

# **Interim report: Optimisation models for long-term workforce planning**

Group 6: SOK

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# 1 Changes in the objectives and the scope of the project

The main objective of developing an optimization model for long-term workforce planning has remained unchanged. The project has 2 phases. In phase 1, the objective is to develop a model that takes into account known future absences, whereas in phase 2, the objective is to include randomness in future absences of the employees.

Currently, our main focus is fully on developing phase 1. We are focused on the model formulation and functionality. We have decided to place more emphasis on model functionality than the model visualization for instance using a Microsoft Excel UI. Due to the current focus on phase 1, the completion of phase 2 is uncertain. Nevertheless, we have adjusted our project schedule accordingly and our objective remains unchanged in completing both phase 1 and phase 2.

## 2 Project status

Overall, phase 1 is ongoing. While tasks related to literature review, data processing and initial model development have been completed, challenges in model formulation have resulted in delays in relation to the planned schedule.

### 2.1 Completed tasks

A literature review was conducted to get an understanding of the topic and identify relevant research. While related studies were found, none of the earlier models were directly applicable or modifiable to be suitable considering the requirements of this project. The dataset provided by the client was preprocessed into suitable format and a parser was implemented for this. In addition, the software setup was configured to support collaborative development. Furthermore, an initial version of the optimization model for phase 1 has been designed and implemented. The key objectives of the project were updated and retrospection on our group work has been conducted in order to improve project work. In practice, meeting times during the week were increased and tasks better divided.

### 2.2 Ongoing tasks

Development of the model for phase 1 is currently in progress, but slightly behind schedule. This delay is partly due to an unexpected challenges related to the modeling of employee absences. Thus, the optimization model formulation for phase 1 is not fully complete. Therefore, the Julia-code and Excel-visualizations are also delayed as they depend on fully functional model. In addition, the literature is being summarized for the final report.

### 2.3 Remaining tasks

The primary remaining task is the validation process of the optimization model, which will be started once a functional working model for phase 1 has been implemented. Our project plan includes a phase 2, in which the uncertainties related to absences of employees are included in the model. However, the current issues with the phase 1 model might mean phase 2 will not be completed, as moving onto phase 2 depends on the successful completion of phase 1 on time. Phase 2 is intended to extend the model of phase 1, requiring an additional literature review, model

development and validation process. In addition, the preparation and writing of the final project is a required task.

### 3 Changes to the project plan

We have largely remained on track with the originally established timeline. However, we have extended the timeline for model formulation in the first phase of the project. Consequently, subsequent tasks of code implementation and model validation have been rescheduled accordingly. Phase 2 of the project has likewise been rescheduled, and while uncertainties regarding its execution remain, we aim to proceed with it in accordance with the revised schedule. Figure 1 presents the updated project schedule and 2 contains the colour codes used in the schedule.

Tasks	Subtasks	January		February				March					April				May			Sum of hours	
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Meetings	Client meetings	2			2				2						2			2			10
	Course meetings			1																	1
	Excursions							4						4						4	12
Reports	Project plan	3	2	2			2														9
	Interim report								2	3	1										6
	Final report								1	1				2	1	3	2	4			14
Literature review	Given reference materials		1	1																	2
	Additional reference materials	2	1	1							2	1									7
	Familiarization with the topic	1	1	1	1																4
Technical preparations	Familiarization with the data			1	1	1								1	1						5
	Software setup			1	1																2
Modelling	Model formulation				3	3	1	2	1	1				2	5	3					21
	Julia-code + Excel-implementation								3	4	3	1		2	4	2					19
Validation	Defining key objectives	1	1	1	1									1	1						6
	Model validation											2	2	1			2	2			9
Retrospection	Group assessment																		1.5		1.5
	Retrospective on group work								0.5					0.5				0.5			1.5
Sum of hours		7	7	9	7	4	5	5	4.5	7	11	7	8	9.5	9	10	8	8	4		130

Figure 1: The updated project schedule.








Colour codes	
Scheduled meetings	
Not yet scheduled meetings	
Reports	
Phase 1	
Phase 2	
Retrospection	
Excursion week	

Figure 2: The colour codes of the schedule.

### 4 Updated risk management plan

The most significant realized risk has been the challenges related to accounting for the employees' absences during Phase 1 formulation and its impact on the time required for the model formulation. As a result, we have had to postpone the subsequent phases. In addition, during the winter, not all project team members have consistently been able to attend in person. Following the retrospective, we decided to hold two shorter meetings each week. Table 1 contains the updated risks.

Risk	Likelihood	Impact	Effect	Mitigation actions
<b>Operational Risks</b>				
Taking the wrong initial approach when formulating the problem (Model formulation took longer than expected)	Medium (High)	High	Large delays in the dependent tasks	Testing while formulating, thorough investigation into limited literature to recognise problematic approaches
The problem is computationally too heavy to be solved	Medium (Low)	High	Implementation will not be usable, the formulation will likely need to be redone	Limiting the variables during formulation, utilizing relaxations while solving the problem
The optimization model has no feasible solution	Low	High	Implementation is not possible, the entire problem needs to be reworked to achieve a solution	Defining clear priorities to the constraints and features of the model and implementing them gradually in order of priority
<b>Scheduling-related</b>				
Project schedule is too optimistic	Medium (High)	Medium	Estimated workload does not match reality, difficult phases can cause large delays and communication issues	Configuring the plan based on very conservative time estimates, updating the plan throughout the project
Foundational tasks and phase 1 take up a lot of time	Medium (High)	High	Phase 2 might not be completed due to lack of time (Still uncertain)	Choosing to overlap some of the tasks in the phases, defining clear objectives to achieve for phase 1
Poor coordination and communication between members	Low	Medium	Time is not used efficiently; some tasks are not completed while some tasks are done multiple times	Clear briefing of the previous tasks and division of new tasks in (two) weekly meetings, retrospection every couple of weeks
<b>External</b>				
The schedules of the members do not align	High Medium	Low	Very little time for efficient co-operation, the work is done less efficiently	Scheduling set, weekly meetings early in the project, checking the need for additional meeting slots for each week
A member's capacity for work changes due to unexpected life events	Low Medium	Medium	Creates some logistical issues; tasks need to be redivided, access to the person's expertise and work is limited	Creating a shared Teams-platform to hold all relevant documents and work, each person briefs the others on their work in the weekly meetings

Table 1: Updated risks associated with the project, as well as their likelihoods, impacts, effects, and mitigation actions. Changes are written in red within parentheses.

## 5 Notice on AI usage

Sonnet 4.6 has been used for checking spelling and grammatical errors. ChatGPT was used for rephrasing of text.