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Evaluating Success in the Digitalized Thesis Management Process

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Abstract—**Digitalization is relevant to all industries, and there are good reasons for it in education. While it is relatively easy to acquire a new information system, beneficial implementation and sustainable process improvements are more difficult to achieve. Here, we investigate how a digitalized thesis management process and a supporting information system have been adapted in a university and evaluate the success of the adaptation. The evaluation is based on data from a survey of thesis supervisors. The results show a high level of adaptation, indicating a good level of perceived usefulness, as well as a good level of perceived visual clarity and usability, indicating ease of use for the new information system. Also, the adaptation can be seen as successful, and the results provide confidence in the sustainability of the digitalized thesis management process. Based on this, we see usefulness and ease of use for this feasible approach to evaluating success in digitalization.**

Keywords—digitalization, thesis management process, information system, adaptation, evaluation, survey

I. INTRODUCTION

Digitalization is a pervasive phenomenon in all industries [1], [2], and there are two good reasons why universities also need to digitize their operations. First, digitalization is an effective way to enhance processes and improve work efficiency, and this applies to the education sector as well [3]. The main objectives of digitalization are to generate useful and easy-to-use tools for users, improve processes, and produce data for decision makers [4], and all three of these are also needed in the education sector [3], [5].

Second, since digitalization is applied in all industries [1], and employees in all different kinds of jobs must understand the objectives, principles, and practices of digitalization, it is essential that these skills and background competencies are embraced during one's education. It is not enough just for workers to know how a specific information system is used, but more and more, organizational knowledge is needed to understand the bigger picture of digitalization, the objectives, and the possibilities.

Although there are good reasons for education digitalization, there is still much room for improvements in practice [5]. The digitalization of education involves two challenges: history and expert work. Some practices and processes have centuries of history in the education sector, especially in universities. Also, lecturing and supervising are often considered expert work [6]–[8] that is difficult to even treat as processes [8], let alone to digitalize it. However, expert work can indeed be treated as processes [8], and it is possible to digitalize related processes [7], which can dramatically change expert work [9]. Therefore, to be effective and successful in digitalization, educational institutions must be active participants, not passive buyers.

Digitalization often appears as a new information system purchased for a specific need. However, while it is relatively easy to acquire a new information system, achieving beneficial implementation and sustainable process improvements is more difficult. Thus, after each digitalization process, it is important to follow how the process works and how the developed information supports the process.

The evaluation of digitalization success is generally considered challenging [10]. Typically, the emphasis is on evaluating the information system development project's success, and traditional iron triangle metrics—time, money, and features—are applied [11], [12]. However, these metrics are insufficient to capture project value, such as business benefits [13], [14]. In digitalization, the business benefits come from improved processes, better tools, and data [4], and we identify them as good criteria for measuring the success of digitalization.

In process changes, it is typical that even after successful implementation, one gradually returns to old practices [15]. If this happens, the process change cannot be considered successful. Based on Kotter [15], the last step in change management is to institutionalize the new approach, that is, make the change permanent and sustainable. Therefore, to evaluate the success of the change and its sustainability, the situation must be evaluated later after implementation.

At Haaga-Helia University of Applied Sciences (UAS), the thesis management process was digitalized, and a new information system was taken into production at the beginning of 2019. In digitalization, an expert-oriented digitalization (EXOD) model was applied [16]. Based on the research done immediately after the implementation [6], it can be stated that all three main goals of digitization (providing usable and

helpful tools, providing necessary data for decision makers with the tools, and incorporating process improvements) were met at some level, but there was room for improvement as well.

The purpose of this study is to investigate how the digitalized process and the information system (called Konto at the time and Wihi currently) supporting it have been adapted in use by the thesis supervisors at Haaga-Helia UAS. The evaluation of the success of digitalization is based on the supervisors' experiences of how well the new information system supports the digitalized thesis management process. Since the new information system implements the new digitalized process, our assumption is that if the information is perceived as useful and easy to use, the process improvement is sustained and digitalization can be considered successful. Based on this, the research question for this study is as follows:

How have Haaga-Helia UAS's thesis supervisors adapted the new information system for thesis management?

To answer this question, we conducted an online survey in December 2020, one and a half years after the full implementation of the digitalized thesis process. In the survey, we asked the thesis supervisors' about their experiences with the information system, and based on the results, we analyzed the success of the digitalized thesis management process adaptation.

II. RELATED WORK

Digitalization is one of the buzzwords of the day and is quite often confused with digitization. However, the difference is important to understand when an organization formulates a mindset toward development. The main difference between the two processes is that, while in digitization the main goal is to automatize the existing processes (for example, by replacing pen-and-paper tasks with digital forms), in digitalization, the objective is to make process improvements as well [4]. Although in some cases digitization can be beneficial, allowing for quick, short-term benefits [17], more often organizations benefit more from digitalization and the process improvements that it includes [18], [19].

Education, like expert work in general, has been considered to be difficult in terms of improving its application processes [8], and its digitalization and automatization are seen as more challenging than strictly mechanical work [7], [9]. One model developed to support expert-oriented work digitalization, especially in the education sector, is the EXOD model [6]. In EXOD, the business process, software development, technology acceptance, and change management approaches are combined [6]. The goal of the model is to support the specialties of expert work digitalization by taking different perspectives into account [6].

One part of process improvements is the sustainability of the change [20]: it is not enough if implementation is successful; the improved process should be in use (and continuously improved) after the implementation as well [15]. To achieve sustainable process digitalization, the eight steps of Kotter [15] are applied in the EXOD model [6]. The EXOD model has been applied in the thesis management process digitalization in Haaga-Helia UAS, the success of which is evaluated in this research.

However, before the success of digitalization can be measured, the meaning of what equals digitalization success must be agreed upon. Traditionally, the focus has been on developing information systems and measuring their success, and the traditional iron triangle metrics—time, money, and features—are applied as measures [11], [12]. However, these metrics are insufficient to capture project value, such as business benefits [13], [14], [21]. As business value is the main objective for most digitalization cases, other perspectives are needed. To cover the various perspectives of project success, Pinto and Slevin [13] proposed a model with six project success areas. The first three cover project performance: time, cost, and the delivery of agreed-upon outputs. The other three address project value for a client: use (of information system), satisfaction, and effectiveness [13]. Similarly, Shenhar et al.'s [22] model divides project success into four dimensions: efficiency (time, money, and features), impact on customers, business success, and preparing for the future.

Although several models exist, there is no clear consensus on how to measure the success of digitalization and information system development projects [10]. Business value is rather often stressed, but frequently, the suggestions are too general to be applied to practical measures, and project measures and results measures are easily mixed together [21]. To overcome this, we decided to analyze the success specifically through the objectives of digitization and leave out traditional project metrics, such as time, money, and functionalities [10].

Generally, digitalization has three main objectives [4]:

1. Digitalization must provide usable and helpful tools for end users. The developed tools should reduce the time needed to accomplish the tasks and decrease, rather than increase, the mental stress of users.

2. The developed tools and practices should provide data for decision-makers. The data should be comprehensive, reliable, and up-to-date, without causing extra work for users [23].

3. Digitalization is not just automatizing existing processes; there should also be process improvements [18], [19].

We claim the three above-mentioned objectives to be good criteria for measuring the success of digitalization as well: they are in line with the Pinto and Slevin client value success areas [13], but they are more practical to measure. The objectives are interrelated, and they more or less culminate around the information system and its usability. Therefore, we argue that the success of a digitalized process implementation can be measured based on the functionality and appropriateness of the information system supporting the process. In the measurement, existing technology acceptance models can be utilized. If the criteria for technology acceptance are met—that is, the users accept and adapt the information system in their daily work—the information system can be considered appropriate for use, and the digitalized process can also be seen to be feasible.

There are several well-known acceptance models, such as the Technology Acceptance Model (TAM), the Unified Theory of Acceptance, and the Use of Technology (UTAUT). Quite often, the key question related to the models is which criteria affect the end users' perception of the usefulness and ease of use of the new information system [24], [25].

Usefulness and ease of use are also incorporated in the EXOD model as well [6], and they can be used as criteria when planning the implementation of an information system. However, they are also useful when measuring the success of technology acceptance and, in the bigger picture, the overall success of digitalization as well.

III. METHODOLOGY

The target population of the survey comprised all Haaga-Helia UAS thesis supervisors, approximately 350–400 active supervisors at the time of the survey. The survey was conducted between October 30 and December 14, 2020. The period was not ideal for the survey because the December graduation ceremony was approaching, and supervisors were busy assessing the theses of students who aimed to graduate. However, despite the timing, 136 supervisors opened, 121 started responding, and 107 completed the survey, indicating a response ratio of 26–31%.

The data were collected and analyzed using the Webropol electronic survey tool. The form was available in Finnish and English. To guarantee the anonymity of the respondents, there were no background questions. The total number of questions was 20, and three were open-ended. The data from 17 structured research variables were analyzed using basic descriptive statistics.

IV. RESULTS

Of the survey data, seven questions, all of which are structured research variables, namely variables 1–5 and 19–20, are relevant to the research question of this paper. This is because we focus here on the usefulness and ease of use of the information system based on its adaptation by the thesis supervisors at the time of the survey and use the results to evaluate the success of the digitalization of the thesis process.

Of the variables, variable 1 (see Table I) measures the level of adaptation, indicating usefulness. Variables 2–5 (see Table II) measure ease of adaptation, indicating the ease of use related to learning how to use the information system and applying the digitalized process. Finally, variables 19–20 (see Table III) measure overall visual clarity and usability, indicating the ease of use of the information system.

A. Level of Use

As seen in Table I, the level of adaptation was high among the respondents. A clear majority (89.7%) had used the information system and had completed some or several thesis processes (advanced to the archive stage). Of the rest, almost all were adapting it for their first supervision.

Because the level of adaptation and the number of completed thesis processes are high, the information system can be seen as useful. Also, based on this, the information system seems to be well aligned with the digitalized process.

TABLE I. VARIABLE 1: LEVEL OF ADAPTATION

1. Which of the following best describes you as a Konto user? (107 respondents)	n	%
I have never used it.	2	1.9%
I am at the moment using it for the first thesis supervisions.	9	8.4%
I have used Konto for a longer period of time, and some thesis projects have advanced to the archive stage.	19	17.7%
I have used Konto for a longer period of time, and several thesis projects have advanced to the archive stage.	77	72.0%

B. Ease of Adaptation

Ease of adaptation was surveyed using variables referring to the guidelines (external manual), support, and training on using the information system, as seen in Table II. Most of the respondents needed guidelines (72.6%) and support (90.5%) and attended the training (62.1%). Based on the answers, the guidelines were the least helpful in the adaptation, since over a third (35.8%) of the respondents either used the guidelines but were not able to find the needed information or could not find the guidelines. The latter is likely due to the guidelines not being integrated into the information system at the time of the survey.

However, the available support and training were helpful. The majority of the respondents (83.8%) occasionally needed support. It is also worth noting that most of the support was received from supervisor colleagues or thesis coordinators, meaning that the support was mainly peer support from fellow experts. Another notable result is that everyone who asked for support received it, and there was a very small minority (6.7%) who did not know who to ask, emphasizing the effectiveness of peer support over written guidelines (external manual).

TABLE II. VARIABLES 2–5: EASE OF ADAPTATION

2. Which of the statements is closest to your opinion about the Konto guidelines (external manual)? (106 respondents)	n	%
I have not needed the guidelines.	29	27.4%
I have used the guidelines and found the needed information.	39	36.8%
I have used the guidelines but not found the needed information.	24	22.6%
I would have used the guidelines but could not find them.	14	13.2%
3. Which of the statements is closest to your opinion about the Konto support? (105 respondents)	**n**	**%**
I have not needed support.	10	9.5%
I have needed support occasionally, and got it.	88	83.8%
I have needed support, but did not get it even when I have asked for it.	0	0.0%
I would have needed support, but did not get it because I did not know from whom to ask it.	7	6.7%
4. (*) If you answered that you have gotten support, from where/whom have you gotten it (you can choose several alternatives)? (94 respondents, 155 selected answers)	**n**	**%**
Supervisor colleagues.	56	59.6%
Thesis coordinators.	71	75.5%
Education Program Services.	18	19.1%
Manager (the head of a program or unit).	2	2.1%
Elsewhere, please specify.	8	8.5%

5. Which of the following best describes your situation concerning Konto training?	n	%
I have not attended the training, or needed it.	39	37.9%
I have attended the training, and it has been sufficient for me.	52	50.5%
I have attended the training, but I would have wished for more.	12	11.6%

(*) It was possible for a respondent to select multiple choices in variable 4.

The training was also attended by most (67.1%) and considered helpful by the majority of the respondents who attended (50.5%), although there were some who would have wished for more from the training (11.6%). Also, over a third of the respondents felt that they did not need training (37.9%). This can be seen as indicating ease of adaptation, to the extent that although the adaptation was not self-evident, it was also possible to sort out the issues regarding it by relying on the guidelines or occasional peer support.

C. Visual Clarity and Usability

Ease of use was surveyed using variables related to the visual clarity and usability of the information system, as shown in Table III. For both, the respondents used a full range of marks (4–10). The average, median, and standard deviations were similar, namely 7.9, 8, and 1.2 for visual clarity and 8.0, 8, and 1.1 for usability, respectively.

TABLE III. VARIABLES 19–20: EASE OF USE

19. Which mark (4–10) do you want to give Konto for its visual clarity? (90 respondents)				
Min.	Max.	Average	Median	Std. dev.
4	10	7.9	8	1.2
20. Which mark (4–10) do you want to give Konto for its usability? (92 respondents)				
Min.	Max.	Average	Median	Std. dev.
4	10	8.0	8	1.1

Considering the early life cycle phase of the information system at the time of the survey, ease of use can be seen as good. Also, the experience was coherent, since both visual clarity and usability were on the same level.

V. DISCUSSION AND CONCLUSIONS

Overall, the results reflected that the respondents had answered properly, and there is no reason to suspect that the sample was biased due to the nonresponse rate, providing good ecological validity. Content validity was secured by choosing the real content of the information system as the target, and some questions were supported by screenshots from the information system inserted into the survey form. Concept validity was assured by using the exact terminology from the information system in the survey form, and the respondents were already familiar with the concepts.

Regarding the research question of how Haaga-Helia UAS's thesis supervisors adapted the new information system for thesis management, the results confirm the usefulness of the new information system based on a high level of adaptation. The results also indicated ease of use, since ease of adaptation, visual clarity, and usability of the information system were perceived as being on a good level. Regarding ease of adaptation, it is notable that for the occasional support needed, the preferred way was peer support, according to most of the thesis supervisors. Regarding visual clarity and usability, it is notable that the perceived levels can be even, though they are very high, due to the early life cycle stage of the information system.

Usefulness and ease of use are the criteria for technology acceptance, and since they were met, meaning that the thesis supervisors accepted and adapted the information system in their daily work, the information system can be considered appropriate for use. The digitalized thesis process can also be seen as feasible. This provides confidence in the process's sustainability as well, since the survey was conducted one and a half years after the digitalized process was introduced, and the results do not show any indication of returning to the practices before the digitalization.

Based on the completed work, we see usefulness and ease of use as very feasible indicators of the success of both the change in the information system and the change in the process. Since these can be measured based on the experiences of the users of the information system and the changed process, they provide a different viewpoint on measuring success than traditional metrics of project success (such as time and money spent or the number of features implemented). However, they are often used as indicators of success in an information system and process change, even though they are mainly related to the properties and goals of the project instead of the information system and process. For this reason, we recommend using usefulness and ease of use instead.

Also, usefulness and ease of use are well aligned with the main objectives of digitalization, especially with the first one, providing usable and helpful tools. Considering that digitalization is technology-oriented and that its success can be measured using usefulness and ease of use, as described in this paper, we can also recommend a similar approach to digitalization projects in general.

The results of this paper are related mainly to the first of the three main objectives of digitalization: providing usable and helpful tools. However, the remaining variables 6–18 have not yet been analyzed and are related to the other two objectives, providing necessary data for decision-makers with the available tools and incorporating process improvements. Therefore, our future work includes an analysis of the remaining variables to gain a more comprehensive view on the success of the adaptation of the digitalized thesis management process and the supporting information system, as well as on evaluating the success of digitalization in general.

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