Product reflection

The purpose of this product reflection is to discuss the graduation process and product. The completeness of data and validity of the results are important discussion subjects here. This chapter is also used to reflect back on the scientific- and societal relevance and utilisation potential which are stated at the start of the report.

Completeness of data

In order for the model to produce a realistic accommodation plan, the input data should be accurate, detailed and complete. While the documentation provided much of the required information, the completeness of data was still not optimal. Multiple reasons were causing this.

First of all, since such a model was not used during the actual negotiation process of the case, but for a simulation, not all constraints and objectives were quantified to begin with. The stakeholders had difficulties to express some of their demands in numbers. This might be less of a problem if the validation of the model took place during a real case, instead of a simulation.

Secondly, other crucial data was never provided because of the sensitivity of the numbers. This primarily includes the financial data regarding realization costs of different elements. The stakeholders involved with this data were not able to get approval to share their documents within the timeframe of the graduation project.

Because of the incompleteness of the data, many assumptions had to be made regarding the constraints of the model. This could mean that the generated solutions might not be feasible after further investigation. However, the structure of the computer model is not influenced by this, which means that the validation of the model can still be done.

Validity of the results

The results of the field test were different than the actual chosen accommodation plan. If the model would be accurate and complete, this would mean that the municipality did not implement an optimal most preferred solution within their real estate. As stated in the section above however, the model had some incomplete data and was partly based on assumptions. Besides this, some aspects of the organization were on purpose not implemented in the computer model, because of the timeframe of the graduation project. The most important aspect was the influence of company culture, and this aspect is also the main reason why the result of the field test differs from the actual implemented solution.

However, the results, while being incomplete for some aspects, are still valuable for an organization as leverage and clarity within the negotiation process. Also, with sufficient time and (quantifiable) data available, the structure of the model allows for the addition of all important constraints in a process.

The result of the field test was not the chosen result for the case, because it was not feasible for reasons that were not implemented in the model, but the stakeholders still agreed that that result would have been more preferred. In the future, when the organization culture has adjusted more to the new ways of working, the result of the field test is indeed the strategy that the municipality want to implement, according to the involved stakeholders.

Scientific relevance

This research project adds value to the scientific domains of real estate management and design and decision modelling. One of the ways it does this is by relating them together by means of a computer model for an accommodation plan, using methods of both domains.

For real estate management, the model offers accommodation solutions based on stakeholder constraints and objectives. The constraints and objectives are subject to change because of the new ways of working, and the domain of real estate management focuses on the added value that real estate can have in meeting these constraints and objectives.

For design and decision modeling, 2 separate techniques are combined into one model, using the strengths of both methods. While linear programming offers a way to determine the existence of a solution space for a problem, and thereby determining the feasibility, the technique of preference measurement can determine the desirability of the solutions in that solution space. Both techniques are practiced before but using them simultaneously is new for the domain of design and decision modeling.

DAS-Frame

For a better understanding of the relation of this study to real estate management, the model can be related to the DAS-frame discussed in part 2 of the report, where the future supply should be adjusted for the future demands of an organization. The third step of the DAS-frame is to generate alternative solutions (alternatives of what we could have). The solutions created here cover the mismatches between future and current demand, and current supply, which is what this model achieves very well.

Not only does the model provide different solutions based on the stakeholder demands and objectives, but also a method to evaluate and select the overall most preferred solution, which is also part of the DAS-frame. These solutions form the basis for the creation of a step-by-step plan.

Utilization potential

The final product, which is the computer model, is constructed inductively, and therefore is not limited to support the case of the municipality of Rotterdam only. The structure used allows for easy changes in constraints, objectives and decision variables (which are the office elements), and the case of Rotterdam is only used the validate its correctness.

Because of this, the model has much utilisation potential. As stated earlier in the report, the use of this model can save time and money determining the existence of the solution space given the constraints, which in other words is the feasibility of the project. Within the solution space, preference measurement is used to determine the most preferred solution without potentially unfair or unclear discussions. Furthermore, by actively using the model in the negotiation processes, stakeholders can be shown the consequences or effect of their demands, creating more transparency in an organization.

While the model is not able to design the layout of the separate office floors itself, it has the potential to provide the architect with very detailed information on the required elements. The level of detail here is set by the level of detail of the implemented constraints, and data on decision variables.

Recommendations

Recommendations for future research relate to the limitations of the model. While the structure of the model allows for adjustments and additions, it should be clear that accurate and detailed input data is required for accurate and detailed results. The first recommendation therefore is to develop a method to "translate" case data into model variables, which are validated by the stakeholders. This could be particularly interesting for soft data that the current model fails to include, such as the influence of organizational culture and the change of that culture over time. This first recommendation is based on the real estate management research area, where stakeholder goals lead to model criteria.

Future research could also be focussed at including preference from the start at the model, which means changing from a single criterion optimization model to a multi-criteria optimization model. For this study, it was not possible to use linear programming to do multi-criteria optimization, so other techniques must be used. If succeeded, this could result into a model which can find the overall most preferred solution that exists for the situation, based on the stakeholder objectives and their weights defined at the start. This second recommendation is based on the design and decision systems research area, and argues to compare linear programming with other techniques.

Furthermore, future projects could be done to extend the model to where it is able to create an actual building design. This would require the complete floor plans as input, instead of just the size and suitability. If the model was able to do this, many additional constraints could be taken into account, such as the pillar placements in a building, and the shape of a room.

As a final recommendation, the model should be given an own GUI (Graphical User Interface) instead of using the excel program. This would be more professional, and would allow the feasibility and desirability check with the same system. This last recommendation is based on computer programming, and not so much on the research areas for this study.

Personal reflection

The purpose of this personal reflection is to discuss my personal experience regarding the graduation process. The study goals defined at the start of the academic year are evaluated, and the striking positive and negative experiences.

Study goals

At the start of the research project, 3 study goals were defined. The first was to better understand the demands and criteria of stakeholders, and how these demands can be implemented in a real estate object. The qualitative demands and criteria of the stakeholders were easy to gather and understand, but in my experience it was more difficult to find a way to implement these. The most important reason for this was because stakeholders have difficulties translating their qualitative thoughts and wishes into quantitative constraints or variables. The process of doing this involved suggesting these "translations" myself, as well as making assumptions about what was meant with a qualitative description.

The second study goal was to better understand the relevant factors in real estate decisions. This was interesting since the study involved the case of the municipality, instead of a real company. Where I had thought that the most relevant factors would probably be finance related because of the times we live in, this was not so much the case. For the municipality, important factors were the city development (explaining the choice of office building), employee satisfaction and image.

The final study goals was to gain more insight in computer modelling, and the study has certainly achieved this. Not only did I get more familiar with the used computer programs Microsoft Excel and TETRA SDM, but the modelling itself forces the programmer to think of constrains and objectives in mathematical terms.

The case of the municipality

The study involved the case of the municipality of Rotterdam, and this part of the reflection describes the experience I had with working together with the stakeholders. In general, this was a positive experience and the stakeholders were very helpful for the study.

Getting permission to use the case was easier than expected. Since I have family relatives working at the municipality, I was quickly provided with the contact data of the right stakeholder in the process, the project leader. The first appointment was used to illustrate what value my research project could have, also specifically for the municipality, after which I had approval for the execution of the study. The stakeholders working in the team for the project manager were important for my study, and the benefits of have approval from a "project champion" meant that they were also willing to assist.

While my overall experience with working together with the stakeholders was positive, one negative aspect was that some of them were very slow to answer e-mail and to send the documents promised during the interviews. Specifically, the program of requirements for the case was a document which I asked multiple stakeholders multiple times for, and only received 3 weeks after. The (legit) reason for this is that the stakeholders simply have more work to do and forgot or postponed it, and I had to emphasize the time limit to which I was bound for the research project.

Scientific definitions

One of my greatest difficulties within this research project, was to correctly define the aspects of the literate study, mostly concerning the aspects of linear programming. Writing a research paper is one of my weak points, and especially for defining a mathematical method like linear programming, I find it hard to use the correct terms. At the end, with the help of my first mentor, I did improve my skills regarding the use of correct terms. Still, I am not always able to correctly translate what I want to say from Dutch to English, resulting in spoken language sentences.

No clear instructions

What makes the graduation project unique compared to other study projects, is that there is not fixed format for the end product, and little concrete guidelines for the contents. In my experience, this much freedom also results in much uncertainty. It is difficult to estimate the value of individual work, since all students have a different subject, method and research area. For me, uncertainty generates stress which might or might not be well placed. Still I appreciate this format and freedom of graduating, because I think it does a good job preparing the student for the assignments in real life, where many times also no guides exists.