Smart Real Estate Management

DEVELOPING A SMART TOOL FOR CAMPUS USER ALIGNMENT

14. REFLECTION

In this chapter there will be reflected upon the research by, firstly describing the process and the used research methods. Thereafter, the research will be placed it into the broader context by exploring the societal and scientific relevance and position within the master and practice.

14.1 Research process

14.1.1 Exploration

As stated in the Foreword, the research started with the realisation that the existing ways to gain useful information about the building are inconvenient or absent. This especially concerned finding an available and preferred studyspace fitting the needs at that particular moment in time. This led to the exploration of the problem area by using several ways to gain information, consisting of: discussions with friends and students and reviewing literature.

Even though I was eager to find my own solution for this problem I first started by looking at existing tools to learn valuable lessons. It became clear that many before me had already tried to solve similar problems using smart tools. In this phase the 'Smart Campus Tools' book released in 2016 was very useful as it had most of the information I required. Then, on the basis of my experience with other applications I started to get an idea of how I wanted the smart tool to function. This resulted in the decision tree as shown in the report and when comparing this to the final result it is clear that there was no mayor deviation from this original structure.

In order to get a greater understanding of how to make this smart tool I engaged in discussions with friends and students who had experience in developing software. Since one of them worked at a supposedly 'Smart Building' he invited me there to see what current smart tools already exist. This visit led me to believe that the current smart tools weren't used to its full potential. After proposing my ideas for the smart tool they were able to help me to cultivate it and figure out how to execute it. For this they proved especially valuable in gauging what was feasible with the limited experience and time. From that point on I started to learn what was possible within IT and how to actualize it.

14.1.2 Moving to P2

The most important objective for the P2 was to have a proper research structure and basis of a literature study, resulting in a research proposal. Leading up to the P2 I set the goal to finish my literature study, allowing me to increase my focus on the development of the smart tool. Considering my inexperience with developing software, it was expected that the development of the smart tool would take a lot of time. Therefore I had set the goal to finish processing most of the literature for the P2. For this, the available literature on current campus management practice provided a good basis for this aspect of the research, consisting of: 'CampusNL' and 'Managing the University Campus'. Even though I was unable to finish the literature research completely, it was rather far along and it motivated me to work extensively on my report.

A reason the literature research was obstructed was because of the unknowns in developing the smart tool. To get a better idea of how the smart tool was going to be built it was key to start with the design of a prototype for the P2. This meant working parallel on the report and model after the P2.

14.1.3 Moving to P3

Since the report was far along and my research structure had been fully set up it presented the opportunity to find an appropriate company for an internship. LoneRooftop was very interesting as it already had a solution similar to my own and had the required WiFi occupancy

detection. Luckily I was able to get into contact with and got accepted by LoneRooftop to do an internship.

During the first stage of the internship I was working solitary for quite some time as I was trying to finish my literature research. When this was finally finished I developed the prototype to carry out the data collection. In this phase it became clear that the internship was very helpful as they provided me with useful information on several subjects. One tip that was particularly helpful was evaluating software with end-users by using a wireframe mock-up (Balsamiq). These tools allowed me evaluate the smart tool to iteratively improve upon the smart tool design.

14.1.4 Moving to P4

From this point on I worked to finish my report by finalizing the literature study, data collection and conclude the research. Unfortunately, this took more time than I had anticipated. For the conclusion it was important to gather all the findings and analyze it. However, because there was not enough time between the final data gathering and handing in the report, the conclusion was not completely finished. However, there was still time available leading up to the P5 to finalize the report.

14.1.5 Moving to P5

From the P4 to the P5 the pressure was off, which was very welcome since I had worked quite hard up till this point. However, the backlash of this was that I needed to reignite my motivation to finish the report in the desired quality. After a short period of taking it a bit slower I was able to find my motivation again for the finalization of the thesis. The feedback on my P4 report mostly included making the report more coherent to improve readability and understandability. Hence, this was the main objective I focused on.

14.1.6 Supervision

From the outset the supervision was very helpful to increase my understanding of what I had read and heard. I experienced a pleasant mix of the 'management' perspective of how to use the generated data in real estate management and a more 'technical' perspective of how to construct and test a smart tool. For this, Alexandra and Rein provided guidance respectively. The mentor sessions assisted in the reflection on the progress and results of the research which helped to focus on the essence.

During each mentor session I took notes, which I transferred into small reports. This was a great way to document the most valuable information, collect thoughts, and inform the mentors that everything that was discussed was understood correctly. This is something that definitely has value for increasing effectiveness of important meetings later on in my career.

14.1.7 Motivation

The process of writing this thesis required considerable effort, self-discipline and time. However, because I thoroughly believed in this subject I had a natural curiosity towards the outcome of the research, which was able to motivate me throughout the thesis. Overall I was very motivated to end this final objective of my studies with something I could be proud of and would give me confidence in starting my career.

As several students had also embarked on their own theses around the same time, getting into contact with them was very helpful and motivational. Their perspectives helped to figure out where the knowledge gap was in this particular subject. While also confirming the missed opportunity that was present, which motivated me even more to develop a smart tool of my own. Additionally, this also led to the realisation that whenever I got stuck it was beneficial to engage with a fellow student or friend to take a step back to regain motivation.

Sometime before the P2 I kept To-Do lists with prioritized tasks for keeping me informed about what needed to be done and in what order. Throughout the process of writing my thesis a frequent to-do was to update my report constantly. This was done to get into the habit of finishing things and decreasing the effort in looking up previous findings. In the later stage of the research I also made a planning for each week in order to finalize the report. However, it also became painfully clear that the actual time to complete tasks is often higher than expected. Especially concerning analyzing, reflecting and concluding the research.

14.2 Research methods

14.2.1 Literature research

With regard to the literature research the dissertation of Den Heijer 'Managing the University Campus' and the more recent 'Smart Campus Tools' and 'Campus NL' books served as a great basis to gain understanding of current campus management practice. This allowed me to have a good foundation from which I could delve into more specific subjects.

Concerning the development of the smart tool I realized that it was important to not only learn but also document this. After some research I found in the 'Business Intelligence guidebook' which covered most of the aspects of designing a proper database which would form the backbone of the smart tool.

14.2.2 Informal interviews

My internship at LoneRooftop presented me with opportunities to learn about every aspect of developing software for real estate management. When after some time questions arose I was able to make appointments for informal interviews with the discipline able to answer the questions for that specific aspect of software development. Through these informal interviews useful information was extracted which helped me improve my understanding of: privacy legislation, front- and back-end development and data science. Being able to easily make these appointments made my internship very worthwhile.

14.2.3 Model Development

At the start of the research my objective was to have an actual working mobile application. However, as the researched progressed I realised the amount of time needed to research was too great to achieve this. Furthermore, my inexperience with software also proved to be a bottleneck for this objective. Therefore, most of the coding was done in Excel which proved to be more functional than expected. For the development of the mock-up Balsamiq was an excellent way to visualize ideas quickly and supporting design iteration.

14.2.4 (Evaluation) Interviews

The data collection consisted of interviews with students and real estate managers. 'User centric evaluation methods' provided me with useful methods to interviews the students. Combining this with prototypes and a mock-up in balsamiq the interviews went very smoothly. Considering the semi structured interview with the real estate managers, it became clear that during the interview it was easy to lose track of what questions were answered. Luckily, there were possibilities to complete the interview by asking more specific questions later through email.

14.2.5 Case study

Using TU Delft as a case for this study was a good decision as it was easy to contact the necessary people for data collection (i.e. students and real estate managers). Furthemore, since the campus was already familiar it was less abstract what needed to be considered. However, when further researching how to implement this it becomes interesting to see what differences exist among campuses.

14.2.6 Ethical dilemmas

No real ethical dilemmas have come across during the research. However, considering the ultimate use of the generated data there are some ethical dilemmas which can become possible issues. These issues include the possibility of users to manipulate the data and that the degree to which the data is useful remains dependent on the behaviour of the decision maker. Considering the personal information that is required as input, it is expected that a simple statement should inform the users and they should have no real reason to object to its use. Furthermore, protecting this information is increasingly regulated and when complying to these regulations the information should be secure enough to protect it from misuse.

14.2.7 Personal learning goals

Leading up to the research I became aware of the opportunities information and smart tools offered and, simultaneously the relatively traditional methods of decision making in real estate management. Since then I was very interested in these opportunities, which this thesis allowed me to explore more. In doing so, my research skills needed to develop in structuring research and meeting scientific requirements. Over the course of this thesis, I believe these skills have developed significantly during the research process.

Clearly, the thesis also required me to establish my software development skills. While I might not have transformed into a full fledged software developer, I am somewhat able to speak the 'language'. Which was one of my learning goals: to be able to bridge the gap between software development and real estate management.

As this master thesis took a substantial amount of time and effort, it can be seen as the biggest project I was involved in during my studies. Moreover, the thesis was a very personal project as I had selected and completed the thesis myself completely. This allowed me to take charge of such a project, really develop approaching research and making project decisions. This enabled to develop my planning, leadership and ultimately skills in documentation of a large project. Furthermore, I have really developed using my network and knowledge of others to progress research. These are all thing I consider to be very valuable in the continuation of my career.

14.3 Dissemination

14.3.1 Societal relevance

The results of this thesis indicate possibilities for real estate management (and campus management in particular) to develop information sources on user demands through smart tools. The main benefits of this thesis, can be found in the fact that it shows what value the proposed smart tool initially has while also providing value over the long term. Initially it is expected that it will increase user satisfaction by supporting user activities. Simultaneously the smart tool shows ways to generate data to improve the campus. The generated information can prove valuable in supporting decision making with respect to indicating which spaces are underperforming and what functions are most in demand by users. Because, this information is quantified there are also possibilities to analyse the data to make new discoveries about what is expected of future demand. Furthermore, the principle of using smart tools for both supporting users while generating data on their demands can also lead to new developments of similarly useful software.

14.3.2 Scientific relevance

The relevance of this thesis in the scientific field primarily exist in the understanding of the development of software for real estate management. With these insights it has become (more) clear what is possible by using smart tools in both the use of buildings and how to generate data to support decision making. The research also showed how Preference Func-

tion Modelling can be used on a greater scale which can also be used for other purposes. Furthermore, it can be concluded that the proposed smart tool has a potential to add significant value to real estate users and management processes. Therefore, it becomes valuable to extend these principles to discover more potential.

14.4 Research Position

14.4.1 Position within Smart Real Estate Management

Since the end result of this thesis is a smart tool which firstly supports campus users in their activities it is argued that the smart tool mostly operates in the functional perspective of CREM. More specifically, this thesis mostly focuses on the product side of smart tools, encompassing the needs of end users in the use of such a smart tool. Thus, the research has taken on a user centric approach, while simultaneously generating data to support real estate management decision making. Taking this approach has given insight into what is important for users in using a smart tool, possibilities with the available sensors and the capabilities of software development to support real estate management overall.

14.4.2 Position within Management in the built environment

Since the data generated by the smart tool ultimately focuses on optimizing use of existing structures it is argued that, within the master 'Management in the built environment', this thesis is most applicable to real estate management practice. However, the results also suggest that smart tools can be implemented to a wide variety of other uses within the built environment. This type of smart tool can also be applied to optimize urban development by gathering more data on urban areas for example. Moreover, for project development the lessons learnt from the generated data can also be accumulated over time to integrate it into a new project.