based project delivery (Barlish & Sullivan, 2012). As a result of these advancements, design is no longer viewed solely as a representational output; instead, it functions as a visual operating system for construction (Volk, Stengel, & Schultmann, 2014). Nevertheless, the current literature remains fragmented, frequently isolating design within discipline-specific frameworks.

This study aims to address this fragmented discussion by analyzing drafting as a fundamental visual tool across four interrelated domains: communication, coordination, regulation, and budgeting.

Each domain reflects its own drawing function. Communication refers to how drawings enable understanding among stakeholders. Coordination encompasses system integration and workflow. Regulation encompasses code compliance and legal traceability. Budgeting involves cost prediction, planning, and resource control. Current research indicates that, despite the widespread use of engineering drawings across these four domains, research tends to explore each separately. There is limited research linking these roles through an integrated framework (Love, Matthews, Simpson, Hill, & Olatunji, 2014; Hartmann, Gao, & Fischer, 2008). Consequently, the systemic value of engineering drawings in the construction process remains under-theorized.

This study addresses this gap by proposing a conceptual framework that repositions drafting as multi-scale visual infrastructures. Drafting is conceptualized here not as neutral representations, but as driving forces that organize actions, materials, policies, and finances (Latour & Yaneva, 2008; Henderson, 1999). This framework draws inspiration from visual studies, information systems, construction law, and project management literature. By combining insights from these diverse literatures, this paper offers an integrated reading of engineering drawing practices. Furthermore, this paper highlights the need for engineering drawing literacy across the AEC profession, not only for drawing production but also for understanding its implications.

Methodology

This study uses a conceptual research approach to investigate the functional role of drafting in building construction. Conceptual research is used to integrate diverse theoretical and empirical insights into a new understanding of a topic (Jabareen, 2009). This approach is particularly well-suited to contexts where practice transcends unified academic theory, as is the case with engineering drawings in the AEC industry (Meredith, 1993). The relevant literature was extracted using keywords including "drafting", "construction communication," "visual coordination," "building regulations," "cost estimating" and building information modeling (BIM).

This study use relevant source namely Elsevier, ScienceDirect, Google Scholar, Taylor & Francis Online, Wiley, ASCE Library, SpringerLink, IEEE Xplore, and MDPI. This study primarily focus on articles published from 2000 to 2024, as this timeframe apprehend the development of contemporary discussions on Building Information Modeling (BIM) and digital drafting. Some of foundational sources are between 1993 and 1998 because they offer significant conceptual grounding for project management, construction processes, and visual representation in design and engineering. Some recent sources are from 2025 supporting the discussion on current project management practices.

Thematic coding was used to extract key insights. This aligns with the method used by Thomas and Harden (2008) in their thematic synthesis of qualitative studies. The aim was to explore how engineering drawings operate across distinct but interrelated construction activities. The articles were looked into by the way they handle visual information, design artifacts, or digital models as tools for implementation. These articles describing the fields of engineering and construction featured architecture (Groat & Wang, 2013) and construction engineering (Oberlender & Trost, 2001).

In the review, a conceptual mapping approach was used to create a framework relating drafting to project outcomes. In careful work on construction innovation, this has been employed to better define

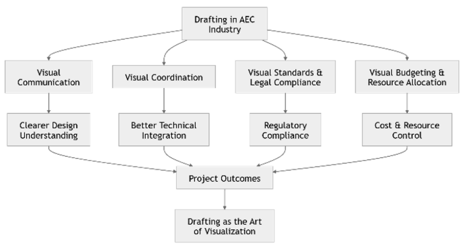

Figure 1. Conceptual Mapping of Framework Relating Drafting to Project Outcomes
(Source: Personal)

underlying relationships between layers of projects (Harty 2005; Winch 2012). This results in a framework that positions engineering drawings within four domains of communication, coordination, regulation and budgeting.

This method does not aim to generate statistical generalizations. Rather, it provides a synthesized perspective on drafting as an under-theorized yet operationally crucial practice. This study lays the groundwork for future empirical research and policy design in construction visualization, particularly in the context of digital transformation (Hartmann, Van Meerveld, Vossebeld, & Adriaanse, 2012).

Result and Discussion

1. Drafting as a Visual Communication Medium in Building Construction Industry

The role of drafting as a communication medium in the construction industry is widely discussed across several key areas. Sketches, diagrams, and annotations facilitate clear design communication and collaboration among stakeholders (Baltes & Diehl, 2014; Hisarciklilar & Boujut, 2007; Détienne, 2006; Maher, Simoff, & Cicognani, 2012). Effective communication through drafting is shown to improve project management outcomes by preventing misunderstandings, enhancing coordination, and increasing participant satisfaction (Kerzner, 2025; Leung, Ng, & Cheung, 2004; Ling & Lau, 2002; Manley, 2008; Mansfield, Ugwu, & Doran, 1994; Meng, 2010). The adoption of digital tools such as Building Information Modeling (BIM) further advances communication accuracy and collaboration across construction phases (Sacks, Koskela, Dave, & Owen, 2010; Eastman, Teicholz, Sacks, & Liston, 2011; Lee, 2001). Growing trend toward distributed and remote project teams emphasizes the importance of managing communication flows through drafting in geographically dispersed contexts (Staple, Knauss, Schneider, & Zazworka, 2021).

Sketches and diagrams are essential tools that help designers externalize ideas and share design intent clearly (Baltes & Diehl, 2014). Annotations in technical drawings improve communication by providing context and supporting mutual understanding among individuals involved (Hisarciklilar & Boujut, 2007). In collaborative design processes, these visual devices are essential as they serve to control complex task dependencies over a period of time and bring many perspectives together (Détienne, 2006). In addition, Maher, Simoff & Cicognani (2012) also describe virtual design studios as applying digital image-making techniques to enable designers to work together in real-time across geographic boundaries. These conditions highlight the need for shared visual representations around communication (Maher et al., 2012).

The sequence of previous research contained herein examines the relationship between communication and the results of construction projects. Project communication has a significant impact on project success (Kerzner, 2025); thus, effective communication can help assure that project planning, scheduling, and control are performed correctly. Participant satisfaction is another indicator of the quality of communication. This is positively related to the degree of collaboration established during the construction process and therefore influences the performance of the construction project (Leung, Ng, & Cheung, 2004). Numerous case studies of major construction projects (i.e., power plants) have demonstrated that when communication fails, the project can be delayed and/or incur costs beyond the original budget (Ling & Lau, 2002; Mansfield, Ugwu, & Doran, 1994). Finally, the way a subcontractor communicates with a general contractor will influence the level of innovation that a subcontractor is willing to provide, which impacts the overall completion date and quality of the project (Manley, 2008). In addition, maintaining effective supply chain relationships requires that all relevant parties have a solid understanding of their interdependencies so that communication can be maintained throughout the course of the project (Meng, 2010).

Several studies have focused on the role of digital tools, particularly Building Information Modeling (BIM), in improving construction communication. BIM combines different data sources to improve clarity and cut down on mistakes during design and construction (Eastman, Teicholz, Sacks, & Liston, 2011). BIM makes construction work smoother and more efficient by boosting teamwork and lowering errors or material waste (Sacks, Koskela, Dave, & Owen, 2010). Digital drawing tools also help project stakeholders share information more accurately and quickly, which helps reduce delays and misunderstandings between teams (Lee, 2001).

Today, an increasing amount of research is dedicated towards understanding how remote teams communicate. Digital technology is on the rise and making it more important for project teams to have a comprehensive communication plan since these teams are becoming more geographically dispersed (Stapel, Knauss, Schneider & Zazworka, 2011). One suggested method for achieving this is through FLOW mapping, which allows team members to visualize and manage communication, ensuring that the correct information gets to the right person at the appropriate time (Stapel et al., 2011). Currently, there are still issues relating to clarity and consistency with virtual communication; this can cause disruptions in coordination for design and construction project teams. This highlights the need for an established clear communication strategy to aid project teams with their collaborative efforts when members are not located within the same geographical region.

2. Drafting for Visual Coordination in Building Construction Projects

Research on BIM-enabled clash Researches show that BIM helps different teams in construction work together better. For example, it helps architects, engineers, and plumbers make sure their parts of the building don't bump into each other. Akhmetzhanova et al. (2022) show that in the case of Kazakhstan construction sector, BIM adoption enhances design precision and facilitates smoother construction sequences if applied as early as possible. Chahrour et al. (2021) also highlight the financial benefits from preserving resources due to clashes being detected beforehand, thus allowing proper scheduling of resources for construction stages. From some technical point of view, Hu et al. (2019) claim that devising a complete method toward modeling dependencies among various components of a building improves detection of clashes significantly helps precise clash detection. Wang and Leite (2016) support this by proposing structured approaches to cope with spatial conflicts occurring in MEP systems which are often handled in unorganized ways.

Due to the fact that MEP systems coordination poses a major problem in construction, many scholars are attempting to improve it. For example, Hassanain et al. (2019a) recommend checklists with all DICP inclusions as one way to improve collaboration and minimize errors. In a later study, Hassanain et al. (2019b) present an advanced knowledge-based framework in Saudi Arabia designed specifically for the construction industry with the goal of aiding MEP coordination management. Both studies remind us how having concrete approaches aimed at improving collaboration between teams reduces system conflicts as well as meshing problems. Korman, Fischer, and Tatum (2003) in a previous project examined how knowledge representation and reasoning can assist in a decision-making process on how to integrate several different MEP components. Lee, Park, and Won looked at a specific project that demonstrated that there were issues with conflict resolution, as well as conflicts in scheduling, based on whether workflows were coordinated in parallel or in sequence.

The widespread use of Building Information Modeling (BIM) has transformed many aspects of construction project management. Azhar (2011) describes the benefits and challenges of BIM use. He points to improved visualization and coordination, but also notes issues such as high initial costs and reluctance within companies to adapt. Hardin and McCool (2015) explain that BIM tools help improve communication, planning, and cost control, which can prevent delays and unexpected expenses.

Using digital tools, working more collaboratively, and focusing on method (rather than tool) will help to improve construction efficiency. Freire & Alarco (2002) suggest using a method called Lean Design, which seeks to reduce waste and enhance collaboration among employees in several fields. According to Griffin & Evans (1994), STEP technology helps to create a better connection among various parts of the construction phase, especially, connecting the design phase to the actual phase of finishing the construction. Teams that do not work effectively together can make mistakes and require rework, according to Kakitahi et al. (2014). This demonstrates why coordination and communication between teams are important.

The previously mentioned studies demonstrate that drafting and coordination are vital components of today's intricate construction projects, with BIM-based clash detection being effective as it helps to improve the accuracy of models and decrease errors in these projects (Akhmetzhanova et al., 2022; Chahrour et al., 2021; Hu et al., 2019; Wang & Leite, 2016). In addition, additional tools can help in the organization of MEP systems as well as assist different teams to collaborate more efficiently than before (Hassanain et al., 2019a, 2019b; Korman et al., 2003; Lee et al., 2014). While BIM has numerous advantages, not all construction companies are currently utilizing it due to its high costs and some individuals resisting the transition to newer working methods (Azhar, 2011; Hardin & McCool, 2015). Furthermore, research has shown that using lean construction principles combined with better sharing of data, teamwork development and encouraging the use of these principles will significantly reduce the likelihood of any errors on projects and improve the flow of systems (Freire & Alarco, 2002; Griffin & Evans, 1994; Kakitahi, et al., 2014)

3. Visual Standards and Legal Compliance in Building Construction Drafting

Visualization in AEC industry is standardized on international level. ISO 128-1:2020 standards worldwide principles of technical drawing, both in 2D and 3D formats, as well ISO 19650-1:2018 posits BIM as a framework among construction stakeholders (ISO, 2018, 2020). ISO 16739-1:2024 also outlines standard for BIM data to be shared across software platforms and throughout all building life cycles (ISO, 2024).

Architectural and technical drawings are essential legal documents within the building permit process. According to Chynoweth (2008), careful examination of these drawings is required to determine their adherence to the building codes associated with construction. These drawings will be used as official evidence when plans are examined and either approved or rejected.

Smith and Tardif (2012) describe BIM as a useful strategy that supports more than just automated rule checking. BIM also improves documentation consistency across projects. Their study demonstrates that the use of digital tools such as Building Information Models (BIM) reduces errors caused by humans and makes it easier for people to understand how processes work because the electronic format promotes transparency in the process. Emmitt (2014) further supports the claim that using Building Information Models (BIM) is also beneficial for design management by helping to clearly document the design and ensure that what is built meets the intent of the original design.

Various researchers have research the influence of rule and regulation on design process especially the drawing exposure. Imrie and Street (2009) explain that planning systems often employ some form of pictorial control regarding the operation and appearance of structures. In this case, drawings serve an additional function beyond demonstrating design concepts; they are used to verify compliance with established requirements. Their findings demonstrate that drawings have a regulatory as well as an imaginative purpose. Lawson (2005) takes a more balanced position and indicates that in addition to being able to develop and produce designs that comply with myriad of regulatory and zoning constraints are many pathways, although limited by the rules and regulations, for designers to imagine or develop/disclose new ideas or modifications to their designs.

In construction projects involving historic buildings and restoration, drawings carry a greater responsibility. Murtagh (2005) emphasizes the importance of producing detailed and accurate drawings that reflect a full understanding of the building's history. These drawings help guide the restoration process and also serve as legal evidence that the work respects the original structure and meets required standards. Yung and Chan (2012) discuss several issues associated with the management of documentation and approvals in the context of cultural heritage projects. In these cases where technically sound drawings have been produced, they clearly aid architects, officials and members of the community in communicating about the cultural heritage project as well as working together towards its completion.

This collection of research shows how important architectural and engineering drawings are to the legal and regulatory aspects of construction projects. These drawings assist with obtaining building permits, determining who is responsible for what, and demonstrating compliance with the applicable regulations and standards (Chynoweth, 2008). As digital tools become more prevalent, BIM adds value to project delivery through automated inspection capabilities and improving the collaboration between diverse teams (Smith & Tardif, 2012; Emmitt, 2014). Drawings are also instrumental in the design process today and can limit design creativity due to the constraints imposed by legal and administrative regulations (Imrie & Street, 2009; Lawson, 2005). With respect to heritage conservation and reuse projects, accurate drawings are legally required and will help all parties involved achieve a common goal and understanding (Murtagh, 2005; Yung & Chan, 2012). In summary, drawings are more than just visual representations; they provide direction for the legal process, assist in obtaining approvals, and serve as guides throughout the entire building process for the project by providing an action plan for managing tasks/responsibilities.

4. Drafting as a Visual Aid in Construction Budgeting and Resource Allocation

Research shows that architectural & technical drafting is essential to financial management and cost estimating in construction projects. Accurate preliminary drawings are typically the basis of most building cost estimation (Brook 2015), allowing contractors to create an accurate estimate of labor and materials, assess the related risks for the project and develop prices for their services. Additionally, Cartlidge (2011) describes the changing nature of the quantity surveyor's role as it relates to the construction industry and explains that the use of detailed drawings is a critical part of planning and estimating project costs.

According to Dutta (2022), accurate material and labor estimates are contingent upon having clear and complete drawings available. Both Peurifoy and Oberlender (2013) support this statement by remarking that cost estimations utilize drawings to convert ideas into quantities that may be measured and worked with. More specifically, Holm et al. (2021) state that estimating is not an isolated step; however, it starts with producing good drawings and is an ongoing process during the scheduling and planning of a project. Therefore, all of these references provide compelling evidence that producing high-quality drawings at the beginning of any project is critical in order to maintain control over the project's budget and schedule.

As the use of digital technologies grows in our global society, the role of the drafter is shifting into more digital drafting. As an example of this trend, Building Information Modeling (BIM) can automate some processes, create efficiencies for people and organizations by reducing time spent completing tasks, and reduce the risk of creating errors through automation (Taghaddos, Mashayekhi & Sherafat, 2016). Additionally, BIM allows for a more consistent and accurate cost estimate for complex tasks (Çepni, Akcamete & Klein, 2020). Elmousalami (2020) provides evidence that the cost prediction capabilities provided by AI are more timely and reliable than those produced through traditional means. Jiang, Li, Lin, Liu & Ma (2023) found that advanced AI technologies such as deep reinforcement learning can adapt cost and resource planning based on actual job conditions in real-time, thus providing a more up-to-date picture of the project site.

Structural design work has a clear connection between drafting and cost planning as well. According to a study conducted by Cho & Chun (2015) on reinforced concrete structures, there was a direct correlation between creating high-quality (i.e., accurate) engineering drawings during the design phase, resulting in reasonable estimates of construction costs. In this way, design decisions can be made in accordance with actual budget limitations. When teams used engineering drawings combined with estimate tools, they were able to eliminate confusion and transfer their ideas from design to concrete financial plans more seamlessly. Therefore, accurate drawings are critical for resource management, cost control, and reducing risk.

The focus of Sherafat; et..al (2019), was to take a look at site conditions and the impact on site equipment tracking by integrating multiple sources of information. In their findings, the authors indicated that if good data were used, it would be possible to make real-time changes to the schedules and resources, Therefore it was necessary for the project to be well-planned synchronously to facilitate use of these systems. Finally, the actual data determined can be directly associated with the draws and plans from the initial documents to conduct the field verification of work performed.

Documentation also plays a crucial role in the business side of construction, especially when companies compete for projects through bidding. Mohemad et al. (2010) explain that tendering systems, which help teams decide whether and how to bid, depend on clear, up-to-date, and accurate documentation. These documents enable teams to make faster and better decisions in a highly competitive environment. Their study shows that well-structured documentation not only supports internal project planning but also helps make the bidding process fairer and more transparent for all parties involved.

All these existing studies highlight that engineering drawings are a core component of the financial and operational aspects of construction. From estimating costs and measuring quantities to managing risks and maintaining schedules, most processes begin with accurate drawings and well-prepared documents (Brook, 2015; Cartlidge, 2011; Dutta, 2022; Peurifoy & Oberlender, 2013; Holm et al., 2021). Digital technologies and emerging technologies, such as BIM, further enhance this by automating critical tasks and helping teams remain flexible and adapt to change (Taghaddos et al., 2016; Çepni, Akcamete & Klein, 2020; El-mousalami, 2020; Jiang et al., 2023). In areas such as reinforced concrete design, high-quality drawings enhance early cost planning (Cho & Chun, 2015). On the construction site, it helps teams coordinate work in real time (Sherafat et al., 2019). And at the bidding stage, it supports faster and more informed decision-making (Mohemad et al., 2010). At every stage of a project, drafting serves as a key tool for successful planning, budgeting, and implementation.

5. Synthesis: The Interconnectivity of the Four Domains

The four aspects described above show that drafting in the construction of buildings is not only an activity that creates drawings. In other words, drafting plays a crucial role as a key visual tool for communication, coordination, compliance, and cost estimation in the process of building construction. It seems that each aspect has its own significance, but at the same time, they are interrelated. Drafting serves as a medium of communication for transmitting design intentions to various parties involved, acts as a coordinator for integrating technical systems across different professions, acts as a medium for legal requirements and regulations, and provides data for cost estimation in the form of construction details.

As for the first sphere, drafting is the medium of visual communication since it allows to externalize thoughts and concepts, explain design choices, minimize misunderstandings, and communicate them to people using sketching, diagramming, annotations, technical drawings, and modeling. This communicative aspect acquires utmost importance in this particular case owing to the fact that the construction project involves numerous stakeholders, each of whom does not necessarily possess a single language, or rather, the language specific to this sphere of activity. Therefore, there is a need for all the participants involved in the process to have a means to discuss design intent and approve it, thus, making drafting a language of construction.

In the second domain, drafting acts as a coordination tool because of the necessity of technical alignment in visual data. Drawings and BIM models serve as mechanisms for different building systems coming together in the same spatial and technical context, specifically in architectural, structural, and MEP systems coordination. Clash detection, MEP coordination, lean design, and integrated BIM approaches prove that drafting is helpful to teams in finding potential issues before the start of construction. By coordinating, drafting does not limit itself to presenting design decisions already made but becomes involved in resolving technical relations between building elements. This function is also closely associated with the third domain of drafting, which is the documentation of visual standards and compliance. Architectural and engineering drawings are used in the process of building permits, code check, heritage conservation permits, and administrative review. The importance of the ISO standards in this regard is increased due to ISO 128-1:2020 that standardizes the technical representation, ISO 19650-1:2018 that defines the nature of BIM as information management structure, and ISO 16739-1:2024 that facilitates data interoperability between BIM software applications.

The fourth domain, drafting serves an important role in construction cost estimating and budgeting in the fourth domain. Accurate cost estimating, quantity surveying, bid preparation, procurement planning, manpower estimating, risk estimation, and construction resource management all rely extensively on accurate drawings. Visual representation becomes financial representation here since not only is the drawing read, but it is also quantified, priced, and scheduled, and serves as a foundation for decision-making. BIM and AI-based technologies take this idea even further by integrating the drawing with automated cost estimating, real-time resource planning, and project management processes. Therefore, drafting helps with the economic rationale behind construction projects in that not only design can be judged for its visual and functional merits, but for its economic feasibility and efficiency as well.

This synthesis reinforces the notion that drafting should be considered the art of visualization within the context of construction work. However, in this case, the use of the word “art” does not imply any notion of expression or creative freedom. In this instance, “art” stands for a disciplined form of making the information of construction visible, legible, coordinated, compliant, and practical. The art of drafting is in the fact that the information that is relevant for construction is rendered visually accessible. By bringing together communication, coordination, compliance, and finance in the form of drawing, drafting becomes the visual infrastructure of construction. Through this, construction projects become possible as buildings move from being conceptualized to being documented, from documents to being approved, from approval to costing, and from costing to being physically constructed.

Conclusion

This study aims to explore how drafting function in construction, not only as a drawing tool but also as a key support for communication, coordination, regulation, and budgeting. After reviewing research in a variety of academic fields, this research provides convincing evidence of how important the role that engineering drawings play in all aspects of construction project management. Engineering drawings facilitate collaboration between construction team members, provide a basis for decision making and assist in the efficient execution of construction projects.

By combining previously unlinked concepts, this paper will provide an integrated view of the use of engineering drawings throughout the various phases of a project. This unifies knowledge about the process; furthermore, it also demonstrates the necessity of professionals within the construction field to understand engineering drawings and their uses for creating engineering drawings and for satisfying legal obligations, working together as members of a team, and developing budgets for construction work that is done in practice.

References

Akhmetzhanova, B., Nadeem, A., Hossain, M. A., & Kim, J. R. (2022). Clash detection using building information modeling (BIM) technology in the Republic of Kazakhstan. Buildings, 12(2), Article 102.

Alwan, Z., Jones, P., & Holgate, P. (2017). Strategic sustainable development in the UK construction industry. Buildings, 7(3), 64.

Azhar, S. (2011). Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry. Leadership and Management in Engineering, 11(3), 241–252.

Azhar, S., Khalfan, M., & Maqsood, T. (2012). Building information modeling (BIM): Now and beyond. Australasian Journal of Construction Economics and Building, 12(4), 15–28.

Baltes, S., & Diehl, S. (2014, November). Sketches and diagrams in practice. In Proceedings of the 22nd ACM SIGSOFT International Symposium on Foundations of Software Engineering (pp. 530–541).

Barlish, K., & Sullivan, K. (2012). How to measure the benefits of BIM—A case study approach. Automation in Construction, 24, 149–159.

Becerik-Gerber, B., & Kensek, K. (2010). Building information modeling in architecture, engineering, and construction: Emerging research directions and trends. Journal of professional issues in engineering education and practice, 136(3), 139-147.

Brook, M. (2015). Estimating and tendering for construction work (3rd ed.). Routledge.

Bryde, D., Broquetas, M., & Volm, J. M. (2013). The project benefits of BIM. International Journal of Project Management, 31(7), 971–980.

Cao, D., Li, H., & Wang, G. (2017). Impacts of building information modeling (BIM) implementation on design and construction performance: A resource dependence theory perspective. Frontiers of Engineering Management, 4(1), 20-34.

Cartlidge, D. (2011). New aspects of quantity surveying practice. Routledge.

Çepni, Y., Akcamete, A., & Klein, R. (2020, October). Automated BIM-based formwork quantity take-off. In Proceedings of the 20th International Conference on Construction Applications of Virtual Reality, Middlesbrough, UK (Vol. 30).

Chahrour, R., Hafeez, M. A., Ahmad, A. M., Sulieman, H. I., Dawood, H., Rodriguez-Trejo, S., ... Dawood, N. (2020). Cost-benefit analysis of BIM-enabled design clash detection and resolution. Construction Management and Economics, 39(1), 55–72.

Cho, J., & Chun, J. (2015). Cost estimating methods for RC structures by quantity takeoff and quantity prediction in the design development stage. Journal of Asian Architecture and Building Engineering, 14(1), 65–72.

Chynoweth, P. (2008). Legal research. In A. Knight & L. Ruddock (Eds.), Advanced research methods in the built environment (pp. 28–38). Wiley-Blackwell.

Détienne, F. (2006). Collaborative design: Managing task interdependencies and multiple perspectives. Interacting with Computers, 18(1), 1–20.

Ding, G. K. (2008). Sustainable construction—The role of environmental assessment tools. Journal of environmental management, 86(3), 451-464.

Dutta, B. N. (2022). Estimating and Costing in Civil Engineering: Theory and Practice (28th ed.). CBS Publishers & Distributors Pvt Ltd.

Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2011). BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors (2nd ed.). Wiley.

Elmousalami, H. H. (2020). Comparison of artificial intelligence techniques for project conceptual cost prediction: A case study and comparative analysis. IEEE Transactions on Engineering Management, 68(1), 183–196.

Emmitt, S. (2024). Design management for architects. Routledge.

Foliente, G. C. (2000). Developments in performance-based building codes and standards. Forest Products Journal, 50(7/8), 12.

Freire, J., & Alarco, L. F. (2002). Achieving lean design process: Improvement methodology. Journal of Construction Engineering and Management, 128(3), 248–256.

Griffin, C. R., & Evans, F. J. (1994). STEP technology for building services projects. Building Services Engineering Research and Technology, 15(4), 205–210.

Groat, L. N., & Wang, D. (2013). Architectural research methods. John Wiley & Sons.

Hardin, B., & McCool, D. (2015). BIM and construction management: Proven tools, methods, and workflows. Wiley.

Hartmann, T., Gao, J., & Fischer, M. (2008). Areas of application for 3D and 4D models on construction projects. Journal of Construction Engineering and Management, 134(10), 776–785.

Hartmann, T., Van Meerveld, H., Vossebeld, N., & Adriaanse, A. (2012). Aligning building information model tools and construction management methods. Automation in Construction, 22, 605–613.

Harty, C. (2005). Innovation in construction: A sociotechnical perspective. Building Research & Information, 33(6), 512–522.

Hassanain, M. A., Adewale, B. O., Al-Hammad, A. M., & Sanni-Anibire, M. O. (2019). Modeling knowledge for MEP coordination in building projects in Saudi Arabia. Journal of Architectural Engineering, 25(2), 04019011.

Hassanain, M. A., Aljuhani, M., Sanni-Anibire, M. O., & Abdallah, A. (2019). Interdisciplinary design checklists for mechanical, electrical and plumbing coordination in building projects. Built Environment Project and Asset Management, 9(1), 29–43.

Henderson, K. (1998). On line and on paper: Visual representations, visual culture, and computer graphics in design engineering. MIT press.

Hisarciklilar, O., & Boujut, J.-F. (2007). An annotation-based approach to support design communication. In Proceedings of the 16th International Conference on Engineering Design (ICED '07) (Vol. DS42, Paper DS42_P_393, pp. 451–452). The Design Society.

Holm, L., Schaufelberger, J. E., Griffin, D., & Cole, T. (2021). Construction cost estimating (1st ed.). Routledge.

Hu, Y., Castro-Lacouture, D., & Eastman, C. M. (2019). Holistic clash detection improvement using a component dependent network in BIM projects. Automation in Construction, 105, 102832.

Imrie, R., & Street, E. (2009). Regulating design: The practices of architecture, governance and control. Urban Studies, 46(12), 2507–2518.

International Organization for Standardization. (2015). ISO 12006-2:2015: Building construction: Organization of information about construction works—Part 2: Framework for classification. ISO.

International Organization for Standardization. (2018). ISO 19650-1:2018: Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM): Information management using building information modelling—Part 1: Concepts and principles. ISO.

International Organization for Standardization. (2020). ISO 128-1:2020: Technical product documentation (TPD): General principles of representation—Part 1: Introduction and fundamental requirements. ISO.

International Organization for Standardization. (2024). ISO 16739-1:2024: Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries—Part 1: Data schema. ISO.

Jabareen, Y. (2009). Building a conceptual framework: philosophy, definitions, and procedure. International journal of qualitative methods, 8(4), 49-62.

Jiang, C., Li, X., Lin, J. R., Liu, M., & Ma, Z. (2023). Adaptive control of resource flow to optimize construction work and cash flow via online deep reinforcement learning. Automation in Construction, 150, 104817.

Kakitahi, J. M., Alinaitwe, H. M., Landin, A., & Rodrigues, M. J. (2014). A comparison of construction related rework in Uganda and Mozambique. Journal of Construction Project Management and Innovation, 4(1), 770–781.

Kerzner, H. (2025). Project management: A systems approach to planning, scheduling, and controlling (14th ed.). Wiley.

Korman, T. M., Fischer, M. A., & Tatum, C. B. (2003). Knowledge and reasoning for MEP coordination. Journal of Construction Engineering and Management, 129(6), 627–634.

Latour, B., & Yaneva, A. (2008). "Give me a gun and I will make all buildings move": An ANT's view of architecture. Explorations in Architecture, 80–89.

Lawson, B. (2005). How designers think: The design process demystified (4th ed.). Architectural Press.

Lee, G., Park, H. K., & Won, J. (2014). Parallel vs. sequential cascading MEP coordination strategies: A pharmaceutical building case study. Automation in Construction, 43, 170–179.

Lee, S. (2001, July). Challenges in building design and the construction industry: The future of design and construction in the Internet age. In International Conference Human Society@ Internet (pp. 225-236). Berlin, Heidelberg: Springer Berlin Heidelberg.

Leung, M., Ng, S. T., & Cheung, S. (2004). Measuring construction project participant satisfaction. Construction Management and Economics, 22(3), 319–331.

Ling, Y. Y., & Lau, B. S. Y. (2002). A case study on the management of the development of a large-scale power plant project in East Asia based on design-build arrangement. International Journal of Project Management, 20(6), 413-423.

Love, P. E., Matthews, J., Simpson, I., Hill, A., & Olatunji, O. A. (2014). A benefits realization management building information modeling framework for asset owners. Automation in construction, 37, 1-10.

Maher, M. L., Simoff, S. J., & Cicognani, A. (2012). Understanding virtual design studios. Springer Science & Business Media.

Manley, K. (2008). Implementation of innovation by manufacturers subcontracting to construction projects. Engineering, Construction and Architectural Management, 15(3), 230–245.

Mansfield, N. R., Ugwu, O. O., & Doran, T. (1994). Causes of delay and cost overruns in Nigerian construction projects. International Journal of Project Management, 12(4), 254–260.

Meng, X. (2010). Assessment framework for construction supply chain relationships: Development and evaluation. International Journal of Project Management, 28(7), 695–707.

Meredith, J. (1993). Theory building through conceptual methods. International Journal of Operations & Production Management, 13(5), 3–11.

Mohemad, R., Hamdan, A. R., Othman, Z. A., & Noor, N. M. M. (2010). Decision Support Systems (DSS) in construction tendering processes. International Journal of Computer Science Issues (IJCSI), 7(2), 35.

Monteiro, A., & Martins, J. P. (2013). A survey on modeling guidelines for quantity takeoff-oriented BIM-based design. Automation in Construction, 35, 238–253.

Murtagh, W. J. (2005). Keeping time: The history and theory of preservation in America (3rd ed.). Wiley.

Oberlender, G. D., & Trost, S. M. (2001). Predicting accuracy of early cost estimates. Journal of Construction Engineering and Management, 127(3), 173–182.

Peurifoy, R. L., & Oberlender, G. D. (2013). Estimating construction costs (6th ed.). McGraw-Hill.

Porwal, A., & Hewage, K. N. (2012). Building information modeling-based analysis to minimize waste rate of structural reinforcement. Journal of Construction Engineering and Management, 138(8), 943-954.

Rodwell, D. (2003). Sustainability and the holistic approach to the conservation of historic cities. Journal of Architectural Conservation, 9(1), 58–73.

Sacks, R., Eastman, C., Lee, G., & Teicholz, P. (2018). BIM handbook: A guide to building information modeling for owners, designers, engineers, contractors, and facility managers. John Wiley & Sons.

Sacks, R., Koskela, L., Dave, B. A., & Owen, R. (2010). Interaction of lean and building information modeling in construction. Journal of Construction Engineering and Management, 136(9), 968–980.

Sebastian, R. (2011). Changing roles of the clients, architects and contractors through BIM. Engineering, Construction and Architectural Management, 18(2), 176–187.

Sherafat, B., Rashidi, A., Lee, Y. C., & Ahn, C. R. (2019, June). Automated activity recognition of construction equipment using a data fusion approach. In ASCE International Conference on Computing in Civil Engineering 2019 (pp. 1–8). Reston, VA: American Society of Civil Engineers.

Smith, D. K., & Tardif, M. (2012). Building Information Modeling: A Strategic Implementation Guide for Architects, Engineers, Constructors, and Real Estate Asset Managers. John Wiley & Sons.

Stapel, K., Knauss, E., Schneider, K., & Zazworka, N. (2011, August). FLOW Mapping: Planning and Managing Communication in Distributed Teams. In Proceedings of the 2011 IEEE Sixth International Conference on Global Software Engineering (pp. 190-199).

Succar, B. (2009). Building information modelling framework. Automation in Construction, 18(3), 357–375.

Taghaddos, H., Mashayekhi, A., & Sherafat, B. (2016). Automation of construction quantity take-off: using Building Information Modeling (BIM). In Construction Research Congress 2016 (pp. 2218–2227).

Thomas, J., & Harden, A. (2008). Methods for thematic synthesis of qualitative research. BMC Medical Research Methodology, 8(1), 45.

Tiesdell, S., Oc, T., & Heath, T. (2013). Revitalizing historic urban quarters. Routledge.

Volk, R., Stengel, J., & Schultmann, F. (2014). Building Information Modeling (BIM) for existing buildings: Literature review and future needs. Automation in construction, 38, 109-127.

Wang, L., & Leite, F. (2016). Formalized knowledge representation for spatial conflict coordination of mechanical, electrical and plumbing (MEP) systems in new building projects. Automation in construction, 64, 20-26.

Whyte, J. (2011). Managing digital coordination of design: Emerging hybrid practices in an institutionalized project setting. Engineering Project Organization Journal, 1(3), 159–168.

Winch, G. M. (2012). Managing construction projects. John Wiley & Sons.

Yung, E. H., & Chan, E. H. (2012). Implementation challenges to the adaptive reuse of heritage buildings: Towards the goals of sustainable, low carbon cities. Habitat international, 36(3), 352-361.