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MOVING BEYOND 'BUSINESS AS USUAL'? EXPLORING DIGITAL TRANSFORMATION IN THE SWEDISH CONSTRUCTION SECTOR

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Digital transformation (DT) refers to a process of integrating digital technologies that will lead to new forms of relationship among actors; organisational processes; and business models. It is frequently portrayed as something that can improve; but also, potentially disrupt; the construction sector (CS) as we know it today. As DT requires distributed actions; collaboration; and coordination across inter-organisational boundaries in the sector; we apply an ecosystem perspective to explore the current state of DT in 14 Swedish construction incumbent firms. Findings show the need to address the heterogeneity of the actors; their respective roles; positions in the value chain. The sense of urgency to transform is highest for actors with business models based on selling hours. DT is mainly linked to incremental improvements regarding internal efficiency and cost reductions rather than exploitation of new business models. Finally, the role of leadership in the transformation process is rather absent and the actors take a more reactive role waiting for others to demand change.

Keywords: digital transformation; disruptive innovation; ecosystem; digital business

INTRODUCTION

Digital transformation (DT) has emerged as a key narrative with an emphasis on the convergence of physical and digital worlds and restructuring of the economies, industries, and society (Vial 2019, McKinsey 2020). It is argued that the increasing diffusion of digital technologies in work processes is disrupting the existing nature of industries and leading to the redefinition of traditional business models (Rachinger *et al.*, 2018). The discussions on DT roots back to two different lines of research; information systems (Yoo *et al.*, 2010) and disruptive innovation theory (Christensen *et al.*, 2018). While the former pays attention to digital and technological aspects, the latter focuses on the organisational and management aspects of DT. Following the latter, this research started exploring the literature on 'disruptive innovation' theory which offers an explanation why established companies fail to recognise the disruptive characteristics of new technologies while new entrants capture the market with either low-cost and low-performance offerings or creating a new market (Christensen *et al.*, 2018). Rather than focusing on what might be accepted as a

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'disruptive innovation' within the context of the construction sector (CS), our interest moved towards understanding the concept of digital transformation and its impacts on value reconfiguration on the ecosystem level.

There is also a growing attention to understand how the construction sector will address the impacts of DT (i.e., Lavikka *et al.*, 2018, Bosch-Sijtsema *et al.*, 2021, Cidik and Boyd 2022). Yet, to date, the scholarly literature on DT has largely focused on exploring digital technologies to improve daily activities of construction while transformational impacts on current business models remain understudied. It is important to note that DT of the construction sector is a multifaceted phenomenon referring to different actions and processes including a variety of stakeholders who have different business models and priorities. Therefore, this research reports the initial results of a research project aiming to map, through an ecosystem perspective, how value is created today and then identify future potential trajectories and states of digitalisation driven business models in the construction sector. The aim of the current paper is to discuss the results of current state analysis of digital transformation based on interviews with 'traditional' actors in the Swedish construction sector.

Digital Transformation

Increased digitalisation has put pressure on companies to reform their current business models, update their product and service offerings and relationships with stakeholders (Kraus *et al.*, 2022). Digitisation, digitalisation, and DT are described as the key phases to explain the impact of digital technologies in business and management in all sectors (Verhoef *et al.*, 2019). Digitisation refers to an initial phase when analogue information was replaced by digital information (i.e., text, scan). Digitalisation is seen as the following phase within which digital technologies are embedded in the business processes to achieve better performance (i.e., CAD, BIM). DT is accepted as the current phase referring to the use of new digital technologies to enable business improvements or change the business models completely (Rachinger *et al.*, 2018, Vial 2019).

Uber, Airbnb, and Spotify emerge as the key points of reference to explain how digital innovations created significant impacts in certain industries and replaced the traditional actors and business models with new ones (Skog 2018). The common argument is that digitalisation creates disruptions on many levels from achievement of simple tasks to the way how value is created in different sectors. As defined by Vial (2019:118), digital transformation refers to "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies". Hence, the DT research in construction requires widening up the research scope from focusing on the use of a specific technology to improve day to day activities to addressing how increasing digitalisation are impacting the entire business ecosystem.

Digital Transformation in the Construction Sector

This research started with a review of construction related literature in the topic of digital transformation. The review showed that DT is mostly used as a keyword within the studies focusing on the use of digital tools to improve current operations (ie. Aibinu and Papadonikolaki 2020, Ezzeddine and Garcia 2021) with few exceptions that emphasizing the transformational impacts of digitalisation on broader scale (Woodhead 2018, Succar and Poirier 2020) or adapting a critical approach to discuss DT in construction (Cidik and Boyd 2022). Hence, much of current research

lacks articulating the broader impacts of digital technologies, especially from the perspectives of new digital business models and value reconfigurations on the ecosystem level. However, the review enabled us to identify four themes that are emphasized as the key issues impacting DT in the construction sector.

Leadership

One common theme is that DT requires dedicated leaders or called elsewhere 'digital champions' (i.e., Morgan 2019, Ernstsen *et al.*, 2021). Morgan (2019) presents an empirical study in a UK based design firm and emphasizes leadership support as one of the key issues enabling successful diffusion of BIM. Similarly, Zulu and Khosrowshahi (2021) cast leaders as the key actors who could embrace DT and identify different leadership approaches exhibited by construction sector leaders. Alternatively, Criado-Perez *et al.*, (2022) introduce four different leadership thinking schemas required to assist DT strategies based on an empirical study in the Australian AEC sector. They argue that leaders need 'future scenario thinking' (1) to create future scenarios which are assumed to be initiated using 'strategic thinking' (2). Then, 'capabilities thinking' (3) is offered as the next step to align the company towards its intended future. Lastly, 'experimental thinking' (4) is seen as the step towards targeted visions. The emphasis on 'future scenario thinking' and 'capabilities thinking' directly resonate with other key themes emphasized in most of the DT studies. Such emphasis on leadership led us to look at how leaders in the Swedish construction sector make sense of DT, especially regarding its impact on the current business models.

Capabilities

The second theme emerges as the capabilities required for DT (i.e. Aghimien *et al.*, 2021, Bhattacharya and Momaya 2021). This line of research draws on dynamic capabilities view which suggests that firms have both ordinary and dynamic capabilities (DC) (Teece *et al.*, 2007). The former relates to operational and technical capabilities required to accomplish tasks; the latter focuses on the ability of firms to adapt to changes in their business ecosystem. The advice is that organisations should improve their DC to embrace DT. For example, Aghimien *et al.* (2021) conducts a bibliometric study to understand the DC needed for successful DT of construction sector organisations. They argue that organisations should develop their capabilities relating to industrial management and strategic planning, organisational learning, enterprise resource management and innovative information technology. There is a call for construction sector organisations to sense disruptions, seize technologies and reconfigure their business models; however, less has been discussed how such capabilities are utilized regarding DT. One key question to address is how the focus of construction sector organisations can be stretched from day-to-day business to developing capabilities to achieve successful digital transformation.

Enablers and barriers

The third theme is the enablers and barriers impacting the DT in the construction sector (Bosch-Sijtsema *et al.*, 2021, Olanipekun and Sutrisna 2021). For example, Olanipekun and Sutrisna (2021) conduct a systematic review of 151 publications in CM related literature. As result, they identify nine enablers (digital champions, attraction of digital technologies, training opportunities, innovativeness, third-party support, new forms of organisation, culture inclusion, external legitimation, and research potential) and ten barriers (complex data processing, data access and ownership, lack of system integration, ROI uncertainty, low standardisation, lack of owner buy-in, displacement of old workers, old business models, digital divide and security risks) in common. However, it is hard to make sense how and why any of

these parameters are seen as barriers and enablers to whom. Considering the heterogeneity in the CS, we selected our interviews representing different actors with an expectation to grasp differences among what they see as enablers and barriers.

Future scenarios

The fourth and most popular category consists of future scenarios regarding DT in the construction sector (i.e., Erdogan *et al.*, 2009, Lavikka *et al.*, 2018, McKinsey 2000). In one of the earlier studies, Erdogan *et al.*, (2009) create scenarios for the construction sector in 2030. The ideas are Lego style design and construction, smart buildings, and offsite construction which are the core arguments populating the currently growing literature on Industry 4.0 (Bolpagni *et al.*, 2022). Another key concern emerging in the future of DT is the importance of data and issues regarding data ownership (i.e., Lavikka *et al.*, 2018). Future scenarios are also in the agenda of global consulting firms. For example, McKinsey (2020) listed four emerging disruptions in the construction sector as industrialisation, new materials and improved logistics, digitalisation of products and processes and lastly new entrants disrupting the current business models. The threat of new entrants (especially start-ups) has long been a key focus of the studies drawing on disruptive innovation theory; however, it is yet to be fully elaborated within the context of construction. Recently, Hall *et al.*, (2022) argue how new entrants accelerate DT and shift to new business models requiring vertical and horizontal integration in the fragmented nature of the construction ecosystem.

The four common themes discussed above supports our argument that understanding DT in the construction sector needs multi levels analysis from individual (i.e., leadership) to organisational (i.e. capabilities) and to broader ecosystem level (i.e., enablers and barriers and future scenarios).

METHOD

Empirical data is drawn from an ongoing research project exploring DT in the Swedish construction sector, focusing specifically on an ecosystem perspective. This approach is grounded in previous research indicating that DT requires distributed actions, collaboration, and coordination across the inter-organisational boundaries (Kraus *et al.*, 2022). To capture an ecosystem perspective, the research project is set up in collaboration with a large group of sector partners, representing the full range of 'traditional' CS companies, including architects, technical consultants, contractors, public clients, material suppliers, and real estate firms. This paper draws on preliminary findings from the first phase of this study in which we interviewed one actor, particularly initiated in business perspectives of digital technologies, representing each one of these sector partners. This interview study consists of 14 open-ended interviews spanning between 60-90 minutes each. While the previous review of the literature on DT (especially the four themes discussed above) was used to structure the preliminary analysis of current states and future trajectories, the interview study was designed in a more open-ended fashion. This was grounded in a methodological consideration that recognizes that open-ended storytelling (Alvesson and Sköldbberg 2017) is an important data source for new insights in construction management research (Sergeeva and Green 2019). Because it is aptly geared to capture the context-specific aspects of the phenomena under scrutiny (Hopf 2004), here being the dynamics of DT unfolding amidst the specifics of the construction ecosystem. We therefore asked the respondents to tell their stories about DT across a few loosely structured thematic areas, including: "How they work to develop and

implement DT in their operations and business offerings today", "what they consider the major challenges and opportunities related to digital technologies", and to "share their visions and examples regarding the potential future(s) of DT", "related both to their own processes and business models, as well as to the construction ecosystem as a whole". Within this open format we intervened frequently with follow-up prompts, such as "why", "what do you mean", "can you give an example" and "who are the 'we' you are referring to ", to challenge them to provide us with thick descriptions. We also persistently challenged them to explicate future scenarios by providing as many details as possible. All the interviews were transcribed verbatim and analysed and discussed by all authors to strengthen the relevance and accuracy of the results (Taylor *et al.*, 2010).

FINDINGS

Incremental Improvements Within 'The Silos'; Internal Efficiency, Cost Reductions, and Business-as-Usual

The results show that digital technologies are increasingly being implemented by the incumbents in the construction ecosystem. Primarily, the implementation of digital technologies is aligned to improve current internal operations of each organisation's core of business. Only for a few of the actors, DT implies deliberate organisational and/or business model transformation. For example, materials supplier #1 has a comprehensive digital and sustainability strategy, that governs all operations in the company, as well as new technologies (i.e., 3D printing). This actor is, however, one rare outlier in our study that have used digitalisation in a clear strategic way, as to transform the whole business model and propel more extensive organisational change. Common for all the actors is a broad uptake of more generic off the shelf IT solutions, used to pave the wave for more efficient administrative processes.

In those instances where digital tools are used for design and construction-related operations, there is a general emphasis on choosing tools that fits current operations, rather than altering them in any significant way. Current transformation in relation to digitalisation is therefore best characterized by incremental improvements of current operations as to improve efficiency and reduce costs, and not as a mean to transform the business models regarding, for instance, generating new revenues or profit. A converging finding across all the actors in the study, is that one major reason for why digital tools is yet to alter the construction value chain in any significant way, is because the incremental improvements remain within each different actors' 'silo' of operations. For digital technologies to transform the operations in the sector, there is an absolute need for coordination, compatibility, and integration across the organisational boundaries. The actors themselves are well-aware of these aspects and repeatedly emphasized this as the main hinder for a more substantial, or even radical, DT. The lack of co-creation and collaboration underlying the vast unrealized potential of digital technologies were described in various ways, but the well-recognized project-based temporality was indeed emphasised as a core hinder, cementing the traditional state of the operations in the value chain: including lack-of long-term alliances between design and production, clients and contractors, contractors, and sub-contractors, etc. It is also considered hard to find either incentives or mandates to influence digital technology development and/or implementation beyond the own organisational boundaries, and as a result the digitalized processes remain undistributed and unsubstantial in their nature.

Envisioning the Future: The Unrealised Potential of Digital Technologies

Table 1 below offers a summary of the actors' own visions regarding the potential future(s) of DT in the construction sector. Seeing that these visions are collected from the perspectives of many different actors, they also reflect the perceptions of how the actors' respective positions/roles in the ecosystem would change, in the case the digital tools would transform the sector in any significant ways in the future. The actors could indeed articulate how digital technologies - in theory - could be used to significantly transform processes and business model in the construction sector. Thus, visions about the future exist regarding digital technologies and data-driven business models. There is a strong consensus that DT will imply possibilities for future business opportunities, but also threats to existing operations and revenues. Most of the technologies listed in the table above exist already today in matured forms; that is, standing in-between these visions are mainly new ways of applying these technologies, rather than technology development as such.

Table 1: Future visions

Type of Company	Role description actor	Key words regarding future visions
Architect firm # 1	CIO	automated design, data-driven business model
Architect firm #2.	Partner	automated design
Architect firm #3	CIO	automated design, data-driven business model
Constr. Client Association	CEO	Data-driven processes, enforced data/IT-standards
Construction Company #1	CTO	Data-driven processes
Construction Company #2	CIO	Total BIM, robots in production
Construction Company #3	CSO	Integrated IT systems, Total BIM, data-driven processes,
Material Supplier #1	CEO	Integrated IT-systems, data-driven processes
Material Supplier #2	CEO	additive manufacturing, big data BIM-objects
Public Client #1	Real Estate Manager	Data-driven maintenance
Public Client #2	CAO	Data-driven maintenance
Public Client #3	Unit Manager	Visualization and integration geo-data
Tech. Consultancy Firm #1	CIO	automated design, big data, data-driven business model
Tech. Consultancy Firm #2	Business Developer	automated design, data-driven business model

In Search for a Roadmap for Digital Transformation

The results contain a significant lack of details regarding any clear and actionable roadmaps to realize these 'digitalized construction futures'; lacking explanations of, for instance, the key-events, leading actors, potential collaborations, and fruitful processes needed to catalyse and facilitate the transformation as such. Put differently, fruitful strategies for the transformation as such is largely missing in the actors' stories. There are also no clear visions for how any transformation would impersonalise in terms of 'change agents', such as radical changes undertaken by existing actors and/or entrance of new types of actors.

It is also important to point out that the sense of urgency for DT clearly differs between the actor categories. The highest sense of urgency for applications of new digital tools is found among the architects and the technical consultancy firms, with business models that currently are based on a 'selling by the hour' logic. Interestingly, this sense of urgency is grounded in a certain dual nature of both the threats and the opportunities that digital tools bring for these actors' business offerings. For instance, the various design automation technologies that already now can speed up parts of the design process in a substantial way, are already now reducing the number of hours that these actors can charge their customer. Following this, finding alternative business models is a prioritized concern.

Accordingly, reflecting the higher sense of urgency, decisiveness, and stream of initiatives among these specific categories of actors is how they already now devote financial resources and personal, at a seemingly much higher rate compared to the other actors in the study (and according to our results, in particular discussing business models based on more value-based offerings and 'productification'). They also gave the impression of a much more structured strategy work geared towards business model transformations, facilitated by digital technologies. With that said, these actors too seem to have a long way to go before being able to realize the potential end-states that they were able to envision, albeit on a general level. One aggravating circumstance is a clear internal demand for the immediate application of new ideas. That is, rather than engaging in radical exploration, they are still restricted to stay within such a creative scope that encapsulates directly billable ideas; as a member of an architecture firm put it, when talking about their current innovation strategies related to new business models and digital tools: "we need to already now be able to walk on the bridges [here referring to new business ideas] that we build".

The contractors', material suppliers' and the public client organisations' stories do not mirror the same sense of urgency. On the contrary, they emphasise the value of digital technologies used to realize more low-risk improvements. Altogether, there is less strategic reorganisation taking place due to DT on the organisational level. Instead, resources are directed and adopted to the individual projects, serving as test beds for new digital technologies and processes, as well as for competence development of their employees (which was perceived as another key dimension). The large contractors seem to devote rather little investments on strategic/organisational level, generally employing one full-time professional being responsible for DT. The public client organisations, generally have no personal focusing on DT, but are buying digital competence on a project-to-project basis. In sum, we can see that the driver for DT comes in the form of a sense of urgency to implement, adapt and react to digital technologies that are already in place, while agreeing that the future is likely to entail more data-driven processes and business models. Thus, 'how to' transform existing business models in line with DT is characterised by an awareness that action is required. However, the road ahead is outlined by looking into the rear-view mirror and slowly adopting risk-free solutions, while also carefully navigating potential threats.

Another aspect, that is mitigating the general sense of urgency, is how the actors experience a lack of demand for digital solutions. This is a very clear finding in the study, in particular pertaining to the interaction between clients and contractors. The contractors express that more demanding customers would speed up the DT, noting, for example, that "other sectors have more demanding customers, we could need that as well" (Citation Contractor). The clients, on the other hand, seem to disagree with this point and pass the initiative back: "they (contractors) do not deliver well enough on the low demands we have today... they keep blaming us for not demanding more from them, yet they cannot even deliver in regard to the present demands " (citation Client Association). Having that said, what the actors in the study express in unified voice is the emphasis on collaboration and co-creation as a central aspect for DT to occur. First, as to develop the required technologies, hardware and software, the construction sector actors must interact with tech-actors as the CS actors do not have this as internal competences today. Second, collaboration is required to enable the necessary integration and compatibility for distributed digitalized processes (which also is seen as a recursive transition as aligning digital tools also can help increase the

general levels of collaborations). Finally, some actors express the value of digital technologies as they might enable interaction with actors that previously only have had indirect connections, but via digital platforms and cloud solutions may enable new ties, and thus, opportunities for increased learning and future business opportunities.

Discussions of the digital transformation in the construction is commonly addressing the sector level; thus, unit of analysis is the sector as a single, homogenous “actor” (i.e., Criado-Perez 2022, Bhattacharya and Momaya 2021). Findings from the study in this paper points to the need to address the heterogeneity of the actors in the sector, and their respective different actor roles, positions in the value chain, business models etc. This inflicts on, for instance, the urgency of transforming: some actors experience a contemporary threat to their current business models, hence, the urgency to transform, whereas others mainly address the potential of digitalisation for improvement of current operations, but not in terms of urgent need to transform the business models.

DT is thus not the same for all actors in the construction value chain, and research and practice would benefit from more studies with a focus on the heterogeneity of actor roles and what DT would entail for the respective role, including the interaction to other direct and indirect parties, in the construction ecosystem. Most likely, actors will transform differently, and some actors might become obsolete and new actors will be part in the ecosystem. Such scrutinisation of DT must consider the different actors’ roles and how these actors relate to each other.

DT is a process, a series of progressive and interdependent steps, in a reimagining of business in the digital age. So far, one could argue that the CS is only taking baby steps in comparison with other sectors (i.e., Lavikka *et al.*, 2018). In fact, DT is not one process, but several parallel processes, when actors act, react and interact over time. DT is hence not only in the hands of the individual actor, but dependent on the interaction among actors, and several processes will feed each other, causing changes in the ecosystem that will, possibly and likely, also transform the value propositions and distribution among the actors. Thus, DT is a myriad of steps, where no single actor has full control over the process in the ecosystem. Managing in the ecosystem regarding the exploitation of digital technologies to transform will thus involve new types of collaborations, and even vertical and horizontal changes in terms of scope of business among incumbent actors and likely, new actors entering the ecosystem.

Leadership research has established a convincing correlation between leadership and successful change on organisational and sector levels. Many construction researchers have also indeed stressed that DT requires successful leadership (i.e., Zulu and Khosrowshahi 2021, Criado-Perez 2022). Our results show, however, that the actors in our study almost never talk about leadership. Instead, they emphasized “demanding customers and collaborators” (on individual and organisation level) as one missing driver. Rather than looking for a leader-like figure who inspires, empowers, takes proactive lead into the future (Criado-Perez *et al.*, 2022), the actors seem instead to wait for any actors that merely could raise the bar for the minimum requirements. Rather than showing any interest in taking on a leadership role which could instil a more proactive and visionary transformational discourse, the results show the actors rather kept passing around in circles the responsibility for actions to others.

While previous researchers have highlighted the need for renewed organisational capabilities to support DT (i.e., Aghimien *et al.*, 2021, Bhattacharya and Momaya 2021), our result highlight how the majority of the hinders lies in the inter-

organisational boundaries. Seeing that the main hindrances are related to process integration and digital tool compatibility, it is unlikely that any intra-organisational transformation would be enough. Instead, our results suggest that DT would be achieved only by new processes that are distributed across many different actors. Any new organisational capabilities would therefore most likely require high degrees of co-creating and collaboration, to achieve the necessary levels of integration and compatibilities across the organisational boundaries.

CONCLUSION

While previous research has portrayed the construction sector as a homogeneous unit and/or level where DT might unfold, our results highlight large differences among the sectors' actors regarding many different dimensions of DT, such as, the resources they spent on it, the sense of urgency, their current progress, as well as their visions for the future. Drawing on these results, it can be concluded that there is a need to understand DT from a multi-level perspective, involving a large group of heterogeneous actors. Furthermore, while many of the key mechanics underlying DT will reside in various inter-organisational spaces, there is a strong consensus the central role that leadership (both on the individual- and organisational level) can play both to catalyse and support such transformation. This paper highlights how leadership perspectives and roles currently are being downplayed, among all the different categories of actors in the sector, which then potentially points at a key barrier for change - one that deserves increased attention from both researchers and practitioners.

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