From Intention to Use to Active Use of a Mobile Application in Norwegian ETO Manufacturing

Pål Furu Kamsvåg, Sylvi Thun, and Joakim Klemets

Abstract The introduction of digital technologies is starting to change the prevailing work practices at Aker Solutions' yard at Stord in Vestland county. However, in order to derive business value and attain real transformative effects of digitalization, the challenges related to implementation must be identified and addressed. In this chapter, we examine the ongoing implementation of the mobile application WeBuild, at Aker Solutions' yard at Stord. The overall goal with the application is to support more efficient work processes, reduce costs, increase organizational flexibility, and thereby ease the coming transition to "green" market segments. We use data from an extensive survey with answers from more than 500 respondents working at the yard at Stord to identify both organizational and infrastructural challenges with regard to this specific implementation. Analyses indicate that training and user involvement, functionality and usability, and technical infrastructure are important determinants which influence the active use of the WeBuild application. In more detail, our findings show that functionality adapted to the needs of the respondents' respective disciplines was the strongest predictor of active use and that poor Internet access in certain parts of the yard makes it challenging to use WeBuild and other digital solutions. Further, we discuss how Aker Solution could overcome some of these challenges and attain business value from WeBuild and other digital solutions and initiatives. WeBuild is one of the many digital initiatives in Aker Solutions. By investigating the implications of this specific implementation along several dimensions, this study sheds light on the many difficulties Norwegian companies are facing when they try to reap the benefits of digital transformation. While Aker Solutions get insights with regard to the

P. F. Kamsvåg (✉) · S. Thun
Department of Technology Management, SINTEF Digital, Trondheim, Norway
e-mail: paal.f.kamsvaag@sintef.no; sylvi.thun@sintef.no

J. Klemets
Department of Health Research, SINTEF Digital, Trondheim, Norway

Department of Computer Science, Norwegian University of Science and Technology, Trondheim, Norway
e-mail: joakim.klemets@sintef.no

P. Mikalef, E. Parmiggiani (eds.), *Digital Transformation in Norwegian Enterprises*,
https://doi.org/10.1007/978-3-031-05276-7_6

contextual challenges at this specific yard, one can extract important learning points that are useful in other contexts as well. Norwegian manufacturers must learn from each other to succeed with digital transformation.

1 Introduction

Digital transformation encompasses the significant changes taking place in business and society through the use of digital technologies [1]. Although the term has received a lot of attention lately, there is no clear consensus among researchers and practitioners when discussing the content of the phenomenon. However, the vast majority believe that digital transformation differs from digitization and digitalization. Digitization is usually defined as the technical process of converting analog information into digital form, while digitalization refers to enabling or improving processes by leveraging digital technologies and digitized data [2]. Digital transformation, on the other hand, could be considered as the final step in the pyramid which is dependent on digitization and digitalization as sub-levels. Digital transformation, in a business perspective, is about using digital technology to transform the company's services into something significantly better. Thus, digital transformation can be regarded as a redesign of the business at all levels [3].

In this chapter, we examine the ongoing implementation of the mobile application WeBuild, at Aker Solutions' (Akso) yard at Stord. WeBuild is one of the many digital initiatives in Akso and an important part of the company's digital transformation vision. While it could be argued that WeBuild as a stand-alone project is not enough to be classified as digital transformation, the expected outcomes of adopting the application are definitely an important part of the digital transformation process. The following definition of digital transformation from Vial [4] substantiates our consideration that the WeBuild application could be regarded as part of an overarching digital transformation process: "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies." The overall goal with the WeBuild application is to support more efficient work processes, reduce costs, and increase organizational flexibility and by that ease the transition to "green" market segments for Akso. These outcomes, if they are achieved, could be considered as "significant changes" and thereby fulfill the criteria in Vial's definition. However, what is meant by significant change is subjective and up for discussion. We will not be pursuing this matter any further but conclude that WeBuild is part of the comprehensive process of digitally transforming the yards of Akso.

The opportunities and potential gains from digital technologies in an industrial context are well described in the Industry 4.0 literature, and a more sophisticated human-machine interaction is even the main vision and goal in the human-centric approach of *Operator 4.0* [5, 6]. While the opportunities and visions are thoroughly discussed in this literature, there are hitherto little empirical research about the perceived benefits from the use of digital solutions in an industrial environment.

Furthermore, there is limited research that looks at the factors that influence the active use of digital technologies, such as mobile applications and tablets. We believe there is a strong need for more empirical research about these topics, so that companies and all relevant stakeholders increase their understanding and can develop strategies to overcome the many barriers they encounter with regard to technology adoption. Thus, this chapter contributes to research literature on digital transformation with empirical findings on actual use of digital solutions, its influencing factors and perceived benefits, and not only the intention to use.

We rely on data from an extensive survey with answers from more than 500 respondents working at the yard at Stord. By investigating this implementation along several dimensions, this study sheds light on the opportunities that come with an extensive mobile application in an industrial setting. We further identify and discuss some of the most prominent challenges big companies are facing when they try to reap the benefits of digital technologies. Based on the data material we discuss organizational and infrastructural challenges with regard to the implementation of a mobile application through the lens of *technology acceptance literature*. Further, we discuss how Akso can overcome some of these challenges and attain real business value from this mobile application. Our ambition is to uncover the factors that influence the active use of WeBuild and identify the perceived benefits of using the application. Hence, our two main research questions are as follows:

- *RQ1:* Which factors influence the active use of a mobile application in a Norwegian ETO-manufacturing company?
- *RQ2:* What are the perceived benefits of using a mobile application in a Norwegian ETO-manufacturing company?

2 Theoretical Background

To reap the benefits from digital solutions and succeed with digital transformation, you naturally need active use of the technology that is being implemented. This might sound trivial, but it is a real challenge which is often underestimated. *Technology acceptance* is a subject area that is useful for understanding the underlying factors which affect both acceptance of technology and usage. We use the technology acceptance model (TAM) and the *unified theory of acceptance and use of technology* (UTAUT) as theoretical starting points for our analysis. The insights from these frameworks/models are important to bear in mind regarding digital transformation. That is because real transformative change requires more than just technology; it requires changed practices and behavior from humans. To derive real transformative effects from digital technology, you must understand which factors affect use and acceptance.

2.1 Technology Acceptance

Technology acceptance has been studied for decades within several research fields and has become increasingly emphasized with the emergence of new digital tools and devices. One of the most prominent and widely used models is the technology acceptance model (TAM) developed by Davis [7]. The intention to use technology is, according to TAM, influenced by two main factors (belief constructs): perceived usefulness and perceived ease of use. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance." And perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free from effort" [7].

Over the years, TAM has been rigorously studied and expanded. Mathieson et al. [8] proposed a third construct, *perceived resources*, and defined this construct as "the extent to which an individual believes that he or she has the personal and organizational resources needed to use an information system." This construct emphasizes the perceptions of the environment where implementation takes place and the characteristics of the technology itself, thus contributing to a better understanding of technology acceptance [8].

A major upgrade of TAM came with the *unified theory of acceptance and use of technology* (UTAUT), which was an attempt to synthesize existing technology acceptance models and theories [9]. UTAUT holds that there are four key constructs that could explain user intention and behavior: (1) performance expectancy, the notion that the technology will contribute to increased job performance; (2) effort expectancy, the degree of "ease of use"; (3) social influence, the perception of the individual that he/she should use the technology as a result of the influence from important stakeholders; and (4) facilitating conditions, the extent to which a person experiences that the organization facilitates the use of the technology [9]. The first three constructs are direct determinants of usage intention and behavior, while the fourth is a direct determinant of user behavior. Further, UTAUT includes four intermediate variables, age, gender, experience, and voluntariness of use, that moderate the impact of the four key constructs [9]. In the following, we present previous research findings relevant for UTAUT four constructs.

Performance expectancy is derived from the notion that the technology will contribute to increased job performance. In manufacturing and an industrial environment, digital applications can be used for visualization purposes and increase the perceptibility of operations and performance status. Furthermore, the end users might achieve a better understanding of the overall production processes and increased situational awareness, which makes it easier to make real-time decisions [10, 11].

One study within construction found a positive relationship between the use of mobile applications and the improvement of overall productivity, with perceived benefits such as "more efficient management of checklists and documentation" and "better performance monitoring and evaluation" [12]. Findings from a study conducted in the Norwegian manufacturing context revealed that production

managers tend to report higher satisfactions with digital technologies being introduced compared with the operators, suggesting that ICT systems and digital solutions often are not implemented or developed with the operator in mind [13]. The last point is of great importance in this setting as well. It is of course crucial that the technology is adapted to the needs of the users.

In a study investigating different aspects of the UTAUT model in a hospital context, some performance expectancy measures were found to affect intention to use a mobile application [14]. The results showed that the use of the application could speed up the administration process and also that employees could save time by applying the solution. These perceived benefits were associated with the intention to use [14].

Effort expectancy, or the degree of "ease of use," could be defined as to which extent a person believes that using a particular system is effortless [7]. In one study, researchers found that variables relevant to effort expectancy, the "ease of use" and the level of effort a user thinks a specific task will require, had an influence on intention to use. If users experience that the use of an application is easy to use and a satisfaction in using it, the intention to use the application will also increase significantly [14].

Social influence is the perception of the individual that he/she should use the technology because of the influence from important stakeholders. The way companies and organizations convey information about technological changes is critical for implementation success and an example of social influence from important stakeholders. To act as an influencing factor, research has indicated that the communication should be aligned with the inherent culture and tailored to the audience [15]. Ideally, communication should take place in the initial phases of the implementation, or even during the development process or selection decision (purchase of off-the-shelf technology). Cross-communication is crucial early in the planning process to set a joint objective for harmonization, coherence, and collaboration for all relevant stakeholders [16]. Thun et al. [17] found that by communicating user needs, practicing flexible involvement of stakeholders, and transparency of the purpose among others enabled the development and implementation process of digital applications.

Facilitating conditions refers to the extent to which a person experiences that the organization facilitates the use of the technology. Training and IT infrastructure are examples of how an organization can facilitate the use of technology. Research shows that the lack of digital skills, and the consecutive need for training, is one of the most significant barriers to the implementation of new technologies [18]. Training could be considered a strategic investment that strengthens the internal resources of an organization by addressing employees' propensity for use and attitude toward current and future technological changes [15]. Training obviously facilitates learning (the users learn to use a new technology), but it could also affect employee perceptions and attitudes about the new technology [19]. Hence, training is an important tool to overcome resistance to change and to increase implementation effectiveness. According to Escobar-Rodriguez and Bartual-Sopena [20], training should have a clear objective, and the mechanism of how it is supposed to enhance

task performance and reduce the perception of risk/threats should be clarified. The experience of easiness to learn the app will also be related to the intention to use a mobile application or not [14]. Further, they found that how fast the speed of the application was affected intention to use.

According to Gartner [21], IT infrastructure refers to the IT components, such as the composite hardware, software, network resources, and services, which constitute the foundation of an enterprise IT environment. The physical systems such as hardware, storage, any kind of routers/switches, and even the building itself are generally regarded as the primary components of an IT infrastructure, though networks and software are also important. In addition to these components, there is usually a need for cybersecurity and skills as well.

In one study, researchers used the UTAUT framework to investigate the factors that influence the intention to use mobile applications for learning at universities (with a considerable focus on physical infrastructure). The findings indicated that factors such as device connectivity, device memory, device compatibility, device performance, network coverage, and network speed all had significant and positive influence on the users' intention to use the mobile application [17]. In particular, network speed and device performance were important factors where the influence was very high and noticeably significant.

While most of the research articles we have cited were conducted in a different context than an industrial environment, the findings are relevant as it exemplifies different findings of the four constructs of UTAUT that to a large degree can be said to be transferable and generic. Furthermore, all the articles investigate which determinants affect the intention to use the technology (mainly mobile applications) from the perspective of the end user. As intention to use has a positive association with actual use, the elaborated findings together with UTAUT present a sound theoretical framework relevant when contributing with knowledge about factors that influence active use of WeBuild and perceived benefits of using this mobile application.

3 Method

3.1 Research Context

3.1.1 Digital Transformation at Aker Solution

Aker Solutions' yard at Stord (abbreviated to Akso) is a well-known supplier within the oil and gas industry in Norway. With its approximately 2800 employees and annual results of several hundreds of millions of euros, the company is considered a major competitor both domestically and in the global market. Akso is considered an engineer-to-order manufacturer (ETO) who both plans and executes engineering, procurement, construction, and installation projects. These projects are usually organized as contracting agreements between customer and supplier, where Akso as a contractor/supplier rely on subcontracting partners for various purposes.

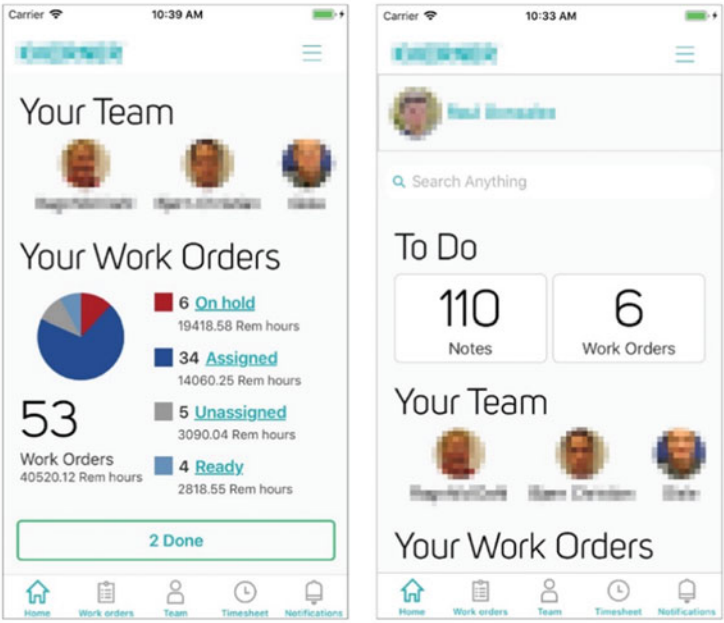
Akso has over the years developed and utilized digital tools in order to support their employees and derive efficiency gains. As a result of the latest advances in fields such as artificial intelligence/machine learning, big data analytics, digital support systems for the employees (from operator level to management), and more, *digitalization* has received even more attention than before. As part of their digital transformation vision, Akso has developed a digitalization program with a roadmap consisting of more than 25 projects which is either unfolding or planned for the future [22]. The overall ambition with this program is to increase efficiency and effectiveness of business operations, provide better technological support for their employees, and improve organizational flexibility.

Akso is currently expanding their product portfolio by entering "green" market segments and is looking for ways to improve their organizational flexibility in that regard. By organizational flexibility, we mean the organization's ability to handle continuous shifts between new growth segments (e.g., offshore wind, recycling, and orders from land-based industry) and traditional product areas within the oil and gas industry. Digital tools are considered as important means to increase the organizational flexibility and tackle the new and even more challenging everyday life at the yard, with more projects of different sizes and varied content which run in parallel.

3.1.2 The WeBuild Case: Purpose and Ambitions

WeBuild is a mobile application that aims to make daily work more efficient for all foremen and operators at Aker Solutions' shipyards in Norway. The overall goal with the application is to support more efficient work processes, reduce costs, increase organizational flexibility, and thereby ease the ongoing transition to "green" market segments for Akso. More specifically, the application is supposed to make it faster and easier to get an overview of who is at work, provide important information to the relevant audience, delegate tasks for managers and foremen, retrieve working drawings, provide the opportunity to report completed work, and reduce the overall time spent on several manual tasks.

WeBuild allows for the distribution of work packages (work orders) with all necessary information and job descriptions. The packages include working drawings, instructions, material lists, and time estimates. Both foremen and operators receive this information on their smartphones (illustrated with the screenshots below):



Traditionally, the work packages have been distributed through team leaders (foremen) and kept in hard copy in folders. This manual and analog procedure have made it time-consuming to do updates and perform revision controls [22]. With WeBuild, the foremen and operators can report progress on the project (s) they work on via their personal smartphone funded by Akso, ensuring that all relevant stakeholders are updated in real time preventing both inertia and inaccuracies. Akso believes this digital solution will lead to less time spent on reporting and status updates by foremen, thus freeing up time for preparation and facilitation of the job of the operator and contributing to better information sharing between shifts. This in turn could make the operators more efficient. Further, when more information is made available among the entire workforce via WeBuild, more decision-making and responsibility can be transferred directly to the operators. As a result, some of the layers of the value chain could potentially be removed and provide significant efficiency gains.

Over time, the application will be expanded with a number of new features, such as 3D models of specific work tasks, an overview of available tools located nearby, and visualizations of the competences among the employees. All the aforementioned opportunities and potential gains from WeBuild make the application a key component of the digital transformation process that is taking place at Akso's yards (and the yard at Stord which is being investigated in this study).

3.1.3 Development and Implementation Strategy

The WeBuild application development was led by the IT department at Akso, although most of the engineering resources were hired consultants. As part of the project, the development approach underwent a major transition as the previous waterfall method was replaced with a more agile and user-centered approach. Hence, a group of operators and foremen (i.e., end users) from a few selected teams were invited to participate in the development process as super-users, inviting them to provide insight and feedback to the system design.

The super-users were involved throughout the development process. In the initial phase, a context study was conducted, in which a multidisciplinary user experience (UX) team carried out observations and interviews at the yard to elicit system functionality requirements. After co-creation sessions with end users and the project team, the final use cases for the WeBuild application were decided. Thereafter, the super-users were also involved in providing feedback on user interface prototypes. Also, before new functionality is released to all end users, a system acceptance test was carried out by the super-users. This involved installing and testing the new version of the application for a few days to uncover inaccuracies (i.e., software bugs).

The implementation strategy selected to ensure that end users would accept and adopt the new application into their daily work also leveraged a lot on the super-users. Although initial plans included various training and dissemination activities to support the implementation process, these were discarded in favor of using available resources to realize application functionality. Therefore, the super-users participating in the development process were to a large extent involved in training and promoting WeBuild to their fellow colleagues [23].

3.2 Research Design

3.2.1 Procedure and Participants

A single case study was chosen as method to understand more about the complex nature of digital transformation in a large ETO manufacturing company located in Norway. Field-based studies can contribute with rich data and deep insights from actual work practices. Case studies enable researchers to generate deeper understanding of the phenomenon within its real-world context as well as new knowledge and theory [24, 25]. The case company was selected from an ongoing 4-year research project that started in 2020 with the aim to develop a competitive organizational flexibility.

To answer among others the research question in this chapter, a large digital survey was conducted January 2021. The survey covered different themes and contained different question types, both validated and new indexes, and the part of the questionnaire covering WeBuild experiences also contained open-ended

questions. 526 employees working in the production area of the yard participated, and a response rate at 61% was achieved. The sample consist of 479 males and 47 females. Participants had different work roles, among others construction managers (0.8%), discipline managers (4.9%), foremen (16.7%), qualified operators (59.3%), and apprentices (2.3%). The participants came from eight different departments. Since this chapter tries to highlight influencing factors of technology adoption and, in this case, active use of WeBuild, some of the participants were excluded. The relevant sample size is therefore 189, and approximately 80% of those participants belong to two of the eight departments. The majority of the active WeBuild users work as qualified operators (78%).

All participants received a written information letter about the purpose of the survey, how data would be used and stored. Furthermore, it was highlighted that participation in the study was voluntary and that participants would be anonymous. A signed informed consent form was required before participation. The Norwegian Social Science Data Service has approved the study.

3.2.2 Measures

Participants answering "yes" at the question "Have you used WeBuild?" received a question whether they use WeBuild actively during their workday. *Active WeBuild users* vs. inactive WeBuild users was as a result measured by the yes/no question: Do you actively use WeBuild during your workday? *Training* was measured with a one-item yes/no question: Have you received training in use of the WeBuild-app? *Wireless connectivity* was measured by one item "WeBuild delays my progress due to poor Internet access" at a 5-point Likert scale with (1) = totally disagree to (5) = totally agree. Influence of *functionality* was measured by the one-item question "My department has had the opportunity to influence the functionality of the WeBuild application," with three response categories, yes, no, and I do not know, and "WeBuild has functionality that is well adapted to my discipline's need" is measured at a Likert scale (1) strongly disagree to (5) strongly agree.

Other relevant influencing factors were "WeBuild is easy to use" and "WeBuild is a tool that gives me support in my work," all measured at a Likert scale (1) strongly disagree to (5) strongly agree. *Benefits of WeBuild use* was measured with different items at a Likert scale (1) to a very small extent to (5) to a very large extent. For instance, "To what extend have work packages via WeBuild released more time for your core task? To what extend have work packages via WeBuild ensured more efficient work processes? To what extend have work packages via WeBuild improved team collaborations?" We also had questions measuring experience with WeBuild and its relation to the work process of number of deliverables. For instance, "WeBuild gives me more up-to-date and accurate information compared to information on paper" and "I get to complete more deliverables/tasks using WeBuild than before (without WeBuild)" measured with Likert scale (1) totally disagree to (5) totally agree.

3.3 Statistical Analysis

Independent t-test (two-tailed) was used to assess mean differences in between active WeBuild users and non-active WeBuild users. Hedges' g provides a measure of effect size where there are different sample sizes. Chi-square tests were used to analyze whether there is an association between active WeBuild use and training and active WeBuild use and influence of functionality. Logistic regression analysis was conducted to test the predictor variables' influence on the categorical dependent variable, active WeBuild use. There was no problem with multicollinearity between the tested variables. Tolerance and VIF values were good. Linearity of the logit was also tested, and the assumption was met. All analysis was performed using IBM SPSS Statistics version 27.

4 Results

4.1 Descriptive Statistics

The total amount of people that have tried the WeBuild application were 218 of the 526 participants in the survey. 160 of those 218 reported "Yes," while 58 reported "Yes, but no longer" on the question "Have you used WeBuild?" Those 160 answering "yes" received the question "Do you actively use WeBuild during your workday?" 82 reported "yes" (active group) and 78 "no" (inactive group); however, we had to make some small adjustment in the survey resulting in that the inactive group in some of the analysis has 57 users.

67.1% of active WeBuild users have received training, and 75.4% active WeBuild users have got the chance to influence the functionality of the WeBuild application. 32.9% of inactive WeBuild uses have received training, and 24.6% of the inactive group have got the chance to influence the functionality of the WeBuild application.

4.2 Influencing Factors and Benefits of Use

Among the participants that have tried to use the WeBuild application, we see that 54.5% partly agree/totally agree that the application is easy to use, 60.3% agree/totally agree that it has a functionality that is well adapted to the discipline's needs, and 60.4% answer partly agree/totally agree that it is a tool supporting their work. Further we were interested to see whether or not there were some differences in these variables among the active versus inactive WeBuild users and among those received training or not.

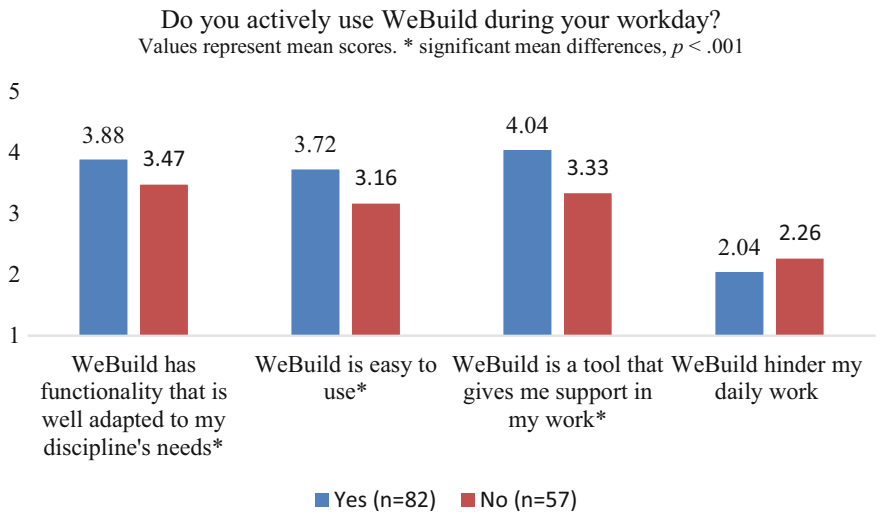


Fig. 1 Difference between the active WeBuild use and inactive WeBuild use and four influencing factors

Among the influencing factors tested, some significant mean differences were found between the active WeBuild users compared to inactive WeBuild users. On allegations regarding functionality fit and usability, the results show higher averages for active users than inactive users (Fig. 1). On the following allegations, we found differences among active users and inactive users that were statistically significant: WeBuild has functionality that is well adapted to my discipline's needs $t(137) = 3.27$, $p < .001$, [95% CI (.16–.65)], Hedges' $g = .56$; WeBuild is easy to use $t(137) = 3.48$, $p < .001$, [95% CI (.23–.89)], Hedges' $g = .57$; and WeBuild is a tool that gives me support in my work $t(137) = 4.63$, $p < .001$, [95% CI (.40–1)], Hedges' $g = .77$. The value of Hedges' g for the three significant differences represents strong effect sizes.

Among the participants who have used WeBuild, it is interesting to test whether training has an effect. Among those 139 answering "Yes" on the question whether they have tried and used WeBuild, 59% of the participants have received training and 48.8% not. Among the 58 participants answering "Yes, but no longer," 46% have received training, and 54% have not received training. We found no significant mean differences on the group receiving training compared to those not receiving training on the four influencing factors same as those presented in Fig. 1. But as stated in RQ1, we are interested to see whether training can act as an influencing factor for daily and active use of WeBuild during their workday.

According to a crosstab, 67.1% of the active users have received training. In line with our results obtained from chi-square analysis, training affects active use. There was a significant association between training or not and whether the persons have a daily active use of the WeBuild application χ^2 (1) = 5.40, $p < .05$. Based on odds ratio (OR), the odds of active use were 2.27 times higher if received training than

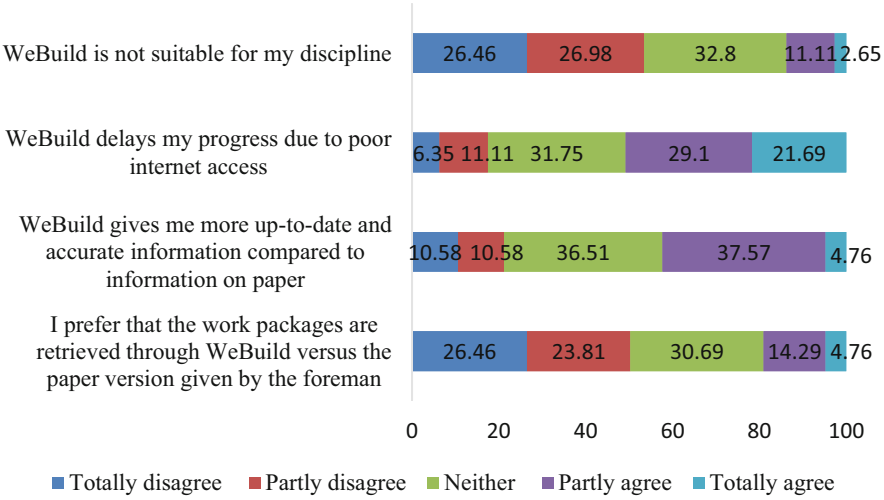


Fig. 2 Frequencies of some experience with WeBuild and its relation to the work process of number of deliverables among 189 participants who have tried WeBuild

not. Further, we found that 75.4% of the active users have received the chance of influencing the functionality of the WeBuild application, and results of the chi-square analysis indicate that being involved by getting the chance to influence functionality also affects active use of WeBuild χ^2 (1) = 8.50, $p < .01$. Based on OR, the odds of active use were 3.74 times higher when the department had been involved and got the chance to influence the functionality of the application.

50.80% reported partly/totally agree that WeBuild delays progress because of poor Internet access (wireless connectivity) (Fig. 2). Further, the figure shows that 42.33% partly/totally agree that WeBuild gives more up-to-date and accurate information compared to information on paper; however, only 19.05% partly/totally agree to the fact that they prefer their work packages are handed out through WeBuild instead of the paper version by the foreman.

Logistic regression was used to test the final hypothesis stating that training and suited functionality, together with stable Internet access (wireless connectivity), would predict active and daily use (Table 1). The independent variables explain

Table 1 Logistic regression of the predictive value of training, functionality, and Internet access on the dependent variable active WeBuild use

Variable	*b*(SE)	Wald	OR [Exp (*b*)]	95% CI for OR
Constant	−5.05(1.31)			
1. Training	.89*(.38)	5.48	2.45	[1.16–5.17]
2. Functionality well adapted to the discipline's need	.94**(.27)	12.19	2.57	[1.51–4.36]
3. Wireless connectivity	.42*(.17)	6.15	1.52	[1.09–2.12]

Note: *$p < .001$, **$p < .05$. Model χ^2 (3) = 23.33, $p < .001$. −2log likelihood 164.84*
Cox & Snell's $R^2 = .16$, Nagelkerke's $R^2 = .21$

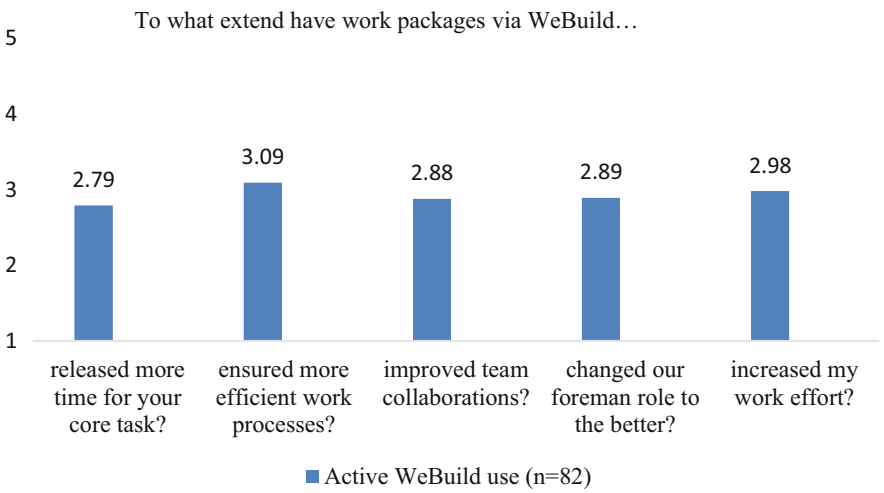


Fig. 3 Mean of five experienced benefits of WeBuild among active WeBuild users: 1, to a very small extent, to 5, to a very large extent

16–21% of the variance of active WeBuild use and the model is significant. All independent variables significantly contributed; however, functionality was the strongest predictor. The OR of 2.57 indicates that if the experience of *functionality is well adapted to the discipline's need* increase, 2.57 greater chance of active use would occur.

Figure 3 illustrates some of the benefits the participants experience when receiving their work packages via the application. For instance, the participants have to some degree experienced that WeBuild has ensured more efficient work processes ($M = 3.09$). The results indicate that those participants using WeBuild actively experience different positive effects, but the mean scores were low.

5 Discussion

From the classical theories of technology acceptance, such as TAM, we know that *perceived usefulness* and *perceived ease of use* are important determinants that influence the intention to use the technology [7]. From UTAUT, the four constructs that could explain user intention and behavior are performance expectancy, effort expectancy, social influence, and facilitating conditions. We used these determinants as our starting point when we analyzed the data with respect to functionality and usability.

5.1 Training and User Involvement

Training is not only important for the end users of the technology to understand the user interface and functionality of the technology; it can also have a positive impact on engagement and perceived usefulness [19]. Moreover, implementing training along with new software and IT technologies can help alleviate frustrations during the transition process, making adoption easier and less painful [26]. An interesting finding in our study is that users who have received training and those who have not seem to consider the functionality of the application as equally intuitive. Nevertheless, those who have received training use WeBuild more frequently during work than the other group. This may indicate that training has served as an internal promotion mechanism during implementation and perhaps contributed to more commitment and a better understanding of the overall objectives. This finding may also indicate that the user interface in WeBuild is relatively easy to understand and that there are other factors that are more important in terms of explaining active use. Regardless, the management of Akso believes that training is absolutely essential for successful implementation and has realized that the training process has not been sufficient so far. Accordingly, they are currently working on developing a better training program consisting of an online course with video lectures that will be available for all employees and good follow-up routines. During the training phase, the management will also have the opportunity to explain how WeBuild is part of the process of digitally transforming the business operations, by producing relatively large changes in terms of work processes and also contributing to increased organizational flexibility that makes it easier to enter new market segments. Such dissemination of information is particularly important in large and complex organizations with context-dependent work routines in the subdivisions and where the employees have been working in almost the same way for decades.

Companies are often in a challenging trade-off situation when trying to develop and adopt new technology. On the one hand, they have to emphasize the functionality needs and technical requirements in order to satisfy the demands of the end users. On the other hand, they must make sure they have financial means and capacity to develop and implement a good training program to succeed with adoption. This situation can be very difficult for companies to handle as they usually have limited resources. As a consequence, functionality and technological requirements often end up being prioritized, while training is somewhat neglected or "set aside for later."

In conversations with project managers in Akso, it became clear that functionality and technical requirements were prioritized as "must-win battles" regarding the WeBuild project. In many ways, this approach is understandable as the application must work as intended and respond to the needs of the end users. However, by prioritizing development and functionality, less resources were unfortunately allocated to training and follow-up procedures. Akso managed nevertheless to create some engagement among some of the employees, and the figures show that a relatively large proportion of employees use the application in the departments

where it has been introduced. Particularly, super-users that were involved during the development phase have been positive toward the application. The super-users have also been central in the dissemination of WeBuild as well as in training their fellow colleagues [23].

Hence, the results indicate that better and more thorough training is needed to reach out to the early and late majority and turn them into active users. That being said, adoption of a new technology in this order of magnitude usually takes time—it requires significant changes in work practices and routines and even a shift of mentality. It reminds us that digital transformation should be thought of as a marathon, not a sprint. When planning for change, we therefore encourage practitioners to design a process and timeline with sufficient resources. This could include allocating enough time for training, preparing a timeline for change of work practices, and engaging ambassadors/change-agents ("super-users"). Further, the process needs to be continually evaluated so that it is possible to make adjustments during the period of establishing new work practices and routines.

5.2 Functionality Fit and Usability

As described in the results section, 75.4% of the active users had the opportunity to influence the functionality of the WeBuild application, and the OR told us that active use was 3.74 times higher when the department had been involved and got the chance to influence the functionality of the application. From the logistic regression analysis in Table 1, we found that functionality adapted to the needs of the respondents' respective disciplines was the strongest predictor of active use. All these findings show that functionality is a very important factor in explaining the active use of WeBuild.

The results from the survey indicate that the respondents find WeBuild relatively easy to use and that the functionality of the application is largely adapted to the different disciplines at the yard. Nevertheless, we have uncovered some interesting contradictions in the data material. For instance, a relatively large proportion of the respondents believe that WeBuild gives them more updated and correct information compared to information received on traditional paper sheets. At the same time, and slightly contradicting with the previous finding, more than half of the respondents still want to receive their work packages manually from foremen in paper format. This finding can be interpreted in several ways. It may indicate that some parts of the application's functionality are considered better than others or that receiving work packages digitally is perceived as little useful and practical by the users. From Fig. 3, we see that the active users of WeBuild experience different positive effects with regard to receiving work packages from the application. However, the mean scores are quite low which are telling us that the perceived benefits are somewhat limited when it comes to this functionality. Further, several respondents said in the section with open-ended questions that the working drawings in particular are better suited for paper format, because of limitations regarding size and readability of the digital

representations (images) on their personal smartphones. This finding is further supported by information retrieved from interviews with project participants conducted in advance of the survey [21]. Larger screens (e.g., tablets) could have been a potential solution to this problem, but it seems rather unrealistic that Akso would invest in personal tablets for the time being, especially as they quite recently bought personal smartphones to their entire workforce.

Regarding the challenges described above, we believe it is important to emphasize the following point: it naturally takes time to change people's habits and work practices. The operators at Akso have been handed their work packages from the foremen for decades; thus, this procedure is incorporated into their daily routine. In a transition phase from an analog to a digital procedure, it may be appropriate to allow for a coexistence between new and old tools/routines. This could make the operation less vulnerable to glitches in the digital solution (WeBuild) and prevent potential interruptions in production [22].

While some of the changes in work practices that the WeBuild application entail are quite easy to achieve, others are much more challenging. The example with "the digitalization of work packages" shows that transforming work practices by utilizing digital technologies often requires significant efforts and some patience from project managers and the organization as such. Measures of effectiveness and the constant need to deliver business profit can act as a barrier to both the development and the implementation of digital tools [22]. In some digital projects, it is difficult to show the instant effect or the return of investment because new work practices need to be in place before it can be documented to increase productivity and efficiency. Sometimes, patience for long-term effects rather than shutting down initiatives with lack of short-term effects is a better organizational practice.

5.3 *IT Infrastructure: A Neglected Necessity in Digital Transformation?*

Digital technologies and a mobile application such as WeBuild depend on proper IT infrastructure to work optimally and as intended. Slow wireless download/upload speeds, instability, software freezes, and delayed systems reactions are common sources of annoyance and key barriers for implementation of ICT [17]. We do not discuss how all of the components of IT infrastructure are affecting the implementation of WeBuild. However, we emphasize the basic infrastructural need of wireless connectivity and explain why this particular need may cause challenges at Akso's yards.

Within the construct of *facilitating conditions* in the UTAUT framework, you find the sub-level of technical infrastructure (which IT infrastructure is part of) and that this is a direct determinant of user behavior. Our findings suggest that poor Internet access in certain parts of the yard makes it challenging to use WeBuild and other digital solutions relying on Internet access. In Fig. 2, we see that more than

50% of the users of WeBuild report that their progress is delayed due to poor Internet access, and in the section with open-ended questions, a large proportion of the respondents claimed that poor Internet access was a "major issue at several locations at the yard and caused the application to work very slowly." In addition, several of the respondents have stated that the mobile data that Akso pays for is nowhere near sufficient if the intention is that this data should be used to execute tasks via WeBuild and other digital solutions. Thus, many of the employees believe that the wireless connectivity must be improved at the yard and that end users must be provided with more mobile data.

The management of Akso is aware of this challenge and takes it seriously. They hope to solve some of the challenges associated with poor Internet access by installing more and better routers and other equipment in some of the exposed areas. However, one may have to reckon that parts of the yard will have slightly poorer Internet access than others and thus influence the use of WeBuild and other digital technologies. For instance, ensuring good Internet access in the department of prefabrication can be easier than doing it in some places at the department of construction, for example, inside the massive concrete structures that form the foundation of oil platforms. It is important to remember that a yard of this size is quite different from a traditional factory in manufacturing and that it may be more problematic to put in place the necessary IT infrastructure in this particular industrial environment.

It is beyond dispute that poor Internet access and issues related to IT infrastructure can have a negative impact on the intention to use WeBuild and other digital technologies. Hence, when implementing the mobile application in more departments, Akso should emphasize the challenges related to wireless connectivity and do their best to solve them. Therefore, we highlight the importance of involving those managing the underlying IT infrastructure early in the design and development process. This is important to ensure that the underlying network is able to support quality of experience (QoE) requirements [27]. Resources for expanding network capabilities need to be budgeted. And, if discovered that wireless connectivity is not feasible in certain locations or environments, the system needs to adopt different coping strategies and techniques to be able to still adhere to user expectations.

6 Conclusion

Our research shows that training and user involvement, functionality and usability, and technical infrastructure (IT infrastructure) are important determinants which influence the active use of the WeBuild application. The findings are indicating that the user interface in WeBuild is relatively easy to understand, which may indicate that training has served as an internal promotion mechanism during implementation and perhaps contributed to more commitment. Thus, the importance of adequate training and follow-up procedures cannot be overstated. Furthermore, our findings suggest that poor Internet access in certain parts of the yard makes it

challenging to use WeBuild and other digital solutions. Poor Internet connection will naturally cause the application to run slower, which in turn becomes an annoyance to the end user and have negative consequences for the intention to use. Moreover, the mobile data that Akso pays for is nowhere near sufficient according to many respondents. This is a challenge that is important to investigate further as the application runs on 4G. With regard to functionality, our findings show that functionality adapted to the needs of the respondents' respective disciplines was the strongest predictor of active use. The vast majority of the respondents find the functionality sufficient and that WeBuild is useful for many purposes. However, for some of the procedures/tasks that have been digitalized through WeBuild, a large proportion of the employees prefer the old way of doing things. For instance, more than half of the respondents still want to receive their work packages manually from foremen in paper format. This tells us that digitalization is not necessarily suitable for all work processes and that companies should think about this in advance. Regarding receiving work packages digitally via WeBuild, we believe that this will gradually become part of the employees' routine. However, companies should recognize that digital transformation requires a great deal of effort and time, as it implies to change employee's habits and work practices. TAM and UTAUT can be used as practical tools and give guidance to the organization about where the challenges are. For instance, it is possible to conduct surveys which are built upon this literature and ascertain the perceived usefulness, perceived ease of use, or other factors (constructs). The findings can be used to evaluate the organizations' overall attitude toward the technology and as a basis to carry out targeted measures to make improvements. However, these theories do not tell us how to ensure use of digital technology, establish new work practices, and make other changes that transform the organization. Future research should therefore give more attention toward the implementation of digital tools and how organizations should work to succeed with implementation processes. There is also a need for a more thorough understanding of how digital transformation is aligned with the establishment of new work practices.

References

1. Majchrzak, A., Markus, M. L., & Wareham, J. (2016). Designing for digital transformation: Lessons for information systems research from the study of ICT and societal challenges. *MIS Quarterly, 40*(2), 267–277.
2. Gobble, M. M. (2018). Digitalization, digitization, and innovation. *Research-Technology Management, 61*(4), 56–59.
3. Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy, 48*(8), 103773.
4. Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems, 28*(2), 118–144.
5. Romero, D., et al. (2016). *Towards an operator 4.0 typology: A human-centric perspective on the fourth industrial revolution technologies*. Proceedings of the international conference on computers and industrial engineering (CIE46), Tianjin, China.

6. Hermann, M., Pentek, T., & Otto, B. (2016). Design principles for industrie 4.0 scenarios. In *2016 49th Hawaii international conference on system sciences (HICSS)*. IEEE.
7. Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982–1003.
8. Mathieson, K., Peacock, E., & Chin, W. W. (2001). Extending the technology acceptance model: The influence of perceived user resources. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems, 32*(3), 86–112.
9. Venkatesh, V., et al. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425–478.
10. Alexopoulos, K., et al. (2018). An industrial Internet of things based platform for context-aware information services in manufacturing. *International Journal of Computer Integrated Manufacturing, 31*(11), 1111–1123.
11. Landmark, A. D., et al. (2019). *S*ituation awareness for effective production control. In *IFIP International Conference on Advances in Production Management Systems*. Springer.
12. Liu, T., et al. (2017). The perceived benefits of apps by construction professionals in New Zealand. *Buildings, 7*(4), 111.
13. Thun, S., et al. (2019). Industry 4.0: Whose revolution? The digitalization of manufacturing work processes. *Nordic Journal of Working Life Studies*.
14. Al Aufa, B., et al. (2020). An application of the Unified Theory of Acceptance and Use of Technology (UTAUT) model for understanding patient perceptions on using hospital mobile application. *Enfermería Clínica, 30*, 110–113.
15. Saghafian, M., Laumann, K., & Skogstad, M. R. (2021). Stagewise overview of issues influencing organizational technology adoption and use. *Frontiers in Psychology, 12*, 654.
16. Kierkegaard, P. (2015). Interoperability after deployment: Persistent challenges and regional strategies in Denmark. *International Journal for Quality in Health Care, 27*(2), 147–153.
17. Alghazi, S. S., et al. (2021). For sustainable application of mobile learning: An extended UTAUT model to examine the effect of technical factors on the usage of mobile devices as a learning tool. *Sustainability, 13*(4), 1856.
18. Molino, M., Cortese, C. G., & Ghislieri, C. (2020). The promotion of technology acceptance and work engagement in industry 4.0: From personal resources to information and training. *International Journal of Environmental Research and Public Health, 17*(7), 2438.
19. Marler, J. H., Liang, X., & Dulebohn, J. H. (2006). Training and effective employee information technology use. *Journal of Management, 32*(5), 721–743.
20. Escobar-Rodríguez, T., & Bartual-Sopena, L. (2015). Impact of cultural factors on attitude toward using ERP systems in public hospitals. *Revista de Contabilidad, 18*(2), 127–137.
21. Gartner Inc. *Gartner Glossary*. Undated. https://www.gartner.com/en/information-technology/glossary/it-infrastructure.
22. Thun, S., Bakås, O., & Storholmen, T. C. B. (2021). Development and implementation processes of digitalization in engineer-to-order manufacturing: Enablers and barriers. *AI & SOCIETY*, 1–19.
23. Klemets, J., & Storholmen, T. C. B. (2020). Towards super user-centred continuous delivery: A case study. In *International Conference on Human-Centred Software Engineering*. Springer.
24. Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal, 50*(1), 25–32.
25. Yin, R. K. (2003). *Case Study Research Design and Methods* (Applied Social Research Methods Series) (3rd ed., p. 181). SAGE.
26. Maali, O., et al. (2020). Change management practices for adopting new technologies in the design and construction industry. *Journal of Information Technology in Construction, 25*, 325–341.
27. Seufert, A., Schröder, S., & Seufert, M. (2021). Delivering user experience over networks: Towards a quality of experience centered design cycle for improved design of networked applications. *SN Computer Science, 2*(6), 1–18.