

How do institutional entrepreneurs aid in BIM adoption?

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Introduction and background

The construction industry is a fragmented industry involving many stakeholders with varied role relationships, networks, and structures. Digital technology, such as Building Information Modelling (BIM) is one of the solutions to multiple problems faced by the construction industry. At the same time, this industry is also known for adopting new innovations very slowly because they tend to follow institutionalized practices. However, an institutional change is possible due to the actions of the purposive actors. There have been efforts to study the factors that affect the change and the challenges these digital transformations face. However, little is known about the role of professionals in bringing about a change in construction firms due to the adoption of digital technology such as BIM.

In this context, by digital transformation, we mean the change brought about by actors (and agents), practices, and strategies that create, disrupt, replace, or blend with the existing practices within the organization surrounding the BIM implementation (Hinings et al. 2018). These change agents change the game, create new ones, or transform the rules of the institutionalized games and can be an individual or collective agent. There have been several studies theorizing technology as a carrier of institutions (Scott 2014). The effectiveness of the transformation process hinges on the mutual interaction between various individuals, groups, and contexts (Langley et al. 2013). Institutional actors or agents include both individuals and groups that create new institutional forms and influence existing ones. They initially participate in the proceedings, interpret the circumstances, and ultimately form customary reactions that gradually evolve into ‘taken-for-granted’ situations.

Institutional entrepreneurs are identified as the ‘actors who have an interest in particular institutional arrangements and who leverage resources to create new or transform existing institutions’ (Battilana et al. 2009; Hardy and Maguire 2017; Scott 2014). They are primarily concerned with shifting field-level norms, routines, and rules rather than directly coercing a particular adversary. These actors may exert episodic agency and exploit the resource dependencies of others. The strategies used by successful entrepreneurs are the occupation of positions with wide legitimacy and bridging diverse stakeholders; the theorization of new

practices; and connecting these practices to stakeholders' routines and values (Levy and Scully 2007 pp. 13, 4).

Thus, the study is about institutional entrepreneurs in the context of innovations in projects of construction firms due to the intervention of BIM. In this study, we unravel the change agents involved in the change and the various strategies they incorporate to bring the transformation. We suggest that in the domain of construction to bring about innovation and digital transformation, there is a collective effort of actors employing different strategies at different phases of the transformation. Towards this, we ask, *Which actors emerge as institutional entrepreneurs, and how do they manage to bring about an organizational change due to BIM adoption in construction firms?*

Research Methodology and approach

We carried out an in-depth qualitative case study using an inductive approach based on grounded theory. A qualitative case-study approach allows more detailed, exploratory accounts of the experiences of the personnel who have lived through the BIM adoption journey. Geiger (2009) posits that analyzing organizational actions and related activities is key to comprehending them, as organizations are constantly enacting processes. Additionally, Hughes suggests that institutions endure because individuals interact and perpetuate them (Scott, 2014).

The process of studying evolution can be challenging as it happens gradually over time, and the signs of change may not always be immediately apparent. However, we gained insight into the role of agents in the application of BIM through extensive interviews with individuals who have been using BIM since 2009 at two prominent construction contracting firms in India, referred to as Firm A (FA) and Firm B (FB), throughout this paper. These conversations help to understand changes in work practices, the purposive actions by these agents, and the use of digital technology.

Alongside this, we collected secondary data from PowerPoint presentations and contract documents from various projects. Our approach was unbiased, with no initial hypothesis in place, and our findings evolved from the data. We conducted a total of 60 hours of interviews with personnel from Firm A and 20 hours from Firm B, with the difference in interview hours being attributed to factors such as company size, BIM team size, level of BIM adoption, and the type of adoption at each firm. Firm B had a slower BIM adoption journey, due to substantially fewer projects executed using BIM compared to Firm A. We conducted multiple interviews with each informant and compared their stories with those of other informants to

increase the data's internal consistency and validity (Yin, 2018). We encouraged informants to discuss their strategies for fulfilling BIM requirements and how BIM affected their workflow, organizational structure, existing ways of working, and roles.

The transcription process for the interviews involved both manual and software methods, with the Descript software being utilized in some cases. For accuracy, any errors in the software-generated transcripts were corrected manually. Our analysis was conducted manually through a process of open and axial coding, following the methodology outlined by Corbin and Strauss (2008). Firstly, we identified overarching concepts through open coding by thoroughly reviewing the transcripts. Next, we organized and related these concepts using axial coding. Our initial focus was on the efforts involved in implementing BIM and initiating the change.

Findings and implications

We investigated the change journey from three different phases – initiation, reconfiguring, and sustaining. Aligning with the previous studies, we considered the changes these agents brought about or how they mobilized the resources (Battilana et al. 2009; Garud et al. 2007; Mcgaughey 2013) in these phases. We closely observed similarities with the resource mobilization strategies suggested by Dorado (2005)- Leveraging, Accumulating, and Convening. In leveraging, actors are ‘catalytic agents bridging unaware, unsure or skeptical actors to explore the possibilities of cooperation’ (ibid p.391). These actors define the project, then gain support from the internal team, and finally gain support from other stakeholders. When it comes to accumulating, these actors continue to follow the actions and interactions accumulated over time which then get diffused. In the case of convening, inter-organizational arrangements are created which then jumpstart the process change. Thus, we identified the change agents and their strategies corresponding to each phase. It was also understood that the change agents were different in the phases. Now, we dive into the three phases along with the actors and the strategies.

Firm A

Initiation

In the first case, the agents modified both their actions and their manner of interacting with other actors, thereby creating an environment conducive to change as suggested by Barley (2020). This phase was more about leveraging where the change agents gained support from and convinced the team to get started using BIM. Project team members initiated the use of

BIM in their work, gradually building their skills by starting small at the project level. In this case, the project design head decided to use BIM in their project. The approach was to build the team by defining the purpose, getting other like-minded personnel on board, and assigning roles. Later, they also tried to get other stakeholders on board.

The VP was instrumental in setting up the infrastructure. As these new practices became habitual and were implemented in other projects, they began to raise awareness and build capacity among other project teams. Later, the design head from the top management formalized BIM at the organizational level, with project BIM managers playing the role of a bridge between the project level and top management. These BIM managers continued the practices, resulting in creating a dominant practice surrounding BIM use. Their involvement helps in routinizing the new way of working. Later, this was taken up by the Head-operations, who constantly helped and guided others in following the new way of working.

Reconfiguring

The actors who were important in this phase were the BIM managers, the Head of BIM strategy, and the Head of operations. This phase was more about working on improving the newly initiated practices. Collaboration increased, and external stakeholders such as BIM consultants, software vendors, and academic institutions supported these changes. In the earlier phase, there were BIM managers at the project level who were trying to diffuse and replicate the newly introduced practices. Here, the BIM managers were the problem solvers.

In this phase, we saw that the Head of BIM strategy was trying to get the attention and propagate BIM among the personnel. This Head of BIM strategy tried to expand the knowledge base by bringing trainers from software vendors who offered new insights to the personnel. This was also expanding the knowledge base around BIM.

Sustaining

This phase has actors who work to routinize the use of BIM in their projects and organization. The actors who were part of this phase were the BIM coordinators, BIM managers, Head of BIM strategy, and Head of operations. BIM coordinators were appointed for each project to facilitate BIM use at the project sites. The responsibility of this role was to dissipate and routinize the new practices in the project settings. These BIM coordinators conducted awareness sessions for the site personnel by demonstrating the use and benefits of utilizing BIM. These BIM coordinators also helped the BIM manager and project team in offering help

with integrating the work schedule into the virtual 3D model to create a time-based simulation to track the work progress in real time. According to one of the BIM coordinators,

“We use some APIs [Application Programming Interface], that was, was like, it was created by another person. So, we, we had these plugins developed from HQ [Head quarters] that was given to us like, whatever like things like that. We tried to overcome the site issues to manage and mitigate them, using some of the plugins developed using Revit API.”

There were actors like the Head of operations and BIM coordinators who were dissipating and routinizing the new practices which was important for sustaining, leading to institutionalized adoption. The actor–strategy mapping is shown in Table 1.

Firm B

The actors involved and the actor profile is shown in Table 2.

Initiation

In the case of Firm B, the main actor to initiate the change was the Head of BIM strategy. This official was excited to use BIM and decided to jumpstart the process change as BIM was known to be a solution to many problems in the construction industry. This actor decided to include the idea of the use of BIM in the vision of the company. The idea was to expedite, and the adoption process. According to the Head of BIM strategy,

“We made a bold decision of, yes, we want to invest in this, but at the same time, we had the patience to wait to see the results, and the fear of any technology implementation within the company was not immediate results. It was more of. How it'll bring in a change in longer. So, we added to our vision statement.”

The initiation phase was handled by the Head of BIM strategy from 2007 to 2017 because the firm followed a top-down approach.

Reconfiguring

In this phase, the Head of BIM strategy continued his approach, while inducting a Manager-operations and technology to offer support and to continue the new practices. This Manager helped to replicate and dissipate the information and awareness of BIM to the decentralized teams, which were operating in different regions of the country. There was also a lack of

consensus building among the team members, and they tried to use BIM because they were asked to. This resulted in a sluggish transition with regard to the use of digital technology.

Sustaining

In this phase, the Head BIM strategy tried to solve the problem of slow transition by recruiting new experts and collaborating with external stakeholders such as software vendors. According to one of the respondents,

“We have now MoU (Memorandum of Understanding) signed with ... [software vendor’s name] to create a new interface and customize the process to help us use BIM better. He [Head BIM strategy] spearheaded this collaboration to expedite the change process.”

Table 1 Actor profile- Firm A

Phase	Initiation		Reconfiguring		Sustaining	
2007-2012	Project Design Head, Project BIM managers	Leveraging Accumulating	-	-	-	-
2012-2017	Design Head, VP Central BIM team, Head operations,	Leveraging Leveraging Accumulating	BIM Managers, Head BIM Strategy Head operations	Convening Leveraging Accumulating	-	-
2017-2023	-	-	BIM Managers, Head BIM Strategy, Head operations	Convening Leveraging Accumulating	BIM Coordinators, BIM Managers, Head BIM strategy, Head Operations	Accumulating Convening Leveraging Accumulating

Table 2 Actor profile- Firm B

Phase	Initiation		Reconfiguring		Sustaining	
2007-2012	Head BIM Strategy	Convening	-	-	-	-
2012-2017	Head BIM Strategy	Convening	Head BIM Strategy Manager Operations and Technology	Convening Accumulating	-	-
2017-2023	-	-	Head BIM Strategy Manager Operations and Technology	Convening Accumulating	Head BIM Strategy Manager Operations and Technology	Convening Accumulating

Discussions and conclusions

Leveraging seemed to be more effective in initiating the change successfully. In Firm A, the change was initiated by leveraging which helped to gain the support from the teams to jumpstart a change. While in Firm B, they tried to bring a change directly, but the teams were not prepared to embrace a change. It can also be seen that instead of embedded agency as studied by many researchers, change agents from an intermediate level were instrumental in the change. The

actors depicted in tables 2 and 3 were from the organizational level and not directly part of any construction projects. These agents were influenced and resulted in the change process from the intermediate level.

Comparing the two cases, it was found that Firm A was relatively successful at adopting or embracing the change compared to Firm B. The main reason for that was identified as the strategy of leveraging, which was found important to gain support from the team members to bring the change, especially in an industry like construction, which is very fragmented with multiple stakeholders being part of the projects. Firm A also had different change agents at different phases thus depicting a 'passing the baton' idea to push forward the change. We also suggest that the change agents are in the intermediate field level against the embedded actors in the field (in this case, individual projects), and the peripheral actors (the external stakeholders).

Keywords: Digital transformation, Institutional entrepreneurs, Innovation, BIM adoption, Qualitative case study, Organizational change

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