Business Models for Construction Organizations enabled by Cloud-based BIM Innovations.

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Abstract:

Purpose:

Cloud-based BIM (CBIM) provides BIM through cloud computing. It is an emerging research area that enables cloud-based BIM activities (Zhao & Taib, 2022). Cloud-based building information modelling (CBIM) is in the intermediary usage phase. Therefore, business models are continually evolving in organizations. These cloud-based construction activities are exhibited differently by organizations. For instance, Software vendors produce BIM tools or host databases, while construction and consultancy companies use the tools (Abbas et al., 2022; Bello et al., 2021). The difference in organizational types implies they have unique business models and seek competitive advantage based on their business strategies. A business model is how organizations create value for their customers while making some form of monetary or non-monetary return. business models identify several business constructs. For instance, Osterwalder & Pigneur, (2012) described business constructs as value propositions, customer segments, channels, customer relationships, revenue streams, key resources, key partners, key activities, and cost structure. Also, competition, customer interface, financial model, and governance are vital business model constructs (Brown, 2018; Das et al., 2020; Schön, 2012).

Methodology:

We aim to draw out business models of CBIM organizations. Based on the constructivist paradigm for grounded theory studies, our study observed the attitude of ten managers from relevant organizations within Europe. They were quoted verbatim, and these recommendations were from them theorized. This study employed a qualitative approach of expert opinion through interviews. with an in-depth knowledge of BIM and a wide overview of their organization's business strategy. The experts interviewed was selected from three categories of organizations, BIM Software vendors, construction companies, and engineering and service companies. the study employed

purposive sampling, and the experts were strategically selected to provide relevant data for the study. They are senior Country managers, global technology officers, strategic managers, and heads of digitalization in their various organizations. This affords the study ample evidence based on knowledge of the organization, digitalization, and wide BIM perspective. We contacted our interviewees through emails inviting them for a thirty to sixty minutes conversation on CBIM.

Findings:

We transcribed and analyzed our interviews using the AtlasTi Software. This analysis led to two phases of coding exercises -open coding followed by thematic coding (Belgrave & Seide, 2019; Charmaz, 2005). First, we developed several codes in the open codes that described the data line-by-line. Then, in the focused coding, we examined underlying themes in the data transcripts of the different contributors (Charmaz, 2005; Strauss & Corbin, 1994). The first stage code resulted in 62 codes and 159 quotes. In thematic coding, we have 42 codes 298 grouped into 18 core groups based on similar responses from the interview.

First, we expressed how Consumers and Producers conduct their CBIM businesses based on the on Osterwalder & Pigneur, (2011) business model canvas value proposition provides an understanding of how CBIM-enabled products and services are offered to clients. Next, we identified customers to whom CBIM-based services are offered. Channels described the ways products are delivered. There are also relationships needed to create value for clients; activities needed to keep value proposition; the type of resources needed to digitally transform the enterprise; other organizations to work with to meet client's needs; the monetary implication of achieving value proposition, and the ways revenues are generated (See Table 1).

After comparing the business model for CBIM consumers and producers (Table 1), we postulated first that: "*The challenge many organizations face is that the traditional business model was designed when computer (technology) business was still at its infancy. It was seen as a department that supplied computers or the server for hosting databases majorly. Even though technology improved business efficiency, it was not the platform for business. This led to frustration on the side of business owners due to the advent of digital transformation.*" Going further to evaluate the effect of digital transformation on the business model of CBIM consumers and producers, we postulate that: *"There will be a continual influx of digital transformation. Hence, while*

organizations are matching up, their present business should also be agile. To achieve this business and technology must be closely aligned." Having identified the necessity for technology and business process alignment is needed for a business model, our last postulate to enhance a CBIM producer or consumer business model is to: *"Understand that commercial realization point of view is hard for CBIM business model. Due to reasons such as the Client's motivation is hard to attain due to certain uncertainties like the COVID 19 pandemic. Hence, measuring the uncertainties and risk of investment in innovation. There should be insights into establishing cost control mechanisms in place for a business model, understanding the organizational procedure to transition from one business model to another, identifying variants and suitability of business models, and identifying organizational, technical and market resources needed to integrate the business model into the cloud platform, evaluating firm performance, and bridging the academic gap by initiating ontological conversation to understand business model".* With these, the CBIM business model for both producers and consumers require an alteration in the traditional business model, retaining old customer, gaining new customers, making more profit, and reducing cost structure.

Implications:

The components of a business model canvas are needed as business drivers for cloud-based building Information modelling. Two categories of actors using cloud-based BIM tools were identified to do business differently. The study finds that to drive strategic growth, value proposition through product and development strategy is needed to develop new and existing CBIM products and services. Also, customer needs are changing, thus, having an awareness of the customer needs informs the businesses on how to sell more of already existing or new products or services. Similarly, for a digital business model, cloud service infrastructure, coupled with customer needs influences pricing logic. Judicious use of customer relationships through a company acquisition, customer retention, and good user experience serves as strategies for business growth, and workforce knowledge in business and information technology. Likewise, utilizing the strength of strategic alliance rather than competition is vital to harness the full potential of CBIM innovations for business growth.

Table 1 Consumer and Producer Business Model Constructs).

Business Model Constructs	Consumers	Producers
Value Proposition	*"We help our clients with planning, designing and maintaining engineering assets".*	*"We design, operate, and maintain software. We also provide a database"*
Customer Segments	*"We like to see them as private and public clients. Private clients are like infrastructure clients, and the public clients are in remediation, and resilience environment".*	*"Our customers are almost everybody in construction and engineering."*
Channels	*"Another view is which kind of people do we need to drive the transformed processes"*	*"Hosting via Amazon service customer relationships, acquisitions, and BIM events."*
Customer relationship	*"We offer them (clients) a very good user experience, link them into a long-term relationship when it comes to framework agreement or getting more involved in sharing the data"*	*"We ensure that whatever our customer invested, we ensure that we can exceed their expected value in return (more return on their investment)."*
Key activities	*"The strategy we have devised to keep them is to ensure that people are being appreciated. The digital team wants to ensure that they are somewhere where they are appreciated and where there is a culture".*	*"There are their different angles to this. One is if we develop products but, there is a second element which is if customers developed products based on our APIs"*
Key resources	*"We need people who have a wide overview of the company and the processes, but also their depth in technology."*	*"We use the Amazon platform to host technology"*
Key Partnership	*"We are settling on having open APIs with our tools. Open APIs require that we can communicate with our sub-contractors, partners, and our clients."*	*" You do a partner support where you have in your organization channel managers"*
Cost structure	*"For tools, we calculate a business case. what do we want to do with the tool, where do we have an of the tool? and we calculate the business case".*	*"We have a subscription pricing structure, there are also total project model and framework model"*
Revenue Model	*"You can sell licenses or licenses based on the revenue you gain with it. This is what we will use for the digital business model. So, we can also charge people for the time. can also charge people based on a percentage of the revenue on their project"*	*"We have now introduced the subscription-based model. For businesses, it also has good possibilities"*

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