Understanding digital transformations of construction firms: A case from India

Sreelakshmi S, Ashwin Mahalingam
Department of Civil Engineering, Indian Institute of Technology Madras
sreepadam11@gmail.com, mash@civil.iitm.ac.in

Abstract

The construction industry is trying to embrace digital technologies. One such digital technology is Building Information Modeling (BIM). Technology adoption is often accompanied by, and in turn, drives organizational change. As the construction industry is highly fragmented and slow to change, an institutional approach through the micro-dynamics of the evolution of the POP model is utilized to understand how change with regards to BIM is operationalized and to identify the institutional work at the organizational level that results in this change. The study uses a qualitative case study approach to understand the journey of BIM implementation in one of the largest construction firms in India. We describe the different mechanisms instituted by members of the firm to bring about the change. We specifically identify the coordination work, a distinct type of Institutional work that triggers the change. We find that to operationalize BIM in construction firms, a cognitive approach is proven to be the starting point, followed by regulative and normative approaches.

Keywords: BIM adoption, POP model, Event system theory, institutional work, organizational change, construction industry

Introduction

The construction industry is fragmented and involves many stakeholders. It faces many problems, such as the lack of the right information present at the right time with the right personnel to do the right job. This leads to errors, rework, lack of resources, and eventually cost and time overruns (Iyer and Jha 2006; Yap et al. 2018). Digital technologies bring about innovation, help in work allocation, manage interdependence and focus on coordination. Therefore, they have the potential to bring about a remarkable change in thinking to the global built environment sector for the better. An example of a digital technology is Building Information Modelling (BIM), a simple yet effective medium to aid the management system. BIM is 'a collaborative way of working, underpinned by digital technologies which unlock more efficient methods of designing, creating and maintaining assets'. BIM embeds a 3-dimensional computer model with key asset information that can effectively manage information throughout a project's life-cycle – from earliest concept through to operation to

demolition (Enegbuma et al. 2016; Kushwaha and Adhikari 2016; Memon et al. 2014; Steel et al. 2012).

Although the technology has much potential to help the industry, the adoption rate is quite low, and there is limited use in practice (Gu and London 2010; Hire et al. 2022; Ullah et al. 2019; Won et al. 2013). It is understood that implementing BIM in construction organizations will involve a lot more than just changing the software currently being used. According to Chan (2018 p. 156), 'there is a deeply entrenched logic in organizing of construction work that drives resistance to technological change and innovation.' For BIM to be adopted across the organization, the company should consider all the challenges related to innovating within the firm, inter-organizational innovation as well as challenges at an industry level. Some findings suggest that new technologies force a change in the existing practices, while few others argue that technologies should adapt to the existing practices (Won et al. 2013). Hinings et al (2018) in their work have stressed the fact that the institutional perspective is considered to be the best lens to understand change and innovation.

Institutions are often taken-for granted, are highly persistent and resistant to change. As actors re-enact institutionally driven practices or routines, these institutions tend to be reproduced and therefore persist. . "Efforts to change prevailing institutionalized practices, customs, and beliefs challenge many conventions and sometimes breed opposition" (Mair et al. 2012). Persistence in the institutions lead to legitimacy and their being 'taken for granted' (Mahalingam and Levitt 2007). According to Kingston and Caballero (2009), existing institutions create groups to preserve the status quo and enable the persistence of those institutions. According to Hughes as cited in Scott (2014), institutions exist and persist because they are carried forward by interacting individuals (Scott 2014).

However, institutions, once created, also tend to change gradually over time. How change processes orient and take root depends on the interactions among different individuals, between individuals and organizations, and between multiple levels across organizations and contexts (Langley et al. 2013). "Institutions do not emerge in a vacuum; they always challenge, borrow from, and, to varying degrees, displace prior institutions", suggests Scott (Scott 2014). Studying institutional work helps to understand how institutions persist and change. 'The purposive actions of individuals and organizations aimed at creating, maintaining and disrupting institutions', termed as institutional work (Lawrence and Suddaby 2006) helps to identify the mechanisms of change in an institutionalized setting such as construction. In our

study, we intend to identify the institutional work associated with the digital transformation in a construction firm. To do so we utilize the Virtual Design and Construction framework in conjunction with institutional theory.

Kunz and Fischer (2020 p. 356) have proposed a Virtual Design and construction (VDC) framework that 'includes explicit specification of client and business objectives and measured performance for the project, project models that include models of the product, organization and process, and explicit specification of project daily, weekly and milestone objectives and measured performance'. In the POP model, 'data flow forward in time as the project progresses and feedback loops enable constant updating of the product, organization and the process design' (ibid).

However, a process-based understanding of the change, and transformation is absent in the literature. To understand the change in practices, one should understand the process of change and how institutions respond to changes in institutionalized practices. Surprisingly various studies either advocate factors that enable digital transformation such as the need 'to develop soft- skills' (Papadonikolaki et al. 2020) or offers different visions of digital transformation (Ernstsen et al. 2021), but fail to describe the pathways to achieving this transformation. The construction industry displays highly institutionalized behaviors which need to change to embrace digital transformation and the use of tools such as BIM. How does this change happen? Therefore, this study intends to answer *How is organizational change with regards to adoption of BIM achieved in construction firms? What institutional work triggers this change?*

Research methodology and approach

Geiger (2009) posits that analyzing the actions and related activities within organizations help to understand organizations better, since organizations constitute continuous enactment of processes. Yin (2018) suggests that when the research questions seek to explain 'how' or 'why' a social phenomenon works, then a case study approach is relevant. He further adds that 'case studies allow to focus in-depth into a case and to retain the holistic and real-world perspective-such as the change in organizational processes'.

There is always the question of how to study change. This is because change generally happens gradually over a period, and the signs of routinization may not be readily recognizable. It is easier to understand change through interviews rather than through observations. Interviews help to trace the journey of the individuals and the evolution of the change the firm went through. The thick descriptions of the experiences that the personnel share, helps to create a

timeline of events and actions that resulted in the organizational change. A case-based approach is followed because there is a need for empirical evidence that can coherently provide in-depth data on the evolution of BIM use. Since the construction industry is project-based this study investigates BIM adoption evolving from project to project. A large Indian construction company is considered in this study that has been implementing BIM and other digital technologies for the past fifteen years in various domains. This company has expertise in handling projects such as residential complexes, industrial buildings, airports, bridges, metros, water treatment plants, ports, and harbours to name a few. The use of digital technology such as BIM is now extensive in the design phase and is also being utilized in execution phase. There are seven sub-divisions in the firm of which two sub-divisions initiated the use of BIM. Sub-division A (SD-A) handles construction of facilities such as airports, residential complexes, and stadium, and sub-division B (SD-B) handles the construction of metro rail projects, nuclear power plants and bridges[1]. Hence this firm was chosen for a longitudinal study. The interactions with personnel associated with projects using BIM since 2005 helped to understand the BIM adoption journey.

As indicated earlier, interactions with the personnel through interviews can help identify the agents, key events, and other factors that lead to the evolution of the organization with respect to BIM. The findings need to evolve from data inductively and hence there are no ex-ante hypotheses. Interviews are prime data sources as the BIM implementation story is an important entity for project participants who have lived through the project. Secondary data comes from contract document, and .ppt files presented during their progress review meetings. Using an inductive approach, drawing upon open-ended interviews with the firm's team heads, architects, BIM managers and coordinators, we identified mechanisms that helped in operationalizing BIM in the organization. As this study uses a qualitative and an inductive research, the data and the existing theory is considered in tandem (Acosta and Gond 2021; Gioia et al. 2012; Zerjav et al. 2018). The study is based on the data collected over a period of six months. Forty interviews were conducted with experts, and personnel belonging to all levels of the hierarchy, including the VP, Design heads & BIM managers involved in implementing BIM. The duration of each conversation lasted between an hour to 1.5 hours.

We conducted multiple interviews with our informants and we compared the stories shared by other informants. This helped to enhance the internal consistency and validity of data (Yin

[1] The name of the firm and the sub-divisions are not mentioned to maintain confidentiality.

2018). The informants had to recall from their past experiences to bring out the timeline of the evolution of events. To avoid missing data, multiple personnel who worked in similar projects were interviewed and, in some instances, we reached back to them again with specific questions so that the missing links can be established. Thus, a retrospective approach helps to understand the stories revolving around how organizations decided to go digital and how BIM was utilized in the organization. The informants were encouraged to talk about the workflow, the organization structure, and how BIM affected the existing way of working. The interviews were transcribed and open and axial coding were used to analyze the data(Corbin and Strauss 2008; Miles and Huberman 1994).

The interviews were transcribed using an online tool and typographical errors were manually corrected. When a recording was not possible or not allowed, the researchers took down detailed notes that were then analyzed as transcripts. There was a total of 500 pages of transcripts. The interview data was analyzed line by line as suggested by Charmaz (2006). We generated codes from the transcripts from practices perspective. Through the coding process we first identified and categorized the various mechanisms through which the firm transformed with regards to BIM. In this process, we categorized based on the informants' description of how the firm initiated the BIM journey and the various mechanisms with which the firm accelerated the adoption journey.

Initially, the concepts that corresponded to the change mechanisms were identified in open coding. These mechanisms included the events and the practices that were the driving force, the role and efforts of each informant, and the practices and responses of various stakeholders toward digital transformation. These codes were informant centric as per Gioia et al (2012). In the axial coding that followed, similar concepts were clubbed together that aligned to similar themes. These themes were linked to aggregate theoretical dimension of institutional work. In this study, we identified 112 codes that corresponded to the BIM adoption process. These codes were clubbed to 14 themes linking to a distinct type of institutional work. This coding structure is shown in Table 1.

Findings

The evolution of the POP models suggested by Kunz and Fischer (2020) are considered for this study zooming in to the relationships between the Product (P- building information models), the Organization (O- intra- and inter-organizational interactions), and the Process (P- change management) that bring change to the organization. Each POP model is project specific. As we

Table 1: Data and coding structure

First order concepts	Second order themes	Aggregate dimension
Observing the trend	Getting the feel of BIM	Coordination work
Working from part to whole		
Observing the beneficial outcomes		
Establishing inter-organizational dynamics	Assembling the coordination team	
Intra-organizational dynamics- assembling volunteers		
Assigning specific roles		
BIM specific recruitments		
Customizing the design workflow	Customizing digital workflow	
Colocation- virtual and physical		
Markups for progress updates		
Work sharing		
Change in mindset	Capability building and consultations	
Providing training sessions		
Setting up BIM studio and conducting BIM workshop		

observed the firm progress from project to project, we observed changes in the existing practices- be it the objectives from the client, the evolution of the use of 'product'- Building Information Models, the practices in the organization, and related processes. As POP model depicts project progress and feedback loop with respect to time, the evolution is explained from an Event-system theory (EST) perspective, which according to Morgeson et al., 'focuses on events, which result in changes in current behaviors and features and the creation of new behaviors, features and events over time and across levels' (Morgeson et al. 2015). Applying EST, we can explain when an event triggers a change in P, O, or P at each point in time and the succeeding POP model that gets improved (shown in Fig 1). Key changes are outlined below:

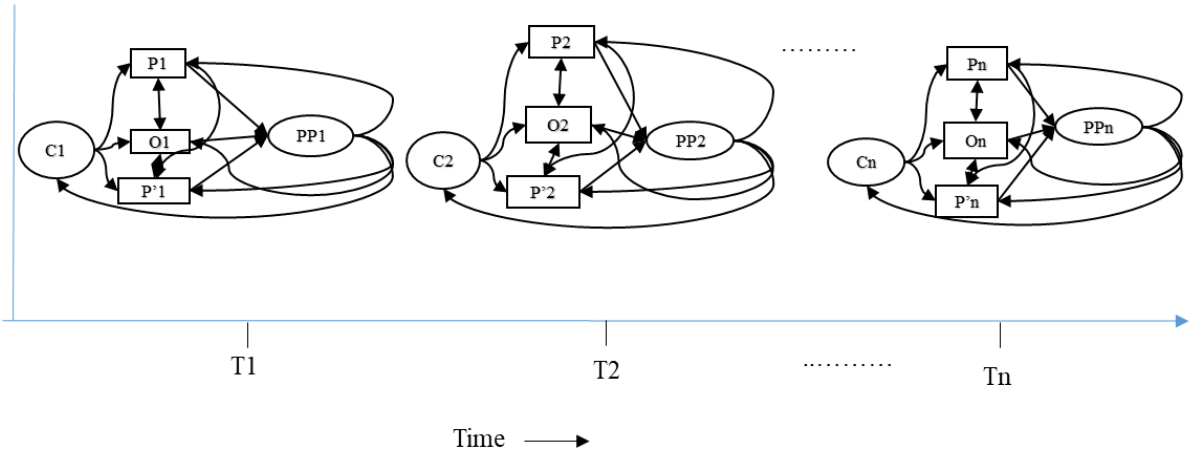

Fig 1. Evolution of POP model

Evolution of client objectives

By 2008-2009, the Indian clients were not aware of the advancements in digital technology and did not mandate the use of BIM. The Indian clients were exposed to BIM's benefits through the project teams. The clients realized that they could easily visualize the facility before constructing it. They were also impressed by the detection of clashes before construction. However, some international projects required the project team to work in the BIM environment from 2010-2015. These clients had laid out clear requirements based on BIM usage. Some international clients also expected the project team to submit a detailed BIM Execution Plan (BEP), which was new to the project team. By 2018, some of the clients in India had developed BIM capability and had their own BIM teams to guide the project team by laying out very detailed BIM requirements.

Evolution of product model

According to the changing requirements, the product models also evolved. In 2005, the project teams became aware of a new trend in the global construction industry – the use of Building Information Modeling. They were tasked to develop two airports in two metropolitan cities in India, characterized by complex designs, stringent deadlines, and high coordination requirements. They initially decided to develop a 3D virtual model for visualization and use it to coordinate the Mechanical, Electrical, and Plumbing (MEP) services.

As they proceeded to the next project, the project team decided to create 4D models by integrating 3D models into the schedule. There were requirements from international clients as well. Hence, the models were used for progress monitoring and energy simulations in addition

to visualization, quantity take-off, and clash detection. By 2022, the teams have started utilizing the 3D models for decision-making at the project site level. For example, a project team at one of the sites created an alternate ducting route to optimize the material usage.

Evolution of organization design

The organization design is agent-centric, giving importance to the players involved in the evolution. The project teams decided to utilize BIM, which could manage the complex design and meet coordination requirements. However, the project team was new to the technology and did not have sufficient capability to execute it. Initially, the project team started by seeking help from external consultants and assembling volunteers. Forming a team was necessary to take the implementation forward. Some of the volunteers from the project teams were assigned new roles and entrusted with extra responsibilities to coordinate with the stakeholders. A few BIM-specific recruitments were also carried out. At the same time, the firm arranged help for sub-contractors and vendors to develop 3D models.

By 2017, the top management decided to implement BIM after realizing the benefits and observing the trend in the global construction market. To help keep track of the developments, the organization had a team to compile the latest technologies that happen around the world. The top management formed a central BIM team to provide awareness and training to the design teams. Many software developers supported this endeavor by offering solutions and expertise by conducting training sessions through their BIM academy. To help the site team, project-specific BIM recruitments were carried out. These BIM specialists held discussions with the clients and their consultants to bring clarity to the BIM requirements. New roles were created at the site to help these BIM specialists. There were called BIM coordinators. Both the BIM specialist and BIM coordinators helped the site team with the basics of BIM. The site teams were also offered training at the headquarters (HQ) of the firm to accelerate the BIM use at the site level.

To ensure the clients, vendors, consultants, and every other stakeholder be part of the BIM process, BIM studios were set up within BIM teams of different sub-divisions with the support from the central BIM team. Also, the design team from the HQ remained connected with the project site teams to discuss the changes highlighted by the site teams. This was helpful in projects with a BIM mandate from the client.

Evolution of process model

The process model includes the processes involved in bringing about the changes in the organization. One of the processes was experimenting by working from part to whole and observing the beneficial outcome. To achieve this feat, the team had to create zones within the floor plan. This enabled them to try clash detection and quantity take-offs for one of the zones and figure out the mistakes. The issues were rectified, and the other zones went error-free. Later, these procedures were compiled to form a 'BIM Manual', developed based on their experiences that could be used to set up BIM processes in other projects in the future. This manual focused on developing the skill of the modeler and setting up of guidelines for the implementation process. The BIM manual talks about the strategy, how the Common Data Environment (CDE) will be set up, how the files will be placed, how to generate a model, common files, and proper coordinates.

Another approach was to customize the process workflow to align with the requirement of the project. Later the workflow was digitalized. This was primarily required to bring all the stakeholders together who were earlier working in silos. The 3D computer models built by various disciplines were projected onto a screen, and the stakeholders from different disciplines came together to rectify the issues identified in the clash detection process. There were discussions on who should be making the changes and how it would affect other disciplines. This process is similar to the 'messy talk' idea put forward by Dossick and Neff (2011;Dossick et al. 2012, 2015). This process of a BIM room helped when there were stakeholders who were separated geographically. The personnel at the project site used to raise issues, if any, during the meeting, and the virtually collocated design teams could come up with responses to the markups. There was a blend of both physical and virtual presence of the project team thus breaking the fragmented approach adopted by the construction so far. Focused inclusive coordination mechanisms such as digitalizing the workflow, collaborative problem resolution, and collaborative checking and approval were other mechanisms that helped to bring about change. These mechanisms helped to strengthen the inter- and intra-organization dynamics.

Discussions and implications

Understanding how change is achieved with regard to BIM was our primary objective. Thus, this study provides an example of how an organization is affected by introducing BIM and the mechanisms of change. The collective actions to bring about an institutional change leads to coordination work (Fig 2). We draw on the perspective that the coordination work mechanisms

were influential in operationalizing the organizational change due to BIM implementation explained through the evolution of the POP model.

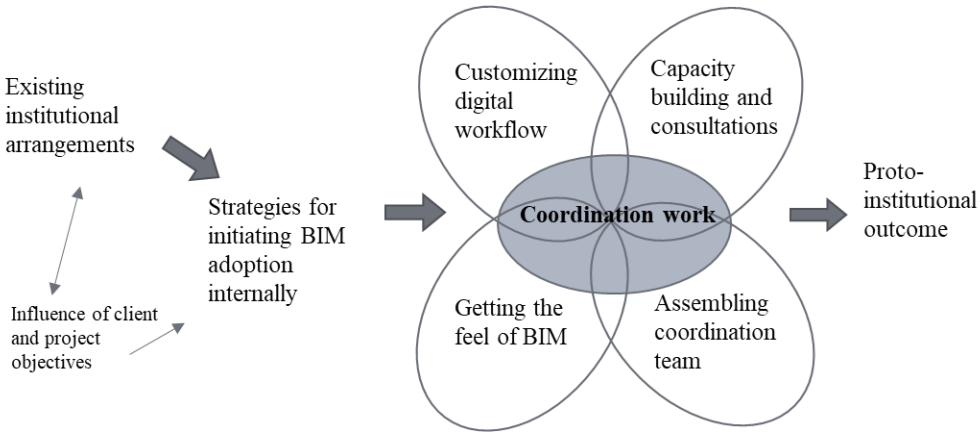

Fig 2. Coordination work

The construction industry aligns with some existing practices- from the institutionalized arrangement of using 2d CAD drawings to different disciplines working in silos. This way of working leads to many coordination issues, and the team tries to work around these issues during the execution. The resolution might lead to other problems and takes longer to resolve, thus leading to time and cost overruns.

Enthusiastic personnel try to overcome these issues by utilizing digital technology. As the project objectives get complex and the client requirements get demanding, the project teams must implement strategies to initiate the use of BIM. In the journey of BIM implementation, the firm initiated the use of BIM when there was no mandate, and when there was a demand from the client, the team had already developed the capability.

The mechanisms identified from the POP evolution is designated as coordination work mechanisms. *Getting the feel of BIM* is a mechanism where the personnel from project teams make themselves aware of the BIM environment. This awareness is achieved by observing new technological interventions in the global construction industry. The knowledge about digital technology, such as BIM, was seeping into the Indian scenario. In 2007, the project teams became aware of a new trend in the global construction industry – the use of Building Information Modeling. The project objectives of complex designs, stringent deadlines, and

high coordination requirements were the starting point for the change. Realizing the benefits BIM can offer construction, the firm made some advancements in BIM implementation.

Assembling the coordination team was influential in the transformation process. When a project team initiated the BIM use, they had to gather personnel interested in digital technology and those with some knowledge. Later, they hired specialists to guide the project teams with BIM. Both these mechanisms of coordination work can be attributed to the cognitive pillar of the institutions suggested by Scott (2014). The initial step towards the change was eying the value created due to the benefits offered by BIM and the individual interest to learn something new to stay apace with the changing technology-driven world. A cognitive-based approach helped to start small and later expand. This approach avoided major retaliation from the project teams of the firm that a regulative approach might have triggered, as observed in the work of Hallet and Ventresca (2006).

Customizing the digital workflow represented the transition from the existing practices of working in their own disciplines to digitalizing the workflow and working in a collaborative environment. There had to be open discussions to submit the deliverables in BIM. Hence, this mechanism aligned more with a regulative pillar of the institutions, as the teams were obliged to follow this digital workflow. The initial self-paced start helped the teams accept digitalization without much resistance.

Capacity building and consultations were important mechanisms to ensure BIM implementation survived. To make sure the teams don't recede from utilizing BIM, constant interactions and discussions proved effective. More personnel such as officials working in costing and contracts divisions, were also targeted to use BIM through this mechanism. The regular training sessions helped even the execution teams attain a 'taken-for-granted' approach towards BIM. This mechanism is more normative in nature, where conformance is obtained via perceived benefits to the team.

We define the institutional outcome of coordination work as proto-institutions, institutional arrangements that are 'narrowly diffused and weakly entrenched, but that have the potential to become widely institutionalized' (Lawrence et al. 2002). In this case, the new digital practices are not fully institutionalized because the firm has some of the projects carried out in the conventional practices using 2d drawings and with little coordination among different disciplines. One of the reasons cited by a few respondents is that the client is not interested in sharing the information with the stakeholders. Also, when the firm bags the contract to only

build the facility, not all the stakeholders have the capability to work in a BIM environment. Hence, BIM utilization is not fully achieved. The firm avoids utilizing BIM and conforms to conventional means, which is also convenient for other stakeholders.

Conclusions

Understanding the processes associated with BIM evolution is enabled through the micro-dynamics linked to each POP model. Each POP model represents how a project is evolving. In addition, over a period, the evolution of the POP models helps to understand the change the organization attains. This study traces the change through different mechanisms utilized to evolve and offers a distinct type of institutional work that triggers the change. We identify the actions that create new sets of mechanisms that modify the existing institutionalized approach and maintain the newly forming institutional arrangement. As the POP models are getting refined, some of the mechanisms get routinized, reinforcing the idea of digital transformation. The coordination work enables the formation of proto-institutions, which sustain to get institutionalized. Finally, we notice that these actions induce change by introducing new mechanisms or co-existing with the old. Thereby this study contributes to the current stream of literature on institutional work by identifying forms of institutional work surrounding this change.

References

Acosta, P., and Gond, J. (2021). “Revisiting Politics in Political CSR : How coercive and deliberative dynamics operate through institutional work in a Colombian company.”

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. SAGE Publications ltd.

Corbin, J., and Strauss, A. (2008). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. *Sage Publications, Inc.*, Sage Publications, Inc, USA.

Dossick, C., Anderson, A., Iorio, J., Neff, G., Taylor, J., Javernick-Will, A., and Dossick, C. S. (2012). “Engineering Project Organizations Conference Messy Talk and Mutual Discovery: Exploring the Necessary Conditions for Synthesis in Virtual Teams MESSY TALK AND MUTUAL DISCOVERY: EXPLORING THE NECESSARY CONDITIONS FOR SYNTHESIS IN VIRTUAL TEAMS.”

Dossick, C. S., Anderson, A., Azari, R., Iorio, J., Neff, G., and Taylor, J. E. (2015). “Messy Talk in Virtual Teams: Achieving Knowledge Synthesis through Shared Visualizations.” *Journal of Management in Engineering*, 31(1), 1–10.

Enegbuma, W. I., Aliagha, G. U., Ali, K. N., and Badiru, Y. Y. . (2016). “Confirmatory Strategic Information Technology Implementation for Building Information Modelling Adoption Model.” *Journal of Construction in Developing Countries*, 21(2), 113–129.

Ernstsen, S. N., Whyte, J., Thuesen, C., and Maier, A. (2021). “How Innovation Champions Frame the Future: Three Visions for Digital Transformation of Construction.” *Journal of Construction Engineering and Management*, 147(1).

Geiger, D. (2009). “The Practice-Turn in Organization Studies: Some Conceptual and Methodological Clarifications.” *Methoden in der Betriebswirtschaftslehre*, (Gherardi), 187–205.

Gioia, D. A., Corley, K. G., and Hamilton, A. L. (2012). “Seeking Qualitative Rigor in Inductive Research : Notes on the Gioia Methodology.” *Organizational Research Methods*, 16(1), 15–31.

Gu, N., and London, K. (2010). “Understanding and facilitating BIM adoption in the AEC industry.” *Automation in Construction*, Elsevier B.V., 19(8), 988–999.

Hallett, T., and Ventresca, M. J. (2006). “How institutions form: Loose coupling as mechanism in Gouldner’s patterns of industrial bureaucracy.” *American Behavioral Scientist*, 49(7), 908–924.

Hinings, B., Gegenhuber, T., and Greenwood, R. (2018). “Digital innovation and transformation : An institutional perspective.” *Information and Organization*, 28(1), 52–61.

Hire, S., Sandbhor, S., and Ruikar, K. (2022). “Bibliometric Survey for Adoption of Building Information Modeling (BIM) in Construction Industry– A Safety Perspective.” *Archives of Computational Methods in Engineering*, Springer Netherlands, 29(1), 679–693.

Iyer, K. C., and Jha, K. N. (2006). “Critical factors affecting schedule performance.” *Journal of Construction Engineering and Management*, 24(5), 757–773.

Kunz, J., and Fischer, M. (2020). “Virtual design and construction.” *Construction Management and Economics*, Routledge, 0(0), 1–9.

Kushwaha, V., and Adhikari, M. (2016). “Exploring the Adoption of Building Information Modelling.” *International Research Journal of Engineering and Technology (IRJET)*, 03(01), 526–530.

Langley, A., Smallman, C., Tsoukas, H., and Van de Ven, A. (2013). “PROCESS STUDIES OF CHANGE IN ORGANIZATION AND MANAGEMENT : UNVEILING TEMPORALITY , ACTIVITY , AND FLOW.” *The Academy of Management Journal*, 56(1), 1–13.

Lawrence, T. B., Hardy, C., and Phillips, N. (2002). “Institutional Effects of Interorganizational Collaboration : The Emergence of Proto- Institutions.” *Academy of Management Journal*, 44(1), 281–290.

Lawrence, T. B., and Suddaby, R. (2006). “Institutions and Instituional Work.” *Sage Handbook of Organization studies*, S. R. Clegg, C. Hardy, T. B. Lawrence, and W. R. Nord, eds., Sage, 215–254.

Mahalingam, A., and Levitt, R. E. (2007). “Institutional Theory as a Framework for Analyzing Conflicts on Global Projects.” *Journal of Construction Engineering and Management*, 133(7), 517–528.

Mair, J., Marti, I., and Ventresca, M. J. (2012). “Building Inclusive Markets in Rural Bangladesh : How Itermediaries Work Institutional Voids.” *Academy of Management Journal*, 55(4), 819–850.

Memon, A. H., Rahman, I. A., Memon, I., and Azman, N. I. A. (2014). “BIM in Malaysian construction industry: Status, advantages, barriers and strategies to enhance the implementation level.” *Research Journal of Applied Sciences, Engineering and Technology*, 8(5), 606–614.

Miles, M. B., and Huberman, A. M. (1994). *Qualitative Data Analysis- An Expanded Sourcebook*. (R. Holland, ed.), Sage Publications, Inc, USA.

Morgeson, F. P., Mitchell, T. R., and Liu, D. (2015). “EVENT SYSTEM THEORY : AN EVENT-ORIENTED APPROACH TO THE ORGANIZATIONAL SCIENCES.” *Academy of Management Review*, 40(4), 515–537.

Papadonikolaki, E., Krystallis, I., and Morgan, B. (2020). “Digital Transformation in Construction : Systematic Literature Review of Evolving Concepts.” *Engineering*

Project Organization Conference, 1–14.

Sage, D. J., and Vitry, C. (Eds.). (2018). *Societies under Construction*. Springer International Publishing, Cham.

Scott, W. R. (2014). *Institutions and organizations: Ideas, Interests and Identities*. *Sage Publications, Inc.*

Steel, J., Drogemuller, R., and Toth, B. (2012). "Model interoperability in building information modelling." *Software and Systems Modeling*, 11(1), 99–109.

Ullah, K., Lill, I., and Witt, E. (2019). "An overview of BIM adoption in the construction industry: Benefits and barriers." *Emerald Reach Proceedings Series*, 2, 297–303.

Won, J., Lee, G., Dossick, C., and Messner, J. (2013). "Where to Focus for Successful Adoption of Building Information Modeling within Organization." *Journal of Construction Engineering and Management*, 04013014(10), 1–10.

Yap, J. B. H., Abdul-Rahman, H., and Wang, C. (2018). "Preventive Mitigation of Overruns with Project Communication Management and Continuous Learning: PLS-SEM Approach." *Journal of Construction Engineering and Management*, 144(5), 04018025.

Yin, R. K. (2018). *Case study research and applications: Design and methods*. *Sage Publications, Inc.*, Sage Publications, Inc, Los Angeles.

Zerjav, V., Edkins, A., and Davies, A. (2018). "Project capabilities for operational outcomes in inter-organisational settings : The case of London Heathrow Terminal 2." *International Journal of Project Management*, Elsevier Ltd, 36(3), 444–459.