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## Newly graduated students' role as ambassadors for digitalisation in construction firms

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### ABSTRACT

This study furthers the understanding of newly graduated students' role in construction firms' efforts to better use digital technologies. The aim is to *increase the understanding of the role that newly graduated students play in digital transformation in construction firms*. The study is based on 18 semi-structured interviews and three focus group interviews with new graduates and construction managers in Sweden's three largest construction firms. The results show that despite having relevant skills, new graduates play a limited role when they are first recruited, as they struggle to close the "knowledge-experience gap". Gradually, whilst familiarising themselves with how things are done, they act as ambassadors for digitalisation and contribute to the modification of senior colleagues' beliefs about how technology could be used. However, this development is hampered by them getting caught-up in messy everyday activities, which forces them – like other staff – to prioritise urgent issues over important ones. An observed lack of established practices for how to make use of students' skills hampers their involvement further. It has been suggested that *urgency* might not only be a problem, but a solution in that it is possible to increase the sense of urgency around new way of working with digital technologies.

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Digitalisation; digital transformation; construction industry; newly graduated students




## Introduction

Digital transformation at an industry level rarely happens quickly. The construction industry is no exception to this and has often been accused of fostering a culture of change resistance, being a 'backwards industry', and slow at adopting new technologies (see Winch 2003, Jacobsson and Linderöth 2012, Davies and Harty 2013). Fragmented value chains, lack of replication, ephemeral relationships, and decentralisation are often highlighted as hindrances originating from the project-based nature of the industry (Dubois and Gadde 2002). Still, the digital state of the industry should not only be described in negative terms. As in most other industries, a majority of actors have adopted and used a variety of digital tools and the industry has taken important digital steps over the last 30 years. Today, it can be argued that construction firms are no longer struggling with the question of *whether* they should use digital technologies, but rather *how* they should use new technologies to

facilitate change and better reap the benefits. It is also in the question of *how* to use digital technologies that the potential of digital transformation lies (Vial 2019).

However, the question of how to use digital technologies in a transformative way is far from straightforward. In an extensive literature review, Vial (2019) explained how digital transformation implies a complex process where new technologies trigger disruption in organisations, which necessitates alteration of strategies, business models and value creation paths, while managing structural changes and organisational barriers. In this process, organisational members' understanding and perception of new digital technologies plays a key role as it influences their actions, their engagement with the technology, and the potential success of the process at large (Davidson 2006). It is this process, and the role newly graduated students have in it, that is at the core of this study.

In the construction industry, newly graduated students have been shown to be a potential source

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of both innovative thinking (Manley and Mcfallan 2006) and digital skills due to their a relatively high level of ICT maturity (Davis and Songer 2009, LinderOTH *et al.* 2017). Newly graduated students' skills in using digital technologies, together with verbal communication, were also recently acknowledged as their greatest strengths from the employers' perspective (Borg and Scott-Young 2020). Moreover, a Swedish survey showed that construction engineering students who had graduated within the last 5 years perceived digital technologies as much more useful than employees with older diplomas (LinderOTH *et al.* 2017). In essence, newly graduated students not only constitute a potential for innovative ways of thinking, and an opening for increased digitalisation based on their digital skills, but they are also more positive towards new digital technologies at large.

Despite these potentials and promises, it is not clear what role newly graduated students actually play in the digital transformation process of construction firms, nor what might hinder them from being involved. Based on current knowledge of how firms operate, there are plenty of potential hindrances that could have an impact. For example, newly graduated students, when employed, might have little influence on work, which means that their skills may go unnoticed or unutilised. Apprentice programmes and no-blame cultures are often highlighted as enablers (see, e.g. Manley and Mcfallan 2006, Walker 2016), but more general hindrances exist in terms of, for example, a widespread "*doer mentality*" (Löwstedt and Räisänen, 2014) where a technological "*status quo*" has been seen as desirable (Jacobsson and LinderOTH 2012, Bosch-Sijtsema *et al.* 2017). Over time, newly graduated students might also become institutionalised, meaning that their way of thinking and acting changes in accordance with established norms (Porac *et al.* 1989). For example, they run the risk of adhering to a culture of scepticism towards change, where the notion of "*it's fine, just as it is*" is a leading star (Jacobsson and LinderOTH 2012, 339). Such development would imply that, over time, newly graduated students run the risk of losing their innovative thinking and positive attitude towards the usefulness of digital technologies. This would obviously be problematic if increased digitalisation is of interest to construction firms at large. Still, newly graduated students' involvement in this process requires further investigation.

Based on the above-described situation, the aim of this article is to *increase the understanding of the role that newly graduated students play in digital*

*transformation in construction firms*. In order to reach this aim, we also need to dig into what might hinder or facilitate their involvement. It should be noted that 'role' here is not to be interpreted in a sociological sense, but rather in its more everyday meaning, referring to students' involvement or participation in the digitalisation efforts of the organisation. The reported-on study combines 18 semi-structured interviews with three rounds of focus group interviews with newly graduated students and their construction managers within the three largest construction firms in Sweden. The study design enables us to juxtapose the perspectives of newly graduated students and their managers, analyse the newly graduated students' current involvement, and discuss ways to overcome potential hindrance and increase the role they play.

This research is situated against the backdrop of how to foster digital transformation in construction, a question that has far-reaching importance for the construction industry of today. However, the study is focussed on construction industry practitioners, how they think and say that they act, and the role this has for construction firms in their aspiration to utilise digital technologies in a more transformative way. Before we describe the method and study design, we will outline the background and theoretical framework of the study.

### Background: conditions for digital transformation

It is often argued that digitalisation is the largest single change factor of our time. Successful application of digital technologies is central to change and increased efficiency in most areas of the construction industry. Consider, for example, virtual reality (VR) and 3D visualisation, which for a long time have provided promises of change regarding everything from customer communication to decision-making processes for architects (Whyte *et al.* 2000). Another example is building information modelling (BIM), which has emerged as a potential game-changer for many actors, arguably having the potential to change both work practices and the collaborative climate within the industry (Sebastian 2011). However, more general research on digitalisation and digital transformation has, over the years, proven that successful and integrated application of new digital technologies (that actually leads to transformation) is dependent on a broad spectrum of conditions, related to everything from the context to organisational processes and individual actors' way of thinking (Orlikowski 1992, 1996).

As a basis for the study, we will outline a three-dimensional conceptualisation of key conditions for digital transformation, which not only positions this article in contemporary research but aids in the analysis of newly graduated students' role in this. The three dimensions are *implementation of digital tools*, *organisational adaptation*, and *change of employees' mental models*. The three-dimensional conceptualisation highlights the need to understand the entanglement of the technical, organisational, and social/mental aspects that simultaneously constrain and enable digital transformation in all types of organisations. Against the backdrop of the three dimensions, we will be able to discuss the newly graduated students' potential to contribute to digital transformation.

### **Implementation of digital tools**

Digital transformation is obviously dependent on the investment in and technical integration of appropriate digital technologies. Historically, this investment and integration has been a clear challenge, not only for the construction industry but for all industries that have undergone the changes associated with digitalisation. Today, however, this is rarely highlighted as a real problem for construction firms due to, for example, the general technical development, improved mobile data coverage, and the plethora of both standardised and customised technologies that exist. Successful implementation of digital tools can, on its own, support existing processes or lead to automation of work practices, which BIM is an example of when used to facilitate clash detection and rapid and accurate updating of changes (Manning and Messner 2008). Such automation can provide clear and direct benefits in terms of cost reduction and control, which is also often the prime rationale for investing in new technologies in the first place (Jacobsson and Linderroth 2010, Bryde *et al.* 2013). To understand the transformative potential of digital technologies in organisations, however, we need to go beyond a sole technological focus, and instead emphasise the context of use (Orlikowski 1996), as well as the individual actors' central role in enacting technology-driven change (Orlikowski 1992).

### **Organisational adaptation**

In addition to the implementation of digital tools, there are the contextual and organisational dimensions, which we have labelled *organisational adaptation*. Previous research in the field has proven that

integrated application of new digital technologies is dependent on significant organisational adaptation (Orlikowski 1992, Melville *et al.* 2004), involving organisational changes, including the change of strategies, work practices, organisational structure, rules, and routines (Brynjolfsson and Hitt 2000). Without organisational adaptation, few digital technologies provide far-reaching benefits, and no digital technologies provide real transformation. Put another way, in order to enable transformative effects of digital technologies and change the way work is done, it is necessary for new technology "to diffuse in an encompassing and integrated use among actors in the construction process" (Bosch-Sijtsema *et al.* 2017, 2). In practice, this implies that organisational strategies, routines, and processes need to be in line with new technologies (Arvidsson *et al.* 2014). In a study on factors affecting diffusion of digital technologies within the Australian construction context, Peansupap and Walker (2005) stressed the importance of adaptation of organisational culture and an open discussion environment as two central factors. With regard to organisational adaptation, they concluded, "*fostering a supportive workplace environment is highlighted as an important lesson to be learned*" (Peansupap and Walker 2005, 35). However, organisational adaptation triggered by new digital technologies can still be constrained by actors' ways of thinking (their mental models), which brings us to the third dimension: change in employees' mental models.

### **Change in employees' mental models**

Mental models, in terms of actors' ways of thinking, consist of views about technology, the identity of the firm, its competitors, suppliers and customers, as well as beliefs about how work should be done and thus what it means to be successful (see, e.g. Porac *et al.* 1989, Davidson 2006). These mental models guide the everyday activities of actors and are thus central not only to this research but to whether or not digitally-induced change ambitions will be achieved in actual operations. As mentioned in the introduction, studies have shown that newly graduated students who have undergone training in digital technologies during their education have a more positive view of digital technologies than employees with older diplomas (Linderroth *et al.* 2017), and thus potentially other mental models than other staff. Considering that digital skills are perceived as one of the greatest skills of newly graduated students (Borg and Scott-Young 2020), and the claimed ability to influence practices

(Manley and Mcfallan 2006), it is likely that newly graduated students could, under the right circumstances, influence mental models of other staff to foster digital transformation. Consequently, actors' mental models might not only be a hindrance but could also facilitate change. Expressed in a simple way, newly graduated students might have the potential to contribute with new fresh perspectives and, by that influence, change employees' mental models at large.

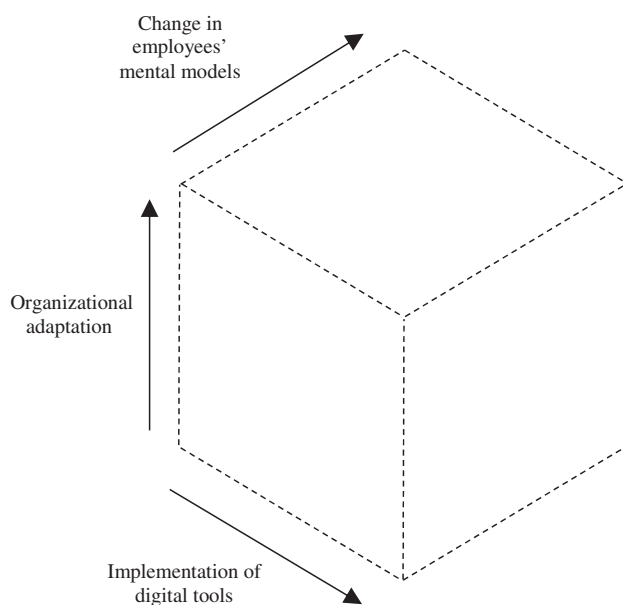
### A three-dimensional conceptualisation

The three dimensions described above are summarised in Figure 1, where change is necessary in all three dimensions for digital transformation to be achieved; that is, digitalisation that leads to innovation and change. If organisations are merely able to change in one or two of these dimensions, their intentions and actions will seldom lead to actual transformation. At best, old things will be done in new ways, but it is highly unlikely that new innovative ways of working will be developed.

Apart from illustrating that successful digital transformation is dependent on a combination of technical, organisational, and social/mental aspects, the three-dimensional conceptualisation also has the potential to clarify the differences among some information technology-related concepts, which are sometimes mixed up in contemporary literature; that is, *digitisation*, *digitalisation* and *digital transformation*. The first outlined dimension – *implementation of digital tools* – is primarily a matter of the level of *digitisation*

in terms of the technical process of “*converting of analogue to digital*” through the investment in and implementation of appropriate digital technologies (see, e.g. Tilson *et al.* 2010). The second dimension – *organisational adaptation* – as described above, relates to a sociotechnical process in terms of technologically induced change of organisations and their processes, which according to Saarikko *et al.* (2020) is to be defined as the level of *digitalisation*. Finally, the third outlined dimension – *change in employees' mental models* – represents an additional dimension in terms of the sociocultural process of adaptation of mental models relating to digitisation and digitalisation processes; that is, *digital transformation* (Nambisan *et al.* 2017). Thus, all three dimensions are needed to be able to create the basis for digital transformation in terms of “*triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*” (Vial 2019, 118). It is important to note here that the conditions in the second and third dimension are interrelated. For example, routines and organisational culture are dependent on actors' mental models and way of thinking, and actors' way of thinking creates organisational culture and routines (Pentland and Feldman 2005).

Having outlined a three-dimensional conceptualisation of conditions for digital transformation, where the use of digital technologies is to be constrained (or facilitated) by organisational adaptation and employees' way of thinking, we turn to the issue of how to study and understand this in the context of construction firms.



**Figure 1.** A three-dimensional conceptualisation of conditions for digital transformation.

### Method and approach: a two-step study design

As mentioned in the introduction, the study reported on was based on a combination of semi-structured interviews and three rounds of focus group interviews, conducted within the three largest construction firms in Sweden. The reason for combining interviews with focus group interviews was that the interviews would provide an opportunity to understand the thinking of construction practitioners, whilst the focus group interviews would allow for discussion of *established practice* (that is, common ways of doing things in the organisations) and reflect on alternative ways of doing things. Thus, interviews and focus groups were carried out sequentially, with an intermediate analysis where the analysis of the individual interviews provided input to the focus group interviews.



**Table 1.** Overview of respondents.

Category	Organisation	On site/off-site	Gender
<b>Newly graduated students</b> (with a construction engineering degree, no older than five years)	Skanska	Off-site	Man
	Peab	On-site	Woman
	NCC	On-site	Woman
	NCC	Off-site	Woman
	Skanska	Off-site	Woman
	Peab	On-site	Woman
	NCC	Off-site	Man
	Skanska	On-site	Man
	NCC	On-site	Woman
	NCC	On-site	Man
	NCC	Off-site	Man
	NCC	Off-site	Woman
<b>Managers</b> (each with more than 10 years of experience)	Skanska	On-site	Man
	NCC	On-site	Man
	Skanska	Off-site	Man
	Peab	Off-site	Man
	Peab	On-site	Man
	NCC	Off-site	Man

### Selection of respondents

Respondents were invited from Sweden's three largest construction firms based on both revenue and turnover: NCC, Skanska and Peab. Choosing the three largest construction firms ensured an interest in digital transformation and increased the likelihood that established practices would exist for thoroughly introducing newly graduated students to the organisations. All three organisations highlight digitalisation and digital transformation as strategically important issues. The selection of respondents was primarily guided by a willingness and commitment to participate, which is of great importance in a two-step study design, where the plan is to first interview respondents individually (Step 1) and later (Step 2) have some of them participate in focus group interviews and reflect on what the interview results (Dahlin-Ivanoff and Holmgren 2017). Loss of participants between the two steps is highly problematic.

Selection of managers was enabled via existing contacts within the three firms. Because the introduction of new employees is related to activities occurring both on the construction site and off-site, we established contacts and interviewed managers of both categories. In total, we interviewed six managers, three of each category. The selection of newly graduated students was based on their educational background and current employment. That is, we set up the criteria that participants, in addition to being employed at one of the three firms, should have a university degree in construction engineering no older than 5 years, and, as part of this degree, shall have passed courses related to digital technologies in construction, encompassing at least 24 ECTS. The criteria for course requirements and age of the university degree were used to maximise the likelihood that the respondents

had the expected digital skills and a positive view on technology, which previous studies have identified as facilitators. In total, interviews were done with 12 newly graduated students working in the three companies. Access (as well as ensuring that the selection criteria was met) was ensured by selecting former students from the department where the researchers are active. This ensured familiarity with the respondent's educational background. In brief, all of the invited respondents had successfully completed courses encompassing at least 24 ECTS, directly related to digital technologies in construction. Courses included topics such as digitally supported planning, production, simulation, analysis and verification. In the selection process, we further set out to identify and invite both men and women to the study, as well as to ensure we had representatives working both on the construction site (on-site) and those working with more administrative tasks and support functions (off-site).

### Interviews

In total, 18 semi-structured interviews were conducted with the two groups (i.e. managers and newly graduated students). Following common recommendations of how to undertake such interviews (see, e.g. Bryman and Bell 2015), all but two interviews was conducted at the respondents' worksite to promote openness and familiarity. Two exceptions were made to accommodate parental leave of respondents. All interviews were recorded and transcribed verbatim. In total, the interview part of this study corresponds to almost 13 hours and 400 pages of transcribed material. All transcribed material was sent out to respondents for validation, whereupon three respondents replied with requests for minor changes/corrections. For an

overview of the respondents, see Table 1. As illustrated in Table 1, respondents in both categories consisted of a mixture of staff working on the construction site and off-site. It is worth mentioning that all of the newly graduated students had gained their current employment within the first 6 months of graduation, consequently having a working experience between 1.5 and 5 years. This contrasts with managers, none of whom had fewer than 10 years of working experience, and one had more than 40 years of experience.

Interviews with the six managers focussed primarily on the introduction of newly graduated students and established practice (or lack thereof) to make use of their skills. By the term *established practice*, we mean the common ways of doing things in the organisation supported by, for example, routines and rules. Consequently, issues related to how the organisations work with recruitment, how they introduce new employees, how they view and value digitalisation and digital skills, and what potential they see in newly graduated students were among the topics addressed. The 12 interviews with newly graduated students focussed on the actions of new employees and their understanding of both the above-mentioned *established practice* and their way of thinking regarding digitalisation. Issues addressed included their views on digitalisation, how it might have changed since graduation, what they do on a daily basis, the role digital technologies and their digital skills play in their work, how they have been introduced to the organisations, and what potential they saw in new technologies.

### Focus groups

In addition to the semi-structured interviews with the two groups (managers and newly graduated students), three focus group interviews were undertaken. Following the practical suggestions by Krueger and Casey (2014), we opted for a multiple-category design that provided a possibility to compare perspectives and ideas. The first focus group interview was conducted with four out of the six managers previously interviewed, while the second focus group interview was conducted with four of the 12 newly graduated students previously interviewed. These two focus group interviews were then analysed before the third and final focus group interview were conducted with a mix of managers and new graduates, all of whom had participated in previous interviews and a focus group interview. The rationale behind this stepwise design was threefold. First, it enabled us to discuss and understand

the different perspectives of the two groups regarding what might hinder or facilitate newly graduated students' involvement in digital transformation. Second, it enabled us to focus on and discuss potential solutions rather than merely analysing problems. Third, it provided a learning opportunity and feedback loop for the study participants and their organisations. All three focus group interviews were moderated jointly by the two researchers involved, recorded and transcribed. In line with the general rationale behind conducting focus group interviews, all interviews were based on specific themes (Dahlin-Ivanoff and Holmgren 2017). For the two first focus group interviews, the themes were deduced from previous semi-structured interviews and focussed on how established practices influence the everyday activities related to digitalisation. For the final focus group interview, the theme was deduced from the two previous focus group interviews, which provided an opportunity to juxtapose the perspectives given by managers and newly graduated students on students' role for digital transformation.

### Analysis

The analysis was conducted in two different rounds. First, immediately after each interview and focus group, a so-called "swift analysis" was undertaken to capture the instant impression of the session. Undertaking such reflection in direct connection to execution is an appropriate strategy when there is an expected time lapse between conducting interviews and analysing them. With all interviews and focus groups undertaken by two researchers jointly, the swift analysis was also conducted jointly. The second round of analysis was more structured, following the generic phases of thematic coding (Braun and Clarke 2006) and with the three-dimensional conceptualisation providing a backbone. Coding was first done based on the interviews and the two groupings separately, and thereafter based on the focus group interviews. The basis for choosing a thematic analysis was that it enables a combination of flexibility and rigour (Braun and Clarke 2006). Rigour is given by the structured stepwise procedure that provides a pathway from familiarising with data to producing the final report. Flexibility is granted by the possibility to identify explicit or surface meanings, but also go beyond the explicit, and interpret the material on a latent level (Boyatzis 1998, Braun and Clarke 2006). In other words, a thematic analysis makes it possible to move from a description of the material to interpretation in a reflective but structured way.

## Two perspectives on current situation

The results will initially be presented based on the two groups: newly graduated students and managers. First, the established practice and experiences of the newly graduated students are presented with a focus on how they get introduced and integrated in the firms, how their digital skills are taken advantage of, and how the everyday activities influence their opportunities to use their skills and work proactively with digital technologies. Thereafter, managers' perspective is presented in terms of, for example, the established practice and views on how they work to integrate the newly graduated into the organisation and make use of their digital skills.

### The perspective of newly graduated students

Based on the interviews with the newly graduated students, three familiarisation processes were identified in relation to how they become integrated into the firms. First, they commonly spend a lot of time trying to understand the firm and become familiarised with established practice of the organisation. As one respondent expressed it, it took time to understand *"where I am, what I should do, what everyone else were doing, and what I could contribute with"*. Second, many of the respondents explained how they spend extensive time learning or familiarising themselves with the existing building practice. This was not a major issue for those who had a background as a carpenter or similar prior to their engineering education, but it was for the majority, who did not have previous practical experience. Some of the respondents explained the challenges of applying what they learned during the engineering education, because older colleagues had their own ideas of how things should be done, and because the organisations had their own established practices that they did not know. In essence, the students experienced a "knowledge-experience gap" that needed to be filled. The third familiarisation process related to how the industry operated. The respondents explained that it took a long time to understand the relations between the different actors in the industry; in other words, to become familiar with the industry logic. The stated reason for this was the complexity of industry and the great variety of, for example, different contractual forms and their consequences on operations.

Beyond the newly graduated students' initial familiarisation, they described an ongoing process of an increased understanding of their respective duties. For example, some respondents stated that it took up to a

year to feel established; or, as one interviewee put it, *"until it felt okay"* and until I know *"how to really do things"*. In general, the respondents acknowledged that the three firms have established practices in place to introduce the newly graduated students, such as mentors, written instructions, net-based courses, and more traditional introductory courses. How well these are utilised, however, depends primarily on the personal commitment of managers and senior colleagues. During the interviews, however, it became clear that the new graduates' digital skills sometimes enable them to learn and take on specific (digitally related) responsibilities that made them grow and feel established. Several respondents stated that, despite experiencing the knowledge-experience gap, this made them feel that they *"could contribute with something"* and that they had skills that were valued. In this way, their digital skills could be seen as a vehicle to facilitate the newly graduated students' socialisation process into the organisations.

When it comes to the use and perceived importance of digital technologies, the newly graduated students expressed having seen a distinct development during the last 2 or 3 years. As one respondent stated, *"all employees [old and young] seem to understand that they must adapt to a more digital way of working"*. Thus, the question is not *if* new digital technology is to be used, but *how*. Another respondent stated that the firm he worked for tries to have newly graduated students in all projects and encourages them to promote more digital work skills. However, doing this seems to be a delicate task, from the new graduate's perspective. As one respondent put it: *"If you should sell this [the benefits of new digital technologies], you really have to think it through, and show how to use the technology. Like, this thing, if we do like this, it is enough if you click here and here, then everything is ready. And then the response is, 'oh wow', that was easy. So, if you promote new technologies, you really need to show how to make use of it"*. The same respondent added, *"the more senior colleagues see the advantages of a digital way of working, the more acceptance you get"*. Thus, clear benefits and direct areas of use are perceived as central. Senior colleagues can be nudged by their newly employed colleagues if they are allowed to and if there is time for it.

Overall, almost all respondents are coming back to the importance of the everyday activities and showing their more senior colleagues what can be done with different digital tools and then letting them try themselves. Even if not all senior colleagues and on-site workers have the courage to try by themselves,



showing a 3D-model, for example, creates an interest in learning more. For example, one respondent described how she once showed an unenthusiastic colleague working on the construction site some details in a 3D-model and, after a while, he asked if he could see the model again because he wanted more information. Her conclusion was that most of the senior colleagues, even if they are not enthusiastic, appreciate the digital tools if they see the advantages, but they cannot really handle the technical part, so the best solution is when she takes responsibility for the technical aspects. This conclusion is confirmed by other respondents, who described a similar situation. Moreover, some respondents state that they are expected to possess digital skills, but it is primarily up to them to take the initiatives to reap benefits for the firm from these skills. They wish that management could be more proactive and more clearly give them responsibility for digital tasks. Another respondent stated that there is a clear interest from management in her firm, who always have encouraged them to work with BIM, but that management is, at the same time, not particularly involved in the BIM work, because they are only interested in *"client relations and financial issues"*. It should be noted that not all senior colleagues have the same need to be supported by the newly graduated students. Still, it appears to be within this group, and especially among senior colleagues working the construction site, where the most hesitation exists.

Similarly, how newly graduated students' digital skills are used in the organisation also seems to depend on where they work and what type of activities they are involved in. When they work on the construction site, major tasks include extracting information from BIM models, or showing the more senior colleagues how digital tools can be used. However, one respondent explained that when she works off-site she can actually have more influence over what tools to use and how a BIM model should look. When working off-site, newly graduated students can manage their time more independently. One respondent stated that there is a clear difference in logic between working on site or off-site. *"When you are on site, it is like, we must solve this now, in two hours the truck with concrete will arrive. When you are in the office, it is more like, no, I can do that next week"*. The same respondent further explained the differences by arguing, in relation to BIM, that when working on-site, you often have very urgent things to deal with and when you have a BIM model you cannot do much more than suggest improvements for the next

time. When you work off-site, however, *"you are involved from the beginning, you can decide a bit more and have impact on what the model should look like"*. The experienced challenges with urgency and the consequences thereof will further be discussed later, but first the perspective of the managers needs to be outlined.

### ***The perspective of managers***

When it comes to the newly graduated students' socialisation into the firms, the interviewed managers share most the newly graduated students' views and confirm that it takes about a year for the newly graduated students to get into the organisation and familiarise themselves with how things are done. One manager said that new graduates are introduced by giving them more responsibility in small steps, so they feel they can handle the tasks at hand and feel that they are *"growing"*. At the same time, the manager described how the firms have compulsory introductory programmes for new employees, where they learn how the firms are operating. If employees are going to change work tasks, competence development is also offered so that the employees can learn about their new position. However, the managers who have direct responsibility for employing newly graduated students admit that they actually do not know what competences and digital skills the newly graduated students have. Basically, they hire a newly graduated construction engineer who is *"assumed to have a certain knowledge base and skill set,"* and because s/he is young and recently graduated, s/he is also assumed to have *"some unspecified digital competencies"*. Most importantly, s/he needs to have the *"right"* personality in terms of personal drive and commitment. However, the managers involved in recruiting newly graduated students also admit that they do not really have a strategy or an established practice for reaping benefits when it comes to digital skills. None of the established practices regarding introduction into the new work environment involve (or consider) newly graduated students' digital skills. However, an *ad hoc* emergent practice is the composition of diverse project teams where newly graduated students are included. One manager said that it is common for them to put *"younger in-experienced staff, like newly graduated students"* together with *"older experienced staff"* so that the former can learn from the latter. When teams are composed, the manager said that he thinks in terms of a *"mutual learning process,"* where the new graduates can contribute with their digital skills, whilst more

senior colleagues contribute with their professional experience. In another interview, a site manager with more than 40 years of experience confirmed this way of working. He stated that *"the youngsters add competence that we [the more senior managers] are lacking"* in terms of their digital skills. This brings at least two benefits, according to the site manager. First, he stated that he needs these digital skills in his project; without them, he would *"need to close the project down"*. Secondly, the newly graduated students get to perform duties that they feel they can master and, in that way, they also feel that they are needed in the organisation. At the same time, the site manager says that while he and the other senior colleagues are not computer illiterate – they are able, for example, to access BIM models and get the information they seek – his newly graduated colleagues *"are ten times faster,"* and time is a key issue when working on the construction site. The site manager also stated that if they are in a meeting and he would navigate in, for example, a BIM model, it would be more stressful because people would probably make comments like: *"Should we not go out and work, and do something useful soon?"*

The situation described by the new graduates regarding the digital development in the firms during the last 2 or 3 years is further confirmed by two site managers in two different firms. Digital technologies are becoming increasingly important and the managers stated that there is a big difference between different projects in terms of how digital tools are used depending on when the project was started. Some of the interviewed managers stated that the increase in digitalisation is rapid and that *"it is hard to keep up with the development"*. As one respondent put it, *"it seems to come something new today [in terms of digital tools], and tomorrow something even newer comes"*. However, he continues by stating that that firms in the industry cannot ignore the development: *"We need to adapt, whether we want to or not"*. In this development, managers clearly acknowledge the importance of the digital skills that newly graduated students possess. All managers also confirm the new graduate's description of how important it is to get more senior, and less enthusiastic, colleagues to see the usefulness of digital technologies.

### Newly graduated students' role in digital transformation

Based on the outlined three-dimensional conceptualisation of conditions for digital transformation (see Figure 1), we will first discuss the ways in which the

newly graduated students are involved in and contribute to this process, and then discuss observed hindrance and potential ways forward.

### Challenges with organisational adaptation

As described in the results section above, newly graduated students engage in three familiarisation processes when they enter the organisations; they familiarise themselves with existing work-practice, the established building practices, and the industry logic. Managers in all three firms, as well as the newly graduated students, also report established practices to facilitate these processes. During the familiarisation processes, newly graduated students close the "knowledge-experience gap" that they initially experience. Given the size of the three organisations and their reported acknowledgement of the importance of digitalisation, however, it is somewhat surprising that none of the firms had any established practices in place for how to make use of the newly graduated students' digital skills. Likewise, it is surprising that the understanding of what digital skills newly graduated students hold seems to be so vague among managers, apart from the assumption that they have some "generic" digital skills. As described in the section on managers' perspective, it has even been said that they did not really know what digital skills their new employees possessed. However, the described *ad hoc* approach of pairing newly graduated students with more experienced staff could be considered an emergent practice (that is, a first step towards developing a more standardised way of making use of students' digital skills). Another seemingly emergent practice is that managers working on the construction site realise that the digital skills of newly graduated students are very valuable for their projects, and that the speed with which newly graduated students manage the new technologies is important. In an environment characterised by time pressure, the ability to perform tasks in a speedy manner is seen as very positive. By getting more responsibility, the newly graduated students, step by step, also utilise their skills by involving more senior colleagues in the use of digital tools. By pairing newly graduated students with a senior colleague, the students have a clear influence on seniors' perception of the technology.

So, are the three firms moving towards a digital transformation, meeting the described conditions, and what role do the newly graduated students have in this process? The three firms can be claimed to have engaged in two out of the three dimensions, partly

thanks to the skills of their newly graduated students. First, the firms have come quite far regarding the more technical aspects by offering a plethora of digital tools to employees (that is, *implementation of digital tools*). Even if there might be single individuals who feel that they want more advanced technology or digital tools, there was no indication during any of the interviews or the focus group interviews that the technological level was seen as an obstacle for digital transformation. As for this dimension, the newly graduated students have little or no role. However, the access to a variety of digital tools enables newly graduated students to, at least occasionally and to some extent, use their digital skills to impact mental models when showing more senior (and less enthusiastic) colleagues the usefulness of the new tools. In that way, the newly graduated students are partly contributing to a modification of senior colleagues' beliefs about how work should, or could, be done; that is, showing that work tasks can beneficially be performed in a digital way (*change in employees' mental models*). As described by the newly graduated students, however, doing this is a delicate task that also takes time – time that they do not always feel that they have.

Consequently, while the firms provide the digital tools, it is up to the new graduates and staff in the operations to reap the benefits of using the tools. However, the third dimension of the conditions for digital transformation (that is, *organisational adaptation*) is mostly missing. The necessary significant organisational adaptation (Orlikowski 1992), involving organisational changes, including the change of strategies, workplace routines, organisational structure, rules, and organisational culture (Brynjolfsson and Hitt 2000), has not yet been witnessed in a widespread way. Influencing the organisational adaptation dimension also seems to be far beyond the reach of the newly graduated students. One explanation for this stems from the need they have to familiarise with everything from existing building practice to how the industry is operated. This leads to the explained "knowledge-experience gap" in terms of the challenges of applying what they learned during their education to practice. Additionally, this seems to be related to the students' lack of management training during their engineering education and hence the reported challenge to understand the more management-related aspect of the operations. To suggest or initiate sensible change to operation without fully understanding how things work is clearly very challenging (if not outright impossible). Also, even when asking managers about more innovative use of digital

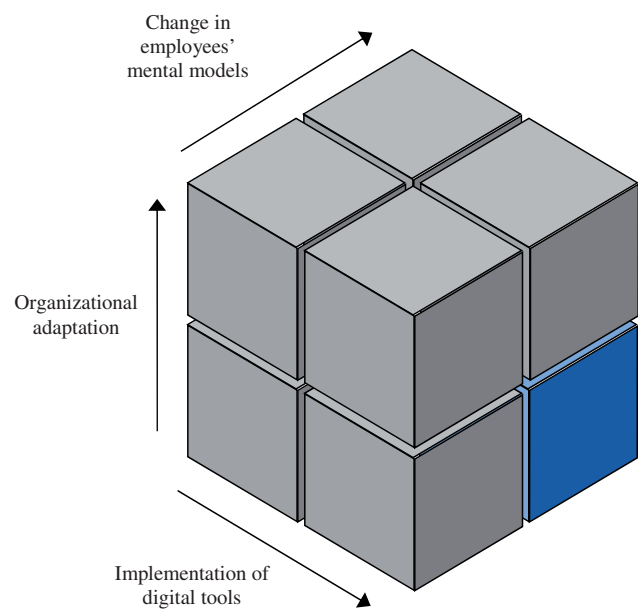


Figure 2. Meeting the conditions for digital transformation.

technologies, not many ideas come up about transforming operations. Figure 2 maps the achievements of the studied organisations in relations to the three dimensions of digital transformation.

All in all, it can be said that although there are no established practices for how to make use of newly graduated students' skills, students do play a role in influencing the conditions for digital transformation in that they, to a certain extent, contribute to a modification of senior colleagues' beliefs about how work could (or should) be done. Additionally, newly graduated students' digital skills also function as a facilitator to (more quickly) get into the organisations, even if it is up to the graduates themselves to take the initiative in terms of utilising their digital skills. One question that remains to be addressed, beyond the need for familiarisation and the described "knowledge-experience gap," is: What else influences newly graduated students' restricted involvement?

### Dealing with urgency and lack of established practices

As previously mentioned, a common explanation for the difficulties in imagining a more innovative use of digital technologies – when students have started to bridge the "knowledge-experience gap" – is the perceived lack of time and the fact that *urgent* issues are always prioritised over *important* issues, especially by those working on the construction site. During both the individual interviews and focus group interviews, numerous examples were given of how a high level of urgency characterises the everyday activities

(especially for those working on the construction site) and thus constitutes boundaries to work proactively. Tight deadlines and a constant influx of unforeseen or sudden events leave practitioners little time to engage in exploration of new digital technologies and new ways of working.

In this sense, newly graduated students can be claimed to be restricted by messy everyday work, rather than experiencing the challenge of being socialised into norms of change resistance, which was highlighted as a potential risk in the introduction of the study. Thus, resistance to change is not reported as a major problem for the studied firms. Instead, *urgency* is the enemy. Similarly, off-site managers “confess” that they are in a similar situation, where they focus on urgent issues like meeting deadlines instead of prioritising (what they themselves acknowledge as) important things like strategic thinking regarding the use of new digital tools. This type of reactive, rather than proactive, pattern has previously been observed in other studies (see, e.g. Löwstedt and Räisänen 2012) and is partly a result of more aggregated challenges related to the way the construction industry functions at large (Jacobsson *et al.* 2017).

Given that perceived *urgency* in combination with *lack of established practices* seem to be two underlying hindrances to utilising newly graduated students’ skills, engaging in new ideas, and facilitating organisational adaptation, beyond student’ needs to familiarise, it is relevant to first ask how to make time for what is acknowledged as important, and not only be imprisoned by what is urgent. Secondly, it is relevant to ask how to develop or improve practices to better utilise the existing skills. These two questions are closely related and sequentially interdependent.

The first question – regarding the tension between urgency and importance – is neither a new one nor unique to the construction context. Even United States presidents have been challenged by this tension. In a speech at the Northwestern University in Evanston, Illinois, President Dwight Eisenhower said, “*I have two kinds of problems, the urgent and the important. The urgent are not important, and the important are never urgent*” (Eisenhower 1954). Whether he was the first to address this tension is debated, but his statement led the way to the so-called Eisenhower Matrix, where urgency and importance are juxtaposed in two dimensions. A key paradox that emerges when simply mapping the explanations given by respondents regarding *urgency* in an Eisenhower Matrix is that strategically important issues (such as making better use of existing digital technologies, or developing strategies for how

to make use of the newly graduated students’ digital skills) are less likely to have *deadlines* than tasks that are strategically relatively “unimportant,” such as unloading a delivery. Most, if not all, urgent issues are bound by clear deadlines; alternatively, due to their nature, they are non-negotiable in terms of time. For example, if a delivery suddenly arrives on the construction site, you cannot ignore it or deal with it tomorrow. The gist of this is that when there is no sense of urgency, or no clear deadlines, not even activities that all respondents agree are important, will be prioritised. A potential solution to this problem is to increase the perceived urgency of important tasks by scheduling them, or creating deadlines.

As for the second question – how to improve practices to better utilise existing digital skills among newly graduated students – inspiration can clearly be drawn from what is already being done. Building on the already emergent practices observed, managers can, for example, develop mutual, or reversed mentorships, where experienced staff, who have a good understanding of how the firm operates, work together with newly employed students with a high level of digital skills. This is both relevant on-site and off-site, even if the observed emergent practice was an on-site initiative. Building on such initiatives would not only enable the utilisation of existing digital skills among newly graduated students but also strengthen the technological self-efficacy among less digitally skilled staff; the belief in one’s ability to successfully perform a technologically sophisticated new task in a specific situation. Changing personal beliefs and employees’ mental models is a slow but important issue in order to be able to also achieve organisational adaptation, and thus alteration of, for example, routines, due to the dual way in which routines are upheld (Pentland and Feldman 2005). Conversely, construction site managers can also authorise and provide opportunities for newly graduated students with a high level of digital skills to take on responsibility for specific (digital) tasks, provide tinkering time, and allow for mistakes to be made. The latter necessitates a no-blame culture (Walker 2016), and potentially that such activities are perceived as urgent, or in other ways ensure that they are prioritised.

In other words, there are several ways in which newly graduated students can be better involved. At the core of this is, of course, a need for managers (both those recruiting and those with a direct responsibility in the everyday operations) to take interest in and understand what skills newly graduated students actually possess. Thereafter, it is possible to match



these with existing needs and future possibilities. In the present study, it is obvious that this is something of a “blind spot” for most managers. Such practices have both direct and indirect benefits. Direct benefits stem from actually utilising the skills of employees, whilst the indirect benefits relate to facilitating a modification of established beliefs of less technologically enthusiastic staff (Porac *et al.* 1989, Davidson 2006), and thereby slowly but surely enabling successful organisational adaptation (which was not at all observed in the present study).

It was mentioned above that the underlying hindrances (*urgency* and *lack of established practices*) are sequentially interdependent. Put simply, it can be said that in order to improve the latter, the former needs to be dealt with first. Even if construction firms acknowledge the digital skills of newly graduated students and develop new practices which enable them to, for example, further engage in activities that help influence other employees’ mental models, little will come out of this if there is no time to do it. One might say that it is not a matter of only developing and “making time” for improved practices, but potentially also increasing the sense of urgency. It should be noted that the presented study was initiated before the COVID-19 pandemic. Interestingly, if we disregard all its devastating consequences for a moment, the pandemic has created the urgency needed to really prioritise digitally related changes in most industries. As for the construction industry it was, for example, recently reported that a majority of construction managers feel that the pandemic has provided a positive push for digital development and forced organisations to make rapid changes (Byggcheferna 2020).

## Conclusions

With a starting point in the importance of digital transformation for construction firms, the aim of this paper was to *increase the understanding of the role that newly graduated students play in digital transformation in construction firms*. By “role,” we referred to the newly graduated students’ involvement or participation in the digitalisation efforts of the organisation. We further intended to understand what might hinder or facilitate this involvement. The study was based on a combination of semi-structured interviews and focus group interviews with newly graduated students and construction managers. A three-dimensional conceptualisation of conditions for digital transformation was developed as the backbone to highlight the entanglement of the technical, organisational and social/mental

aspects of digital transformation. The developed conceptualisation was further used to discuss the firms’ efforts and the role that newly graduated students’ play in enabling digital transformation.

From the results, it can first be concluded that newly graduated students do play a potentially important role in the process of digital transformation. Their involvement mainly consists of the way in which they influence the conditions for digital transformation through their contribution to the modification of senior colleagues’ beliefs about how work could (or should) be done. Based on this, one can say that newly graduated students, based on their skills and often positive view on technology, act as ambassadors for digitalisation in the organisations. Additionally, their digital skills function as a facilitator to (more quickly) get into the organisation, even if it is up to themselves to take initiatives in terms of utilising their skills. Thus, there are no established practices in place to make use of the skills newly graduated students possess. This is a clear area of potential improvement from the firms’ point of view, although this requires a better understanding of what skills newly graduated students actually possess. The mentioned reversed mentorships are also an initiative that is worth developing further.

In terms of more institutionalised hindrance, contrary to what could be expected based on observations in previous research, the results indicate that newly graduated students do not seem to be subject to a socialisation process that results in a change-reluctant mindset. Rather, newly graduated students spend time familiarising themselves with the established practice of the organisation, existing building practice, and how the industry works. During the period of familiarisation, and whilst they bridge the experienced knowledge-experience gap, the newly graduated students get caught up in the messy everyday activities where constant time pressure forces them, like most other staff, to prioritise *urgent* issues over *important* ones. Basically, there is rarely time to do what most respondents (newly graduated students and managers) acknowledge as important, which is to better engage in organisational adaptation and thus innovative ways to use existing technologies. However, it is clearly very difficult to avoid a situation where newly graduates students are not socialised into an urgency mind-set.

Thus, urgency is highlighted as an underlying challenge where less important issues have to be prioritised ahead of important ones. Simultaneously, *urgency* might be one of the key components in the



way forward, as *urgency* enables priority for those things that normally are not prioritised. In a nutshell, if something is truly important, it might help to make it urgent. Similar to what has been noticed during the COVID-19 pandemic, urgency forces individuals, organisations, and entire industries to engage in new ways of using digital technologies. For example, as a consequence of the pandemic there is an increase in the demands for new digital tools in the Swedish construction industry (Svensk byggtjänst 2021). McKinsey (2021) also report that “contractors, architects, engineers, and suppliers have quickly shifted to working and collaborating digitally,” which has led to an increased use of integrated software platforms that better serve customer needs. Furthermore, there has been a reported positive change in perception regarding digital technology among Swedish construction managers (Byggcheferna 2020). Overall, it does not seem to be an exaggeration to claim that there is a *digital momentum* created in the industry due to the COVID-19 pandemic. Due to the pandemic, we have witnessed the necessary *urgency* to really prioritise digitally related changes. However, the pressing question is how firms should go about to avoid losing this momentum when the urgency of the pandemic is over? Thus, an avenue for future studies would be to dig deeper into the notion of *urgency* in this context. For example, it would be very relevant to explore how the urgency that the pandemic has caused, have forced construction firms to mobilise around digital transformation and how firms could uphold this mobilisation.

### Limitations

As with all qualitative and interview-based studies, this study is subject to the limitations common in such an approach. With our interest in how people think and say that they act, and the role this has for construction firms in their aspiration to utilise digital technologies in a more transformative way, there was an inevitable trade-off between sample size and depth in designing this study. In this trade-off, we opted for an interview-based study with a limited number of respondents, which we combined with focus group interviews to get an in-depth understanding. We wanted to know how newly graduated students and managers were thinking and why. The empirical study could have been supplemented with data that would have captured a more general assessment of newly graduated students’ impact on the process, or follow the newly graduated students longitudinal to detect

changes in the process. On the other hand, such approaches would have reduced the in-depth nature, solution orientation, and feedback possibilities granted by the two-step qualitative design.

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