How are institutional logics guiding BIM adoption pathways?

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Introduction and background

Construction firms can follow different pathways for technology adoption. The literature talks about top-down and bottom-up approaches utilized by organizations in decision-making (Brady and Walsh 2007). Most firms take a top-down approach where the top management makes the decisions and the middle and lower management follow the set strategies. While this approach has worked, some studies also try to unravel the bottom-up approach. This paper attempts to understand the different pathways of BIM adoption by two construction contracting firms and two engineering works units of public universities. We use a combined institutional and practice perspective and contribute to the literature on institutional logics.

Institutional theory provides a framework to understand how the rules of the game result in a taken-for-granted approach. According to Mahoney and Thelen (2009), 'changes often take place incrementally and through seemingly small adjustments that can, however, accumulate into significant institutional transformation'. The change, be it rapid or gradual, is underpinned by the persistence of original institutional choices or structured political dynamics. Actors belonging to multiple institutional fields can be instrumental in inducing new practices and ideas. Institutional arrangements evolve within the boundaries of the socio-economic environment and are established as a result of social interactions (Furnari 2016). When these actors try to establish their interests, it results in institutional pluralism (Kraatz and Block 2017, pp. 532–557; Yu, 2013). Institutional pluralism is a source of contradictory logics that eventually brings about an institutional change.

Friedland and Alford (1991) introduced the idea of institutional logic. Institutional logic is defined as 'a socially constructed set of material practices and symbolic constructions (assumptions, values, and beliefs) that constitute its organizing principles and which is available to organizations and individuals to shape cognition and behavior'. In other words, logics are taken-for-granted beliefs and practices that guide the actor's behavior in the fields of activity (Battilana and Lee 2014; Besharov and Smith 2014; Friedland and Alford 1991; Scott 2014). When fields have settled prioritizations of logics and elaborated institutional arrangements, the members in the field have a clear idea of what to expect, and the ideas can drive their behavior (Zietsma et al. 2017). In other words, the behavior is not driven by interests

but by preconscious acceptance of institutionalized values or practices. However, the literature does not explore an understanding of the socially constructed practices that shape the cognition and behavior of individuals and organizations about BIM adoption in construction firms as existing logics give way to new ones that embrace the adoption of digital technology. Thus, this study intends to answer *What are the different institutional logics that guide construction firms in selecting the BIM adoption pathways? How did the construction firms in this study decide on the pathways to adopt BIM?*

It is important to note that we did not begin our study focusing on the theory of institutional logics. Entities such as innovations and legitimacy emerged as we proceeded with the analyses. Through our study we highlight the different institutional logics at play to bring about a digital transformation in construction entities.

Research Methodology and approach

Our study is based on an in-depth qualitative case study approach following grounded theory. A qualitative case-study approach allows more detailed, exploratory accounts of experiences of the personnel who have lived through the BIM adoption journey. Four case studies were conducted on four organizations – two contracting firms and two public owners. The cases will be represented as Construction Contracting Firm A (CCFA), Construction Contracting Firm B (CCFB), Engineering Works A (EWA), and Engineering Works B (EWB).

Data collection was primarily through interviews, and secondary data included documents such as contract clauses, progress review meeting presentations and reports. The interview hours were clocked at 90 hours in total. The findings evolved from the data, and no ex-ante hypothesis was considered. The interviews were transcribed either manually or using transcribing software. The analysis was done manually through open and axial coding (Corbin and Strauss 2008). Through open coding, we examined the transcripts to identify broader concepts. These concepts were then linked using axial coding.

From the data, we tried to understand where the idea of BIM stemmed from and how that idea got materialized. The support mechanisms used to monitor the strategy and operations of organizations regarding BIM were considered next. The affinity for innovation and the types were identified that enhanced BIM implementation. Legitimacy is fundamental for firms to survive in the business, and we looked at how legitimacy affected the BIM adoption journey. We identified instances supporting each of the factors mentioned above. Through axial coding, we identified the different logics that influenced the BIM adoption pathways.

Findings and implications

The firms followed different approaches in pushing BIM utilization. In the case of CCFA, it started small at the project level. The idea to utilize BIM was to meet the stringent deadline of constructing complex airport projects in two of the cities in India. The teams considered the MEP services as the starting point and then slowly ventured into different BIM uses and developed the capability. As the project teams displayed better performance, the top management realized the importance of BIM adoption. This marks the transition from a project level to an organization level. At the same time, the various project teams (including middle and lower management) were constantly improving and improvising at the project level. In this case, we could see bottom-up followed by bottom approach with the constant influence of external stakeholders leading to a stable BIM implementation.

EWB focuses primarily on digitalized document management and has tried to make it robust. The team, led by their chairman, initiated BIM among their internal team. Once the internal team gained some understanding, the other stakeholders who were part of the projects were involved. When they explained their inability, the internal team was able to help them by demonstrating how things can be done.

On the contrary, EWA has pressure from external entities such as faculty members, and the top management follows or takes their advice. There wasn't any effort from the top management or the internal team to make themselves aware or enhance the capability of the team. This also led the team to not extend any support to the stakeholders who were part of the projects and expected them to submit the deliverables.

In the cases of CCFB, there was top management involvement regarding BIM implementation. Realizing the global market shifting to incorporate digital technology in construction, the top management decided to utilize BIM in their projects. However, BIM usage did not gain traction among the middle and lower management. Hence, they decided to decentralize and make each region to start implementing BIM. Top management made some guidelines and manuals were made available to the teams. The top management handled each regional level individually, and cross-learning at the regional level was not occurring.

Based on the analysis from the observations, we arrived at two logics that determine how the firms decide on BIM utilization. These logics are completion logic and innovation logic. *Completion logic* can be defined as values, assumptions, and beliefs, materialized in practice and artifacts, that assume completing a project using digital technology such as BIM is of

utmost priority. This logic is guided by the support offered to the teams to promote the use of digital technology and can be identified as follows:

1) Passive support - where the teams are forced to use BIM and submit the deliverables without much support. This should not be confused with the idea of regulation because there are no standing instructions from the company or the organization, still the top management because of the external influence, pushes the team without providing any support from their end.
2) Partial support- the teams are given some help in terms of training and upskilling but do not provide constant support. The top management wants the teams to realize the benefits and take it forward by themselves rather than being made to implement due to the involvement of the top management.
3) Proactive support- the project teams are self-motivated, and the top management provides support to keep the teams up to date with the improvements in the technology and promotes awareness of the digital technology. They provide training to the personnel. It also offers help to some of the sub-contractors to enable the information sharing and the process of information flow in BIM.

It should be noted that providing support alone doesn't warrant BIM implementation. This condition is supplemented by the firm's enthusiasm to innovate. Thus, the next logic in play is the Innovation logic.

Innovation logic is defined as values, assumptions and beliefs, manifested in practice, that assume innovating and implementing new digital technology as a task among many tasks performed to complete the project. We adapt the framework suggested by Partanen et al. (2014), where they combined two dimensions of innovations- the nature of innovation and the revolutionarity of innovation. According to this framework, we arrive at four different types of innovations, which is shown in Fig 1.

We also find that these logics are enabled by three kinds of legitimacies (Suddaby et al. 2017):

1) Legitimacy as property – Here, legitimacy is conceptualized as a capacity or trait possessed by some organization.
2) Legitimacy as process – Here, legitimacy is considered as an emergent or structured set of activities that describe affiliation acquired in a social order.

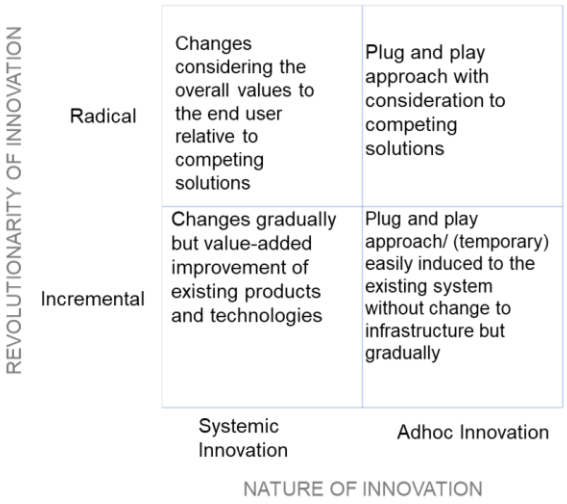

Fig 1. Types of Innovation

3) Legitimacy as perception – In this case, legitimacy is a conception of validity as a collective level of judgement that makes them capable of executing certain activities.

Combining these logics, we arrive at a network that describes various pathways that help in BIM implementation. The network is shown below in Fig 2.

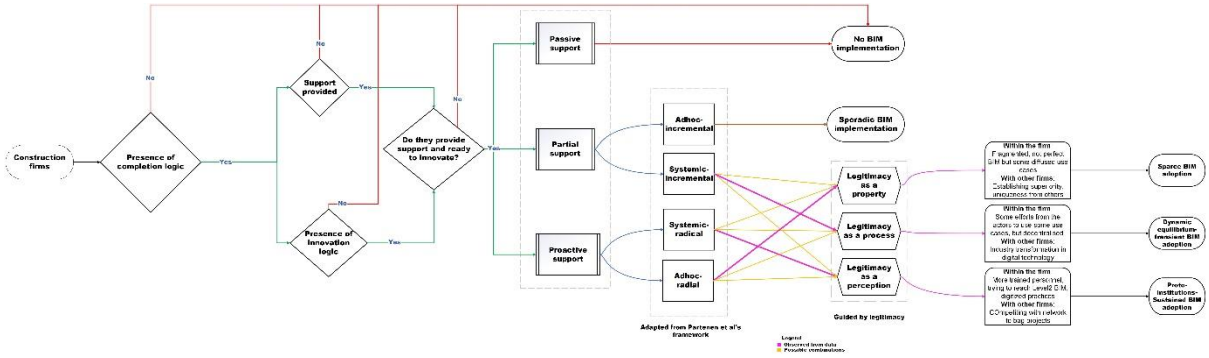

Fig 2. BIM implementation pathways

Discussions and conclusions

Through our research, we have arrived at the following propositions.

P1: Proactive support is most likely to result in radical innovation.

P2: Radical innovation, along with systemic innovation, most likely is guided by legitimacy as perception, which has a higher chance of leading to proto-institutionalized BIM adoption.

P3: Radical innovation, along with adhoc innovation, most likely is guided by legitimacy as property and has a higher chance of sparse BIM adoption.

P4: Partial support most likely results in incremental innovation that is guided by legitimacy as process and tends to dynamic equilibrium.

We set out to identify the pathways of BIM adoption and the logics guiding these firms to achieve it. The paths can be identified from the propositions, and the guiding institutional logics are completion logic and innovation logic. It can be observed that the bottom-up approach with some improvisations seems more successful in BIM implementation as observed in CCFA. It can also be observed that the innovation logic has more influence on predicting BIM adoption.

Keywords: BIM adoption, Institutional logic, Innovation, Legitimacy, Qualitative case study, Organizational change

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