The Synergy of Technology Usage and Human-driven Support Activities in an AAL Pilot Region

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Abstract: The project Smart VitAALity – the Carinthian pilot region for AAL and Smart Living Technologies was realized in Austria between 2016 and 2019. The one-year field trial focused on testing and evaluating a set of technologies with accompanying services to improve the health and wellbeing of older adults. During this time, various parameters regarding the usage of the different services and devices were recorded. This paper presents an insight into the results of the usage analysis with a focus on provided support material and the documentation of the established human-driven support activities. The investigation shows that there are synergies between the constantly high system usage during the field test and the provided support opportunities.

1 INTRODUCTION

Today's societies are facing challenges like climate change and lots of trends such as globalization, digitization and the demographic change, which also interfere with each other (Petersen & Steiner 2019). The last one – demographic change – has been seen as an important topic in the European Union (EU) and its member states for more than ten years. As a result, the funding programme AAL Joint Programme[1] (for Active and Assisted Living) was created, which sets the ground for the research and development of assistive technologies for older adults. The programme is available to several member states of the EU, all of which are committed to open up and develop new technologies so far mostly used by younger people to older adults and thus allowing them to live a longer independent life.

1.1 Pilot Regions in Austria

Almost at the same time, Austria created a similar research funding programme on national level called benefit [2] . Within this programme, collaborative projects are realized to develop and test technologies which ease the life of older adults in many ways. After several years of funding research and development projects, the benefit programme management figured out that lots of technologies have already been developed and that ways need to be found on how to open markets for them.

As a consequence, in 2012, calls[3] for so called test region projects[4] were opened. Nine projects around assistive technologies for older adults (seven of them described in Ates et al., 2017) have been started since then and many of them have already finished in the meantime. The major goals of those projects and the technologies to be used and tested within them were chosen by the consortia and therefore varied among the different projects, but they had similar framework conditions, e.g., more than 100 persons or households should be part of the tests and the tests should run at least for one year. Some requirements for dissemination activities were also defined like setting

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up demonstration apartments which can be visited by interested persons for the purpose of gaining information about the project and the specific technologies and services offered by them.

Beside the differences in goals and technologies, the projects also defined different ways how to involve the (potential) end-users of their systems and how they are supported before, during and after the test phase. In one of the mentioned pilot regions, a structured support-system was implemented for participants which offered different action possibilities. The evaluation results of the necessary effort to maintain the delivered technology and services will be presented in this paper.

1.2 The Project Smart VitAALity

The cooperative research project Smart VitAALity[5] is a pilot region in the center of Carinthia, Austria with the aim to implement AAL hardware and services to improve the daily living of seniors at home and empower them in using new state of the art technologies. For the project, 227 people were recruited, 104 people received all the technologies and services (intervention group) and the other group was classified as the control group without any interventions in the one year of pilot testing (Majcen et al., 2019; Ströckl et al., 2019).

As main interaction technologies, the participants in the intervention group received a tablet computer with a self-implemented Smart VitAALity application and a smartwatch with an emergency call system and a step counter. Furthermore, they got vital parameter measurement devices for their blood pressure, blood glucose and body weight; all of them transferred the measured data via Bluetooth LE® or ANT+ to the project server. As accompanying services, they were able to join to a care center with professional medical employees who had a look at relevant parameters, intervened when necessary and added a 24/7 call center to their emergency alarm call chain (Majcen et al. 2019; Ströckl et al. 2019).

The described technical system and services were developed based on the user-centered design process, which means the later end users and other related stakeholders were involved already in the requirement analysis (Krainer et al. 2018). Thus, the user-focused process was also pursued in the testing phase of the project. In this paper, the focus is set on a specific direct service provided to the intervention

group during the testing phase: the technical support process, which will be further explained in chapter 2.

In 2019, the project ended after the testing phase with the finalization of the evaluation process. To this end, different parameters were collected during the project to evaluate the subjective quality of life, acceptance, socio-economical potential analysis, technology acceptance, user experience and usage. The comprehensive evaluation model provides the basis for anchoring the Smart VitAALity system and service model on the market (Plattner et al. 2018).

2 METHODS

This chapter describes two parts of the evaluation model in detail: the usage analysis and the implementation and evaluation of the technical support process.

2.1 Usage Analysis

To evaluate the frequency of use of the Smart VitAALity system, the usage behavior patterns of participants were surveyed during the one-year test phase and subsequently analyzed. During the analysis, a basic distinction was made between different types of data like direct data (usage logging of the Smart VitAALity app), indirect data (e.g. number of steps counted by the watch, from which the watch usage is derived) as well as surveys of usage behavior, which were carried out at the end of the field test. The use of the Smart VitAALity tablet was recorded using the open web analytic platform Matomo[6]. In this way, it was possible to track elementary interaction elements within the project application, e.g., button clicks and opening screens. However, since Matomo can only record usage data of self-implemented applications, third-party apps such as an e-mail program or WhatsApp[7], which were integrated into Smart VitAALity, could not be recorded directly. In addition, other applications, which were used on the tablet but outside of the project application, could not be captured with Matomo. In order to be able to make comparable statements about the use of third-party applications and about the general tablet use, the user behavior was obtained in subjective interviews. To evaluate the usage of the Smart VitAALity application, the total usage (12 months) of each participant was divided

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into three phases, since not all participants received the system at the same time and therefore the usage calculations could not be carried out based on the actual calendar date. The first month represents the initial phase, which includes the training phase for the systems and merely shows whether there was a high interest from the participant's point of view at the beginning. The second phase shows the actual use of Smart VitAALity and lasts 10 months. The phasing out phase represents the last month of use of each participant and within this period, people tended to use the devices less often, or if errors occurred, they did not report it to the support team anymore, as the year of testing was coming to an end.

In addition to the evaluation of the usage behavior in consideration of the different phases, the analysis of the frequency of use was also carried out on extended dimensions such as gender, age, user type and place of residence.

2.2 Support Evaluation

The planning and conduct of necessary support processes and resources turned out to be rather difficult. Technical support was already performed in other pilot regions in different variations. Based on experience reports, the different options were: splitting up the support based on different system components, so every component-owner is the direct contact point for related support questions or using one single contact point and performing the technical support together with other provided services (e.g. during the telemedicine process). However, regarding needed time and financial resources, little to no documentation existed. Nevertheless, it must be kept in mind that within a pilot region usually a system prototype with a technology readiness level (TRL)[8] below 8 is tested. The technology of Smart VitAALity was categorized as level 7 at the beginning. This means a system prototype was tested in the future operational environment, and therefore technical problems and issues have to be kept in mind during planning processes. Experiences from other pilot regions showed that the necessary technical support process was often underestimated and not well-considered during the planning of the field trial.

As a consequence, it was decided to create a comprehensive documentation of all support activities during the pilot test of the Smart VitAALity system. To capture required first-level support operations, an adjusted software documentation tool was implemented based on web technologies. The focus was set on the documentation of telephone calls, driving times and stay times during service trips and a categorization and processing of arising problems and incidents in an issue-tracking-system. Each ticket provides the framework to process a problem according a standardized workflow and documents the interaction with participants (Plattner, 2020).

2.3 3-step Support Model

Due to the fact that there was a limited possibility to draw on documentation or evaluation of already performed support processes in pilot projects, a new process was developed. For the Smart VitAALity project, it was important to design a functional support model, to assist the 104 participants in the intervention group in the best way possible. Therefore, the project team decided to support participants in a three-step model which is presented in Figure 1. Each step provides a different interaction possibility. As a first step, a printed manual was developed. It comprises detailed explanations of every component and function including pictures as well as textual descriptions and step-by-step instructions to make the available interaction with each function as clear as possible. It was handed out
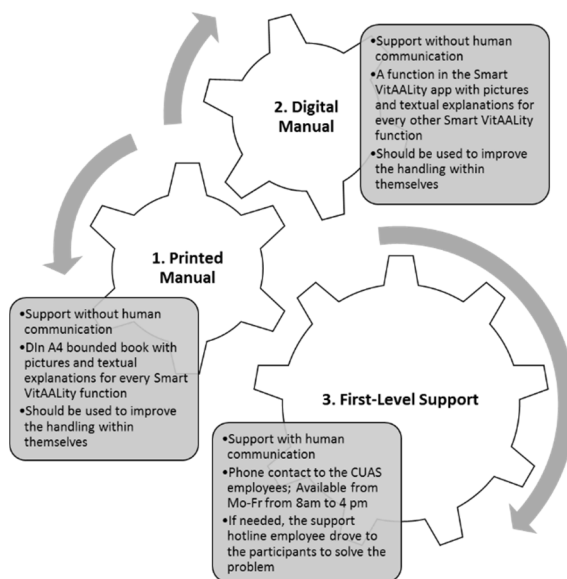

Figure 1: 3-step support model developed for the pilot region Smart VitAALity.

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to all participants during the system roll-out. Next, the printed handbook was digitized and inserted as a separate function into the Smart VitAALity application on the tablet. Thus, participants were able to choose how to read the instructions, like an e-book on the tablet computer or like a normal book in a printed booklet. Both information/support options are meant to assist participants to get familiar with the system – there is no communication or any other interaction with humans provided. This provides low-barrier access to information about the system, especially for persons with almost no or low technical experience. As a third support option for Smart VitAALity participants, a communication-based support alternative was provided. During the field test phase, participants could call the technical first-level support hotline from Monday to Friday between 8 am and 4 pm and ask for help. If it was not possible to solve problems and issues through the telephone call, support employees drove to participants' homes and provided on-site service. The three different options were meant to interlock as a support combination / alternatives for participants, as shown in Figure 1.

Before starting the field trial, the development team created different theories about the usage from the different support options. The theories were:

1. Participants of the selected target-group (60-85) are used to printed books and will preferably use the instructions in the printed manual.
2. For more technically experienced people, the e-book version will be the preferred option to use because it is always available (no extra book to carry).
3. Participants will tend to hesitate to call the technical support hotline because of personal reasons such as sense of shame or polite reluctance.

At the end of the field test, these questions were meant to give an idea which support options are preferred and should be integrated in a pilot region and which are maybe obsolete for future projects.

3   RESULTS

In this section, an overview of the results from the evaluation of the support model is presented. The results are clustered according to the three steps of the support model.

3.1   Usage of Printed Manuals

As shown in Figure 2, 58% of participants answered at the deinstallation survey (n=98) that they had used the printed manual and 10% had used the printed manual in combination with the e-book version. As a result, 68% of participants used the written support instructions (Step 1 and 2 of the support model).

In addition, participants answered an open question on the frequency in which they had used the two manual options. The informal answers were clustered as

- unique - answers like "used it once" during the whole test time,
- seldom - answers like "I used it very seldom" or "I used it just to look up telephone numbers",
- sometimes - answers like "I didn't use it very often but sometimes" or "I used it from time to time",
- regular - answers like "I used it regularly" or "I used it once a week" and
- initially - which means that users added to their answer that they just used it at the beginning of the test time no matter how often.

Furthermore, 30% mentioned that they had never used the manual. Only 10% of participants had used the printed manual on a regular basis, 15% of participants had used the manual just at the beginning of the project to get used to the Smart VitAALity system. The usage of the printed manual is visualized in Figure 3.
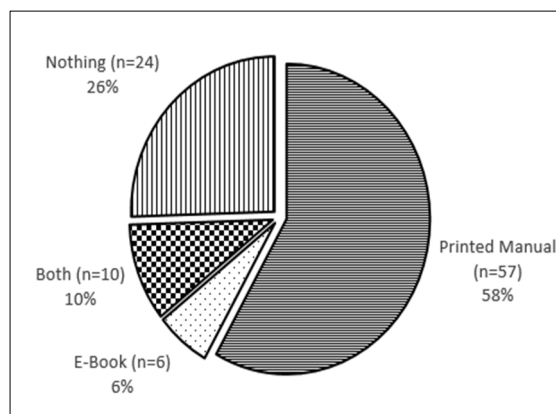

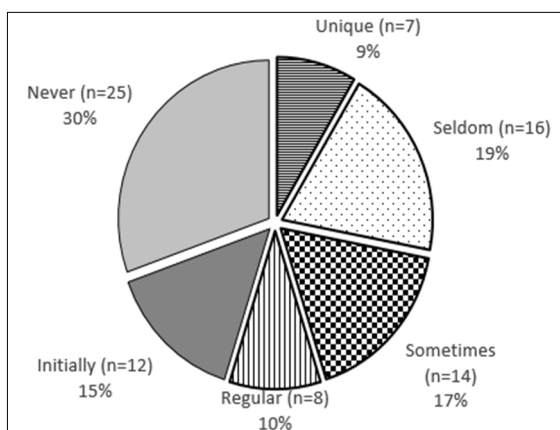Figure 2: Distribution of the usage of the written manual in printed and e-book version.

Figure 3: Clustering of statements regarding usage frequency of the printed manual.

3.2 Usage of e-Book Manual

As shown in Figure 2, only around 6% of participants used the e-book exclusively, and another 10% used the e-book together with the printed manual. At the beginning of the testing phase, an initial questionnaire was done with all participants. In this, around 71 participants reported that they are used to technologies like smartphones. Therefore, the hypothesis was that they may use the e-book manual more likely, but this was not the case. For follow-up projects, it should be reconsidered if e-book versions of manuals are necessary. The required resources to create the electronic manual and its benefits should definitely be weighed.

Having a closer look at the statements of participants using the e-book manual it becomes clearer that the development of such an option was not relevant for the Smart VitAALity pilot region. All six people answered that they had used the e-book manual occasionally or just once at the beginning.
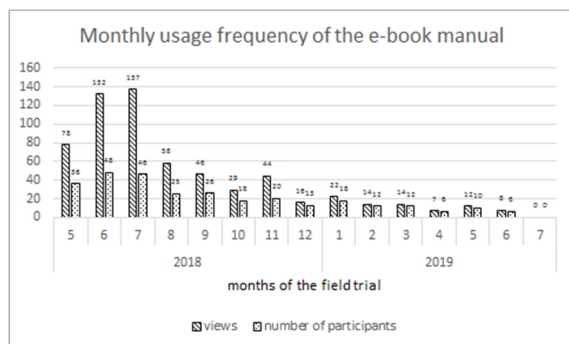

Figure 4: Monthly usage frequency of the e-book manual - views and number of participants.

Figure 4 shows the use of the e-book manual on the Smart VitAALity tablet. The total number of button clicks and the number of people who used the function at all is presented on a monthly basis. On average, the e-book manual was used 41 times by 20 different people per month. Especially in the first months of the field trial, the function was used more frequently. Towards the end of the one-year testing phase, the number of participants as well as the number of button clicks decreased steadily.

3.3 Usage of First-level Support

Figure 5 shows the number of calls which were recorded in each month of the field trial. Having a participant number of 104, this shows a very high motivation to contact the first-level support. 92 participants (89%) contacted the support hotline at least once and almost every second person out of this set had more than 4 calls with the first-level support. This shows that the assumption regarding perceived barriers to ask for personal support did not apply to the participants of Smart VitAALity. It was possible to solve most incidents via telephone but some issues had to be tackled directly and resulted in approximately 280 service trips. The number of monthly service trips is also shown in Figure 5. There is a slight decrease of necessary service trips after eight months of the test duration. In the last two months, no calls and trips were documented. This may be based on the fact that the rollback of the system already started in June 2019 and lasted until mid of July 2019.
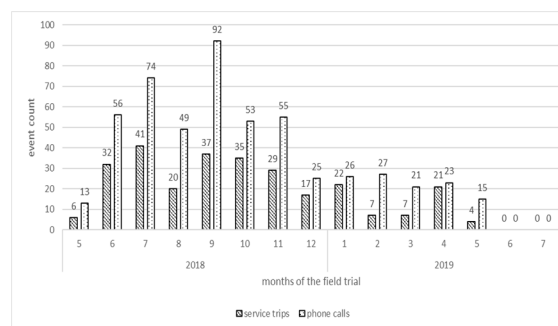

Figure 5: Monthly service trips and calls at the first-level support hotline (Plattner, 2020).

3.4 Support Demand and System Usage

Another interesting perspective is the comparison of usage frequency and support demand. To generate comparability of support activities, the demand was categorized in three groups based on the telephone calls – low (1), moderate (2) and high (3) usage of the

technical support hotline. The created groups were compared to the usage groups of the whole system – which represent low (1), moderate (2) and high (3) usage of the Smart VitAALity system. This comparison is visualized in Figure 6 for the whole test duration of 12 months. It shows that the support demand and system usage tend to overlap, especially in the category of low and medium users. Persons with a high system usage (group 3) also tended to contact the hotline more often. This may result from the fact that persons with a high system usage frequency were more likely to come across errors and system bugs and tried to really contribute to enhance the system and therefore took the opportunity to use direct personal support. Whereas persons with a low system usage may not have been that interested in the system at all and also tended not to contact the support hotline in case of issues. Users categorized in the moderate usage group also tended to contact the support hotline on a regular basis.
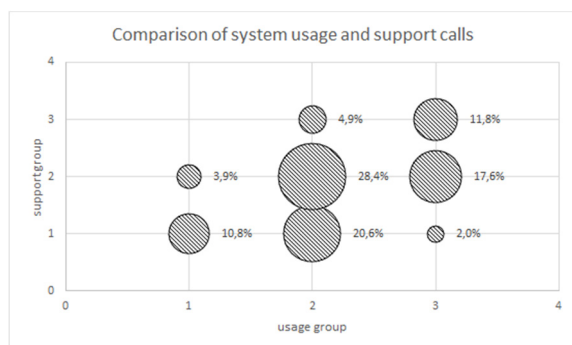

Figure 6: Comparison of usage frequency and support demand using group allocation.

4 CONCLUSIONS

The presented results show that the usage of the system and accompanying support activities are strongly interlinked. It was demonstrated that the opportunity for personal contact was strongly used throughout the whole test duration. Concerns that participants will hesitate to use the opportunity for personal support were not confirmed. It is hard to determine up to which point personal support has a direct influence on the system usage but at least it helped to avoid bigger issues and incidents such as transmission errors and hardware problems affecting the system usage in a negative way. The approach to provide only one direct contact point for participants regarding technical issues did also have a positive effect on the support process. Requests could be handled very easily and a clear and structured workflow accelerated the process of integrating fixes and improvements to the technical system.

This process was supported by the availability of well-structured printed manuals, which were important especially at the beginning of the test phase. The creation of comprehensive manuals should also be part of follow-up projects because it facilitates the first contact with the system, especially for people with a low technical pre-education. Nevertheless, it is not possible to cover all requirements only with written materials, a personal contact opportunity should always be provided.

The needed time and staff resources to create the described 3-step support model were very high but the overall feedback on the provided support process was very positive and the constantly high system usage over the whole test duration demonstrated that it created a benefit for the whole project. This process also has to be taken into account when developing the business model for an AAL solution.

Summing up it may be said that the technical support process is an important factor for the launch of AAL projects and solutions, and that the necessary resources have to be allocated already in the project proposal.

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