Aalto University
MS-E2177 - Seminar on Case Studies in Operations Research

Project plan: Optimisation models for long-term workforce planning

Group 6: SOK

Adrian Alfatoni
Anna-Maija Kangaslahti
Iina Manninen (Project Manager)
Salla Nicholls

May 25, 2026

Contents

1 Background

Our client for this project is Suomen Osuuskauppojen Keskuskunta (SOK), the central organization of S Group, whose member cooperatives are among the leaders in the Finnish retail market, particularly in grocery retail as well as in the hospitality sector through hotels and restaurants. In the context of SOK's business operations, the topic of human resource planning is crucial to ensuring that the available workforce resource meets the demand of the business [1]. This is particularly relevant where demand varies seasonally, and the workforce supply needs to be adjusted accordingly to meet that variation.

Decisions on recruitment planning are not only useful for meeting the seasonal demands of the business but also for reducing additional costs that come with overstaffing and understaffing. Overstaffing is when a business unit has a surplus of employees compared to demand, thus accumulating unnecessary additional costs that are slow to eliminate. On the other hand, understaffing is when a business has too few employees to meet demand, causing resourcing difficulties and overburdening the productivity and well-being of employees, leading to difficulties in running the business as a whole as expected. Thus, it is in the best interest of SOK and the objective of this project to optimise recruitment planning in order to reduce personnel costs, ensure employee well-being and operate business units effectively.

To optimize recruitment planning, it is suitable to employ a mathematical optimization model such as Mixed Integer Linear Programming (MILP) for recruitment planning based on demand forecasts of each business unit. An MILP seems appropriate due to its ability to optimise hiring decisions under a finite amount of budget & capacity constraints while handling integer decisions such as hiring employees and the number of employees needed. It is crucial to account that the adjustments and decisions made with the model adhere to current employment regulations on working time and wages such as PAM's collective agreement for the commerce sector and can be accounted for in the MILP model.

2 Objectives

The overall objective of this project is to develop an optimisation tool for long-term workforce planning in a time horizon of 18-24 months on a weekly basis. This tool aims to reduce both over- and understaffing. The objective is furthermore divided into two phases. In phase 1, the objective is to develop an optimisation tool that takes into account known future workloads, absences, and fixed personnel changes. The objective of phase 2 is to build on the model developed in phase 1 and include randomness in the aforementioned subjects.

Specifically, the optimisation tool is required to give recommendations on which recruitments or increases of hours of part-time employees' contracts should be made and when. The aim is to minimize expected personnel costs resulting from existing employees, new hires and rental work. The constraints taken into account include accounting for future workloads, absences, fixed personnel changes, part-time employees' flexibility in extra work, balancing periods, and business units' constraints on the mix of contract hours. In addition, the requirements set by laws and collective bargaining must be followed.

The optimisation tool should be such that it can be used without expertise in optimisation across different business units. In addition, the optimisation model should be flexible in the sense that minor differences in needs and practices between different business units can be accounted for.

3 Tasks

The objective of the project is to implement optimisation models for long-term recruitment and contract hour increase planning. This section describes the tasks required to achieve the objectives.

3.1 Meetings

In order to define the key objectives of the project, discuss the implementation of the model, and review the progress of the project, we have meetings with SOK. In the first meeting, we signed non-disclosure agreements, discussed the project outline and received data from the earlier vacation planning project. We intend to schedule meetings with the client for the entire project. Additionally, we have course meetings and excursions (6.3., 10.4., and 22.5.) where the project deliverables will be presented. Our project group also has weekly meetings.

3.2 Reports

The progress and outcomes of the project will be documented in three reports: this project plan (due on 4.3.), the interim report (due on 8.4.), and the final report (due on 20.5.). In this project plan, we define the objectives and an initial schedule for the project. This helps us to identify risks related to the project and set suitable timing for each task. The interim report contains information on the progress made so far towards the objectives, updates in the project schedule and risks. The final report provides a summary of the project and presents the key results.

3.3 Literature review

After reviewing the scope of the project, we continue by studying previous research on optimisation models used in workforce planning. Human resource planning literature contains an earlier course project on vacation schedule planning at SOK [2] and a master's thesis on evaluating contract structures under uncertainty [3]. We will also familiarise ourselves with the Commerce sector collective agreement [4]. Moreover, each project group member finds at least two additional references that we will discuss together. We have also reserved time for reviewing additional references at the beginning of the second phase of the project.

3.4 Technical preparations, modelling and validation

Before we start formulating the actual optimization models, we will get familiar with the data from the earlier vacation planning project and the provided example data for this project. As the optimization model will be implemented in Julia and the data is in Excel files, we will have to make some preparations regarding the coding environment.

In the modelling phase, we begin by formulating the optimisation model, its objective function for minimising the costs and the constraints for the minimum number of employees, the minimum and maximum number of contract types, the workforce supply being at least as high as the expected demand, etc. After model formulation, we start implementing the model in Julia and a user interface in Excel. However, the emphasis is not on refining the user interface.

Our project has two different phases. We have scheduled both phases, but as we are uncertain about how much time the first phase takes, the schedule is tentative.

Once the optimisation model is ready, we will validate the results in light of the key objectives and constraints. The key objectives are defined separately for the two different phases of the project, and we have reserved time for validation after both parts.

3.5 Retrospection

We will have a brief retrospective after each excursion week so that we can reflect on past work and improve our teamwork. At the end of the project, we have a bit more time for group assessment so that we can discuss how well we succeeded in the project.

4 Schedule

A tentative schedule for completing the tasks described in Section 3 is presented in Figure 1. Figure 2 gives the explanations of the colour codes used in the schedule. The numbers in the schedule describe the estimated hours for subtasks for each project group member, and the estimates are given as averages per person.

Our group has also agreed on a weekly meeting. In addition, we review weekly objectives each week in order to ensure that everyone knows what to do. We will update the schedule as the project progresses.

Tasks	Subtasks	January		February				March				April				May				
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Sum of hours
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					5	3	1	2				2	5	3					21
	Julia-code + Excel-implementation						3	2	3	3					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	6	8	7	7.5	8	7	6	8	9.5	6	7	8	8	4	130

Figure 1: The tentative 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.

5 Resources

The project requires several types of resources, including data, tools, team effort, and time. The main input data will be provided by the company and handled under a non-disclosure agreement (NDA). This dataset contains internal workforce planning information that will be used to develop and test an optimisation model for long-term recruitment planning.

In addition to company data, relevant background knowledge will be obtained from scientific literature on workforce planning and optimisation, as well as from employment regulations applicable to the commerce sector. We also received a lot of feedback from the professor Ahti Salo. Julia will be used for model development and computational implementation, while Excel will serve as the client-facing interface for running the model and presenting the results in a practical and accessible way.

The project team consists of five Operations Research students. The workload will be shared across regular meetings, literature review, technical preparation, model development, validation, reporting, and retrospection. The project spans 18 weeks and corresponds to a total planned effort of 130 working hours, as specified in the schedule section. Throughout the project, the team will also benefit from feedback and domain expertise provided by the company's experts.

6 Risks

We identify three types of risk associated with our project: operational, scheduling-related, and external. Operational risks encompass all risks associated with the formulation and technical implementation of our solution. Scheduling-related risks, in turn, encompass risks associated with scheduling internal and customer meetings, the overall project plan, and the effectiveness of our time use. In addition to these two risk types, we consider external risks arising from conditions and events that we cannot influence.

We detail the most significant risks associated with this project in Table 1 below. This table also describes the likelihoods, effects, and our proposed mitigation actions associated with this project.

Risk	Likeli-hood	Impact	Effect	Mitigation actions
Operational Risks				
Taking the wrong initial approach when formulating the problem	Medium	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	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
Scheduling-related				
Project schedule is too optimistic	Medium	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	Phase 2 might not be completed due to lack of time	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 the weekly meetings, retrospection every couple of weeks
External				
The schedules of the members do not align	High	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	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: Risks associated with the project, as well as their likelihoods, impacts, effects, and mitigation actions.

7 Notice on AI usage

Grammarly was used for checking spelling and grammatical errors.

References

[1] K. Sarwary, F. Faizi, and M. R. Banayee. The role of human resource planning on the improvement of employees' recruitment process. *Journal of Corporate Finance Management and Banking System (JCFMBS)*, 2(05):2799–1059, 2022. https://doi.org/10.55529/jcfmbs.25.29.41.

[2] A. Sultanbekov, P. Heir, H. Karras, K. Laurila, and A. Wilhelmsson. Computational models for evaluating contract structures under uncertainty, 2023. An Optimization Model for Vacation Schedule Planning. Final report for Aalto University course "MS-E2177 Seminar on Case Studies in Operations Research". https://sal.aalto.fi/files/teaching/ms-e2177/2023/3.%20SOK%20-%20Final%20report%20-%202023.pdf.

[3] A. Wilhelmsson. Computational models for evaluating contract structures under uncertainty, 2025. Master's Thesis. Department of Mathematics and Systems Analysis, Aalto SCI. https://sal.aalto.fi/publications/pdf-files//theses/mas/twil25_public.pdf.

[4] Service Union United PAM and the Finnish Commerce Federation. Commerce sector collective agreement, 2025. Accessed 9 February 2026. https://www.pam.fi/en/tes/commerce-sector-collective-agreement/.