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The Use of Generative Artificial Intelligence in Public Procurement

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Master of Engineering

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Preface

This thesis has been at times a journey of both exhilaration and discovery, relating both to the subject and the method. I am grateful for the experience.

First, I would like to thank my thesis instructors at Metropolia University, Dr. Thomas Rohweder and M.A. Sonja Holappa, who both generously offered their time and advice. I am also thankful and indebted to other lecturers of the decree programme, for everything they gave us, the students, during the past, intensive, eight months.

I am also grateful to the entire team of Procurement and Contract Services at Helsinki Social Services, Health Care, and Rescue Services Division, both my colleagues and the leadership, who provided not only access to essential data but also invaluable insights that enriched the practical aspects of my research. Their openness and professional generosity can be seen throughout the study.

Finally, this thesis would not have been possible without the enduring support of my family and friends, who provided both motivation and respite throughout this demanding academic process. Thank you.

Toni Rissanen

Espoo, April 28th, 2024.

Abstract

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This thesis explored the possibility of integration of Generative Artificial Intelligence (GenAI) into the public procurement process within the Helsinki Social Services, Health Care, and Rescue Services Division (SOTEPE). The objective of the thesis was to give recommendations for employing GenAI tools to help to optimize the public procurement process, thereby improving operational efficiency and reducing costs.

The research was structured in four stages: (1) current state analysis through department documentation review and stakeholder interviews; (2) a literature review to frame GenAI capabilities; (3) co-creation of initial recommendations with the stakeholders, via a workshop; and (4) validation of these recommendations with selected department leaders. Data collection was qualitative, focusing on interviews and participatory workshops to gather insights from the stakeholders.

The research identified non-productivity points related to time use, as well as to accuracy and quality of certain tasks in the current procurement practices. GenAI was found to be a viable solution to these non-productivity points due to its ability to assist in or to automate some of the tasks in the public procurement process, thus freeing up employee time for more strategic activities.

The outcome of the study was a set of recommendations on integrating GenAI into various stages of the public procurement process.

Keywords: Generative artificial intelligence, Public procurement process, Efficiency.

Contents

List of Abbreviations and Terms

AGI: Artificial General Intelligence. Theoretical AI that has exceeded humans in capabilities.

AI: Artificial Intelligence.

Category work: A way of organizing procurement projects to designated specialists to increase synergy between procurement projects.

GenAI: Generative Artificial Intelligence. AI using so called generative models.

HANPA: Department of Procurement and Contract Services.

LLM: Large Language Model.

OPHA: Unit of Operative Procurement, part of HANPA.

RFQ: Request for quota.

SOTEPE: Social Services, Health Care and Rescue Services Division of the City of Helsinki.

STRAHA: Unit of Strategic Procurement, part of HANPA.

Substance: Core operations, certain area of core competence of the division, e.g., dental care, or child welfare services.

1 Introduction

In Finland the public procurement process, a process of public tendering and contracting, is subject to national law that comes from the European Union directives on public procurement. The purpose of these laws and directives is to guarantee transparency and fair competition between suppliers, as well as the efficient use of public funds. (Public procurement in Finland, 2024.)

Generative artificial intelligence, GenAI, is artificial intelligence that can generate text, images, and other media, by using so called transformer-based models (LLM), that were proposed by Vaswani *et al*. (2017). Even though the first of these models was created already in 2018, it took four more years for them rise to public awareness at the end of the year 2022. Since then, large language models for example by Anthropic, Google, Meta and OpenAI have set new standards in language and media generation, showcasing abilities in writing, coding, and more; the pace of change in the field of AI has been so fast that practical applications based on the technology can already be outdated by the time they are released for the public. Prudent approach in most instances would seem to be to wait and see.

On the other hand, the price at the end of the rainbow seems to be vast and closer than most experts would have expected even a few years ago. The so called artificial general intelligence (AGI), a human level artificial intelligence, though not yet achieved, could revolutionize, or upend, most aspects of life in our current societies. Large scale process optimization through less powerful current versions of GenAI could affect both public and private sectors, that in turn could affect labour markets, societies, and economies. (Czarnitzki *et al.*, 2023; Dell'Acqua *et al.*, 2023; Martin *et al.*, 2024.)

1.1 Context of the Case Organization

The case organisation, Helsinki Social Services, Health Care and Rescue Services Division (SOTEPE) is a division of the city of Helsinki, responsible for providing health, social and rescue services for a population of over 670 000 people while having over 16 000 employees. The foremost priority of SOTEPE is to secure these services for the residents of Helsinki.

In one sentence, SOTEPE's vision statement is "We create health, wellbeing and safety for Helsinki residents through cooperation and strong expertise." To achieve this strategic vision, SOTEPE's service strategy has been split into several thematic entities and priorities to describe the goals of the organization; of specific relevance to this thesis is the ways of organising services and cost-effectiveness. (City of Helsinki, 2023.)

From 1 January 2023 onwards the reform of healthcare, social welfare and rescue services to wellbeing services counties has changed the funding base to be provided through the government of Finland. This presents a challenge, as there is now less flexibility in the funding for the services its citizens need.

At the same time the city's population is aging and is going to require additional services. The aging population is going to mean that a large portion of the current employees, like nurses, practical nurses, and doctors, are also going to go to retirement. This presents two more challenges for the city, growing service requirements as well as the replacement of qualified and competent employees; costs are increasing at the same time as SOTEPE is constrained by the limited annual index raise to its budget due to the reform of wellbeing services counties.

Procurement and Contract Services (HANPA) operates under the administration of SOTEPE, whereas Operative Procurement Services (OPHA), is part of HANPA. The main responsibilities of OPHA are planning, implementation and monitoring of procurements in accordance with the legislation, support of other

acquisitions, support during the contract period, and support for service voucher introduction and operational development. The procurements that OPHA makes include for example social and health service procurements for the municipalities, other service procurements (mainly to support own operations), goods procurements, and system procurements. The public procurement process, the process that is examined in this thesis, is the main process at OPHA.

1.2 Challenge, Objective, and Outcome

The starting point for this thesis is the question whether the public procurement process (the process of public tendering and contracting) can be augmented via the application of GenAI. Considering how many orders of magnitude faster than a human a computer can be, there should be at least some room for improvement in the flow of the public procurement process. The process itself is rigid, as it is subject to national law, but there is some flexibility in the individual points of action. As GenAI's can increase the speed of work and processes, HANPA, the department of Procurement and Contract Services of SOTEPE, have identified GenAI as a possible tool to achieve a higher work output at the cost of lower monetary inputs.

The objective of this study was to propose recommendations on how to utilize GenAI tools to improve the public procurement process, and the outcome of the study was the recommendations on the use of GenAI tools for an improved public procurement process.

1.3 Scope and Outline of the Thesis Report

This thesis focuses on the use of generative artificial intelligence in the process of public procurement. As the technology is still immature, the implementation of the solutions is outside the scope of this study. This thesis contains seven sections. Introduction, this section, sets the stage for the study, introducing the main topic. Section 2 discusses the methodology used for the study, including data collection methods. Section 3 provides a current state analysis and an in-

depth look at the existing public procurement process, along with key findings from the analysis. Section 4 covers the literature review and outlines the conceptual framework of the study. Section 5 presents the guidelines developed based on the findings from Sections 3 and 4. Section 6 describes the process of validating the proposed guidelines through feedback from the leadership team of the department of procurement services. Section 7 concludes the report with a summary, proposals for future actions, a self-evaluation, and final remarks from the author.

2 Project Plan

Section 2 presents the research approach and design, as well as the data plan for the thesis at hand. First the research approach is explained, continued with the research design, and then concluding with the data collection methods.

2.1 Research Approach

Research approaches vary, for example, between the axis of qualitative vs. quantitative research and basic vs. applied research. Depending for example on study context, goals and data gathering methods, the chosen approach can differ between several possibilities. (Kananen, 2013.)

As the objective of the thesis was to clarify our understanding of the current state of the public procurement process, and to find practical applicable solutions, in the context of GenAI, for the current perceived non-productivity points, the chosen research approach for this study is applied action research, a form of qualitative research. According to Kananen, applied action research (or design research) is the fitting term for research that deals with organizational issues with the researcher working with the people who are involved with the process. Unlike basic qualitative research, applied action research does not just analyse the subject, but aims to develop the current state towards something better. (Kananen, 2013.)

2.2 Research Design

The objective for the thesis is to give recommendations on how to utilize GenAI to improve the procurement process. The Research Design for achieving the objective is presented below in Figure 2.1.

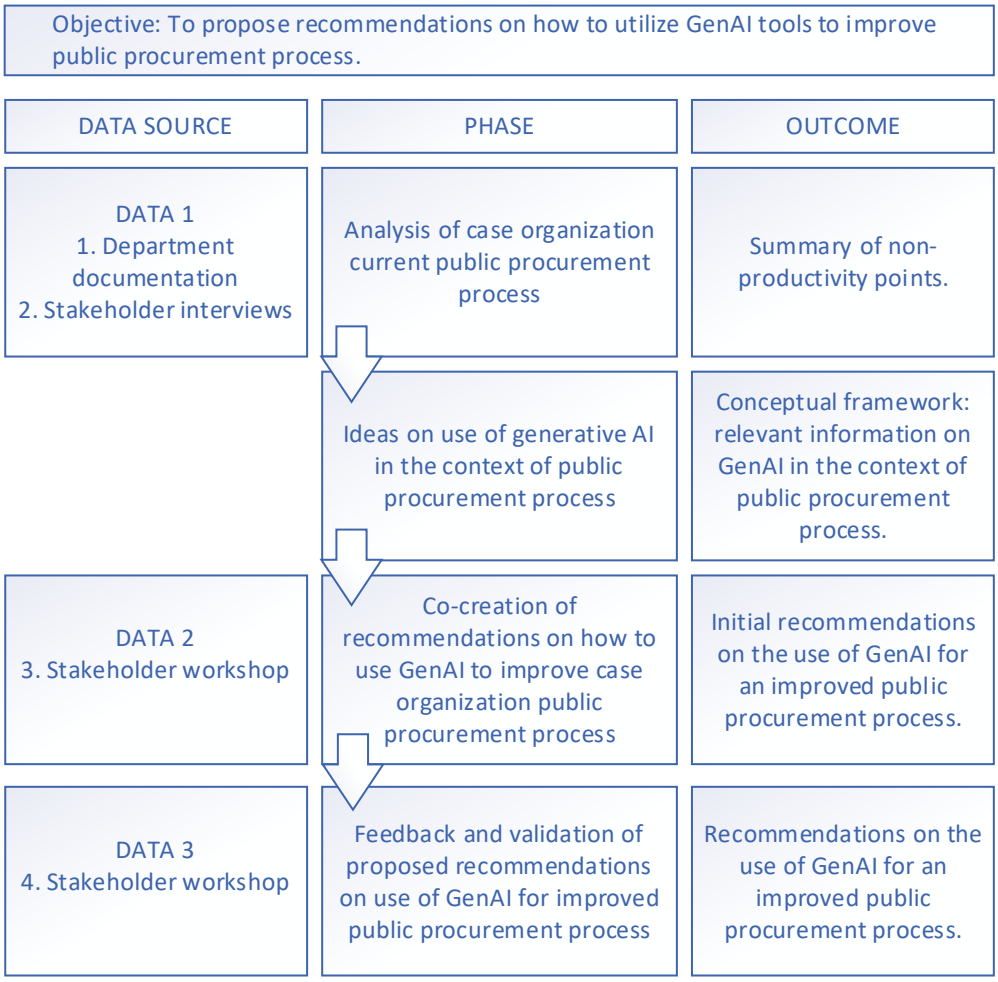

Figure 2.1. Research Design of the Thesis

As shown in Figure 2.1, the design includes four phases in progression, each continuing and building from the previous ones.

The first phase was the current state analysis, done to gain understanding on the current procurement process and to form a contextual basis for the second phase of literature search and review. For this first phase, data 1 was gathered from the department documentation, as well as from the stakeholder interviews inside the procurement and contract services. This data was analysed to gain a summary on current non-productivity points in the process.

The second phase was the literature review on GenAI in the context of findings from the first phase. The outcome of this phase was a contextual framework, which presents ideas, concepts, and possible tools to benefit the public procurement process.

The third phase of the study, the crafting of initial recommendations for improvement, was done through a workshop. The findings from the first and second phase were presented to a group of stakeholders, with a series of problems and tasks to work on. The resulting answers and viewpoints, data 2, was collected and moulded to the initial recommendations for improvement.

In the fourth phase, in a workshop with the leaders, the initial recommendations were validated. This workshop produced feedback, forming data 3. After incorporating the comments into the initial recommendations, the concluding outcome were the recommendations for an improved procurement process.

2.3 Data Plan and Analysis

The data plan for this study includes three phases, at phase one of current state analysis, phase three through an initial workshop with the stakeholders, and at phase four through a workshop with the leaders. These three data collection phases are visualized in tables 1, 2 and 3 below.

Table 1. Details of Data 1 collection for the current state analysis

Data 1 - Current State Analysis					
	Data source	Data Type	Topic	Date	Document
1	Internal strategy document	Document (pdf file)	HANPA strategy	Accessed 2.1.2024	
2	Internal process description document	Document (pdf file)	Public procurement process	Accessed 2.1.2024	
3	Senior procurement specialist 1	Interview (Teams)	Process current state	2.1.2024 1 hour 10 minutes	field notes
4	Senior procurement specialist 2	Interview (Teams)	Process current state	3.1.2024 1 hour 10 minutes	field notes
5	Senior specialist 1	Interview (Teams)	Data analysis	4.1.2024 45 minutes	field notes
6	Strategic procurement manager 1	Interview (Teams)	Current state, current challenges	4.1.2024 30 minutes	field notes
7	Procurement director 1	Interview (Teams)	Legal aspects, current challenges	4.1.2024 30 minutes	field notes
8	Tendering and contract manager 1	Interview (Teams)	Current state, current challenges	5.1.2024 45 minutes	field notes
9	Senior planning officer 1	Interview (Teams)	Market dialogue and data gathering	5.1.2024 30 minutes	field notes
10	Senior specialist 1	Interview (Teams)	Market surveys	5.1.2024 30 minutes	field notes
11	Senior procurement specialist 3	Interview (Teams)	Process current state	9.1.2024 50 minutes	field notes
12	Senior procurement specialist 4	Interview (Teams)	Process current state	10.1.2024 40 minutes	field notes
13	Senior procurement specialist 5	Interview (Teams)	Process current state	11.1.2024 25 minutes	field notes
14	Senior procurement specialist 6	Interview (Teams)	Process current state	11.1.2024 45 minutes	field notes
15	Senior procurement specialist 7	Interview (Teams)	Process current state	15.1.2024 45 minutes	field notes

As shown in Table 1, the current state analysis was done by reviewing the existing department documents on the current procurement process, as well as conducting interviews with the stakeholders. The interviews were conducted with all the leading procurement specialists from the operative procurement unit, three department leaders, and a selection of members of the strategic procurement unit. The following Table 2 shows the second phase of the data collection, which was done after the literature review.

Table 2. Details of Data 2 collection for the initial recommendations

Data 2 - Building initial recommendations					
	Data source	Data Type	Topic	Date	Document
1	Procurement manager 6 x Senior procurement specialist 6 x Procurement specialist Coordinator 2 x Senior planning officer Senior specialist	Workshop (face-to-face)	Co-creation of initial recommendations for an improved public procurement process.	21.3.2024 90 minutes	field notes

As shown in Table 2, Data 2 comes from a workshop for the co-creation of the initial recommendation for an improved procurement process. The results of the current state analysis were presented to the working group, along with selected findings from the literature, after which Data 2 was created through discussions about AI use in the public procurement process. Data 2 was then used to refine the initial recommendations for an improved public procurement process. The following Table 3 shows the last phase of the data collection.

Table 3. Details of Data 3 collection for the validation of the initial recommendations

Data 3 - Validation of the initial recommendations					
	Data source	Data Type	Topic	Date	Document
1	Procurement manager Unit manager	Workshop (Teams)	Initial recommendations for an improved public procurement process.	2.4.2024 45 minutes	field notes

As seen in Table 3, in this fourth phase, in the workshop for the validation of the initial recommendations, the workshop participants were two of the three department leaders from the first phase. The whole project was presented to and discussed with the leaders, after which feedback was collected for this report as Data 3.

The data collected for this study was analyzed by doing thematic data analysis, which is a qualitative research method for identifying, analyzing, and reporting patterns within data, leading to a better understanding of the examined phenomena. The method is adaptable and capable of offering analysis of both surface content and the underlying patterns.

The next section of this thesis presents the results of the first phase of data collection and discusses and analyzes the current state of the public procurement process in the case organization.

3 Analysis of Case Organization Current Public Procurement Process

This section inspects the current state of the public procurement process in the case organization.

This section starts with an overview of the phase, as well as an overview on how Data 1 stage was undertaken. This overview is followed by a description of the most common version of the public procurement process. Next, an analysis of non-productivity points is presented, followed by a selection of the most essential non-productivity points suitable to be tackled with GenAI.

3.1 Overview of How This Data Stage Was Undertaken

The objective of conducting a current state analysis was to understand how the public procurement process of the case organization is currently performed. The results of this analysis were meant to form a selection of non-productivity points, which could be improved upon in the Section 5 of this thesis.

In accordance with the Data plan presented in Section 2, Data 1 was collected from internal documentation as well as by conducting a series of interviews with the department internal stakeholders. Both data sources were used to draft a visual presentation of the process, a chart, that was validated during the interviews with the leading procurement specialists. The whole process was reviewed during these interviews. Based on those reviews, certain aspects of the process were deemed to be more noteworthy and prone to errors than the rest.

The stakeholder interviews were run as individual interviews through Teams. The selection of questions was chosen based on the role of the interviewee. The questions presented to the procurement specialist were mostly identical, a series of questions on all five process steps as well as a selection of general questions on the subject. For leadership and the members of the STRAHA,

questions on process steps were omitted, with a focus on one's individual viewpoint to the procurement process.

3.2 Description of Current Public Procurement Process

The presented version of the public procurement process is divided into five separate phases including, preparation, competitive tendering, processing tenders, decision and contracting.

Figure 3.1 presents the most common version of the public procurement process, the open procedure. The process description figure is based on a HANPA internal process description documentation and was validated by the leading procurement specialists during the interviews.

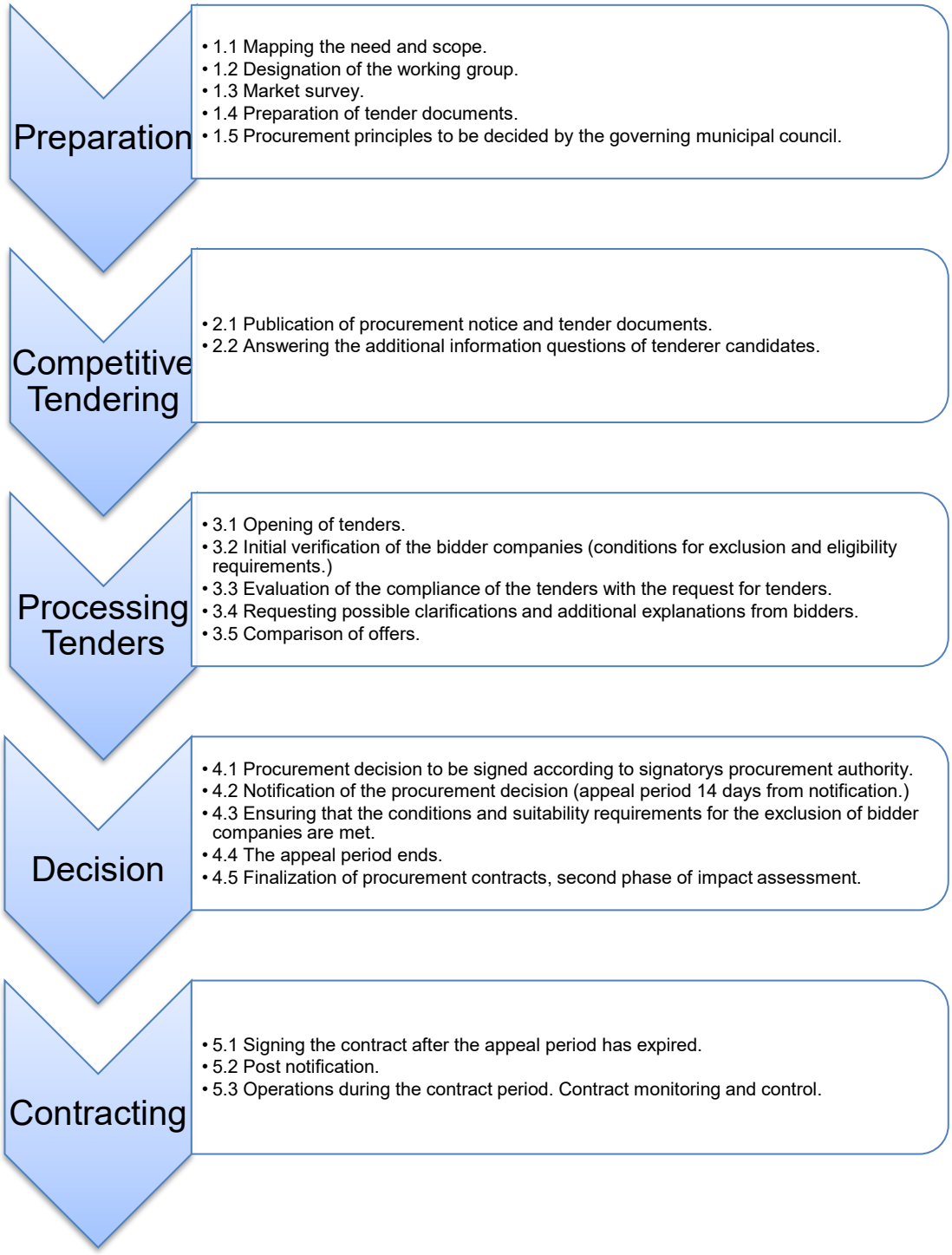

Figure 3.1 The most common version of the public procurement process.

In the context of an open procurement process, the procedure starts from a need for the substance, which is defined during the preparation phase, and published during the phase of the competitive tendering. Electronic and transparent accessibility of a solicitation is ensured for tender proposals, thereby enabling all interested suppliers to submit their tenders. The tenders are processed during the third phase, after which a decision is made. After the appeal period has ended, the contracts are signed and the operations during the contract period begin. The five phases are described in more detail below.

3.2.1 Phase 1, Preparation

The actual need for sourcing services, systems or products usually comes from the substance (the place of core operations, a certain area of core competence of the division, e.g., dental care, or child welfare services.) The need, the scope of the need, the monetary size of the procurement, as well as the likely impact of the procurement are mapped by the substance. The monetary scale of the procurement determines if the procurement is a so-called small-scale procurement, a national procurement, or an EU procurement, and if the substance should do the procurement by itself, or if support from the Department of Procurement and Contract Services, HANPA, is needed. If support is needed, the substance contacts HANPA, and the project is put into the procurement calendar and a procurement specialist is assigned to the project. After the designation of the procurement specialist and the rest of the working group, and at the right time, there is usually a kick-off meeting, where the roles and responsibilities are checked and confirmed.

The procurement specialists are at the helm of the procurement project, doing work as a project manager, coordinating, and connecting the working group and other parties as necessary. The procurement specialists also draft the contract and take care of the technical work with the contract management software. Figure 3.2 presents the preparation phase.

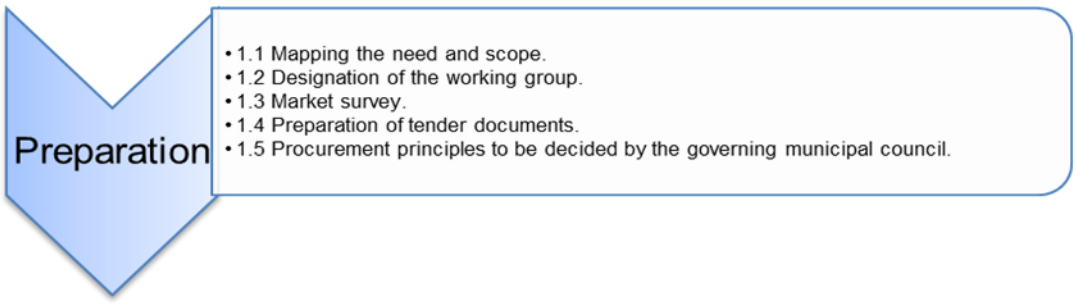

Figure 3.2 Preparation phase.

Depending on the procurement project, markets, the information needs of the substance, and if the project is done for the first time or not, the preparation phase can include a market survey.

The procurement specialist, in the role of a project manager, assembles the working group, holds the kick-off meeting, creates a scheduling proposal, schedules the meetings, guides the working group, eventually prepares a draft contract, and participates in the preparation of tender documents. In the interviews, Informant #3 commented as follows:

> There is a risk that the procurement specialist does not know how to describe the matter or does not know how to give instructions precisely enough; one can get the impression that a service description or a mapping of the need is being made [by the substance] for the procurement specialist [instead of for the substance itself]. (Data 1: Informant #3)

The process requires that everyone recognizes their own roles and responsibilities and manages their personal schedules.

The preparation of the tender documents is maybe the single most demanding part of the whole project. The working group will make everything that is needed for the tender to be published and for the contract to be done. This includes the

request for quotation, service description, contract drafts, data protection attachments, as well as a series of other documents.

The service description plays a key role in service procurement, as it explains what is being acquired, the desired outcomes, a required process, or the required resources. The service description will be used to make a draft for the contract and a request for quote. When doing sourcing, for the procurement to succeed, the party with a need must be able to explain the service, system or product required. But for most, one’s core competence is rarely in how to describe the current state, problems relating to it, solutions to the problems and the desired end state. And as such, creating the service description, or the requirements for the IT system needed, can be at times challenging. According to informant #13,

> There is a risk of missing something. You don't specify and there is a problem with the offers, or the offer is not suitable, or maybe the procurement specialist or the substance has not thought about the detail. (Data 1: Informant #13)

Sometimes, mistakes can happen even due to internal communication barriers; one can have a vision on the desired end state, without the capability to express the vision clearly enough. Even though the service design and description are the responsibility of the substance, a procurement specialist benefits from having the know-how on how to ask relevant questions, to guide the dialogue and the ability of the working group participants to express their ideas. Informant #2 stated the following:

> In the substance, there is not necessarily enough understanding that the Procurement and Contract Services do not know the substance. We cannot assess the quality of work done by them. (Data 1: Informant #2)

In its essence, the procurement process is mostly a process of dialogue, and a process of data and information sharing and processing, where imprecise descriptions of objects, systems or services are compared between each other, based on imprecise description of what is needed. As such, how well the procurement project succeeds is often directly dependant on the quality of the description of the service, system, or object, done during the preparation phase.

The interviewees also gave comments on time use. Informant #6 asked the following question:

> If the working group is not doing its job, or the substance is not working, is it a question of our project management skills? (Data 1: Informant #6)

As the working group usually includes people that do not engage in procurements as their core work, but in addition to the core work, finding time for a procurement project, and its specifications and descriptions can be a challenge. According to informant #2:

> Project that is based on previous project can [in optimal situation] be done in weeks, new or bigger projects can take more than half a year. (Data 1: Informant #2)

The total project length depends on the project in question, with most taking roughly six months. A more general sentiment, expressed by several informants, was phrased by Informant #12 as follows:

> There is always a rush with procurement preparations, which eats away our creativity; we could be more innovative if there was time to plan and experiment with new ideas. Some procurement specialists have too much workload. (Data 1: Informant #12)

Time use, both in the sense of conflicts in the scheduling and the lack of total available time, was a theme expressed by most interviewees, as a general challenge relating to procurements.

3.2.2 Phase 2, Competitive Tendering

In this phase the procurement specialist does data entry work to Cloudia, a contract management system, importing attachments and publishing the request for quote, as well as keeping the substance up to date on what's going on, compiling additional information questions from the suppliers, and arranging meetings with the substance. Figure 3.3 presents the competitive tendering phase.

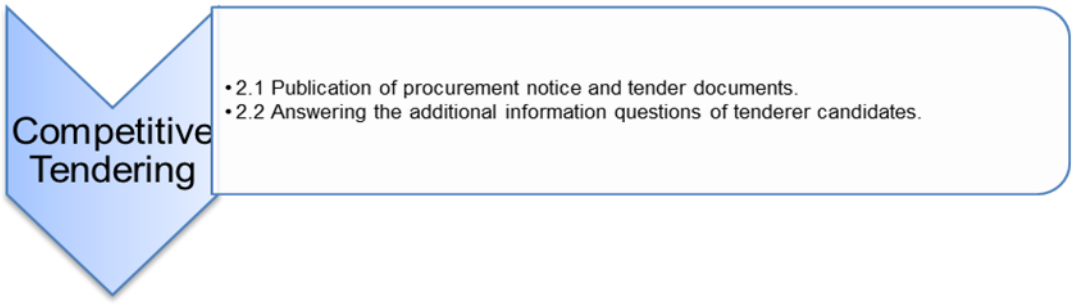

Figure 3.3 Competitive tendering phase.

Suppliers are given from 14 to 35 days to ask questions for more information, depending on the monetary size of the procurement project. The additional information questions are considered with the substance. The procurement specialist will answer technical questions relating to the procurement, whereas the substance answers quantitative and qualitative questions related to the service, system, or products. Informant #3 commented about possible complications in this phase in the following way:

> Errors arise from the fact that we have the worst knowledge of how a purchase can solve a certain problem. (Data 1: Informant #3)

These errors are usually caused by inaccuracies or poor quality of work done in the preparation phase. Because of this, in this phase, requests for quotation are sometimes, but rarely, interrupted during the offer period if there is a fault in the invitation to tender. If the preparation phase was done thoroughly, this phase is usually fast with little work.

3.2.3 Phase 3, Processing Tenders

In this phase the procurement specialist opens the quotes, takes the opening minutes, quotes, and comparison tables from Cloudia, and sends them to the working group. The procurement specialist checks whether the offer complies with the invitation to tender, marks the possible problems for which clarification should be requested, or whether it is even possible to ask for clarification. Figure 3.4 presents the processing tenders phase.

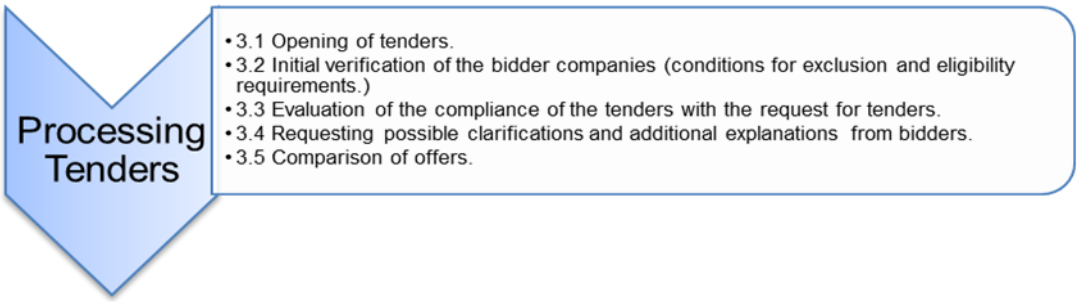

Figure 3.4 Processing tenders phase.

Emphasizing the preparation phase, informant #1 commented as follows:

> During preparation we should think about the decision. The offer may not be changed at this stage, specifying is possible. (Data 1: Informant #1)

The substance has a major role in this phase, as the requirements, references, and permissions of the responsible persons go to the substance for review. The procurement specialist again checks matters related to the tenders, but not

those related to the service or product; checking and comparing the quality criteria belongs to the substance. According to informant #2:

> There is a possibility of error if qualitative factors are involved, or questions include other than yes/no questions. (Data 1: Informant #2)

Missteps done during the preparation are usually noticed in this phase, for example, if the provider misunderstood some detail, did not provide required information, or provided conflicting information. Informant #4 explains this in the following way:

> If there is any ambiguity, we go through the offer with lawyers, and if rejected the bidder can make a claim for rectification, and the rejection may become a market court case. (Data 1: Informant #4)

An offer can be rejected for an incorrect reason, or conversely, an offer could be accepted even though it should have been rejected. Also, the allocation of comparison points used to compare tenders could be disputed. In all cases, the result can be a claim for rectification.

From this phase on the procurement specialist also needs to do an increasing amount of data entry work with the contract management software. Depending on the number of contracts, the required amount of work can at times be massive. When asked if there was work that should be done elsewhere or by someone else, Informant #13 answered:

> Data entry to Cloudia. Especially those contract entities where there are a lot of contracts. (Data 1: Informant #13)

This sentiment was notable as it was expressed by most leading procurement specialists.

In this phase, time use depends on the procurement project and how much time for data entry work is required, as well as the time needed for clarifications, but usually at least several weeks for comparisons and two weeks for clarifications.

3.2.4 Phase 4, Decision

During and after the comparisons are done, the procurement specialist prepares a decision. If there are exclusions, they need to be justified and explained. The procurement specialist checks the substance for comments, and if everything is as it should, sends the decision to an appropriate director for a signature. A notification of the procurement decision is posted, with an appeal period of 14 days from the notification. Figure 3.5 presents the decision phase.

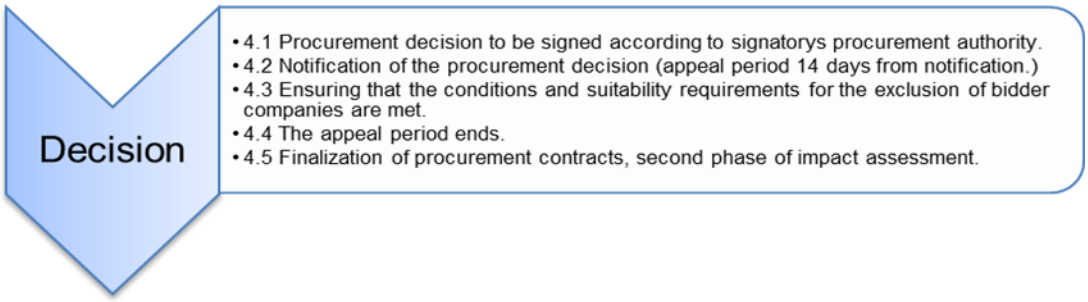

Figure 3.5 Decision phase.

Informant #7 explains a possible source of problems as follows:

> This phase can reveal errors in the comparison, resulting in a claim for rectification. E.g., if rejected on false grounds, the bidder may disagree with what was wanted. (Data 1: Informant #7)

In other words, even this phase can reveal a problem that stems from rushed or uninformed preparation.

After the appeal period ends, the procurement specialist finalizes the procurement contracts and the attachments, and the second phase of the impact assessment can begin.

3.2.5 Phase 5, Contracting

In the last phase of the public procurement process, after the appeal period has ended, and the claims for rectification have been processed, the procurement specialist starts making the price attachments, and the subcontractor attachments. Extracts of criminal records both from the company and its leaders are checked, after which the contracts can be signed. Figure 3.6 presents the contracting phase.

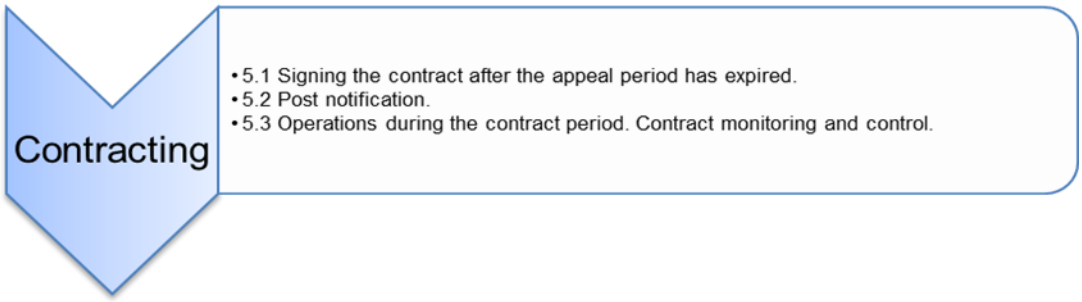

Figure 3.6 Contracting phase.

Procurements that exceed the EU threshold for the contract value require a post notification within 30 days of the signed contract.

Depending on the procurement project there can be a kick-off meeting for the companies involved or the substance employees, on how to proceed with the contract and what should be done.

3.3 Analysis of Non-Productivity Points in the Process

The previous five sub-sections discussed the current state of the case organization public procurement processes by examining the five major steps of the process. Based on what was discussed in those five sub-sections, the single biggest source of possible failures, of halted projects, seems to happen because of mistakes done in the preparation. These mistakes often boil down to miscommunication and misunderstandings, possibly to one's sometimes-limited ability to transform ideas to coherent expression, or someone else's expression to own personal understanding. We humans also tend to presume that others understand a word in the same way as we do, with little need for clarification when we communicate, or when we try to understand others; exact definitions can be essential when doing procurement work, contracts, and documents.

Wherever the failure stems from, it usually actualizes in the documents needed for the competitive tendering phase. A fundamental error in documentation can arise when a sentence is constructed in a manner that it permits multiple interpretations, thereby obscuring its intended meaning and leaving the reader uncertain about how to accurately comprehend the sentence. When drafting a document, there is also a possibility of a typographical error that can change the whole meaning of a sentence. In addition to the above faults in the communication, it is also possible that certain critical concept is not even thought about, and a document might lack for example, a subordinate clause or a whole explanatory sentence.

In the working group, the lack of procurement experience is a hindrance, in the same way as the lack of the substance understanding is for the procurement specialist. As the understanding of some concepts can be critical for both parties, if needed, the project often requires that the members of the substance familiarise themselves with the basics of procurement work, including the individual responsibilities relating to the work, and that the procurement specialist studies the basics of the service, product or system that is being procured.

A common theme in these problems of non-productivity is the fallibility and the limits of us humans, that leads to a decreased accuracy and quality of the work. The consequence of these problems can be the discontinuance of the procurement.

A second point of non-productivity relates to time use in general. The interviewees expressed how there were challenges in scheduling and staying on schedule. The length of the projects and lack of total available time in general was mentioned several times, as something taken for granted. Even though they are rare, unexpected fast schedule projects were also mentioned as something that can affect one's schedule negatively. Yet another way how time use can be a problem is in the largest procurement projects, where data entry to forms and systems can take a considerable amount of time.

Almost all the above, in section 3, comes from the interviews with the leading procurement specialists and their answers relating directly to the process itself. In addition to questions relating to the actual procurement process, these interviewees were asked a series of more general questions relating to the procurement projects and procurement work. Also, a group of internal stakeholders not directly doing procurement projects were interviewed for the Data 1 stage, with questions relating to the procurement work done at HANPA. These questions were asked to reveal the whole context of the procurement work, so as not to do partial optimization at the expense of the whole. From that second series of questions emerged several insights relating especially to the preparation phase.

One comment mentioned earlier proposed if we should question our project management skills if the working group is unable to proceed with the preparation of the procurement or to stay within the set schedule. Relating to that, interviewee #10 expressed the following:

> The processes are long - but it is easy to get busy, is resourcing a problem at the service end? Is the procurement specialist left alone with something? (Data 1: Informant #10)

According to some interviewees at least a partial reason for the possible working group non-productivity could be caused by the lack of resources.

Each interviewee was also asked what information they would need to be able to do their job better. The answers ranged from desires of data and system integrations to exact examples of what data should be accessible in what system or time (of the procurement process). A common theme in these answers related to time use; data usually exists, but time is wasted in retrieving or processing it.

When asked if there are tasks that should be done elsewhere or by someone else, data entry work was mentioned several times, and that it should probably be done by an assistant. This relates to the theme of time use.

Relating to the previous question, the interviewees were asked if there are tasks that we are not doing now, but that we should do. Several informants responded that OPHA has sometimes too much work, but that is due to the project nature of the work, i.e. there is more work in some phases than in others. Most respondents gave examples of useful things that could be done if there was time for it. This relates to both themes of time use and work accuracy and quality.

As said earlier in section 3.2.1, in its essence, the procurement process is mostly a process of dialogue, and a process of data and information sharing and processing, where imprecise descriptions of objects, systems or services are compared between each other, based on imprecise description of what is needed. As such, it would seem reasonable to assume that non-productivity also happens in the dialogue (and therefore in the machinery of the dialogue, our brains) as well as in the technical sharing and processing of the data and information. These thoughts lead us well to the selection of the non-productivity points most suitable to be tackled with GenAI.

3.4 Selection of the Non-Productivity Points Most Suitable to be Tackled with GenAI

In the previous sub-section, the common themes identified relating to non-productivity included the challenges in the time use and scheduling, and the accuracy and quality of the dialogue and the preparation work.

Relating to the accuracy and quality of work, the aim is to find out if it is possible to raise the working group up to par on the preparation phase work accuracy and quality using GenAI. Or, in other words, is it possible to nullify some human errors with the help of a GenAI.

In relation to the time use, the aim is to find out, if it is possible to overcome the challenges in scheduling, and in having limited amount of time to do the projects, by utilizing GenAI.

3.5 Summary of the Selected Non-Productivity Points in the Process

The current state analysis revealed two clusters of topics of non-productivity that formed the two abovementioned themes of non-productivity. The non-productivity points in the procurement process at HANPA selected for improvement in this study are shown in Table 4.

Table 4. Themes of non-productivity with topic discussed.

Themes of non-productivity	Topics discussed
Accuracy and quality	Mistakes in the preparation; miscommunication and misunderstandings. Possible lack of procurement experience in the working group Possible lack of substance understanding by the procurement specialist Inadequate working group resources
Time use	Challenges in scheduling Challenges in staying on schedule Length of the projects Lack of total available time Unexpected fast schedule projects Data accessibility and retrieval Data entry work Need for an assistant

These two themes listed in Table 4. could be considered worthy targets of optimization from the viewpoint of GenAI, therefore, both are examined in section 4, which provides the literature review which was examined for solution ideas to the selected themes of non-productivity.

4 Literature on Generative Artificial Intelligence in the Context of Improving the Public Procurement Process

This section examines the current literature relating to the use of GenAI for improving the public procurement process for the case organisation. Based on the reviewed literature, most of the solutions, tools and ideas mentioned in this section seem possible already but may not have yet been created in practice at the time of writing.

Previous industrial revolutions have been gradual, with bottlenecks on infrastructure and change happening over decades (Attali and Leggart, 2011, pp. 64-70; Schwab, 2017, pp. 6-11). At the present time, the required infrastructure is somewhat parallel to already existing IT infrastructure, which means that the change has been remarkably fast in comparison to previous industrial revolutions. This is also seen in the selection of research papers and literature on the subject, as some of the papers read were still in pre-print and not yet published when read for this phase of the study.

4.1 GenAI Now and in the Future

At present, GenAI can produce qualitatively impressive text, images, and other media, depending on the model, at times being almost mesmerizing in its expression and depth. The applications and impact of the current versions of GenAI could be profound, even if the progress was to come to a complete halt.

But for the past several years the speed of progress in the realm of AI has been so fast, that it could be even said to disincentive the actual operational solution building, as the solution can end up outdated already before the launch. This leads us to the concept of “wait calculation” in the likely long-term projects, which involves evaluating the risk-reward ratio of early adoption compared to the benefits of waiting for more mature solutions. The questions are, how effective certain variations of AI are, when are they employable, and how much we

save time or resources by waiting? (Mollick, 2024). Or from another perspective, what do we wish from a particular AI solution and how long are we willing to wait for it? The answer for analytical strategy work at STRAHA is different than for creative working group work at a procurement project for a member of the substance or OPHA.

The judgement call of when to go ahead with AI implementation project could be said to be dependent, at the minimum, on understanding of the contextual environment of the business process, the current and likely future states of the AI technology, and the levels of change and disruption the technology could entail. (Mollick, 2024.) This adequately informed framework of the current operational environment could in turn feed into the viewpoints of efficiency, productivity, quality, and process optimization.

As the discussion on AI timelines among the thought leaders has considerable differences (Bostrom, 2014; Grace *et al*, 2024; Poole and Mackworth, 2023; Suleyman and Bhaskar, 2023), it could be said that no one knows even the medium-term impact of the currently developing technological AI landscape, and for now, the totality of expected change is obscured from the view, and what is left is to rely on short term projections. This could, for example, be interpreted to imply that continuous process management and development, at this moment, would have a better expected value than what would have been considered typical in the previous decades, because of the variance in the possible outcomes; a topic that is discussed in section 4.4.5.

As the progression of AI technology will likely be non-linear, understanding of the likely future inflection points in the technology for AI solutions could prove to be useful. One such inflection point could be AI agents; AI agents are an autonomous or semi-autonomous AI's that perform tasks, make decisions, and try to achieve goals, being able to observe their environment through incoming data, analysing the data, and then acting based on the data and AI's goals. (Huang *et al*., 2024; Poole and Mackworth, 2023; Xi *et al.*, 2023; Yang *et al.*, 2023) Being

autonomous, reactive, proactive, and able to be truly social, AI agents could be a major leap even for creative working group tasks at OPHA; more on this in section 4.2.6.

4.2 Ideas for Increased Accuracy and Quality of Work Using GenAI

The integration of GenAI in enhancing the accuracy and quality of creative teamwork has several challenges. For the working group, the preparation of tender documents often involves processes that include brainstorming, conceptual development, and design iteration. These processes rely at times on human intuition, emotional intelligence, and subjective judgment. The objective of this sub-section is to ascertain whether GenAI can complement these human modes of operation as well as attributes by providing solutions to the exact problems expressed in Table 4. and again, in table 5. below, relating to the theme of accuracy and quality.

Table 5. Topics of non-productivity relating to the theme of accuracy and quality.

Theme of non-productivity	Topics discussed
Accuracy and quality	Mistakes in the preparation; miscommunication and misunderstandings. Possible lack of procurement experience in the working group Possible lack of substance understanding by the procurement specialist Inadequate working group resources

These topics relate to communication and collaboration, personal understanding of one's roles and responsibilities in the working group, general understanding of the topic at hand, and to the amount of work in general.

Conversational applications and AI assistants are a theme in literature for increasing productivity for managerial and specialist tasks, as well as for whole

teams, with humans usually being able to focus on more challenging problems while the AI assistant takes the more basic and repeated tasks. (Sowa *et al.*, 2021; Barcaui and Monat, 2023).

4.2.1 GenAI Assisted Communication and Collaboration

For communication and collaboration, GenAI could automate tasks such as sending reminders, notifications, and follow-ups to stakeholders, possibly by utilizing self-directed or autonomous agentic behavior, mentioned in sub-section 4.1., for example by the GenAI deciding from the contextual or historical information what reminders and information the users need. This would help to ensure that everyone is on the same page and that important information is shared as needed. As it is now, GenAI can for example assist the employee in creating drafts and summaries, and in organizing and summarizing information from meetings, reports, and projects, making it easier for team members to access and utilize organizational knowledge.

An additional approach how GenAI could be used as a collaborative tool is as an assistant in the ideation and brainstorming phases of creative projects. GenAI can process vast amounts of data, identify patterns and trends, and suggest novel ideas that might not be immediately obvious to human team members. This solution would utilize the AI's capability to enhance creativity by providing new perspectives and by stimulating innovative thinking (Holmström and Carroll, 2024). It would also position GenAI as a supportive tool that strengthens human capabilities without replacing the creative essence of the human team.

4.2.2 GenAI Assisted Document Generation

To improve accuracy and quality, as well as productivity, when drafting service descriptions and contracts, GenAI could automate repetitive tasks by analyzing the texts of existing service descriptions and contracts, identifying patterns and

common language used, and then generating new text that is similar in structure and meaning. Additionally, GenAI could also be trained to understand the specific requirements and language of a procurement category, allowing it to create more tailored and accurate documents for the projects of that category. Also, by formatting and organizing text under work, and by providing suggestions for language and structure, GenAI could also help to ensure consistency and accuracy in the language used, reducing the risk of errors and misunderstandings. (Dwivedi *et al*., 2023; OpenAI, 2016)

4.2.3 GenAI For Risk Assessment

GenAI could increase the work accuracy by doing risk assessment and data monitoring relating to the service description or contract during the procurement preparation work by analyzing the documents provided and comparing the documents to current legislation, procurement manuals, templates, or checklists. (Chakrabarti *et al*. 2018) GenAI could also provide recommendations on how to mitigate these risks and bring about faster review cycles.

4.2.4 GenAI Assisted Employee Experience Accumulation and Learning

GenAI could help to improve the general understanding of procurement preparation work for the working group members, as well as one's role in the process, by providing relevant and accurate information, summaries, answering questions, and providing guidance. For example, GenAI could help to identify and explain key concepts and terminology related to procurement projects for the members who are doing procurements for the first time. Relating to small-scale procurements done by the substance, where procurements specialists are not necessarily needed, GenAI could also provide guidance through the process, for example on how to prepare and submit a request for tender, as well as how to draft the required documents. (Dwivedi *et al*., 2023; Tamkin *et al*., 2021) In the thesis case organization, an easy way to implement this would be by creating a chat interface to the city's intranet, where GenAI would answer questions

relating to procurements by accessing the current versions of the city's procurement and contract manuals and direct the worker to OPHA in unclear cases.

GenAI could be also used to create customized learning materials and resources for team members; by using project-specific requirements and objectives as inputs, GenAI could be used to generate training documents, FAQs, and guides, thereby enhancing team capabilities and help new employees or inexperienced working group members accumulate work experience at a faster pace. (Brynjolfsson *et al*., 2023; Dwivedi *et al*., 2023; Tamkin *et al*., 2021).

4.2.5 GenAI Assisted Decision Making

By offering novel solution suggestions and ideas, by processing data and simulating scenarios, and by being an intellectual sparring partner, AI could provide an aid for decision-making. When used as a recommender, counterpoint to the possible benefits would be the development of over-reliance and diminishing of user's analytical thinking, if AI is accepted uncritically. But this could also be balanced by using AI as the devil's advocate, by presenting counterarguments or by highlighting the flaws in co-AI-human reasoning. (Ma *et al*., 2024) Open questions are, for example, when and how AI should be leveraged, and how much information should be presented to the human, to avoid cognitive overload (Steyvers and Kumar, 2023).

For public procurement, the use of AI for decision making could, for example, come about as AI doing collusion detection from procurement data, by detecting anomalies or fraudulent activities. By integrating GenAI with internal databases and information management systems, employees could also use natural language queries to access data, reports, and analytics, thereby enhancing data accessibility and decision-making processes. (Siciliani *et al.*, 2023).

4.2.6 GenAI as a Member of a Team

Sub-section 4.1. discussed the concept of AI agent, an AI capable of being autonomous, reactive, proactive, and social. When viewed from those attributes, an outstanding version of AI would have the ability to respond to changes in the environment in a timely and context-appropriate manner, the ability to monitor its environment continuously and adjust its actions based on perceived changes, the ability to be able to anticipate the future needs or problems and acting in advance to address them, and to be able to be a social member of a team, it should be capable of understanding and engaging in human-like interactions. (Xi *et al.*, 2023).

For now, as a tool, AI can fill some roles, in non-agentic capabilities, for example text producer, language editor, research assistant, coach, or innovator – roles that have been examined in this section. (Dwivedi *et al.*, 2023).

4.3 Ideas on Improved Time Use Via GenAI

During the current state analysis carried out in Section 3 of this thesis, problems relating to time use were mentioned by most procurement specialists. The use of GenAI for improving time use relates closely to the topics discussed in the previous sub-section 4.2. through the concepts of productivity and efficiency. As a field of study, time management research is interdisciplinary, combining insights from disciplines such as psychology, business management, and organizational behavior. Empirical research in the field has found that time management behaviors, for example goal and priority setting, could lead to a perception of control over time, affecting job satisfaction positively (Macan, 1994). On the other hand, some research relating to time management research and technology has suggested that digital tools could also have negative effects on productivity, such as information overload from the abundance of information and notifications that leads to unwanted interruptions, which could decrease productivity

and increase stress levels (Mark *et al*, 2008). These viewpoints relate to persons subjective experience on time use, whereas some of the topics mentioned below in table 6. are about the objective lack of time. The challenges relating to time use, especially in the context of productivity and efficiency, are complex.

Table 6. Topics of non-productivity relating to the theme of time use

Theme of non-productivity	Topics discussed
Time use	Challenges in scheduling Challenges in staying on schedule Length of the projects Lack of total available time Unexpected fast schedule projects Data accessibility and retrieval Data entry work Need for an assistant

These topics relate to project management, time management, workload management and information management. The underlying concepts that connect these subjects include organizational efficiency, resource allocation and data management. This sub-section examines the use of GenAI within the theme of time use mainly from the viewpoint of project management, as the work at OPHA is structured around clear-cut procurement projects.

4.3.1 GenAI For Project Management Systems

Challenges in scheduling and staying on schedule, in addition to resource and risk management, are issues that are at the core of project management and that can impact organizational efficiency. Project management systems are digital frameworks that combine processes, methodologies, tools, and technologies to help the planning, execution, and monitoring of projects. (Maylor and Turner, 2022).

With GenAI, optimization of resources and time allocation could be done by utilizing it to assist in the development of project plans and schedules. GenAI could help in drafting project proposals, outlining project scopes, and defining tasks and milestones based on input criteria. Integrating GenAI with project management software could further refine scheduling by suggesting adjustments and optimizations based on project progress and feedback. GenAI could also assist teams in revising project plans and schedules in response to unexpected changes, facilitating decision-making by providing suggestions for adjustments based on predefined criteria and project objectives. Even though AI is a helpful addition to project management work, humans will still bring valuable domain knowledge and a nuanced understanding of organizational and stakeholder goals and expectations. (Barcaui and Monat, 2023).

Relating to inadequate employee resources, a subject that sub-section 4.2. also addressed from various viewpoints, GenAI could help with optimizing worker resource allocation by analyzing the workload and identifying the most efficient way to allocate resources. This could involve analyzing the skills and availability of each worker, as well as the workload and deadlines for each project. GenAI could take into consideration factors such as the priority of each project and the potential impact of resource allocation decisions on overall project timelines and budgets. By using this information, GenAI could suggest the most optimal resource allocation plan to ensure that projects are completed on time and within budget. (Barcaui and Monat, 2023). This paragraph was written from a more generalist viewpoint of project management, as it likely would not apply to work done at OPHA because of the way procurement categories and category work is organized.

The problem of work interruptions was mentioned in the beginning of this subsection as one possible cause of decreased productivity and increased stress levels. GenAI could be used to resolve this issue by prioritizing tasks and alerts based on urgency, importance and historical data on work patterns and project timelines, therefore helping individuals focus on work without being sidetracked

by less critical tasks or alerts relating to them. (Barcaui and Monat, 2023). This also relates to the idea of an AI assistant, that could serve as an intermediary, for example between information requests and the worker, by handling the communication and the actual delivery of the answer or document.

4.3.2 GenAI Assisted Data Entry Work

GenAI, by using machine learning and natural language processing, could automate structured input of data into forms and systems. Traditional data entry methods are usually labour intensive, prone to errors and time-consuming. The automation of data entry tasks using GenAI could help in enhancing operational efficiency, reducing manual errors, and optimizing resource allocation. (Carlan and Vanelslander, 2021).

4.4 Implementation and Transition

The implementation and transition to utilizing GenAI within an organization can be an arduous task involving the modification of processes, workflows, technical infrastructures, employee skills, and, for example, maybe even the way decisions are made. This sub-section is divided into five parts, employee requirements for the transition, challenges, success factors, change management, and the continuous process management and development.

4.4.1 Employee Requirements

From an engineering perspective, the development and optimization of systems and processes will likely rely progressively more on AI-driven analytics and automation. This could require a reevaluation of employee requirements, both an evaluation of what are the necessary new skills and what skills will become obsolete.

It is possible that AI skills could eventually be considered as important as the ability to use the computer on tasks other than to interact with an AI – a viewpoint based on the assumption that AI can eventually, at least partially, operate those other applications on behalf of humans. For most it would mean that work will require at least a combination of AI and domain-specific skills, relating to the actual goal of the employee. Another viewpoint on necessary skills could be a group of human competences, which can be divided into social, emotional, leadership and cultural skills, which could end up defining the difference between tool-orientated versus human orientated work, in a world where AI handles an increasing part of the technical workload. (Johannessen, 2021).

But at this moment, the current skill gap and the pace at which AI is evolving could present challenges in training and maintaining a competent co-human-AI workforce. This includes not only analytical and technical skills in data science and AI but also training in ethical and secure AI use, as well as the ability to integrate AI applications into existing business processes and strategic goals. Investing in comprehensive training, as well as continuous learning and adaptation, is essential for creating an AI-ready culture within organizations. (Chatterjee and Ghosh, 2022; Hopf *et al.*, 2023; Ångstrom *et al.*, 2023).

4.4.2 Challenges of Implementation and Transition

Transition to the use of AI systems has challenges, relating to the actual implementation, data management, reliability of GenAI, legislation, and ethics.

Regarding technical complexity and integration of AI into existing systems, the challenges involved could include for example ensuring software and framework compatibility, computational requirements of infrastructure, and the integration interfaces (API, application programming interface) compatibility. (Palumbo and Edelman, 2023). The goal is to ensure the existing technical infrastructure can support the integration of GenAI and related AI tools. When it comes to data management and security, ensuring the availability, quality, and accessibility of data is a prerequisite to successful AI implementation. This could for example

involve the creation of standardized data governance frameworks to unify data definitions and structure the data, to utilize the data effectively. (Hopf *et al.*, 2023; Lauterbach and Bonime-Blanc, 2018; Weber *et al.*, 2022; Ångstrom *et al.*, 2023).

The issue of GenAI reliability, relating to instances where AI generates incorrect, misleading, or fabricated information, called hallucinations, is a problem possibly highlighting the importance of human-AI collaboration, where the human's role could partially be to verify the work done by AI. (Nah *et al.*, 2023)

On regulatory and compliance issues, legislation related to artificial intelligence passed on EU level on 13.3.2024, whereas on national level, some changes had already been made to existing legislation. If personal data is processed with artificial intelligence, the GDPR, general data protection regulation (EU2016/679) and compliance to it must also be considered.

On ethical and societal implications, the deployment of GenAI systems could have a multitude of consequences and side effects, for example, job displacement, biases in decision-making, privacy issues, and the potential for misuse. Addressing these implications could require a joint approach from AI developers and policymakers, and maybe even the whole society. (Floridi and Cowls, 2019)

4.4.3 Success Factors

In addition to overcoming the challenges mentioned above, the deployment of GenAI benefits from addressing some key success factors, including leadership support, business value addition, funds, and tool design.

Leadership support and strategic alignment from the organization's leaders and policymakers is crucial. Their vision should outline the objectives, expected outcomes, and the role of GenAI in achieving development goals, providing a roadmap for implementation. (Chatterjee and Ghosh, 2022; Guida *et al.*, 2023; Ångstrom *et al.*, 2023).

Regarding business value addition and adequate funds, conducting a thorough cost-benefit analysis to understand the economic implications and value generation of GenAI applications is also important. Depending on the organization, this could help in prioritizing investments and ensuring that resources are allocated effectively to areas with the highest impact. (Chatterjee and Ghosh, 2022)

Tool design, both from the functional and usability viewpoints, is also crucial, as it is often the point of contact between the worker and the process. Intuitive and simple user interface can achieve on smaller scale parts of the same benefits as GenAI in general: more time for value added work done by the human. (Chatterjee and Ghosh, 2022)

4.4.4 Change Management

Change management, a structured approach to supervising the transition in some organizational element or elements, should be considered almost necessary in the case of AI implementation to organizational processes and technologies. Stakeholder engagement and communication, workforce development mentioned earlier, and support structures are some of the themes that could be addressed to help employees to adapt to the coming change.

Important elements would be early and continuous communication of benefits and objectives to the stakeholders, as well as user involvement in the change process, and addressing any concerns and questions. (Buschmeyer *et al.*, 2022).

Another viewpoint found in the literature discussed the reconciliation of tension between artisanal craftwork perspective of data scientists, highlighting mastery, creativity and all-roundedness, to mechanical perspective of efficiency and predictability, often followed by managers. This tension could manifest for example as inflated management expectations, treating AI projects as traditional IT projects or lacking the understanding of organizational needs for predictability, efficiency, and clear communication. Solutions to these differing viewpoints could

include educational initiatives towards managers, executives and data scientists, flexible project management approaches allowing continuous learning and adjustments to unforeseen challenges, as well as the formation of cross-functional teams encouraging both innovation and organizational goals. (Hopf *et al.*, 2023).

4.4.5 AI Assisted Process Management and Development

Business process management (BPM) is about focusing on the management of organizational work to ensure consistent outcomes and to capitalize on improvement opportunities. From individual tasks, the approach extends to managing entire sequences of events, activities, and decisions that bring value to an organization and its customers. BPM is based on a variety of tools and methodologies that help the identification, discovery, analysis, redesign, implementation, and monitoring of business processes. (Dumas *et al*, 2018). Appropriately, this could also be done with the help of GenAI. (Vidgof *et al.*, 2023).

In the identification and discovery phase GenAI could be used to automate the extraction and synthesis of information from large amounts of varied documentation. In the analysis phase GenAI could assist in identifying issues within processes by, again, analyzing large volumes of unstructured text from various sources. During redesign and implementation GenAI could help by generating innovative improvement suggestions and by providing detailed explanations of process models (Holmström and Carroll, 2024; Vidgof *et al.*, 2023). For monitoring, assuming the process generates a continuous flow of data, GenAI could generate quick summaries of process performance, as needed. (Vidgof *et al.*, 2023).

4.5 Conceptual Framework

The ideas and concepts found from the literature, discussed in this section are summarized in a conceptual framework. The conceptual framework is presented as a group of lists in Figure 4.1.

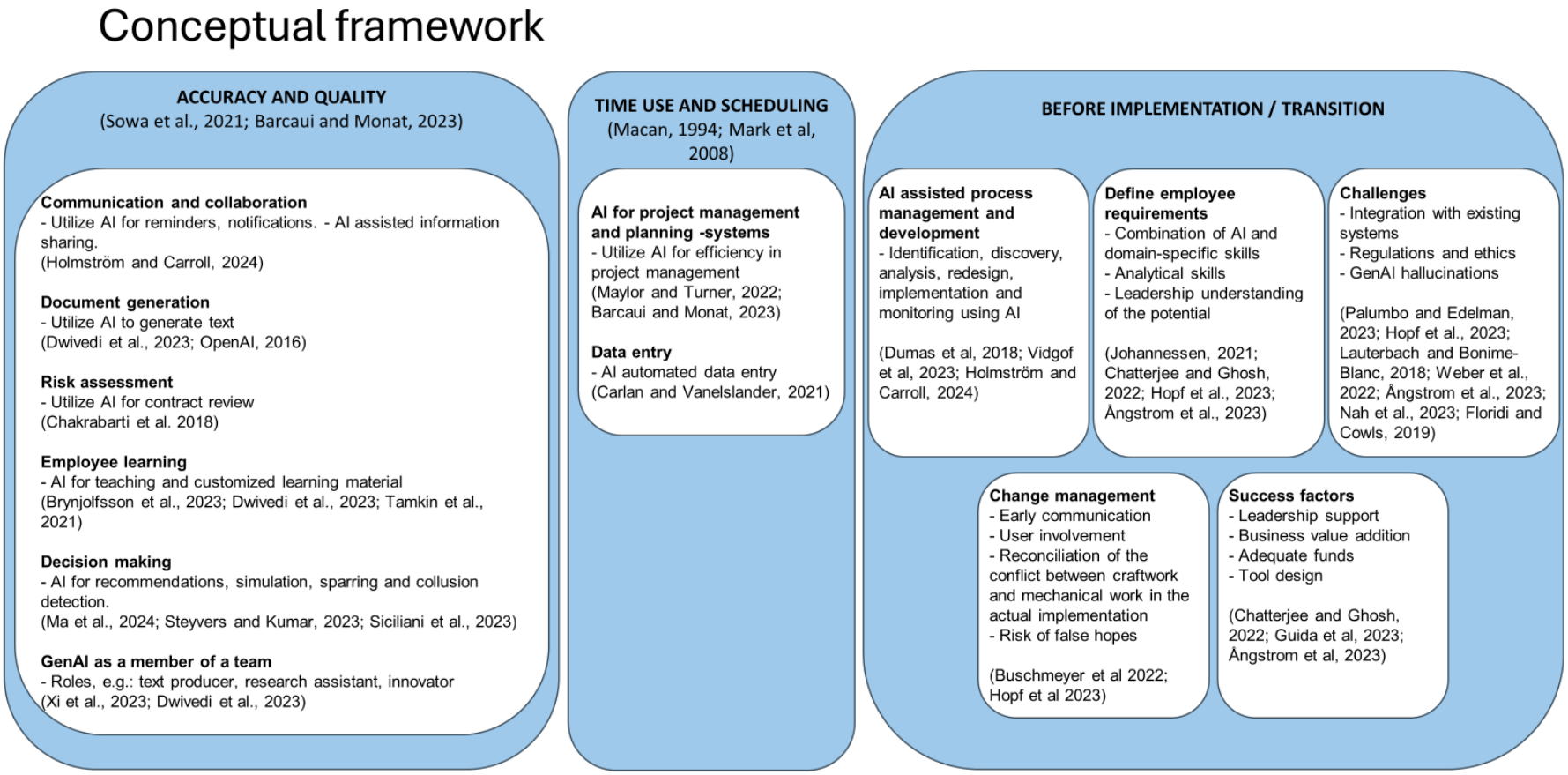

Figure 4.1 Conceptual framework of the study

In Figure 4.1, the conceptual framework is built of four parts. The first part examines the uncertainty of the future state of the technology. The second part presents an assortment of ideas on the use of AI for accuracy and quality, for example for communication and collaboration, risk assessment and decision making. The third part presents ideas on the use of AI for time use and scheduling. Lastly, the fourth part examines what should be considered before implementation and transition, for example, the use of AI for process management, and the challenges and success factors of transition.

In next section the ideas presented in the conceptual framework are examined and applied with the stakeholders, to develop the initial set of recommendations on how to utilize GenAI tools for an improved procurement process.

5 Developing Recommendations on How to Utilize GenAI Tools to Improve Public Procurement Process

In this section the results of current state analysis and the conceptual framework are used to create recommendations on how to utilize GenAI tools to improve public procurement process at Helsinki SOTEPE Procurement and contract services. The first sub-section presents the overview of the proposal building. The next sub-section examines the findings of the Data collection 2. The last sub-section presents the summary of initial proposal for the improved public procurement process.

5.1 Overview of the Proposal Building

The objective of the study is to give recommendations on how to utilize the GenAI tools to improve the public procurement process.

The proposal building workshop for Data 2 was organized as follows. The results of the Data 1 were presented and briefly commented, after which the ideas found from literature were presented, examined, and discussed more closely. After the presentation and the ensuing discussion, the stakeholders continued the proposal building in small groups. After the small group stage, the notes created by the groups were discussed by everyone in attendance. The notes by the participants and the field notes by author formed the Data 2.

The participants for the Data 2 workshop, seen in Table 2 of the thesis, were mostly the same as those interviewed for the Data 1, except for the addition of procurement specialists to this stage.

5.2 Findings of Data Collection 2

The expected outcome of Data Collection 2 was to co-create a set of initial recommendations to present to decision-makers in the validation stage. The findings from the current state analysis combined with the contextual framework

were used as a basis for discussions of Data Collection 2, which lead to the initial co-created recommendations. The stakeholders went through discussions on what ideas and solutions they found most desirable and useful, as well as on what should be done during implementation and transition to the use of the solutions.

5.2.1 Improving Accuracy and Quality

The co-creation of the recommendations for the most useful functionalities for AI tools for the public procurement process, to improve accuracy and quality, led to a selection of recommendations and comments. The recommendations regarding accuracy and quality are shown in Table 7 below. The process steps mentioned in the text and tables below refer to Figure 3.1.

Table 7. Co-created recommendations to improve accuracy and quality.

Co-created recommendations to improve accuracy and quality			
	Theme from CSA	**Recommendation**	**Additional information**
1	Accuracy and quality	AI checks tender requirements, analysing and prioritizing offers	Process steps 3.3 and 3.5
2	Accuracy and quality	AI assists in using case management and decision making system	Process steps 2.1 and 4.5.
3	Accuracy and quality	AI parses the decision texts	Process step 4.1
4	Accuracy and quality	AI makes the contracts	Process step 4.5
5	Accuracy and quality	Writing documents: AI helps with text production, editing and formatting, notifies of repetitions, and corrects sentence structures	Most steps throughout the process.
6	Accuracy and quality	Writing documents: AI finds contradictions, and does double checking	Most steps throughout the process.
7	Accuracy and quality	Writing documents: AI peer reviews documents	Most steps throughout the process.
8	Accuracy and quality	Risk assessment: AI checks and compares contracts and service descriptions to existing documentation	Process steps 1.4 and 4.5.
9	Accuracy and quality	Risk assessment: AI reviews legislation and its relationship to documents	Process steps 1.4 and 4.5.
10	Accuracy and quality	Training for: AI assists in general employee skills development	Training during employment.
11	Accuracy and quality	Training for: AI assists in inducting employee to work or role	Training of new employees.

The stakeholders recommended that AI should be used to check tender requirements, do analysis, and prioritizing of offers during process steps 3.3 and 3.5, therefore possibly reducing errors in these phases. This should help in reducing the number of appeals and claims for rectification during process step 4.2.

For the process steps 2.1 and 4.5, it was recommended that AI should assist in the use of Ahjo-system, a case management and decision-making system, presuming that the AI functionalities can be integrated into the system.

During process step 4.1 AI can be used to draft and check the decision texts to be presented to the municipal board committee, and for the process step 4.5 AI can assist in making the contracts. The stakeholders mentioned both cases as desirable, to increase accuracy and quality for document generation.

The benefits in the examples shown in the previous paragraph apply for most steps of the process, as AH can assist in writing a diverse number of different documents. It was recommended that AI to be used to help with text production, editing and formatting, and to notify of excessive repetitions, and correct sentence structures. It was also recommended to use AI to find contradictions in texts and do double checks, and to use AI to peer review documents; as mentioned in section 4.2.2, AI would analyse and compare draft to existing documentation and create context appropriate suggestions for the ongoing procurement.

It was proposed that AI should be used in process steps 1.4 and 4.5 AI for risk assessment, to check and compare contracts and service descriptions to current legislation, procurement manuals, templates, and checklists, as mentioned in section 4.2.3. Further, it was proposed to use AI to review legislation and its relationship to existing documents.

The stakeholders suggested that AI should be used for training of both experienced and new employees. For experienced employees it should be used for general employee skills development, whereas for new employees it should be used for induction to new work or role.

5.2.2 Improving Time Use

Continuing from the previous sub-section, it should be noted that even though the recommendations on accuracy and quality presented in the previous sub-section as well as the ideas on accuracy and quality presented in section 4.2 were labelled as such, regardless, most of them also relate to time use by AI possibly being able to do same quality work faster than what humans are capable of. The recommendations regarding time use are shown in Table 8 below.

Table 8. Co-created recommendations to improve time use.

Co-created recommendations to improve time use			
	Theme from CSA	**Recommendation**	**Additional information**
1	Time use	During contract period, AI is used to process price increases	Process step 5.3.
2	Time use	AI handles 3rd party data requests	Arduous extra work that can require knowledge of large number of previous procurements.

The stakeholders commented that AI could be used for processing price increases. If a contract allows it, contractual price increases can happen once a year, and are usually based on contract terms and possibly applicable index or indices by the Statistics Finland (Statistics Finland, 2024). At its simplest, the proposal usually comes by email, is compared to contract and indices, forwarded to decision maker along with calculations, the answer is drafted to suit the decision, transferred to the Ahjo-system for signature, and sent to one who made the proposal. With an agentic AI, most if not all these steps done at HANPA's end could be automated in the future.

Another proposal relating to time use was to use AI to handle the data searches needed for 3rd party data requests. These requests often include several contract entities, each contract entity containing several contracts, therefore possibly being a substantial amount of work even for an experienced procurement specialist.

During the workshop, in addition to asking questions on what the stakeholders view as worthwhile implementation worthy ideas relating to the presented literature, the author also asked questions on how the procurement specialists would use the extra time gained.

Table 9. Co-creation, on how to use extra time.

Co-creation, on how to use extra time			
	Theme from CSA	**Comments from stakeholders**	**Additional information**
1	Accuracy and quality	Studying and participating in training programs	
2	Accuracy and quality	General professional skill development	
3	Time use	Decreasing the response delay in communication	
4	Time use	Time for better quality	Especially regarding process step 1.4.
5	Time use	Time for creativity	Especially regarding process step 1.4.
6	Time use	More procurements	
7	null	80% working time	Some stakeholders expressed interest in 4-day workweek.

Similarly, as it was recommended to use AI to train employees, stakeholders expressed the desire to use time gained using AI to increase the capabilities of procurement specialists, by participating in training programs. As it is, the work requires constant learning and relearning as laws, regulations, tools, and the operational environment changes.

Next comment related to communication and response delays; the stakeholders stated that the use AI would likely enable faster replies to emails and other forms of communication.

The lack of time for creativity and better quality was a problem mentioned during the current state analysis, and again during the workshop as a possible use for the extra time gained from the use of AI. Both would likely lead to improvements, especially in process step 1.4, where preparation of tender documents

happens. An example of this is in changing the procurement process itself; the open procedure shown in Figure 3.1 is the most common way to organize a public procurement; given extra time, the use of other procedures would become more frequent.

The last comments about the use of extra time were the ability to do more procurements, and the possibility of doing a four-day workweek if the use of AI was to give enough free time. I.e. more of the actual core work or less hours at work.

The next topic of discussion was on how to utilize the possible future GenAI-agent assistants in the public procurement process. These recommendations by the stakeholders related and were expressed mostly through time use, even though the recommendations could also be examined as improvements in accuracy and quality.

Table 10. Co-created recommendations on how to utilize GenAI-agent assistants.

Co-created recommendations on how to utilize GenAI-agent assistant			
	Theme from CSA	**Recommendation**	**Additional information**
1	Time use	AI does data transfers between systems	Process steps 2.1, 3.1, 4.1, 4.5 and 5.1.
2	Time use	AI does contract changes	Process step 5.3.
3	Time use	AI does contract information extraction	
4	Time use	AI does post notifications	Process step 5.2.
5	Time use	AI does analysis and data processing in spreadsheets	Process steps 3.3 and 3.5.
6	Accuracy and quality	AI does procurement calendar updates	
7	Time use	AI does data compilations	
8	Time use	AI does reports	

This topic was considered significant because of the likely versatility of agent-assistant solutions. As it is, at the spring of 2024, the functionalities of AI agents are limited in their use cases. But the expectation is that agentic functionalities will be implemented to generic GenAI's (generic in function, not to be mistaken

for AGI) in the near future. This topic was touched upon in sub-sections 4.1 and 4.2.6.

As said in sub-section 4.1 AI agents are an autonomous or semi-autonomous AI's that perform task, which, for example, means that AI agents can operate computer on behalf of human. As such, it was recommended that GenAI agents should do data transfers between systems, as well as data entry to systems and forms. This recommendation touches several steps of the public procurement process, as shown in table 10 row 1.

The stakeholders proposed to use GenAI agents for contract changes, made during the contract period (process step 5.3) involving a brief analysis of the current version of contract, the change required, generation of the new document, and a validation of the change. Mentioned in sub-section 4.2.2 on GenAI assisted document generation, GenAI can be used to automate the generation of documents. The use of GenAI for contract changes is possible already, but adding agentic functionalities to the process will make the work even more efficient.

The logic explained in previous paragraph also applies when GenAI is used for contract information extraction; the document is analyzed, the required parts are extracted and moved to a new document. This same logic also applies to gathering and editing of third-party data compilations; applicable network folders are scanned for relevant files, and the required data is compiled.

For EU procurements, it was proposed to use GenAI agents in process step 5.2 for drafting and posting follow-up notifications to HILMA system. As it is, GenAI can be used to draft notification documents, referring to sub-section 4.2.2, but the execution of posting of the notification would likely require use of agentic functionalities mentioned in sub-section 4.1.

The process steps 3.3 and 3.5 both require analysis and data processing with a spreadsheet editor. Mentioned in sub-section 4.2.5, GenAI can be used for data

analysis and processing, and decision making. The stakeholders recommended that GenAI agents should be used to assist in these parts of the process; depending on the size of the procurement project, work done with spreadsheets can consume a significant amount of total time used by the procurement specialist.

The next proposal by the stakeholders was on the use of GenAI for procurement calendar updates. The procurement calendar is an interactive Power BI dashboard used for procurement and contract data visualization. In this situation, the use of GenAI would require agentic functionalities mentioned in subsection 4.1, as the process of the update requires the use of Power BI -system.

The last recommendation regarding the topic of the use of GenAI agent assistants was on reports to leadership. This relates to both sub-sections 4.2.2 and 4.2.5, as the work often consists of document generation and data analysis. The logic follows what is mentioned earlier; the subject is reviewed and analyzed, and a new document is generated based on the subject.

5.2.3 Implementation and Transition

The next step of the co-creation process was to consider the pre-requisites of the implementation of AI-tools and transition to their use. Themes of the discussion divided to addressing training-requirements and what should be done beforehand.

Table 11. Co-created recommendations for implementation and transition

Co-created recommendations for implementation and transition			
	Theme	**Recommendation**	**Additional information**
1	Training	Introductory and basic use training	
2	Training	Tool and task specific training	
3	Training	Training through practical examples	
4	Training	Instructions on the logic of use	
5	Training	Training on how to ask the right questions	
6	Training	Training on how to be critical of AI answers	
7	Training	Instructions on how to not misuse AI	
8	Training	How to identify risks	
9	Training	Guidelines on data protection	
10	What to do	Agreeing on "general rules of the game"	Rules on how to use and not to use AI
11	What to do	Monitoring, supervision and auditing of artificial intelligence	
12	What to do	Organizing a working group	Group for planning and deployment of AI solutions.
13	What to do	Pilot projects	

Based on the ideas presented from sub-section 4.4.1, the stakeholders gave a series of recommendations, or requests, on how they should be trained in the use of GenAI tools.

Regarding basic use and tool-specific training, it was requested that the stakeholders were familiarized with the foundations of AI and its use, as well as specific functionalities of AI tools. This would mean step-by-step guides on how to navigate the interface and the features of the tools, possibly combined with realistic simulations that allow the practice in controlled environment.

The next recommendation was on receiving training through practical examples, i.e. hands-on workshop sessions where users would apply AI tools to solve specific problems with the guidance of an expert.

The next topic that the stakeholders conversed on was the uncertainty on the quality of answers the GenAI gives back to the user. The stakeholders recommended that they should be given training on how to ask the right questions and that they should receive instructions on the logic of GenAI use. This relates to the subject of prompt engineering, i.e. the process of designing GenAI tool inputs for the desired output.

Continuing from the previous paragraph, the stakeholders also recommended training on how to be critical of GenAI answers, as well as instructions on how to not misuse GenAI. This would require education on the limitations and potential biases of GenAI tools, as well as skills in critical thinking and rationality to assess GenAI's accuracy, relevance, and applicability. To ensure ethical use, training should include clear rules and examples of what constitutes misuse.

To help users to recognize and mitigate potential risks associated with GenAI use, the common risks should first be identified, after which strategies should be developed and implemented to minimize them, along with training that is given to stakeholders on said risks.

On data protection, the stakeholders recommended that the goal should be to educate users on its importance and secure data handling practices. This could include education on relevant legislation, combined with best practices on data handling procedures.

The next theme was on what to do in addition to training programs mentioned previously. It was recommended that there should be an agreement on "general rules of the game", meaning that there should be a predefined and agreed upon set of rules on how to use and not to use GenAI tools. Second, it was recommended that, if possible, AI should be monitored, supervised, and regularly audited.

The final proposal was on organizing a working group. The group would review other work processes at HANPA; i.e. try to find answers in what other processes GenAI could assist the employees. In addition to searching for solutions, the group would do planning for piloting and the actual use of GenAI tools. Relating to training about GenAI risks, the group would do risk identification and prevention planning. And relating to training, the group would plan and implement training and instructions.

5.3 Summary of the Initial Proposal for an Improved Public Procurement Process

The co-created proposals from the workshop were presented in sub-section 5.2. The summary of proposals is presented in Figure 5.1.

Co-created initial recommendations and commentary

Co-created recommendations to improve accuracy and quality
AI checks tender requirements, analysing and prioritizing offers
AI assists in using case management and decision making system
AI parses the decision texts
AI makes the contracts
Writing documents: AI helps with text production, editing and formatting, notifies of repetitions, and corrects sentence structures
Writing documents: AI finds contradictions, and does double checking
Writing documents: AI peer reviews documents
Risk assessment: AI checks and compares contracts and service descriptions to existing documentation
Risk assessment: AI reviews legislation and its relationship to documents
Training for: AI assists in general employee skills development
Training for: AI assists in inducting employee to work or role

Co-created recommendations to improve time use
During contract period, AI is used to process price increases
AI handles 3rd party data requests

Co-creation, commentary on how to use extra time
Studying and participating in training programs
General professional skill development
Decreasing the response delay in communication
Time for better quality and creativity
More procurements and/or 80% working time

Co-created recommendations on how to utilize GenAI-agent assistant
AI does data transfers between systems
AI does contract changes
AI does contract information extraction
AI does post notifications
AI does analysis and data processing in spreadsheets
AI does procurement calendar updates
AI does data compilations
AI does reports

Co-created recommendations for implementation and transition
Introductory and basic use training; Tool and task specific training
Training through practical examples
Training on how to ask the right questions; Instructions on the logic of use
Training on how to be critical of AI answers; Instructions on how to not misuse AI
How to identify risks; Guidelines on data protection
Agreeing on "general rules of the game"
Monitoring, supervision and auditing of artificial intelligence
Organizing a working group
Pilot projects

Figure 5.1. Co-created initial recommendations.

As seen in Figure 5.1, the co-creation workshop produced recommendations on four separate subjects, first on improving time accuracy and quality, second on improving time use, third on how to utilize GenAI-agent assistants, and fourth on implementation and transition, as well as commentary on how the stakeholders think extra time could be used.

In the next section of the thesis, the co-created initial recommendations are presented to the stakeholders for validation.

6 Feedback and Validation of the Recommendations

In this section the results of the validation stage are reported. The first sub-section presents the overview of the validation stage. The second sub-section reviews the feedback by the stakeholders. After the validation the final recommendations are presented.

6.1 Overview of the Initial Proposal Validation

The previous part of the thesis presented the co-created initial recommendations, which was based on the current state analysis and contextual framework. The validation was done in one Teams-meeting. The author presented to the stakeholders the objective, results of the current state analysis, ideas from the literature, and the initial co-created recommendations. The stakeholders present at the meeting were procurement manager of OPHA and the unit manager of STRAHA. After the presentation, the literature and the co-created recommendations were discussed. The stakeholders validated the work, and gave feedback and improvement proposals, based on which the final recommendations were created.

6.2 Feedback Received and Corrections to Initial Process

The stakeholders agreed with the recommendations as a basis of action for the likely changes that the GenAI tools will bring to the workplace. The feedback given was forward-looking and encouraging.

The stakeholders gave some remarks and changes to the co-created initial recommendations and commentary. The changes can be seen in Table 12.

Table 12. Validation of initial recommendations, changes.

Validation of initial recommendations, changes			
	Theme	**Changes to initial recommendations**	**Additional information**
1	null	Wait for Copilot-data from STRAHA	STRAHA is testing MS Copilot, wait for their initial impressions.
2	null	Consider assembling working group when Copilot-data has been analysed	
3	null	Draft use case presentations for the leadership	

The first change was to wait for an ongoing project at STRAHA to end. The employees at STRAHA are testing the use of Microsoft Copilot and trying to evaluate on what work steps the Copilot offers extra value for them, and the Copilot can and should be used, considering its current capabilities.

Based on the Copilot analysis results, the next step is to consider assembling a working group, to find answers if GenAI tools would benefit other teams in HANPA, to plan the use of GenAI in those other processes, and to plan training and manuals for the use.

The differences in the work processes between OPHA, STRAHA and other teams in HANPA need to be considered when doing the evaluation on the usefulness of GenAI solutions, as well as the needs for different kinds of training.

The stakeholders also expressed the importance of gathering and reviewing applicable case studies of successful GenAI implementation projects elsewhere, in- and outside of the organization.

6.3 Summary of Final Proposal on How to Improve the Public Procurement Process

The changes to the initial recommendations can be seen in Figure 6.1, marked with orange colour.

Validated final recommendations and commentary
Recommendations to improve accuracy and quality
AI checks tender requirements, analysing and prioritizing offers
AI assists in using case management and decision making system
AI parses the decision texts
AI makes the contracts
Writing documents: AI helps with text production, editing and formatting, notifies of repetitions, and corrects sentence structures
Writing documents: AI finds contradictions, and does double checking
Writing documents: AI peer reviews documents
Risk assessment: AI checks and compares contracts and service descriptions to existing documentation
Risk assessment: AI reviews legislation and its relationship to documents
Training for: AI assists in general employee skills development
Training for: AI assists in inducting employee to work or role
Recommendations to improve time use
During contract period, AI is used to process price increases
AI handles 3rd party data requests
Commentary on how to use extra time
More procurement projects
Decreasing the response delay in communication
Time for better quality and creativity
Professional skill development
Recommendations on how to utilize GenAI-agent assistant
AI does data transfers between systems
AI does contract changes
AI does contract information extraction
AI does post notifications
AI does analysis and data processing in spreadsheets
AI does procurement calendar updates
AI does data compilations
AI does reports
Recommendations for implementation and transition
Introductory and basic use training; Tool and task specific training
Training through practical examples
Training on how to ask the right questions; Instructions on the logic of use
Training on how to be critical of AI answers; Instructions on how to not misuse AI
How to identify risks; Guidelines on data protection
Agreeing on "general rules of the game"
Monitoring, supervision and auditing of artificial intelligence
Wait for Copilot-data from STRAHA
Consider assembling working group when Copilot-data has been analysed
Draft use case presentations for the leadership
Pilot projects

Figure 6.1. Validated final recommendations and commentary.

Figure 6.1 presents the outcome of the thesis, recommendations on how to utilize GenAI tools to improve the public procurement process. This section ends the development of the recommendations. In the next section follows the discussion and conclusions on the thesis.

7 Discussion and Conclusions

This final section presents the summary of this study, recommendations for the next steps, self-evaluation of the work and the outcomes, as well as the closing words.

7.1 Executive Summary

As said in sub-section 1.1, for the SOTEPE division of the city of Helsinki, because of the aging population, both the costs and the number of required services is increasing at the same time as SOTEPE is constrained by the limited annual index raise to its budget. To rephrase and simplify the problem, the inputs will increasingly lag the outputs required by the legislation. The options seem to be to make budget cuts, decrease the unit cost of operations by increasing the efficiency, or to decrease the outputs and/or quality.

The objective of this study was to propose recommendations on how to utilize GenAI tools to improve the public procurement process. The connection between the problem and the objective was the possibility that GenAI as it was at the autumn of 2023 was enough to offer a considerable increase to the efficiency of most administrative or back-office work processes in the following years, as the task specific GenAI tools are developed and available. The outcome of the study, the co-created recommendations on how to utilize GenAI tools to improve the public procurement process, gives an outline of what the tools could do in the selected process, as well as what actions would help the department to implement the tools as they become available.

The research design of the study had four phases. The first phase of the study comprised of a current state analysis of the case organization public procurement process, including an analysis of the non-productivity points in the process. The phase was run as one-on-one interviews with the department stake-

holders. The composed field notes were later structured according to the process steps and interview topics. The themes of non-productivity found from the analysis were time use, and the accuracy and quality of work. It is noteworthy that the points of non-productivity identified in the interviews, where significant self-criticism was shown at times by the interviewees, are universal problems related to work efficiency that almost every organization struggles with. Considering that no other evident problems were found in the interviews, the current state of the process seems to be excellent.

The themes of non-productivity from the first phase formed the base for the second phase of the study, where a conceptual framework was created. Conceptual framework presented a synthesis on ideas and relevant information on the use of GenAI in the context of public procurement process, based on relevant literature. The themes presented in the framework addressed time use, accuracy, and quality, as well as what to do before implementation and during the transition.

In the third phase both the results of the current state analysis and the conceptual framework were discussed with the stakeholders and used as a basis for the co-creation of initial recommendations. The workshop included most of the same stakeholders who were interviewed for the current state analyses, as well as an additional group of procurement specialists. After the initial presentation and discussion, the stakeholders formed small groups to co-create the initial recommendations, after which the outcomes were jointly reviewed and discussed further.

In the fourth phase, the end-results of the third phase were presented for the management of OPHA and STRAHA for validation, along with objective, outcome, and the summaries of the current state analysis and conceptual framework. The initial recommendations were reviewed, after which the management team offered feedback on the project. The final co-created recommendations can be seen in Figure 6.1 in sub-section 6.3.

Finally, continuing from the second paragraph of this sub-section, on the usefulness and relevance of the technology, the theoretical upper boundaries of process improvements and efficiency gained from AI in the context of HANPA and the public procurement process is currently hard to estimate. The utility of chat based GenAI's is partially based on the skills of the user, i.e. training, enthusiasm and the ability to learn, which underlines the importance of training programs for the stakeholders. But the possible eventual transition from a human initiated interaction to an autonomous, social, proactive, and reactive AI agents or AGI with a better ability to understand the context of action and the environment, and therefore the AI being able to give better feedback and recommendations, as well as being able to automate process tasks, will likely cause the upper boundaries to be more easily obtainable. Time will tell what the extent of the process improvements will ultimately be.

7.2 Recommendations for Next Steps

How the recommendations are realised, depends both on the GenAI tools that are created in the following years based on the current technology, as well as on the technological change of the field itself, affecting said tools.

The short-term next steps discussed in sub-section 6.2 were to wait for the Copilot-data from STRAHA, and based on the data to consider when the right time is to assemble a working group, for example, to map out what other processes could be redesigned, how the processes would be redesigned, with what GenAI tools, and what training programs are needed.

The concept of wait calculation and the likely coming jumps in the capabilities of AI is a subject that should be viewed as a one continuing point of attention and analysis when considering what to do next. Some recommendations can already be realised with a basic use of GenAI chatbots or Copilot, latter of which is in testing in the city of Helsinki. But some recommendations, for example,

with multi-step tasks should likely be kept on hold until agent functionalities are available.

7.3 Self-Evaluation of Thesis Project Credibility

This self-evaluation of thesis project credibility consists of defining the evaluation criteria and the details of the project that the criteria are applied to, and the actual self-evaluation based on the criteria and the details. The applied criteria chosen for the self-evaluation are based on the work of Lincoln and Guba (Bell et al, 2019), who proposed a way to assessing qualitative research based on trustworthiness. The criteria of trustworthiness were credibility, transferability, dependability, and confirmability. (Bell et al, 2019).

Credibility, akin to internal validity in quantitative research, refers to the quality of the methods, or if the data collected was accurate (Bell et al, 2019.) The credibility of the study was fulfilled by using applicable research approach and design, based on the business problem and study objective, which are described in section 1 and again in sub-section 7.1. The study was organized according to the guidelines of qualitative research approach and suitable research design, with the help and guidance from the thesis supervisors. Research approach and design are described in section 2. The fulfilment of the research design phases is described in sections 3 to 6.

Credibility of the study is also based on the applied methodology of triangulation, of having multiple informants and data sources, multiple perspectives from the literature, and having a process of co-creation of solutions (Bell et al, 2019.) For the current state analysis, Data 1, the author read relevant internal documentation and conducted thirteen interviews with the stakeholders. In the literature review phase, summarised in the conceptual framework in section 4, a number of sources were found, a list of which is in the references, with concepts and ideas showing a possible adequate expected value. During the co-creation

phase for Data 2, a workshop with eighteen participants including the author, results from the current state analysis and literature review were presented, and a series of recommendations was formulated by the stakeholders. The validation for Data 2, leading to Data 3, was done by the leaders of OPHA and STRAHA, the first directing the public procurement process, and the second leading the team in which Copilot is tested in the department. The validation included a review of the previous phases and their results.

Another source of validation for the research design itself can found from the process of business process management and development discussed in section 4.4.5, and as seen in Figure 7.1.

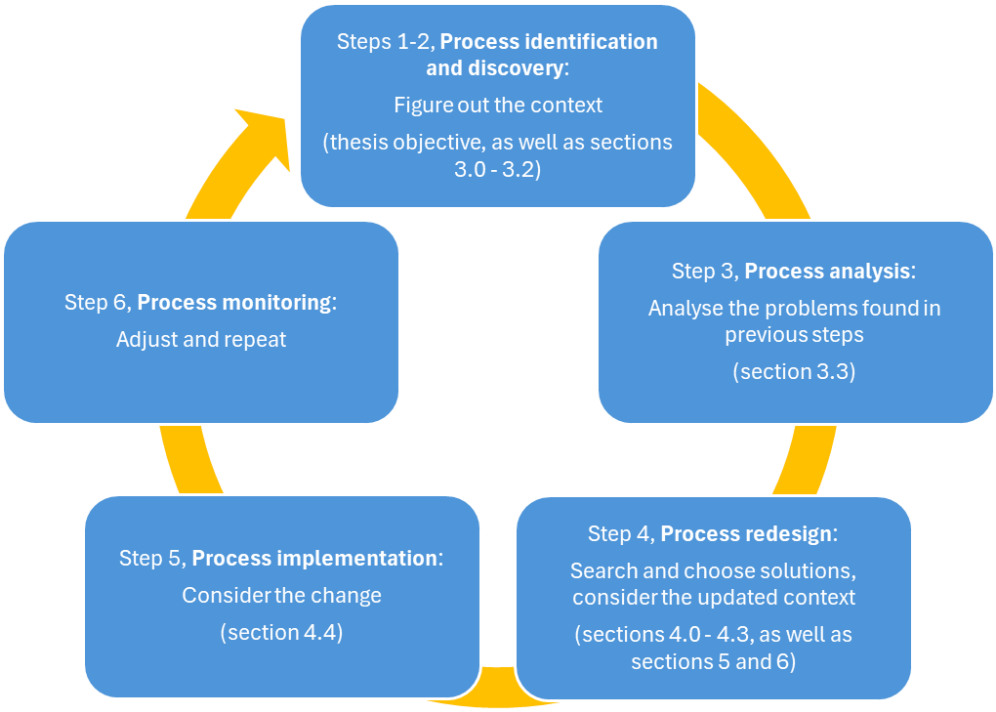

Figure 7.1 Process improvement cycle in the context of this thesis

The research design method followed in the creation of this study is similar to the process of business process management found in the literature. (Dumas *et al*, 2018.)

Transferability, akin to external validity in quantitative research, refers to the extent of the outcomes applying in other contexts (Bell et al, 2019.) Whether in HANPA, SOTEPE division, the city, or other organizations, considering the almost universal nature of the individual tasks the recommendations are intended for, it is not unlikely that at least some of the recommendations would be applicable to many administrative processes as is, or with slight modifications.

Dependability, akin to reliability, refers to the consistency of study results, and if the description of the study methods and results would allow the study to be replicated if the study was done again (Bell et al, 2019.) The study being done again in the context of the HANPA department, before any possible AI training courses that could affect the outcome, the answer would likely be positive. Considering how the public procurement process is defined by the legislation, it is also likely that similar studies in other similar procurement and contract departments in the public sector would lead to similar results.

Confirmability, akin to objectivity, questions if the author was unbiased in his approach to the thesis. Biases might be found, for example, in study design, stakeholder selection, interviews, data recall, data selection, or data analysis. (Bell et al, 2019). Additionally, potential source of bias for the author was, at minimum, having worked with the stakeholders. The fixed research approach and design, combined with having a large group of involved stakeholders, a varied set of literature, and documentation of the process, hopefully alleviates some of the flaws of being a human.

Considering these criteria and the relevance of the outcome mentioned in subsection 7.1, the author regards the objective achieved.

7.4 Closing Words

The field of procurement at SOTEPE is growing increasingly complex and challenging due to its interaction with numerous social issues. OPHA consistently needs to address various difficult and novel problems in procurement and

throughout the contract period that are unrelated to the technical aspects of procurement. As such, tools that could help in solving problems in general should prove to be particularly useful.

The advance of artificial intelligence affects a multitude of things other than business processes, some of them exciting and some unsettling. Through productivity gains, AI agents and AGI can be thought to be equal to an unprecedented labour force expansion. Therefore, what happens to the economic value of human work? What happens to the competitive differences between industrialized countries and economic zones? As Finland is dependent on foreign trade, ignoring this technology is not an option. These are critical questions that will need answers.

Similarly to how the now ongoing fourth industrial revolution has been exceptionally fast, the required training for the workforce should likely be equally fast, considering the competition mentioned in the previous paragraph. Thus, AI literacy matters.

The author feels a sense of urgency. But for now, while curiously waiting for the future, the author hopes to have contributed to a fruitful discussion on the subject, at least in his workplace.

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