Regionaal Bouwen aan Human Capital: The 'Normalization' of the Usage of Digital Tools in the Construction Sector

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Executive Summary

This research, part of the Regionaal Bouwen aan Human Capital (RBHC) project, focuses on understanding the level of digitalization in the construction sector and how to increase the extent to which people employ digital tools. We involved relevant stakeholders in a study that employs Normalization Process Theory (NPT) to explore the extent to which digital technologies are used in people's everyday working routines. NPT is a conceptual framework to evaluate how change is adopted in the field of science and technology studies. This report presents and discusses the preliminary results of fifteen semi-structured interviews among office workers of construction companies of all sorts and sizes situated in the south of the Netherlands. This study concludes that digital technologies are not employed if they require a time investment that is perceived as detrimental in the short term or if they present new challenges that must be tackled systematically (e.g., data sharing). This type of decision concerns company culture and management's attitude and trust toward digital technologies. Only by changing the belief that digitalization is an obstacle to productivity will it be possible to advance the normalization of digitalization further and/or at a quicker pace.

Recommendations:

- Accompany managers in finding digital solutions tailored to their key problems, especially focusing on time minimization.
- Find effective ways (e.g., training, talks, events) to make digitalization part of each company's culture.
- Devote sufficient time and budget to the internal development of digital technologies usage, based on the evaluation of previous experiences.

1 Introduction

As part of the larger Regionaal Bouwen aan Human Capital (RBHC) project, we conducted a research study that employs Normalization Process Theory (NPT) to explore the extent to which digital technologies are used in the everyday working routine of people employed at construction companies located in the south of the Netherlands. NPT is a conceptual framework to evaluate how change is adopted in the field of science and technology studies.[1] If a technological innovation becomes part of the everyday working practice, we can say that it is normalized in that specific context.

Semi-structured interviews based on NPT and its corresponding Toolkit were used to assess the level of normalization of digital technologies usage among professionals working in the construction sector in the south of the Netherlands. A sample of fifteen stakeholders employed at construction companies of all sorts and sizes was considered. This report presents and discusses the most important yet preliminary results of the study.

[1] Farr M, Banks J, Edwards HB, Northstone K, Bernard E, Salisbury C, et al. Implementing online consultations in primary care: a mixed-method evaluation extending normalisation process theory through service co-production. BMJ Open. (2018) 8:e019966. doi: 10.1136/bmjopen-2017-019966; Finch TL, Rapley T, Girling M, Mair FS, Murray E, Treweek S, et al. Improving the normalization of complex interventions: measure development based on normalization process theory (NoMAD): study protocol. Implement Sci. (2013) 8:43. doi: 10.1186/1748-5908-8-43

2 The Normalization Process Theory Toolkit

The questionnaire employed for this study consisted of two parts. The first part consisted of twelve questions covering basic information about the respondents (e.g., demographics) and the place where they work, but also about their view on digitalization (in construction) and knowledge about prevailing legislation concerning digitalization (in construction). The second part, which is comprised of sixteen statements to evaluate, implements NPT with the Normalization Process Theory Toolkit (NPTT), a methodology developed to measure the four constructs of the NPT with four statements per construct: 1) Coherence, 2) Cognitive Participation, 3) Collective Action, 4) Reflexive Monitoring. The first construct assesses whether each respondent understands and is able to work with the new technology; the second measures how respondents engage with it; the third focuses on understanding the extent to which each actor promotes the employment of the new technology; the fourth appraises the effects of the new technology on the working routine.

The statements used in the interviews were taken from the NPTT[2], and adapted to fit the specific context of our research. Since the original Toolkit is in English, all statements have been carefully translated to Dutch, since all interviewees were Dutch. Table 1 presents the sixteen statements, inserting first the number of the construct (1-4) and second the number of the order in which they were discussed (1-16). For instance, question 1 belonging to construct 1 is labeled 1:1, and question 4 belonging to construct 4 is labeled 4:16. Each interviewee was asked to express their level of agreement with each statement with a score ranging from 1 to 7, where 1 means they completely disagree with the statement and 7 indicates full agreement. A summary of the scores given to these statements can be found in Figure 1. The figure uses boxplots to show each statement's median and lower and higher quartiles.

After assessing each statement during the interview, the respondents were invited to motivate their answers. This contextual information is used to understand and interpret the results in more detail. Some relevant quotes are presented in the report. The entire interview was delivered in Dutch. Quotes in the original language (Dutch) are provided in the footnotes.

[2]https://normalization-process-theory.northumbria.ac.uk/npt-toolkit/

Table 1: The numbering shows the construct (1-4), followed by the number of the order in which the statement has been discussed (1-16) after the colon.

Number	Statement	**Number**	Statement
1:1	The way of working in a more digitalized construction sector is clearly distinct from the current way of working.	**3:9**	I am able to execute the tasks that have become part of my job due to the digitalization of the construction sector.
1:2	Me and my colleagues have a shared understanding of the aims and the expected outcomes of digitalization in the construction sector.	**3:10**	I maintain my trust in the quality of work and the expertise of others now that the construction sector digitalizes.
1:3	I understand how my work is changing due to digitalization in the construction sector and what this requires of me	**3:11**	Work required by the digitalization of the construction sector is allocated to people with the right mix of skills and training.
1:4	I understand the importance of digitalization in the construction sector and the potential benefits it has for my work.	**3:12**	Digitalization within my firm/organization is adequately supported by its management and other stakeholders (e.g., through policy measures, money, materials and other resources).
2:5	Key figures in the construction sector (e.g., your supervisor(s), policymakers) succeed in involving others in what is needed for further digitalization of the sector.	**4:13**	I access information about the effects of the digitalization of the construction sector to determine how effective and useful it is.
2:6	I believe I should be involved in the digitalization of the construction sector, and that I can contribute to what is needed for further implementation.	**4:14**	Me and my colleagues collectively agree about the worth of the effects of the digitalization of the construction sector after careful evaluation.
2:7	Me and my colleagues are able and willing to organize ourselves in order to collectively contribute to the digitalization of the construction sector.	**4:15**	I personally assess the digitalization of the construction sector as worthwhile.
2:8	Me and my colleagues are able and willing to collectively define actions and procedures that are needed to keep the digitalization of the construction sector going	**4:16**	I modify my work practices in response to both my individual appraisal and the communal appraisal of the worth of the digitalization of the construction sector.

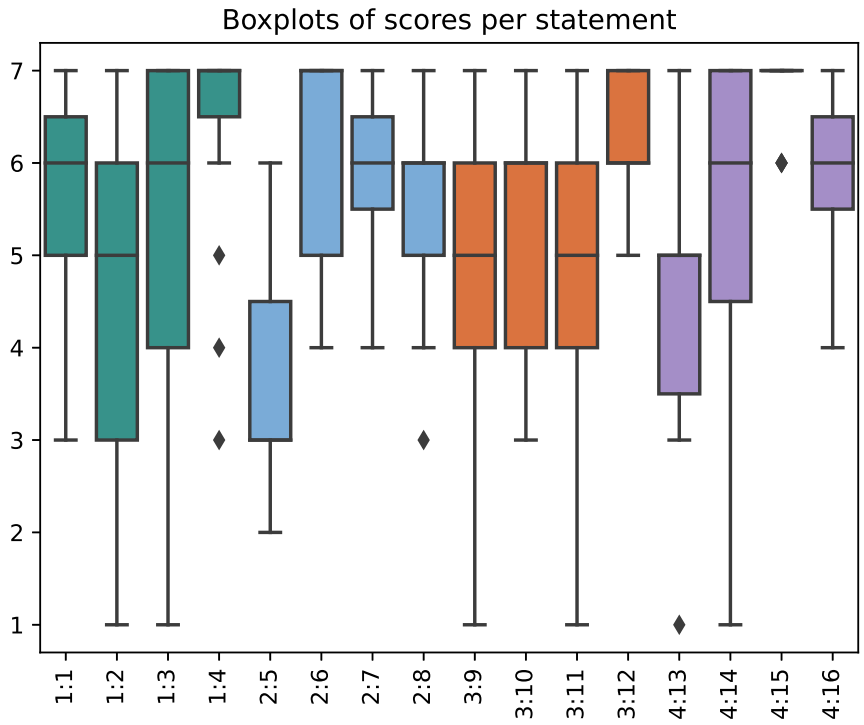

Figure 1: Boxplots of scores per statement: Median and quartiles on display
Green: Coherence (1:1 - 1:4). **Blue**: Cognitive Participation (2:5 - 2:8). **Orange**: Collective Action (3:9 - 3:12). **Purple**: Reflexive Monitoring (4:13 - 4:16)

3 Overview of respondents

The average age of the respondents is 43.7. Seven respondents have a master's degree, six have a bachelor's degree (equivalent to HBO), and two have a PhD degree. The respondents cover a wide array of office-based jobs in the construction sector, for instance, Building Information Modeling (BIM) modeller, project manager, and CEO. Four respondents work for large companies (250 FTE and more), five for medium-sized companies (50-249 FTE), two for small companies (10-49 FTE), and four for micro-sized companies (1-10 FTE). The respondents work for 14 unique companies in the construction industry, and hence, two respondents work for the same company. Note that most of the respondents came from the networks of the parties involved in this research project, and thus might be relative "frontrunners" when it comes to digitalization.

4 Construct One: Coherence

The first set of statements (1:1 - 1:4, see Table 1) assesses the Coherence construct. "Coherence is the sense-making work that people do individually and collectively when they are faced with the problem of operationalizing some set of practices."[3]

We can appraise the results from the first four green boxplots in Figure 1. Statements 1:1 and 1:3 have a median of 6, while statement 1:4 presents a median of 7 (even if there are some outliers). Overall, respondents have a coherent understanding of what working with digital tools entails for the construction sector, and they are able to differentiate digital from non-digital working routines. Statement 1:2 shows scores that are lower than the others. This statement indicates whether respondents and their colleagues have a shared understanding of digitalization and its outcomes. The evaluations were lower and more heterogeneous, showing that respondents perceived a different understanding between their own and their colleagues' usage of digital tools in their work practice.

Contextual information provided with the motivations for the scores attributes the misalignment to differences in the willingness to digitalize between companies and even within companies. Some respondents mention that their company has no specific goals for digitalization or is very early in its journey toward becoming digitalized. According to one respondent, companies doing the actual physical construction are the most hesitant to digitalize. *"I think we builders are still quite conservative and do not see the value [of digitalization]; they are doing their own thing, with their own goal. Once the building has been built and sold, the job is done."*[4] Others share this sentiment. *"Well, in practice, it always turns out differently [than the willing to digitalize]. In construction, things never go as they are planned."*[5]

Several respondents say builders will fall back on traditional techniques rather than digitized ones as soon as something goes wrong. The overall sentiment seems to be that while companies would like to work more digitally, it is still quite ad hoc. It is preferred to digitalize certain work practices if everything is going well (positive economic tide, projects running well, et cetera), but it is easy to fall back on traditional processes if not. Figure 2 shows that this effect is somewhat stronger for small and medium-sized enterprises (SMEs).

We can conclude that even if what digitalization in the construction sector entails is clear to respondents (i.e., they have a coherent understanding), they perceive different levels of involvement and outcomes when looking at respondents representing companies of different sizes. Large and micro companies show the highest coherence, while SMEs present lower levels of such coherence. It is possible to attribute those differences to the extent to which companies are able and willing to put resources into digitalization according to their budgets and goals.

[3] Normalization Process Theory — Coherence `https://normalization-process-theory.northumbria.ac.uk/what-is-npt/coherence/`, (Accessed on 03/06/2024)

[4] "Ik denk dat wij als bouwers nog vrij conservatief zijn en daar niet de meerwaarde van in zien, we zijn bezig met met ons eigen doel en als dat gebouw gerealiseerd is en het is verkocht, dan is het klaar."

[5] "Ja, in de praktijk is het toch anders. Of ja, op de bouw gaat het toch nooit zoals van tevoren bedacht."

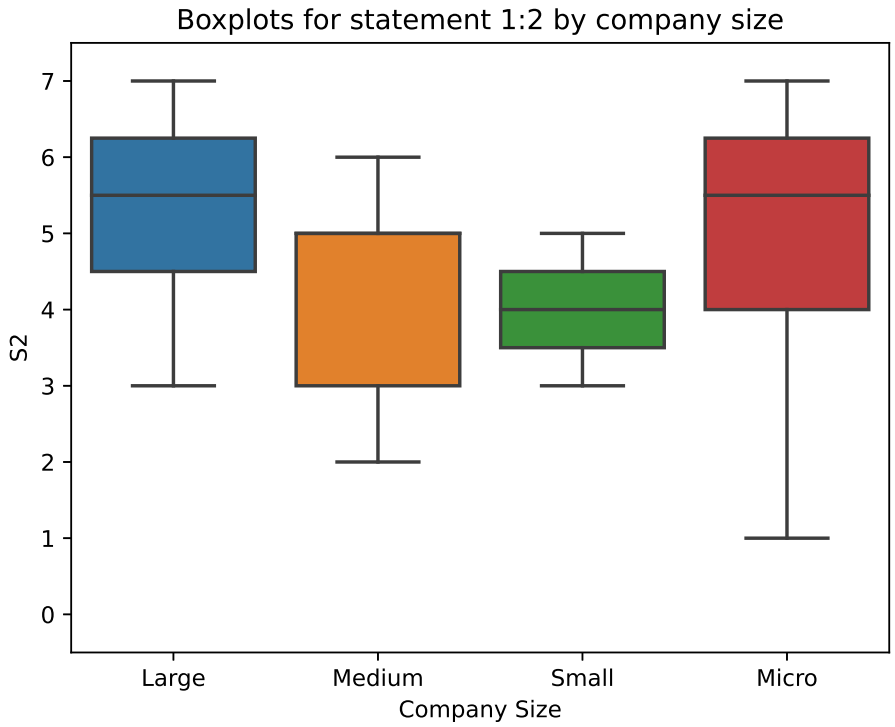

Figure 2: Boxplots for statement 1:2 ("Me and my colleagues have a shared understanding of the aims and the expected outcomes of digitalization in the construction sector.") by company size

5 Construct Two: Cognitive Participation

The second set of statements (2:5 - 2:8, see Table 1) assesses the Cognitive Participation construct. "Cognitive Participation is the relational work that people do to build and sustain a community of practice around a new technology or complex intervention."[6] We can appraise the results from the second block of boxplots (blue) in Figure 1.

The medians for statements 2:6, 2:7, and 2:8 are between 5 and 7, suggesting a high level of cognitive participation among respondents. They show commitment to sustaining the permanent shift of their working routines to digitalized ones. However, statement 2:5 shows relatively low scores. This statement evaluates the role of management and policymakers toward a digitalized construction sector. One respondent said: *"When I look at the management level, they don't fully understand what benefits digitalized work can have."* [7] Another respondent said about management: *"And then you have the top management of large companies or SMEs, early adopters in digitalization in the construction sector, and I feel like they aren't always succeeding in digitalization, because they also don't know what it means and how it can help you."*[8]

Figures 3 show the distribution of scores given to 2:5 by company size. We can appraise that low scores are evenly distributed, but small and micro companies are the ones where the perception of a lack of support from management is the strongest. Larger companies are, in general, more supportive of digitalization than smaller ones. However, for what concerns micro companies, the low scores are due to the lack of central management. Even if respondents show high levels of cognitive participation overall, the conclusion is that they do not often feel that management supports digitalization to the fullest, since other, more pressing issues are often given priority as soon as they emerge.

Some respondents feel that if upper management can see positive examples of how digitalization could help their business, they are more likely to go through with it. The general sentiment amongst our respondents on upper management is that, while they are not against digitalization in general, they also do not see a direct benefit. They only seem willing to change if there is a direct (financial) benefit for them to do so. Amongst our sample, this seems to be the biggest hurdle in digitalization of the construction sector. Lower-level office workers would like to see more digitalization, but if upper management does not see the (long-term) benefit, then there is not much they can do. It should be noted that this is not the case in all companies of the ones we interviewed. Some managers are quite willing to help their employees out with organizational and financial means.

[6] Normalization Process Theory — Cognitive Participation `https://normalization-process-theory.northumbria.ac.uk/what-is-npt/cognitive-participation/`, (Accessed on 03/06/2024)

[7] "Als ik richting het directieniveau ga kijken, daar wordt vaak nog niet helemaal begrepen welke impact het digitaal werken of digitaler werken kan hebben."

[8] "Dan heb je directieleden van grote bedrijven of directieleden van MKB-bedrijven, eigenlijk een soort early adopters van digitalisering in de bouw, en ik vind dat die er niet altijd in slagen, omdat zij ook niet weten wat het allemaal inhoudt en hoe het je kan helpen."

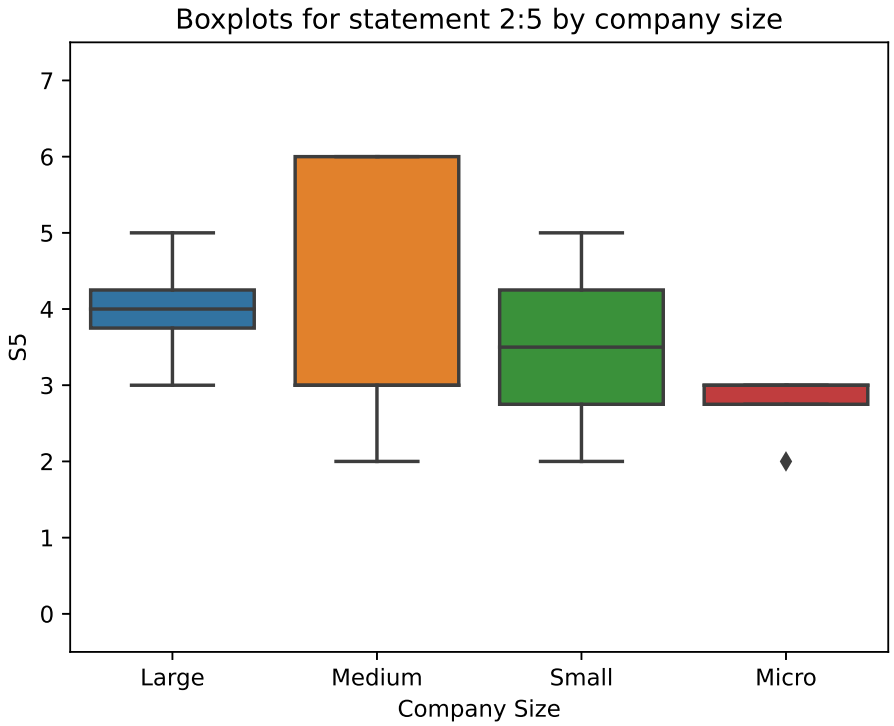

Figure 3: Boxplots for statement 2:5 ("Key figures in the construction sector (e.g., your supervisor(s), policymakers) succeed in involving others in what is needed for further digitalization of the sector.") by company size

6 Construct Three: Collective Action

The third set of statements (3:9 - 3:12, see Table 1) assesses the Collective Action construct. "Collective Action is the operational work that people do to enact a set of practices, usually representing a new technology."[9] We can appraise the results from the third block of boxplots (orange) in Figure 1.

The scores resulting from the evaluation of the four statements show a median between 5 and 6, indicating a high level of digitalization enactment among the respondents. Still, we can pinpoint a few segments where there are barriers to respondents' propensity to embrace digitalization.

A crucial aspect of digitalization (in the construction sector) concerns the open sharing of knowledge and data that digitalization facilitates. Rather than seeing an appealing opportunity, some respondents see a problematic situation that constitutes a barrier to adopting digital tools and processes. A respondent stated: *"That would be mostly in the fact that you give another party access to your platform, so to your project and also data related to our building which they could take and use in another context."*[10] Another respondent declared: *"I think we need a change of attitude. We very often think we have a unique selling point when we will tell our suppliers or each other as little information as possible."*[11].

Statement 3:12 discusses whether digitalization is supported by management and stakeholders through various means. The reaction was positive amongst almost all respondents, with the overall sentiment being that the availability of resources - financial or otherwise - is not inhibiting the digitalization of their companies. One respondent claims: *"ICT monitors the budget, but the budget is never completely fixed. An investment has never been canceled for budget reasons."*[12] Another respondent: *"Money is not a problem; it is always made available when asked. Very rarely does management say there's no money available."*[13]

When asked what upper management could do better: *"Prioritization. Since digitalization is such a topic now, a lot of new things have to be done to support it. However, none of these things are being finished."*[14] This sentiment is shared by other respondents. Upper management is willing to make the necessary financial investment into digitalization, but seems less willing to make the structural changes required to complete projects and to start new ones succesfully.

[9] Normalization Process Theory — Collective Action `https://normalization-process-theory.northumbria.ac.uk/what-is-npt/collective-action/`, (Accessed on 03/06/2024)

[10] "Dat zit hem dan toch in het stukje dat je een externe partij toegang verschaft tot jouw platform, dus tot jouw project en ook bij gegevens kan over ons gebouw en daarmee zelf de hort op kan."

[11] "Ik denk dat er een gedachteverandering nodig is. Wij denken namelijk heel vaak een unique selling point te hebben door middel van niet te veel prijsgeven aan leveranciers of elkaar zo min mogelijk informatie te verschaffen"

[12] "Het budget wordt bewaakt door ICT, maar het budget is eigenlijk nooit helemaal vast. Er is nooit om een budgetreden een investering niet doorgegaan."

[13] "Geld is geen probleem, geld wordt altijd vrijgemaakt. Het is zelden dat de directie zegt dat er geen geld voor is."

[14] "Prioriteiten bepalen. Dus wat je ziet is, doordat digitalisering een topic is, dat er heel veel dingen tegelijk opgepakt worden, maar dat we eigenlijk niks afmaken,"

Figure 4 gives the distribution of scores for statement 3:12 by company size. We can appraise that material resources such as money are not a problem anywhere. Managers support the digitalization process when it is considered the solution to a problem or a promising new direction. However, combining the findings of construct two and three, what impinges a collective action toward a permanent adoption of digitalization is the managers' lack of trust in the benefit of digital solutions in the short term or the lack of perspective about the importance of digitalization in the longer run. It is not so much the practical and material issues that impinge digitalization, but the lack of perception of its (long-term) benefits.

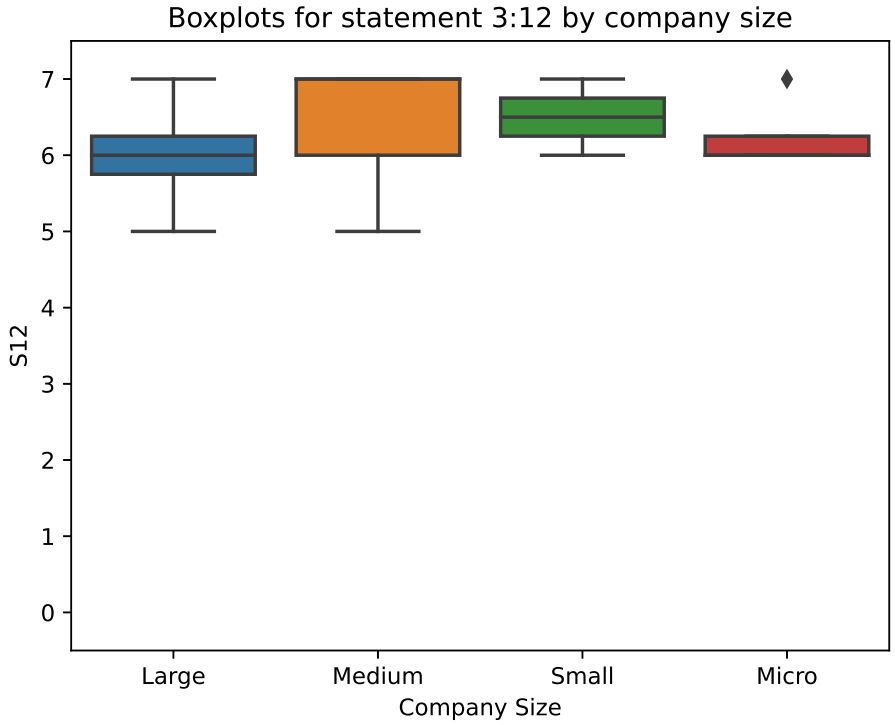

Figure 4: Boxplots for statement 3:12 ("Digitalization within my firm/organization is adequately supported by its management and other stakeholders (e.g., through policy measures, money, materials, and other resources).") by company size

7 Construct Four: Reflexive Monitoring

The fourth and final set of statements (4:13 - 4:16, see Table 1) assesses the Reflexive Monitoring construct. "Reflexive Monitoring is the appraisal work that people do to assess and understand the ways that a new set of practices affect them and others around them."[15] We can appraise the results from the fourth block of boxplots (purple) in Figure 1.

Statements 4:14, 4:15, and 4:16 show very high median values (6 or 7), showing that the process of reflexive monitoring on the adoption of digitalization is already taking place in the construction sector. However, there are some differences in the level of monitoring and evaluation of the state of digitalization between companies. Some of them have clear and concrete methods of evaluation (4:14). For instance, R5, R8, and R9 work for companies owned by larger parent companies, which seem to have more structure in place when it comes to evaluating digitalization.

As expected, companies that are not very digitalized yet, do not have a clear structure for evaluation either. It is done on an ad-hoc basis instead. They do evaluate what went well in one project, but these lessons are not always used in other, future projects. It seems that for these companies, digitalization is helpful and promising, but delivering the final product to the client and finishing buildings fast has priority. Some of our respondents see this as an impediment to further digitalization.

Statement 4:15 asked respondents to evaluate whether they saw the digitalization of the construction sector as worthwhile. As can be seen in Figure 1, the response to this question was overwhelmingly positive. This indicates that there is a willingness for further digitalization.

Statement 4:13 shows a median value lower than the average, and its distribution according to company size is displayed in Figure 5. Overall, it seems that it is easier to get information in small and micro companies rather than medium-sized and large ones. Most of the larger companies in our sample evaluate their internal and external processes. External evaluation is done with other companies in the conglomerate or special interest groups within the construction sector. Internal evaluation seems more informal, while external evaluation with stakeholders is more formal. When asked whether they had access to data about the effects of digitalization, the responses indicated that while there is certain information available, most would like more concrete information on how digitalization impacts building projects. A respondent said: *"The construction sector is cost-driven, so you would want to know what you gain [from digitalization]."*[16] Another respondent said that with new tools, the sector could get insights into what resources went into a building; there is not yet an option to see how many FTE were saved or where the cost reduction was most impactful.

A reflexive monitoring about the extent to which companies are digitalized and should move

[15] Normalization Process Theory — Reflexive Monitoring `https://normalization-process-theory.northumbria.ac.uk/what-is-npt/reflexive-monitoring/`, (Accessed on 03/06/2024)

[16] "Ja, de bouw is ook kostengedreven, dus je zult eigenlijk wel willen weten wat het nou eigenlijk oplevert om zoiets te doen."

further with digitalization is already taking place in different ways. Small and micro companies seem to be more transparent in their evaluation if compared to large and medium-sized ones. It emerges from the responses we collected that if digitalization is perceived as an advantage, management fosters its implementation and normalization. However, digitalization is often perceived as an impingement to speed and as an additional unnecessary cost, and this seems to hold back many companies.

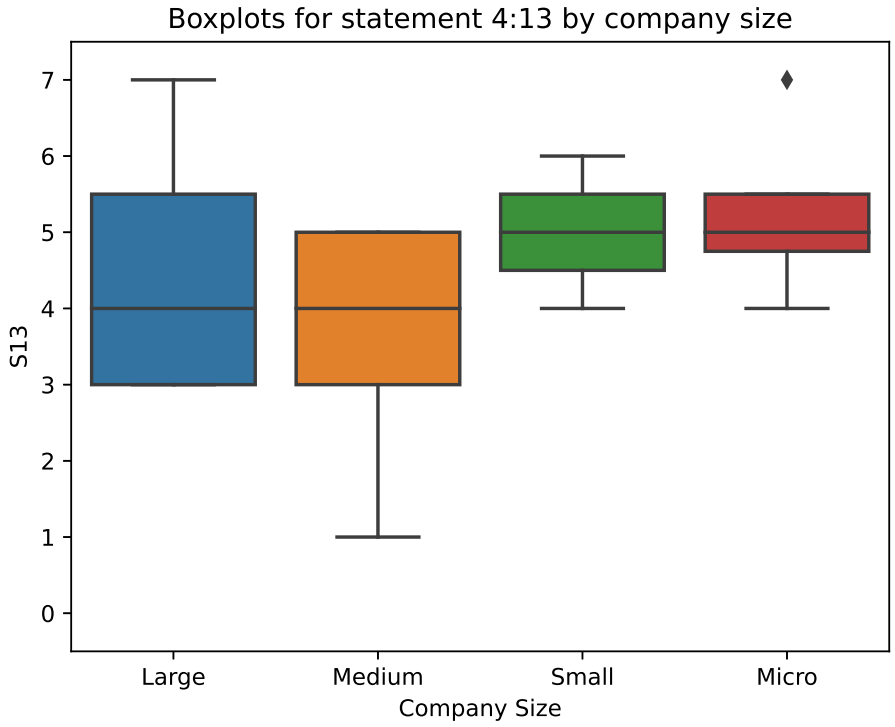

Figure 5: Boxplots for statement 4:13 ("I access information about the effects of the digitalization of the construction sector to determine how effective and useful it is") by company size

8 Conclusions and Recommendations

By observing the four constructs, we appraise that digitalization in the construction sector is in an advanced state of normalization. In fact, most statements in each construct scored very high. Still, more work to reach a fully digitalized construction sector in the south of the Netherlands can be done. It should be kept in mind that most interviewees represented companies that might already be further in their digitalization journey than the average construction company.

By looking at the coherence construct, we appraise that stakeholders are able to clearly perceive the difference between working in a digitalized and non-digitalized setting in their respective domains. Respondents perceive differences in what is defined as a digitalized construction sector based on heterogeneous company cultures and aims.

The cognitive participation construct measured the extent to which individuals believe in building and sustaining the employment of new digital technologies together as a community (e.g., through company culture). It emerges that respondents do not always see their management as true supporters of digitalization.

Concerning the collective action construct, we measure the enactment of the beliefs pinpointed by the second construct. Respondents are willing to advocate for digitalization and even request funds to further develop digital practices within their employer companies. When management sees the potential of digital techniques, there are no resource impingements for their requests. Still, management does not always seem to prioritize digitalization. If digitalization requires a long-term investment that, in the short run, causes delays, management might create barriers to the normalization process of digitalization.

Finally, the fourth construct measures the extent to which there is reflexive monitoring of digitalization's normalization. Most companies have monitoring tools in place, but they do not always capitalize on what they learn due to the time investment it takes. This causes the reiteration of practices that slow down the normalization of digitalization in the sector.

This study concludes that digital technologies are not employed if they require a time investment that is perceived as detrimental in the short term or if they present new challenges that must be tackled systematically (e.g., data sharing). This type of decision concerns company culture and management's attitude and trust toward digital technologies. Only by changing the belief that digitalization is an obstacle to productivity will it be possible to advance the normalization of digitalization further.

We conclude with a recommendation to accompany managers in finding digital solutions that will help them believe and trust digitalization further and create ad-hoc learning moments for specific companies to integrate digitalization into specific typologies of company culture even further. We also recommend pushing for company cultures to have a systematic method to learn from their own internal and external reviews, so that they do not repeat practices that have been evaluated

as inefficient. This type of change is possible with sufficient time and budget allocated to improve their own digital transformation efforts.