



# **THE USE OF GENERATIVE ARTIFICIAL INTELLIGENCE FROM AN INNOVATION PROCESS PERSPECTIVE**

Lappeenranta–Lahti University of Technology LUT

Industrial Engineering and Management Master's Thesis

2024

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Examiners: Associate Professor Lobna Hassan

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## ABSTRACT

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Generative Artificial Intelligence's (genAI's) rapid development and enormous potential offer small and medium-sized enterprises (SMEs) a way to scale up their businesses through efficiency and innovation. However, there is little evidence on how well SMEs have been adopting genAI, if at all. Therefore, the study aimed to understand the current state of generative Artificial Intelligence use (or lack thereof) in the innovation process of SMEs. The qualitative semi-structured thematic interview's data collection was conducted in the summer of 2024. A total of 9 SMEs' semi-structured interviews were thematically analysed and the findings formed the current state analysis on genAI in innovation of 9 SMEs.

Conclusions were: 1) genAI use in innovation in SMEs was in its infancy, focused on incremental process innovations, and the more structured the innovation process the company had the more advanced the adoption of genAI within the company was. 2) Three different barriers of use were recognised: lack of adequate infrastructure, overall readiness of the organisation, and decision to delay action. The study also confirms that the most challenges arose from adoption of genAI rather than from the tools itself, and that the biggest challenge of genAI adoption in SMEs was the lack of understanding.

Five future research topics were suggested: 1) Expanding the perspective of current study to include top management (beyond ICT leads) and employees, 2) Further elaboration on this exploring the potential damages to business from non-adoption of genAI, 3) A deeper investigation into the findings related to the connection between genAI adoption activities and the innovation process, 4) Investigation of the implications of speech recognition technologies within genAI for innovation in SMEs; and finally, 5) A follow-up study to assess how the findings evolve over time.

## TIIVISTELMÄ

Lappeenrantaan–Lahden teknillinen yliopisto LUT

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Tuotantotalous

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### **Generatiivisen tekoälyn käyttö innovaatioprosessin näkökulmasta**

Tuotantotalouden diplomityö

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86 sivua, 6 kuvaa, 11 taulukkoa ja 2 liitettä

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Generatiivisen tekoälyn (genAI) erittäin nopea kehitys ja valtava potentiaali tarjoavat pienille ja keskisuurille yrityksille (pk-yritykset) mahdollisuuden laajentaa liiketoimintaa tehokkuuden ja innovaation avulla. Näyttää siltä, kuinka hyvin pk-yritykset ovat omaksuneet genAI:n innovaatioissa on hyvin vähän, jos lainkaan. Tutkimuksen tavoitteena oli ymmärtää genAI:n käyttö pk-yritysten innovaatioprosesseissa. Laadullisen, puolistrukturoimattoman teemahaastattelututkimuksen aineisto kerättiin kesällä 2024. Yhdeksän pk-yrityksen löydökset analysoitiin teemoittain ja esiteltiin nykytilan kuvaus genAI:n käytöstä innovaatioissa pk-yrityksissä.

Tutkimuksen johtopäätökset olivat: 1) GenAI:n käyttöönotto innovaatioprosessissa oli vasta alkutekijöissään, keskittyen inkrementaalisiin prosessi-innovaatioihin. Lisäksi havaittiin, että mitä strukturoidumman innovaatioprosessin yritys oli kehittänyt, sitä pidemmällä se oli genAI:n jalkauttamisessa. 2) Kolme erilaista genAI:n käyttöä estävää haastetta tunnistettiin: infrastruktuurin puute, yleisen valmiuden puute ja päätös lykätä toimintaa. Eniten haasteita tunnistettiin genAI:n käyttöönotossa eikä genAI teknologiassa. Suurin haaste oli ymmärryksen puute.

Tunnistetut viisi jatkotutkimusehdotusta olivat: 1) laajentaa perspektiiviä kattamaan ylin johto (ICT -johdon lisäksi) ja työntekijät, 2) tutkia mitkä ovat (potentiaaliset) haitat liiketoiminnalle genAI:n hyödyntämättä jättämisestä 3) tarkentaa genAI:n käyttöönoton ja innovaatioprosessin välistä yhteyttä 4) genAI:n puheentunnistuksen vaikutukset innovaatioihin pk-yrityksissä ja 5) seurantatutkimus ajan kulumisen vaikutuksien ymmärtämiseksi.

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It will certainly be a while before I can fully reflect on the project and all the lessons it brought. Tackling this topic was not easy. Everything related to generative artificial intelligence seems to become outdated as soon as it is created. Additionally, my initial knowledge on the subject was not impressive, as I have been on parental leave for years. However, I am glad that I took it on, as I think the result was decent, and one thing is certain: I learned a tremendous amount during the research.

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Thank you, Antti and children, the project is finally wrapped up and we can enjoy ordinary, everyday life. Thanks to my mother-in-law, especially for enabling the final push in the last weeks in terms of childcare. Thank you Sanna, friend, schoolmate, colleague for your everlasting support, ability to clarify, and childcare, how fortunate to know you!

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Espoo 19.11.2024

*Hanna Vannesluoma*

## LIST OF ABBREVIATIONS

### Abbreviations

AI	Artificial Intelligence
GAN	Generative Adversarial Network
genAI	Generative Artificial Intelligence
GPT	Generative Pre-Trained Transformer
LLM	Large Language Model
ML	Machine Learning
MS	Microsoft
NLP	Natural Language Processing
NPD	New Product Development
PoC	Proof-of-Concept
SaaS	Software-as-a-Service
SME	Small and Medium-Size Enterprise
VAE	Variational Autoencoder
VQ-VAE	Vector Quantized-Variational Autoencoder

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Tiivistelmä

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# 1 Introduction

## 1.1 Research Background

Statistics Finland published Artificial Intelligence (AI) usage statistics in 2021, the latest at the time of writing, showed that the percentage of all Finnish companies utilizing AI was 16%. Usage divided by size differed. 39% of the companies who had more than 100 employees, 24% of the companies within size group 50-99 employees and 12% in both 10-19 and 20-49 employees utilized AI (*Official Statistics of Finland (OSF)*, 2021). Since then, the AI field had developed rapidly; OpenAI released ChatGPT in autumn of 2022 accelerating an enormous hype around generative Artificial Intelligence's (genAI's) potential and benefits (Chui *et al.* 2023). Although research has recognised the huge potential for innovation in the use of genAI (Bilgram and Laarman, 2023; Dwivedi *et al.* 2023; Dwivedi and Mariani, 2024), the lack of research remains in multiple areas in innovation management (Dwivedi and Mariani, 2024). The learning curve regarding genAI use within most organizations was based on individual experimentation (Bilgram and Laarman, 2023, p. 24), thus more evidence is needed to understand the current level of the usage, challenges, and realized benefits of genAI in organizations.

With its enormous potential for benefits, adoption of genAI into large companies and turning the potential into competitive advantage is a matter of time, as already of 2021, 39% of large companies utilized AI (*OSF*, 2021). But what is the current usage of genAI in resource scarce Small-and-Medium-size-Enterprises (SMEs), where adoption of AI was already lagging in 2021 (*OSF*, 2021)? And What are the reasons behind non-utilization, despite the extensive opportunities? SMEs, in this study, are the companies that have an annual revenue within the recognised SME limits, or that have a number of personnel within SME limits. Small companies' limits for annual revenue are less than 45 million euros (50 million dollars) and a maximum of 100 employees. For midsize companies, the limits are more than 45 million euros up to 920 million euros (>50 million dollars to 1 billion dollars) and employee number over 100 up to 999 (*Gartner*, 2024).

Innovations enable leveraging business and reach for competitive advantage – it's the strategy to success of organisations (Pérez and Pertuz, 2020, p. 177). As one of the most



promising benefits of genAI is the possibility of increased innovation (Bouchery *et al.*, 2023; Candi and Roberts, 2024), it is logical to include innovation within the study.

*“Generative AI (GenAI) is one of the most promising and fascinating forms of AI from an innovation management perspective.” Dwivedi and Mariani, 2024, p. 16*

There are very few empirical research studies completed on the intersection of genAI, and innovation management (Dwivedi and Mariani, 2024, p. 5), even more so with the SME focus. The innovation process is a conceptual method that describes the activities leading to innovation within organizations (Trott, 2017). SME characteristics, such as lack of resources, provide an interesting flavour, worth investigating.

## 1.2 Objectives and Scope

The objective of this study is to understand the current state of the usage of the genAI in innovation in small to medium-sized enterprises. As an outcome of the research, a description of the current state of the utilization of genAI in innovations is outlined as well as the challenges and obstacles of the use in small-medium-sized enterprises. In addition, future research topics are suggested. This research aims to fulfil the objective by finding answers to two research questions:

### **Research Question 1:**

How do small-medium-sized enterprises use generative AI in innovations?

### **Research Question 2:**

What are the factors behind non-utilization of generative AI in small-medium-sized enterprises?

To reach the objective of the research, findings from interviews with 9 small-mid-sized enterprises' representatives were thematically analysed by the researcher. Results were additionally ran through genAI application ChatGPT 4o for the uncovering of any additional novel conclusions that the researcher may have missed. Findings are presented together with future research topic suggestions. The findings of the research would be valuable for SME

companies considering genAI adoption to enable innovation as well as service providers and others interested in SME genAI usage.

This research focuses on the usage of genAI, mostly covering its' applications based on Large Language Models (LLMs) due to its popularity. To simplify the process of gathering interviewees and creating a more relaxed, and more data intensive environment for the interviews, a geographic delimitation was set to Finnish small to medium-size market. There was no need to restrict samples to a specific industry as the research aims to understand current state together with challenges and obstacles of use. The topic of AI evolving extremely fast creates the pressure to complete the data collection phase within a short period; to allow feasible comparison between cases. Thus, the data was collected within a month and a half. For the holistic view of the current state the target number of enterprises was set between 7-12 companies. A total of 11 companies were interviewed and 9 companies were ultimately included in the sample.

### 1.3 Conduct of the Research

The research was conducted during in 2024. The phases and timeline of the research project is presented in Figure 1. Project phases were executed in parallel and sometimes simultaneously as is often the case in qualitative research and process writing (Hirsjärvi *et al.*, 2010, pp. 63-65). To complete the project plan, the research project's topic had to be defined, and preliminary literature reviewed. This was followed by the actual literature review together with research design and execution. July was a freeze period due to the summer holiday season, causing the research execution being to be in two parts: 9 interviews before and 2 interviews after the break.

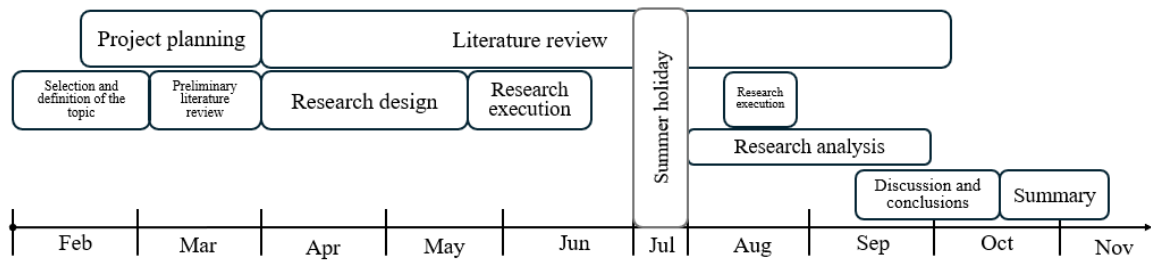


Figure 1 Study's Project Plan

Research analysis began and literature review continued after the holiday break. The break allowed research papers published during summer to be included in this research's literature review. The discussion and conclusion were started together with the finalization of the literature review and research analysis. Summarizing was the final stage of the research project.

#### 1.4 Structure of the Report

The research report was conducted as presented in Table 1. In the left column of the table is the data utilized as an input for each chapter. On the right of the chapter column is the output (chapter description). In the far-right column is the description of how genAI were used in each chapter of the research.

Table 1 Structure of the Report

Data	Chapter	Chapter Description	GenAI Use
Research needs and background	Chapter 1: Introduction	Positioning of the study in existing literature, clarification the need for the study, definition of objectives, research questions, scope and delimitations, project plan	ChatGPT utilized for ideating and clarification of the topic, translations between Finnish and English
Literature review of genAI from SME perspective	Chapter 2: Generative Artificial Intelligence (GenAI)	GenAI terminology, opportunities for SMEs, challenges for SMEs, characteristics and elements of adoption of genAI for SMEs	ChatGPT was utilized to search for suitable literature, seeking direction for terminology, helping to understand terminology and

			concepts, translations between Finnish and English
Literature review on innovation process	Chapter 3: Innovation Process	Different innovation processes and phases, SME consideration on innovation process	ChatGPT was utilized to search for suitable literature, seeking direction for terminology, helping to understand terminology and concepts, translations between Finnish and English
Literature review genAI and innovation	Chapter 4: GenAI and the Innovation Process	Understanding the current state of an emerging research area, implications of genAI on innovation process	ChatGPT was utilized to search for suitable literature, seeking direction for terminology, helping to understand terminology and concepts, translations between Finnish and English
Data collection	Chapter 5: Research Method	Study plan and execution	ChatGPT was utilized in helping to understand terminology and concepts, sparring and revision of the interview questions, forming the contact letters of interviewees, helping with the preparation of the interviews, translations between Finnish and English
Data analysis	Chapter 6: Current State of GenAI in Innovation of 9 SMEs	Description of the current state of genAI use in innovation	ChatGPT was utilized to review the researcher's analysis and suggest possible unseen results, translations between Finnish and English
Analysis and review of the study	Chapter 7: Conclusions and Recommendation	Key findings, answers to research questions, reliability and validity discussion and suggestions for future research topics	ChatGPT was utilized to re-review the conclusion and recommendations in case of novel conclusions, translations between Finnish and English
The study report	Chapter 8: Summary	Summarised background, objective, execution, findings and conclusions	ChatGPT was utilized in translations between Finnish and English

## 2 Generative Artificial Intelligence (GenAI)

### 2.1 Terminology and Definitions

In order to understand the term Generative Artificial Intelligence (GenAI), it is feasible to divide it into two parts: 1) generative and 2) artificial intelligence (AI). Generative refers to creating (=generating) new content based on synthesizing enormous amounts of data (Lapata, 2023). Artificial Intelligence, in simple terms, refers to techniques completed by machines that mimic human abilities like logical reasoning, planning, and innovating (Edukamu, 2023; Lapata, 2023). To elaborate, the term AI includes many fields of study and techniques like Machine Learning (ML), algorithms (neural, decision trees, deep learning, reinforcement learning), text mining and Natural Language Processing (NLP) (Dwivedi *et al.*, 2023 p. 3). So, genAI is AI with the ability to innovate: where AI can recognize reoccurring patterns from data, genAI is able to create new, similar data (Edukamu, 2023). GenAI is often used when referring to systems that produce content by utilizing AI techniques. The content created can be in many formats such as text, pictures, code, video, audio, and synthetic data (Herman and Puntoni, 2024 p. 7; Rajaram and Tinguely, 2024, p. 2; Salo, 2024).

Depending on the content type, different generative models are utilized: text generation utilizes Large Language Models (LLM), generating images Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), or Diffusion Models, and generating audio utilizes Autoaggressive models, Vector Quantized-Variational Autoencoder (VQ-VAE), or transformers (Dwivedi and Mariani, 2024, p. 3). All these models include a variety of AI techniques, however the data used to train the models differ. While LLM trains from text to produce text, GANs utilize images for training to create images (Edukamu, 2023). The term unimodal genAI is used for applications that utilizes one of these models to turn inputs into outputs and the term multimodal refers to applications utilizing more than one of these models to create outputs (Dwivedi & Mariani, 2024, p. 13).

LLMs predict sentences and next words based on the probability of their occurrence next and the given context (Rajaram and Tinguely, 2024. p. 2). To be able to predict the words desired in the output, the model needs to be trained with huge data sets. Generative Pre-

trained Transformers (GPTs), which is an example of an LLM, is a pre-trained model. As the name suggests, it has been pre-trained with a lot of generic data. For the model to be able to process more specific (e.g. medical related) tasks or when it is required to perform tasks in certain ways (helpfully, honestly, and harmlessly) the pre-trained model needs to be fine-tuned with a domain or task specific data (Lapata, 2023).

To be able to use outputs of the various genAI applications, one must provide inputs for them. Prompts are the inputs that shape and determine the output of genAI systems. It has evolved as its own entity called “prompt engineering,” as the value of the outputs is maximized with the quality of prompting (Holmström & Sundberg, 2024, p. 563).

## 2.2 Opportunities in SMEs

Cronin (2024) summarizes that genAI holds groundbreaking potential in many industries through generating new solutions as well as redefining machine capabilities. Within businesses, it enables efficiency and innovation, and it is predicted to change human-computer interactions drastically (Cronin, 2024). Wade introduces in Dwivedi *et al.* (2023, p. 7) that genAI applications are the biggest potential source of disruption in knowledge work, especially ChatGPT’s ability to create “the first draft” (Dwivedi *et al.*, 2023, p. 7). Also, Mithas contributed to Dwivedi *et al.*’s (2023, pp. 42-43) research by presenting the economic value of AI technology:

- Add revenues: scaling up volumes, improving pricing decisions, or by customization
- Differentiate: create personalized products and services for differentiation
- Reduce cost: automation, elimination of tasks
- Optimize risk: AI helping risk reduction, thus creating new risks that are not understood and require evaluation by managers and policymakers
- Innovate: enable innovation and faster new product development
- Transform: help to transform society, reach for sustainability, empower minority groups.

Related to the adding revenue, McKinsey & Company published research including estimations of how genAI could affect the global economy by 2.6-4.4 trillion of dollars through the 63 use cases they investigated. Estimation doubles if other use cases such as

genAI embedded software were also included in the estimation. In addition, they forecasted that genAI will impact all industries significantly, more so in the fields of banking, high tech, and life sciences where impacts on revenue growth are discussed in hundreds of billions (Chui *et al.*, 2023, p. 3).

Edwards and Duan contribute within Dwivedi *et al.*'s (2023, pp. 39-41) research by highlighting more tangible improvements genAI ought to bring within businesses. Improvements to customer interactions e.g. detailed interactions customized to each user within sales, marketing content creation, presentations across units, to enable employees with good ideas to communicate them within the organization, and creating computer code Dwivedi *et al.* (2023, pp. 39-41).

All above mentioned effects create an impressive picture of the capabilities of genAI however, research lacks the evidence of concrete realization of these benefits (Chui *et al.*, 2023; Dwivedi *et al.*, 2023). Some evidence can be found in grey literature: McAfee and colleagues (2023) introduce a concrete example of how genAI together with ML improved performance of customer service. A large company utilized AI as a supporting tool for customer-service agents in two ways: 1) LLM (genAI) was finetuned to good customer service including responses with same wording as the customer and to recognize phrases leading to good customer service outcomes 2) ML technique which collected correct answers from manuals and documents supporting the LLM responses sensemaking. The pilot took seven weeks. After 1500 agents used the tool for two months, the results were promising: staff (especially newly joined) improved their average ability to resolve issues per hour improved by 15%, chats an agent could handle at the same time improved by 15%, average chatting time decreased by 10%, and customer satisfaction improved (McAfee *et al.*, 2023, pp. 43-44).

Evidence of such detailed benefit examples for SMEs could not be found from the literature. However, Rajaram and Tingley (2024, p. 2) in their study convey that SMEs' opportunities lie with genAI's potential of facilitating scalability and creativity. Easy access to the applications of genAI enables the SMEs to access capabilities of usually large enterprises, which means it democratizes scalability and creativity, which is also discussed by Dwivedi *et al.* (2023). The opportunities of genAI are those within nonroutine, cognitive skills required tasks. Rajaram and Tingley (2024) provide a set of SME opportunities that genAI provides:

- Supporting decision making in strategy planning, operation, and growth by enabling more accurate, data driven, agile, and proactive decisions
- Boosting productivity by enhancing administrative tasks and processes
- Accessing human knowledge widely, as genAI models have been trained with large datasets based on human knowledge (e.g. coding knowledge)
- Easier access to insights not considered without genAI to enable innovation
- Improvement of creative processes with more comprehensive ideating through visualization tools
- Increasing differentiation of products and services e.g. by exploring new raw material combinations and easier customization of products and services
- Accelerating product development by enabling quicker iterations of product design and development (Rajaram and Tinguely, 2024, pp. 3-5)

Despite the many opportunities genAI provides, not all SMEs will aim to develop and customize the genAI within their ecosystem, thus many will only focus on using some applications (Rajaram and Tinguely, 2024, p. 2).

### 2.3 Challenges in SMEs

GenAI systems and applications are emerging (Holmström and Sundberg, 2024, p. 561) and although they possess enormous potential, there are challenges in both genAI and its characteristics as well as in the adoption of genAI (Rajaram and Tinguely, 2024, p. 5). The challenges within GenAI systems persist regardless of the size of the company, but adoption challenges differ based on the size of the company, as the level of resources and economies of scale are fewer in SMEs than for large companies (Guptad *et al.*, 2017, p. 328).

For a company to benefit from an AI system, the benefits should be understood and the business focus and need clarified within. Heikkonen *et al.* (2024) states that one of the biggest challenges for SMEs in the (gen)AI adoption is the lack of fully understanding of the opportunities that AI could enable. Further, uncertainty of the benefits, the necessary investments, and changes in the organization's ways of working together with the level of business management, causes difficulties to even present AI's opportunities for SMEs (Heikkonen *et al.*, 2024),



Rajaram and Tinguely's (2024, p. 2) research calls for more evidence on resource scarce SMEs' adoption challenges. Due to the lack of vast resources, the adoption of genAI will be the responsibility of those who already perform many roles and responsibilities within the organization, with limited time, support, and guidance. In addition, the leaders within SMEs have multiple functions that they are responsible for – thus integrating genAI across functions and departments will be solely on their shoulders (Rajaram and Tinguely, 2024, p. 2).

Furthermore, genAI can perform complex tasks that require creativity in addition to boring routine tasks, which is a shift off from past AI systems (Rajaram and Tinguely, 2024, p. 2). As genAI is able to complete complex tasks, performance of humans completing similar tasks ought to be surpassed. This might seem scary and seen as a threat to professional identity from the employee point of view, requiring attention to managerial aspects (Rajaram and Tinguely, 2024, p. 2). On the contrary, Candi and Roberts' (2024) research results shows the opposite. GenAI's ability to resolve more complex problems allows humans to focus on even more creative and fulfilling aspects of their work as genAI could enable humans to delve deeper into new, different ideas and focus more on meaningful human-to-human interactions (Candi and Roberts, 2024, pp. 2, 5, 9). Either way, managerial considerations need to be addressed.

In addition to understanding the benefits, increased existing responsibility entities as well as increased need for managerial aspects, Edwards and Duan contributes to Dwivedi *et al.*'s (2023, pp. 39-41) research; SMEs cannot build and run genAI systems themselves on current technology. A training database is needed to include both generally available information as well as internal company information to grasp the immediate opportunities of both customer-facing and internal use. Thus, SMEs are dependent on 3<sup>rd</sup> party providers of the technology (Rajaram and Tinguely, 2024, pp. 6-9). As SMEs often rely on cloud and service-based solutions (Heikkonen *et al.*, 2024), a related challenge occurs. GenAI systems are in their era of ferment, as Dwivedi and Mariani (2024, p. 10) describe. The competition on the leading designs of genAI technology might take a while to settle (Dwivedi and Mariani, 2024, p. 10). Hence, selection of technology and its provider become a challenge. As the topic of genAI has been in such a hype, everyone wants their piece of the economic potential it ought to provide (Chui *et al.*, 2023), which increases the number of product and service providers whose quality and competence ranges widely. In the case of selecting the wrong

3<sup>rd</sup> party provider, the quality of the services provided might be inadequate. In addition, as SMEs operate in more of a niche and require knowledge for adoption to meet the business requirements which causes fewer service providers to target that niche market (Rajaram and Tinguely, 2024, pp. 6-9).

One of the most profound limitations of SMEs is also the constraints in financial resources. GenAI will certainly stress the financials – investments in process infrastructure are needed to incorporate genAI into the SME operational ecosystem and the need to train employees arises leading to increase in costs (Rajaram and Tinguely, 2024).

Looking into the challenges within genAI characteristics, one cannot avoid topic of biases, inaccuracy, and ethical concerns. Dwivedi *et al.* (2023) argue that one of the biggest challenges is that genAI systems, such as ChatGPT, can produce correct sounding yet logically incorrect results (Dwivedi *et al.*, 2023, p. 9). This can result in users either not trusting the model or allowing erroneous information to spread if the user is unable to detect the false information.

In addition, Dwivedi *et al.* (2023) discuss numerous disadvantages and their possible effects on multiple viewpoints within their article. Table 2 explains the challenges of genAI systems. No matter the article or resource related to genAI, bias comes as a challenge (Cai *et al.*, 2023; Dwivedi *et al.*, 2023; Rajaram and Tinguely, 2024). In case the input data, that is used to train the system and/or models is already biased, the system will learn the biased data and utilize it in the outputs, causing the outputs to be biased too.

Table 2 GenAI systems' challenges (drawing on Dwivedi *et al.*, 2023; Rajaram and Tinguely, 2024; Chui *et al.*, 2023).

Challenge	Explanation	Possible causes
Bias	“Garbage in, garbage out” if the input data is biased, the output will be too.	Presence of unintentional or unconscious bias, reproduction of previous mistakes, passing on existing human bias
Accuracy of predictions	Random inaccuracies or falsehoods	Users not trusting the models and tools, causing resistance of use/adoption

Transparency and explainability	Model's functioning logic not transparent, lack of traceability difficult, model's logic is a "black box"	Difficult to understand why the output is as provided by the model, causing resistance of use/adoption
Risk of misuse	Production of deepfakes, outputs are based on incorrect or inappropriate data	Plagiarism, significant monetary losses, reputational damage
Ethical issues	Accountability for errors or misjudgement, trust and authenticity concerns, GenAI models do not have the ability to understand and consider ethical aspects	Decision making conflicting with ethics
Legal issues	Misuse of proprietary data, ownership of intellectual property rights of the output generated by genAI, vulnerability of confidential and sensitive data	Possible copy-right breaches, data compliance breaches
Design of prompts	Output quality dependency on the input quality	Training needed to address the required skills
Computational capacity	The massive amounts of parameters used for training models require a lot of computational power	Risk of becoming a bottleneck in development

There are multiple takes on the ways to address the challenges, at least related to the adoption of genAI, that will be covered in the next section 2.4. Some of the challenges related to the genAI characteristics may ease with technology development, and future regulations, some risks might be reduced by efficient risk management.

## 2.4 Adoption in SMEs

In order to realize the opportunities and potential that genAI possesses, organizations need to adopt genAI successfully. McAfee *et al.* (2023) claims that genAI should be considered by business leaders as general-purpose technology like electricity, the steam engine, and the internet. The difference between earlier general-purpose inventions and later ones is the speed of adoption, as today the needed infrastructure is already in place. Infrastructure like cloud computing, software-as-a-service (SaaS), application stores, application programming interfaces etc. also decreases the costs and the need for expertise that deploying a new information system within a company would require (McAfee *et al.*, 2023).

GenAI has democratized the use of AI systems (Bilgram and Laarman, 2023, p. 18), which is an aspect in favour for easier adoption in SMEs (Rajaram and Tingley, 2024, p. 2). Adoption of technology to attain improvements within organizations is a topic of many studies and theories. Al-khatib (2023) formed the basis for his hypothesis, based on extensive theory, to test the factors affecting the adoption of genAI. The study concluded that relative advantage, top management support, organizational readiness, and customer pressures positively influenced genAI adoption. Negative implication to adoption was the complexity of the technology when compatibility and competitive pressures impacts were seen as insignificant to adoption of genAI (Al-khatib, 2023, pp. 8-9).

Bilgram and Laarman (2023) claim that organizations are in the early stages of reaching genAI's potential, and for those companies in the first parts of the learning curve, they suggest starting by systematizing AI efforts through cross-departmental initiatives (e.g. interest communities, platform to share knowledge), understanding the skillsets and roles needed and composing an AI strategy (Bilgram and Laarman, 2023, p. 24). Mithas contribution within Dwivedi *et al.*'s (2023, pp. 42-43) research also emphasizes the importance of developing the AI strategy and urges it to be done as part of the overall IT strategy. Further, a competitive strategy should be developed too, by reimagining digital and business strategies throughout the company's different levels, leveraging genAI's business opportunities (Dwivedi *et al.*, 2023, p. 43).

Holmström and Sundberg (2024) continue to a more concrete recommendation of four managerial suggestions for adoption:

- 1) Start out small
- 2) Explore organizational data
- 3) Scale through integration
- 4) Educate prompt engineers

Starting out small enables the continuous change and improvement of the technologies and helps to avoid developing something that becomes irrelevant as well as creates foundation for iteration and further development (Holmström and Sundberg, 2024, pp. 567-568). This way the risk of failure becomes more tolerable too. Kicking off with small yet effective improvements does not require modelling entire business processes from the beginning, yet it smooths the way towards bigger productivity improvement (McAfee, 2024 pp. 3-4).

The exploration of the organizational data can be done in any organization, no matter the size, as all organizations possess textual data. Identified, valuable, and optimized data sets are the key for tailoring genAI assistants to provide value within the organization's context. When initial small experiments have been successfully implemented, scaling through integration can be done utilizing easy-to-use APIs. While educating prompt engineers is the last step on the list, it is suggested to be executed simultaneously beside all the other activities to increase competence. This requires both AI expertise and domain knowledge. Furthermore, it is suggested that diverse skill-possessing teams be established (Holmström and Sundberg, 2024, pp. 567-568).

Adapa *et al.* (2023, p. 8) propose more detailed, practical implementation phases for concretely implementing genAI as presented in Figure 2.

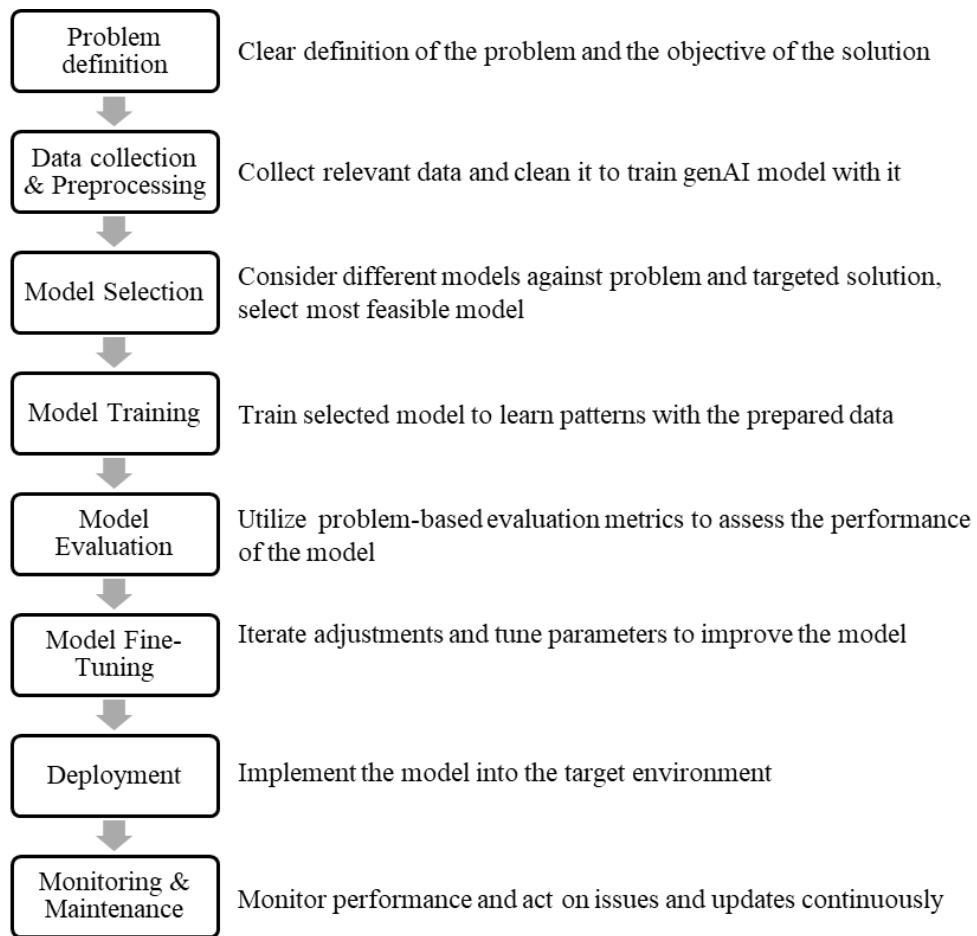


Figure 2 Implementation of genAI, drawing on Adapa *et al.* (2023)

Adapa *et al.* (2023) approach adoption of genAI from the perspective of organizations developing the system by themselves. This approach assumes that the needed knowledge and resources exist in the organization as well as that the organization has identified the problems to be resolved with genAI models. However, as presented previously, developing and running genAI models without third party help is difficult, if not impossible for SMEs currently (Dwivedi *et al.*, 2023, pp. 39-41). Thus, understanding is needed to be able to manage relations with 3<sup>rd</sup> parties.

On the other hand, Rajaram and Tingley (2024) claim that as SMEs are nimble by nature, adopting genAI might therefore be straightforward. Although McAfee *et al.* (2023) are not differentiating by company size, they suggest that ease of deployment is caused by the type of interaction genAI allows for, making the users feel as if they are talking to another person. Rajaram and Tingley (2024) and McAfee (2023) both suggest that technology adaptation

should not be a blockade for the usage of genAI. Rather than focusing on the technology selections and decisions Rajaram and Tinguely (2024) build on the above-mentioned thought of “ease” of the technology deployments when defining its take on the focus points for SMEs:

- Competency of employees
- Effective leadership and work values
- Organizational culture, collaboration and cooperation
- Relationship with third parties

Competencies needed from employees include a learning orientation, technology savviness, curiosity, and adaptability. As the structure of SME organizations is usually flat, the ability to learn individually is crucial. In addition to learning, one must remember unlearning old ways of doing and thinking. Learning should be done amongst all other work, possibly in addition to multiple roles. Curiosity and adaptability are crucial to adopt, learn, and unlearn as well as cope and resolve challenges when adopting genAI (Rajaram and Tinguely, 2024, p. 9).

SME leaders must make trade-offs by considering resource allocation, costs, and potential. To do so, there must be a clear strategy and vision for genAI adoption too, supporting earlier presented views from Dwivedi *et al.* (2023), and Bilgram and Laarman (2024). Rajaram and Tingley (2024) highlight the leaders’ role as a change agent. Change agents (SME leaders) are the ones promoting the change, inspiring and raising others’ spirits in transition, supporting them to improve the capability to act in more interdependent way, and empowering the employees to embrace the benefits and opportunities of genAI. In addition to work values, agility, and responsiveness of the leaders, it is also considered important to meet the emerging technology development as well as addressing the customers’ needs (Rajaram and Tinguely, 2024, p. 9).

Organizational culture, collaboration, and cooperation refers to the cross function and possible hierarchy levels. Organizational culture defines how employees interact with both internal and external stakeholders, driven by beliefs, values and patterns of behaviour. Therefore, its importance in the adoption of genAI may be significant: adhocracy culture supports innovativeness and adaptability, where hierarchical culture tends to be slower and

stiffer. Collaboration refers to employees and leaders working together towards a common goal. Cooperation refers to the need to recognize alongside collaboration the existing individual focus and independence, without losing the common goal (Rajaram and Tinguely, 2024, pp. 13-14).

Finally, the inevitable third-party involvement within the adoption of genAI in SMEs. Third parties are the bridge to reach e.g. the tool side of genAI, including hardware and software infrastructure, innovative research, latest knowhow, and talent. Interacting with third parties enables knowledge sharing. However, utilization of third parties requires resources of the SME in a different way: project and risk management in addition to communication skills. It is important to clarify goals and monitor progress (Rajaram and Tinguely, 2024, p. 15).

As presented earlier, small adaption in the beginning will, over time, turn into large and deep changes. These changes are key elements enabling innovation and competitive advantage. Hence, it is crucial for leaders to act instead of waiting to see how usage of generative AI develops (McAfee *et al.*, 2023 p. 4).



### 3 Innovation Process

#### 3.1 Different Innovation Processes

Innovation management is not straight forward and easy, but rather it is based on a complex and dynamic process (Gay and Szostak, 2019, p. 173). Bessand and Tidd (2018, p. 73) conclude, based on years of innovation research, that innovation processes differ greatly (size, type, sector etc.), but also that there are some similar basic characteristics: innovation is a process which needs to be managed. Consequently, there are multiple descriptions of innovation processes (Bagno *et al.* 2017; Bessand and Tidd, 2018; Everett, 2003; Trott, 2017). Although Bagno *et al.* (2017) states that there are many weaknesses in these process models – their popularity is based on their strengths: simplicity and easy managerial interpretation (Bagno *et al.*, 2017, p. 646).

Bagno *et al.* (2017) studied 16 different innovation processes, or models, as some are circular and continuous in nature. They grouped models into four categories: linear models, funnel models, organizational and interaction focused models, and capability-centred models. Models within the linear model group tend to follow New Product Development (NPD), where often stages, from idea to fully developed product, are followed by evaluation gates and as a result, an innovation is born. Because the ideas arise from existing technology at the company and/or current market conditions, these models tend to support creation of incremental innovations (Bagno *et al.*, 2017, p. 643).

In addition to linear models, funnel models emphasize the selectivity happening within the process. A vast number of ideas are recognized, evaluated, and most potential ones are passed forward into the development portfolios of companies. These models consider the limitations of resources, in addition to the stages also recognized in linear models, as not all ideas can be turned into development projects due to resource limitations (Bagno *et al.*, 2017, pp. 644-645).

The third group of models focus on strategy, organization, and interactions between organizational elements. These models consider the fact that innovation should be considered as a companywide activity, not limited to one function (R&D) only, and that

there should be a strategy for innovation activities. Thus, they tend to be circular to describe the connection between different organizational elements and indicate continuity (Bagno *et al.*, 2017, p. 645).

Finally, capability-centred models are presented by Bagno *et al.* (2017), which focus on the organization and its elements' balance, rather than just a process. These models consider the importance of many organizational elements, such as learning, when considered in management, might enable fostering of radical innovation (Bagno *et al.*, 2017, pp. 645-646).

### 3.2 Elements of the Innovation Process in SMEs

Innovation in SMEs is seen as a two-fold challenge by Gay and Szostak (2019): 1) SMEs possess a great capacity for innovation but also 2) sometimes SMEs cannot keep up with the risk involved. In this instance risk means the changes and the nature of the environment the SME operates in. Gay and Szostak (2019) also consider SMEs as open and agile organisations, which are the very characteristics encouraging innovation. (Gay and Szostak, 2019, p. xxix)

When investigating the SME's side of the innovation processes further, Dossou-Yovo *et al.* (2021, p. 24), challenges the linear, networking, and integrated models approaches as those tend to focus on internal actors and exclude interactions with external actors, learning process, entrepreneurial role, and resource mobilization. All these are seen as important factors for SMEs, whose innovation are dependent on external resources. Especially interactions and utilization of external factors are seen as an important factor of resource scarce SMEs (Boronat-Moll *et al.*, 2014; Bresciani *et al.*, 2017). Networking models and integrated models tend to, according to Dossou-Yovo *et al.* (2021, p. 24), include the aspects of the learning process and more external factors, leaving the resource mobilization process unclear and the entrepreneurial point of view missing, hence the reasoning for the need for an additional model focusing more on SMEs.

Dossou-Yovo *et al.* (2021) introduces a multi-level process conceptual framework to address SMEs' needs and emphasizes the importance of organizations adaptation to both internal and external factors. In addition, Dossou-Yovo *et al.* (2021, pp. 24-26) reasons that it is essential for SMEs to have a network that has the resources that may complete the innovation

process of SMEs on those parts where resources are simply lacking. They compiled six subprocesses that form the overall innovation process to emphasize this importance: 1) Idea generation and selection, 2) Transformation, 3) Learning, 4) Resource Mobilization, 5) Commercialization and 6) Coordination.

The idea generation and selection sub-process refers to the activities that generate input from internal and external actors into outputs. In this case, output means e.g. ideas, tools or even selection criteria that could grow into new projects. The second sub-process, Transformation, focuses on the interaction and management of the actors who produce outcomes like pilots, new products, or/and new services. Learning considers turning new knowledge into outputs like repositories, new tools, or innovation tasks. Through Resource mobilization, commonly done by the entrepreneurs or leaders, focus on interactions that turn new contacts into social connections and a network which enables reaching the external resources needed for innovation. The fifth sub-process, Commercialization, includes the activities with internal and external actors to transform collaborations and partnerships into e.g. new market or sales growth. These sub-processes allow managing of interactions with internal and external actors and stimulates resource mobilization in parts within the sub-processes rather than on a complete process at once. (Dossou-Yovo *et al.* 2021, pp. 25-26, 30-31)

The empirical study of Dossou-Yovo *et al.* (2021), focused on Canadian small and-medium-sized software companies, recognized three critical process stages within the model: 1) Concept development, 2) Research and development (R&D) and 3) Commercialization. These stages were critical as their resources were completely dependent on external resources - in other words without external actors in these stages the innovation process would not be able to proceed. Resource wise, these included the innovation idea, knowledge and competences, financial support, and new markets. However, they also emphasized the need, especially in SMEs, to adapt within the companies' own environment (Dossou-Yovo *et al.* 2021, pp. 26-31).

The innovation process presented in Pérez *et al.*'s (2020) study presents a more dynamic view with the emphasis on continuous adjustments and recognizes the need for interaction between both internal and external resources. Pérez *et al.* (2020) completed a review study on implemented innovation management practices within SMEs around the world. The results revealed the sequence of the most used innovation process phases (based on the used

practices mapped into phases): 1) Implementation 2) Resource Mobilization 3) Ideation 4) Strategy construction 5) Evaluation and 6) Prospecting. Pérez *et al.* (2020) conclude a variety of practices utilized in SMEs are improving innovation management and development within the companies. The difference of these models indicates that managing more than just the stage of the process is essential for producing innovations, which is a stage in itself (Bessand and Tidd, 2018, p. 73).

Furthermore, Pérez *et al.*'s (2020) study supports Dossou-Yovo *et al.*'s (2021) thinking that SMEs might not be able to utilize entire innovation processes, but rather some sub-processes and activities within. Thus, Trott (2017), and Gay and Szostak (2019) conclude that the activities performed, and process stages completed differ from one organization to another as innovation management activities are dependent not only on size, but on the industry too (Trott, 2017, p. 591; Gay and Szostak, 2019, p. 45).

Organizations perform innovation management practices to manage the innovation process successfully. Structured administrative practices or technological help that is utilized to implement the innovation process are considered innovation management practices (Pérez *et al.*, 2020, pp. 177-178). Innovation practices by nature are uncertain, include risks and tend to have a high failure rate. The characteristics together with the limitations of SMEs create challenges in innovation management. In addition, Gay and Szostak (2019) suggest that the perception of barriers is more valid within small companies than larger ones.

Gay and Szostak (2019) highlight that SMEs have created multiple innovations, suggesting that they possess a high level of capacity of innovation. They also claim that all SMEs do not innovate, yet the ones that do won't succeed systematically. Some of the benefits they hold are distributed decision making, systemic behaviour, direct and informal relationship with market for new ideas, and employee participation. These factors enable flexibility and speed compared to large organizations who are usually considered more bureaucratic and therefore stiff and slow (Gay & Szostak, 2019, pp. 46-48).

Leadership is considered one of the key items to enable the orientation towards innovative activities and management of the innovation process. Leaders are hugely impactful on the organizational climate and culture; therefore, their support is extremely important. Leaders set the example for the employees and employees are sensitive to the leaders' example, therefore the leaders' attitude and actions matter greatly (Gay and Szostak, 2019, pp. 74-77).

It is often considered that the management of the company are the ones responsible for development of the company's culture which supports creative approaches, values innovation, and ideating. When the management emphasises such a culture it allows the employees to follow which leads to the tendency to innovate (Gay and Szostak, 2019, p. xxix).

## 4 GenAI and the Innovation Process

### 4.1 GenAI is a Game Changer in Innovation

Although the full potential and opportunities of AI in innovation is not yet recognized, it has been acknowledged that AI can be seen both as an initiator of innovations and an enabler of change in the innovation process (Dwivedi and Mariani, 2024, p. 2). As AI's full potential remains unrevealed, naturally gaps of knowledge within genAI in innovation management become apparent too (Al-khatib, 2023; Dwivedi and Mariani, 2024). GenAI systems are emerging and therefore research within the organizational and business context is emerging too (Holmström and Sundberg, 2024, p. 561). Nevertheless, emerging research has already recognized genAI being a potential game changer within innovation management (Dwivedi and Mariani, 2024, p. 16; Bouschery *et al.* 2024, p. 150) and a means to aim for competitive advantage.

Al-khatib (2023, p. 9) highlights through his research that adopting genAI improves the innovation capabilities of organizations due to its ability to provide new content and simulation models, enabling access to completely new opportunities (radical innovation) as well as improving existing products and processes (incremental innovation). Al-khatib supported the connection between the adoption of genAI and the enhancement of organization innovation capabilities, which was also supported by Dwivedi and Mariani (2024, p. 10). Dwivedi and Mariani (2024) analysed more thoroughly the myriad of ways genAI effects innovation management overall. Some of the many improvements genAI provides innovation management, discussed by Dwivedi and Mariani (2024), are faster idea and concept creation, faster prototyping, automation of tasks within the process, leveraging of knowledge and opportunities, and reduced innovation process costs due to faster process (Dwivedi and Mariani, 2024).

Bouschery *et al.* (2024) elaborate within their research the increasing need for and rise of hybrid innovation teams – teams including both humans and genAI members – enabling faster and more efficient search for innovation. Dwivedi *et al.* (2023, pp. 7-8) contributes to the concept of hybrid teams, noting that the idea of hybrid teams is as old as AI itself, but recognizing that genAI applications, like ChatGPT, can be in more sophisticated roles that

may contribute to new ideas and concepts. Examples of those more sophisticated roles are a coach, software developer, and an innovator. These changes will cause the need to develop approaches, strategies, and ways to lead these hybrid teams (Dwivedi *et al.*, 2023, p. 8).

Bilgram and Laarman (2023), and Holmström and Sundberg (2024) approach the intersection of genAI and innovation in a more practical study. They introduce genAI capabilities of improving the innovation process by showing examples of actual prompting within a genAI application for idea creation and prototyping. They conclude that genAI improves prototyping drastically (Bilgram and Laarman, 2023, p. 19) together with some managerial suggestions for implementation of genAI presented earlier in section 2.4 (Holström and Sundberg, 2024, p. 569).

#### 4.2 GenAI Implications on the Innovation Process

Based on existing literature, genAI can be seen as having a two-fold role in innovation: it enables innovations (Bilgram and Laarman, 2023; Holmström and Sundberg, 2024; Dwivedi and Mariani, 2024), and it can be used to improve the innovation process (Candi and Roberts, 2024; Dwivedi and Mariani, 2024). Dwivedi and Mariani (2024) provide a list of 10 possible implications and further research topics in their study based on literature review and a delphi study of field experts. Candi and Roberts' (2024) research collected data via survey and interviews on companies and as a result gained information on the possible benefits of genAI in innovation management. These themes and possible benefits from the research are mapped into the critical stages of innovation process recognized by Dossou-Yovo *et al.* (2021) and presented in section 3.1 below and Figure 3 that visually illustrate genAI's impact and benefits on the innovation process.

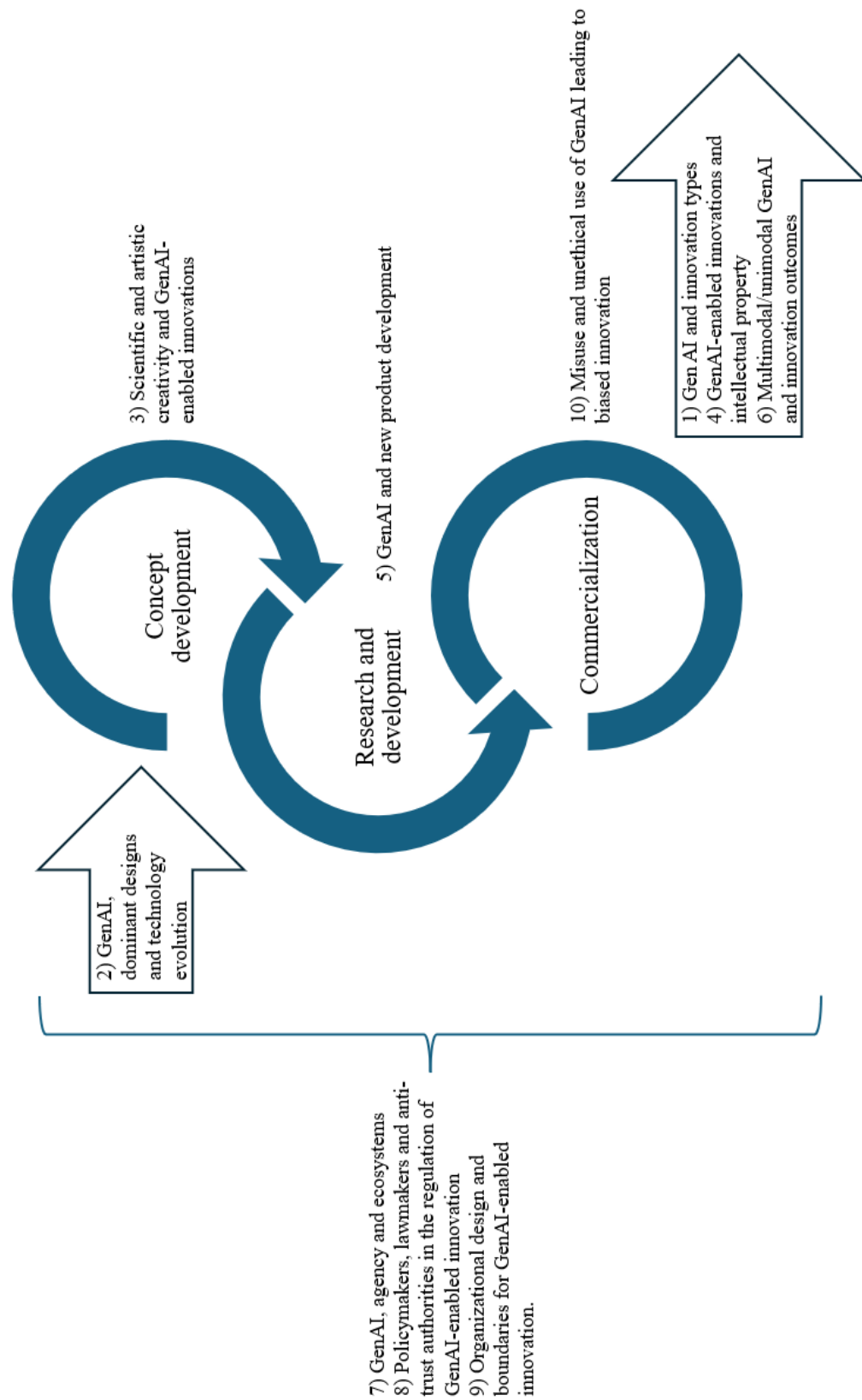


Figure 3 GenAI implications and gained benefits on the innovation process, drawing on Candi and Roberts (2024), Dossou-Yovo et al. (2021) and Dwivedi and Mariani (2024)



The implications of genAI on innovation (Dwivedi and Mariani, 2024) are numbered 1-10 and the possible benefits (Candi and Roberts, 2024) are smiley faces within Figure 3. The two white arrows in the picture indicate the process input and output. The blue arrows are the process stages: concept development, research and development, and commercialization (Dossou-Yovo, 2021).

The implications mapped to the process stages (Figure 3) is explained below *as per process stage* (input, concept development, research and design, commercialization, output, and overall process). The implication of the process input is implication no. 2) GenAI, dominant designs and technology evolution, by Dwivedi and Mariani (2024), which will impact the concept development via technology selection. As the competition on the leading design is still unsettled, it effects the selection of the technology which differ in characteristics and capabilities therefore effecting the innovation process too (Dwivedi and Mariani, 2024, p. 10). Most benefits of genAI in innovation were considered to better support the understanding of customers' needs, competitors, opportunities, and trends, which all feed into the process concept development phase. For the actual stage of concept development, an implication no. 3) was mapped to: Scientific and artistic creativity and genAI enabled innovation. The study of Dwivedi and Mariani (2024) found out that genAI empowered creativity might end up being completely reconceptualized, as genAI has better memory capacity and computational skills than humans which allows it to effectively create big networks of possible associations and also find possible paths through the possible associations (Dwivedi and Mariani, 2024, p. 11).

Implication no. 5) GenAI and new product development, is the implication of the process stage research and development, as it included the discussion of the NPD process as well as the implications on future NPD teams. It is suggested that GenAI could enable improvement of the NPD process by reaching all three targets that have been previously considered to be contradictory: reducing the development cycle time to a minimum, and maximizing the product fit to customer's needs with reduced development costs. Some suggestions of how to reach such objectives are facilitation of prototyping, digital rendering, and enabling validation of assumptions of innovation managers nearly in real-time (Dwivedi & Mariani, 2024, p. 13).

Implication no. 10) Misuse and unethical use of GenAI leading to biased innovation was recognized affecting commercialization, as using e.g. deepfakes (digitally manipulated

content that never happened but are created on e.g. real places and humans) which might cause both innovation and challenges like damages to reputation, loss of jobs, image and trustworthiness (Dwivedi and Mariani, 2024, p. 15).

For the innovation process outputs, the impacts were mapped from Dwivedi and Mariani's (2024) study were the implication numbers 1), 4) and 6). Number 1) GenAI and innovation types impact the output of the process and the stage concept development as it is recognized that GenAI supports all types of innovation and might enable different types emerging (Dwivedi and Mariani, 2024, pp. 8-10). Implication 4) GenAI -enabled innovations and intellectual property was seen as part of the outputs, as innovations are the outputs of the innovation process. As these innovations are done with genAI, which utilizes existing data to learn and generate new data, and the original ownership of the initial data cannot be traced. This impacts the entire conceptualization of intellectual property. Implication 6) Multimodal/unimodal genAI and innovation outcomes suggests that the technical composition of genAI affects the innovation's outcome type, radical/incremental. As multimodal genAI systems can diffuse a bigger variety of data, and uniquely generate from it, enabling high personalization among other abilities, it is suggested that it might be the key to higher production of competitive advantage compared to unimodal genAI systems (Dwivedi and Mariani. 2024, pp. 12-14). Related to the outputs of the innovation process was also included the possible benefit "helps us develop more radically novel new products/services." Because of the enormous amounts of data and ability to create outputs from it, it is considered to provide configurations that would not otherwise come up, enabling more ideas of radical innovation (Candi and Roberts, 2024, p. 5).

Finally, the impacts affecting the entire innovation process and management, implication numbers 7-9 and the potential benefit of "speed up our innovation process". Implication 7) genAI, agency and ecosystem refer to the likelihood of emerging of dense hybrid networks of stakeholders and actors consisting of humans and computers. The cooperation of humans and genAI agents in addition to innovation teams that include both, is seen as a factor enabling innovation. In addition, it might, in long run, create a decrease of human involvement in the innovation process as the interaction between the two evolves. Implication 8) Policymakers, lawmakers and anti-trust authorities in the regulation of GenAI-enabled innovation consider the need for radical changes in the regulatory frameworks of the entity of genAI. Regulations, naturally, may restrict and allow innovation,

but will in either case require resources to comply with them. 9) Organizational design and boundaries for GenAI-enabled innovation theme addresses the implication of genAI on the skills, knowledge, and organizational structure of companies. Strategy, skills, and competences need to be upscaled to enable genAI innovations, and those knowledgeable will be the ones shaping the work design. As the content of the jobs differs, managing and organizational structure will need to be reshaped as well (Dwivedi and Mariani, 2024, pp. 14-16).

Whereas Dwivedi and Mariani (2024) encouraged future research on innovation management, Candi and Roberts (2024) focused in their research on the actual usage of AI and genAI in the innovation process. Their innovation process had three phases: idea generation, development, and commercialization – similar to the critical innovation stages recognized by Dossou-Yovo (2017) (see section 3.1.) The use of AI was significantly higher within the development phase than the others. This was because AI is good at improving existing processes, which is in line with the development stage. The development stage includes prototyping, which AI helps in cost and time reducing manners (Candi and Roberts, 2024, pp. 7-8).

There was no significant difference within the extent of genAI use between different process stages, as genAI is still an emerging technology and its integration within the innovation process is not clear for managers yet (Candi and Roberts, 2024, p. 8). Within their study Candi and Roberts (2024) also concluded that there is no correlation between the use of genAI and company size (measured by employee number) (Candi and Roberts, 2024, p. 7). This conclusion is somewhat contradictory to other research e.g. Dwivedi *et al.* (2023, pp. 39-41), and Dwivedi and Mariani (2024), although it could be explained by the democratization as earlier introduced in section 2.2. The latter's research suggests that even just the regulatory implication (implication number 8) might create such a burden on SMEs that it might prevent them from implementing genAI into innovation activities (Dwivedi and Mariani, 2024, p. 15). The data on the usage of AI in Finnish companies also appear to behave contrary to Candi and Robert's finding as larger Finnish companies clearly had utilized AI more than smaller ones (*OSF*, 2021) and these statistics did not specify the emerging genAI technology. All of this lack of research and inconclusive findings further strengthen the need for this research.

## 5 Research Method

### 5.1 Qualitative Research Strategy

This research aimed to understand how genAI was utilized in innovations of SMEs. It also aimed at understanding what contributes to non-utilization of genAI in SMEs. Therefore, the problem of the research was that the use of genAI in innovations in SMEs is not clear. To be able to understand the phenomenon under study, real-world companies were needed, that allow the study objects (SMEs) to tell in their own terms how they perceived the usage. The outcome aimed at a description of the current state in innovation process perspective. It was feasible to label the research problem as both explanatory and descriptive, which according to Hirsjärvi *et al.* (2010, pp. 138-139) suggested a qualitative research strategy. When further considering the purpose and aim of the study together with Hammersley's (2013, pp. 10-14) listing of common qualitative characteristics, it became evident that a qualitative research strategy needed to be selected.

From the most common qualitative data collection methods, such as observation and interviews (Hirsjärvi *et al.* 2022), the latter was considered in this study, to be more specific semi-structured thematic interview was selected as the data collection method. The decision was based on the consideration of the most feasible way to gather enough necessary data within the existing time frame. Thematic interviews give voice to the interviewee subjects of the study yet allowing flexibility and consideration for the researcher during the interviews (Hirsjärvi *et al.* 2022). As the name suggests, thematic interview preparation requires forming of themes which direct the interview rather than strictly define questions like in structured interviews (Hirsjärvi *et al.* 2022). Selection of themes was seen as a supporting factor for answering the research questions. Exclusion of observation was done based on the realistic utilization of the time available for the research and because it was thought that observation would not bring any depth of understanding to the topic.

This study's data analysis method was thematic analysis, a qualitative data analysis method (Hirsjärvi *et al.* 2022). It was seen as complimentary to the data collection method, as it was seen to allow the collected data and the analysis to synchronize in the selected themes. Thematic analysis and the coding process will be expanded upon in section 5.3.

## 5.2 Semi-structured Thematic Interviews

A target of 7 to 12 interviews was set, to allow for a reasonable sample size for this research. The target size of the companies selected in the sample was small to medium sized companies, based on the SME definition by *Gartner* (2024) to understand the experiences of those who usually have less resources. To answer both research questions, it was recognized that two types of companies were needed in the sample:

1. Those who utilize genAI to understand the usage of genAI in innovation and
2. Those who do not use genAI to understand the barriers and challenges of use

As users and non-users of genAI were needed, convenience sampling was utilized by recruiting companies from the researcher's network.

The initial aim was to interview those holding positions at the executive level. However, due to the relative novelty of the topic, the focus was adjusted after first contact. Instead, the researcher interviewed those responsible for genAI within the company or those identified as a more suitable person to be answering the questions of genAI for a wide enough view on the organizations' usage of genAI and innovation process. Hence, not all of the participants were at the CxO level. Interviews were agreed with 11 companies, however after the interviews, the final sample size was 9 companies. Interviews were conducted between May and June 2024 (9 interviews) and in August 2024 (2 interviews).

Two of the interviews were excluded from the analysis as the roles (Sales Director and Business Development Manager) were not responsible for genAI activities in their companies thus they didn't have a wide enough view to answer on the questions of genAI usage and implementation company wide. These excluded companies are marked in red in Table 3 below. In addition, demographics of the interview sample are presented in the Table 3.

Table 3 The Limited Interview Sample

Company nr	Industry	Size category	Title of the interviewee
Company 1*	Wholesale	Small	Sales Director
Company 2*	Manufacturer	(Large) Small	Business Development
Company 3	Manufacturer	Small	Growth Director
Company 4	Energy	Midsize	Business Director, Customer Experience and Digitalization
Company 5	Wholesale	Midsize	ICT Manager
Company 6	Real estate	(Large) Midsize	CTO, CIO
Company 7	Energy	Midsize	Development and ICT Director
Company 8	Insurance	(Large) Midsize	Senior ICT-Manager
Company 9	Real estate	(Large) Midsize	CTO, CIO
Company 10	Construction	Midsize	CIO
Company 11	Insurance	(Large) Midsize	Head of Robotics

Preparation for the interviews was done after the preliminary literature review (Figure 1, section 1.3). The themes were selected based on both the literature and the aim of the study to understand the current usage of genAI in innovation and the barriers of use. Four themes were identified and initial questions to investigate these themes were also prepared (Table 4):

Table 4 Defined Themes and Supporting Questions

Theme	Theme description	Supporting questions
1	Current way of utilizing genAI	<ul style="list-style-type: none"> <li>• How would you describe your company's general understanding and awareness of genAI?</li> <li>• To what extent has genAI been utilized in your organization?</li> <li>• Could you describe a recent project where genAI was used?</li> <li>• How was genAI adopted in your organization?</li> </ul>
2	Innovation process and activities	<ul style="list-style-type: none"> <li>• How do you use genAI in innovation?</li> <li>• How would you describe your innovation process?</li> <li>• How does your organization's culture and management practices support the use of genAI?</li> <li>• How is skills development in genAI supported in your organization?</li> <li>• How does your organization utilize the expertise available in the ecosystem (customers, suppliers, educational collaborations, networks) for the use of genAI?</li> </ul>
3	GenAI pre- and post-adoption challenges	<ul style="list-style-type: none"> <li>• What barriers or difficulties have you encountered in the adoption of genAI? <ul style="list-style-type: none"> <li>○ Leadership &amp; organizational culture, skills &amp; learning, ecosystem, technical aspects: data &amp; infra, security</li> </ul> </li> </ul>
4	Prospects	<ul style="list-style-type: none"> <li>• What expectations or plans does your organization have for the use of genAI in the future?</li> <li>• How does your organization plan to promote and develop the use of genAI in innovations?</li> </ul>

The interview framework (Table 5) was prepared following the themes yet keeping in mind that two types of companies were targeted to be interviewed. The first section – questions for all, included the demographics of both the company and interviewee, and also a question to clarify whether the company is utilizing genAI or not. Based on the answer, the interview either continues to section 2) current state and adoption of genAI or 3) questions if genAI was not used. During the interviews, it became clear that such division of sections was not particularly useful, as the use of genAI was not easily categorized simply as “using” or “not-using”, but rather those who are more advanced in the use and those who are using it discretely. The semi-structured thematic interviews’ flexibility became essential within this research, as it guided navigation depending on the level of usage.

*Table 5 The Interview Framework*

Section 1 <ul style="list-style-type: none"> <li>Demographics of company &amp; interviewee</li> <li>Understanding and extent of use of genAI (theme 1)</li> </ul>	
Section 2 USERS of genAI <ul style="list-style-type: none"> <li>Current state and adoption of genAI (themes 1, 2)</li> <li>Innovation process and activities (theme 2)</li> <li>Challenges in utilizing genAI (theme 3)</li> </ul>	Section 3 NON-USERS of genAI <ul style="list-style-type: none"> <li>Barriers to use (theme 3)</li> <li>About innovation (themes 2)</li> </ul>
Section 4 <ul style="list-style-type: none"> <li>Prospects and development directions (theme 4)</li> <li>Possible additional topics raising from interviewee</li> <li>Greetings to other companies related to genAI use</li> </ul>	

Before starting the actual interviews, all participants were provided with the study’s commitment to privacy and confidentiality. It was done by going through a slide with the statements:

- All information revealed during the interview and in the results will be treated confidentially and used solely for the purposes of this thesis

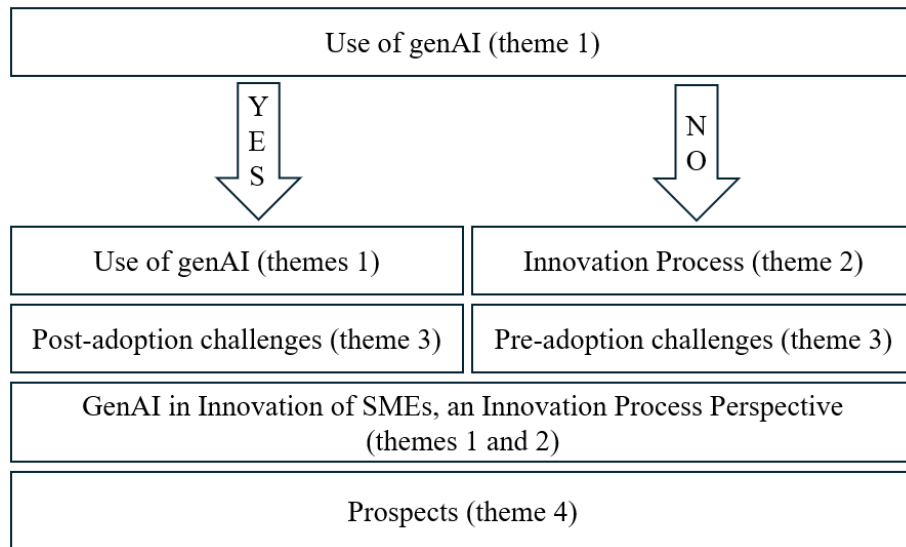


- The interview will be recorded and transcribed using Microsoft Teams
- The recordings will be anonymized (all names will be removed)
- The anonymized interview material will be analysed using generative AI (ChatGPT 4 and/or Copilot)
- No names will appear in the final thesis (neither company names nor the names of the interviewees)
- The recordings will be deleted once the completed thesis has been published and evaluated

Before proceeding to the actual interview, all participants accepted the presented way of work. All the interviews were held on MS Teams, with video and recording on as well as transcript directly by MS Teams.

### 5.3 Thematic Data Analysis

As the interviews were recorded and transcribed by MS Teams, the analysis began with proof reading, anonymization, and correcting of the existing transcripts. Then the material was coded by using a thematic approach, and finally the actual analysis was made. After the analysis and conclusions, ChatGPT 4o was utilized to check if there were any novel facts left unseen by the researcher. For this, a new, personal GPT was created. The instructions, given knowledge, and other parameters used to define the GPT, are presented in (Appendix 1). Furthermore, the prompts used are introduced in (Appendix 2). One of the ChatGPT suggested topics were added into the conclusions in chapter 7: Embedding GenAI in Long-Term Strategy.



*Figure 4 Current State Structure*

The current state structure, which follows thematic analysis, is presented in Figure 4. Analysis began by dividing the companies into groups “users” and “non-users”. This allowed focused analysis on both of the study’s research questions. After that, the coding was completed according to the themes. The current state was built based on the findings from thematic analysis of the interviews and presented following Figure 4 above.

First, the “non-users” state of the usage of genAI was described, to understand what is concretely meant by “non-users”. Then, the recognised pre-adoption challenges, or barriers, are presented as well as the non-users’ innovation processes.

For the “users”, the use of genAI is first presented through topics: general awareness on genAI, adoption of genAI, genAI use cases, and post-adoption challenges. The following section “The section genAI in innovation of SMEs, an Innovation Process Perspective” includes descriptions of the genAI in the Innovation Process of “Users”, Non-users’ Innovation Processes, Utilization of External Expertise, Leadership and Organisational Culture, and, finally, Skills and Learning. The current state is finished off with Prospects.

## 6 Current State of GenAI in Innovation of 9 SMEs

### 6.1 Description of Data

Altogether, 9 companies formed the sample of this research. The interviewed companies' industries, company size (in two parameters; personnel and revenue), and size category were compiled. Size category is defined based on Gartner's SME definitions:

- *small* – both size indicators (revenue and number of employees) are within *Gartner's* (2024) “small” enterprise definition,
- *medium* – both indicators within “midsize” enterprise definition levels
- *large medium*, where one of the size indicators falls between the “midsize” category and the other being larger than midsize definition (marked with a star).

The industries presented in the sample included manufacturing, construction, wholesale, energy (2 companies), real estate (2 companies), and insurance (2 companies). More detailed descriptions of industries and company sizes are excluded in order to respect the anonymity of the companies as well as interviewees. Additionally, interviewees demographics are presented below (Table 6).

Table 6 Study Sample Demographics

	Industry	Personnel	Revenue, million e	Size category	Title of the interviewee	Experience years of interviewees	Age group of interviewees
Company 3	Manufacturer	0-99	<45	Small	Growth Director	<5	40-49
Company 4	Energy	100-999	45-920	Midsize	Business Director, Customer Experience and Digitalization	10-14	40-49
Company 5	Wholesale	100-999	45-920	Midsize	ICT Manager	5-9	30-39
Company 6	Real estate	999+*	45-920	(Large) Midsize	CTO, CIO	<5	30-39
Company 7	Energy	100-999	45-920	Midsize	Development and ICT Director	5-9	40-49
Company 8	Insurance	100-999	920+*	(Large) Midsize	Senior ICT-Manager	20+	50-59
Company 9	Real estate	999+*	45-920	(Large) Midsize	CTO, CIO	20+	40-49
Company 10	Construction	100-999	45-920	Midsize	CIO	20+	50-59
Company 11	Insurance	999+*	45-920	(Large) Midsize	Head of Robotics	20+	40-49

Most of the interviewees were clearly from IT/ICT/Technology functions, with many leading that function, but also the titles “Growth Director” and “Business Director” are included in the mix. Most interviewees had more than 20 years of experience in their field according to the interviewees themselves. All interviewees were older than 29 years, two interviewees were between 30-39 and 7 interviewees were older than 39.

To better understand the use and barriers of genAI use in innovations, two user groups were recognized: genAI users and non-users. Companies were divided into these two groups based on the general level of genAI usage within the company. The group “users” include those companies who had utilized genAI more widely than just on an individual level, had proof-of-concepts on-going or completed genAI implementations, had wider than individual level

pilots on-going or completed, and a genAI application(s) in use company-wide. Non-users were companies who either did not recognize using genAI at an organizational level, or it was utilized unsystematically, sporadically by individual(s) or individual teams, not systemically across the organization.

*Table 7 The Demographics of the User Groups*

	<b>USERS</b>	<b>NON-USERS</b>
<b>Company number</b>	6, 8, 9, 10, 11	3, 4, 5, 7
<b>Level of usage</b>	Structured, organization-wide implementations of genAI	Limited, individual or discrete usage patterns of genAI
<b>Industries</b>	Real estate (2), Insurance (2), Construction	Energy (2), Manufacturer, Wholesale
<b>Size categories</b>	Large Midsize (4), Midsize	Midsize (3), small
<b>Interviewee experience years</b>	20+ (4), <5	5-9 (2), <5, 10-14
<b>Interviewee age group</b>	40-49 (2), 50-59 (2), 30-39	40-49 (3), 30-39

Demographics of the companies as well as two factors related directly to interviewees are presented in Table 7 above. Users included both real estate and insurance companies and a construction company within the more large, midsize category. Almost all interviewees had extensive experience and were leaning on the more mature end of the age category. “Non-users” interviewees age was on more a mid-age range and with less years of experience. The size of the companies of non-users leaned on the solid midsize section. Industries presented within the “non-users” were both energy companies, a manufacturer and a wholesale company.

## 6.2 “Non-users” Group and GenAI

### 6.2.1 The State of GenAI Usage

Following are the summarizations of each of the company’s current state at the time of the interviews. These summarizations enlighten the variety of approaches on genAI and provides a reasoning for why the companies were categorized as “non-users”.

**Company 3:** The company had individuals who were aware of genAI, might have utilized available genAI applications and were eager to understand more. There were also individuals who didn’t utilize nor understand genAI. The company’s top management defined the ambition level of genAI and recognized the subdivisions and processes for piloting genAI. Strategy alignment had supported the company in taking initial steps to prepare for the adoption of genAI by spreading awareness, providing learning opportunities, and by seeking more potential use cases. The company had started to increasingly and systematically discuss the topic, e.g. share best practices for the usage of ChatGPT within the individuals’ work. The company had recognised that enabling utilization of the company’s own data could bring business value, and enabling leveraging of their own data was the objective for the company. Simultaneously, the basic infrastructures’ state prevented broader utilization of genAI. The company had the data stored in network drives and migration to cloud was on-going. Copilot had been considered as a potential go-to technology after completing the basis for further development.

**Company 4:** Company stated that genAI is a theme they will want to focus on. They had initially recognized some areas of applications and evaluated the impacts they may have on business. GenAI was considered an area part of automatization and robotization. However, execution of activities had been halted, as they wanted it to be included in the implementation of the upcoming strategy work. A strategy-driven approach was seen as the way to proceed, and it had been scheduled to start in fall 2024. There had been initial experiments done by a small group of employees, to try Copilot’s capabilities e.g. summarization, however the results had not been too promising, language-wise. ChatGPT licensing had been in the consideration, but not yet bought. The company had many other on-going activities requiring capabilities and resources, which justified the postponing of the purchase of genAI agenda.

**Company 5:** After the release of ChatGPT in 2022, the company's IT team took it into use and tried to ideate use cases for leveraging it. As an organization utilizing Microsoft products, Copilot was thought of as a natural continuation, and was taken into use after it was included in the existing licensing. Initial experiments with these tools had enabled creating awareness of genAI within the company. Experiments included support in the forms of Excel and Microsoft Active Directory (AD) environment's tips of use, which was considered the biggest benefit thus far. As a next step, the company considered expanding the use into business in the form of utilizing genAI to create meeting notes, meeting preparation, translations etc.

**Company 7:** The use of genAI in the company was considered sporadic by the interviewee as genAI had not been integrated into any process nor had it been harnessed for daily operations either. The company characterized itself as naturally prioritizing a responsive approach to emerging topics, rather than proactively pursuing them. GenAI was considered as a support tool for people, and the free Copilot version was available for use to all within the company. A pilot group of 10 had been established for the elaboration of Copilot for Business, concluding that it is a support tool for text summarization, translations and such. In addition, an initiative handling platform had been in use by a few, which had ChatGPT integrated within to challenge and analyse the initiatives and, therefore, it had not been seen as a major factor of the utilization.

As can be seen, two of the companies were clearly not in the phase of fully engaging with genAI, where one clearly had recognized the potential but couldn't elaborate due to infrastructure barriers. One company utilized genAI and claimed that they had benefited from the use, however the use of genAI was seen as insignificant, especially when compared to the "users" (section 6.3).

### 6.2.2 Challenges

The non-users' challenges were two-fold: 1) there were concrete challenges that prevented the use of genAI (barriers) and 2) recognized challenges based on the initial experiments and individual use of genAI tools.

Barriers of use were:

- Organisational readiness:
  - Old infrastructure: data in network drives (migration to cloud on-going), unable to utilize genAI systems with own organisation's data (Company 3)
  - The company was not yet prepared to integrate further, however there were already plans to leverage genAI use (Company 5)
- A decision to postpone and include genAI in the future strategy (Company 4)
- A decision to wait and see. The company's approach towards new technologies had been to follow-up on the topic and wait for validated input-output ratio offering ready-made solutions (Company 7)

The challenges emerging from the initial experiments have been listed and categorized in the table (Table 8) below. Challenges within the category leadership, skills and organisation are considered as genAI adoption related challenges, where challenges in technical aspects are considered as genAI technology related challenges.

*Table 8 The Recognised Challenges of "non-users"*

Category	Challenge	Emergence in Organization
<b>Leadership, skills and organization</b>	Lack of understanding	<ul style="list-style-type: none"> <li>• Employees seeing the obvious use cases of genAI, like translation, but not more advanced possibilities</li> <li>• Difficulties in defining actions to gain business benefits</li> </ul>
	Lack of (key) resources	<ul style="list-style-type: none"> <li>• Shared resources for regular tasks and development, when contradicting development seen as secondary</li> <li>• Simply no time for experimentation</li> </ul>
	Expectation management	<ul style="list-style-type: none"> <li>• Employees having misaligned expectations regarding genAI capabilities</li> </ul>



	Managing the continuous change and development of technology	<ul style="list-style-type: none"> <li>• Difficulty in addressing the sufficient selection of rapidly developing technology: a tool selected today might be insufficient tomorrow</li> </ul>
<b>Technical aspects</b>	Information security	<ul style="list-style-type: none"> <li>• Ensuring data security is a one of the primary factors in the selection of technological solutions, critical in sectors where protection of sensitive information is paramount</li> </ul>
	Immaturity of technology	<ul style="list-style-type: none"> <li>• Focus of the company in ready-made solutions, but there are no ready-made solutions available</li> </ul>

Most of the recognized challenges focused on the people and organization rather than on the tool. There were no challenges recognized from the environment category.

### 6.3 “Users” Group and GenAI

#### 6.3.1 General Awareness

When specifically asked about general understanding and awareness of GenAI within the organization, responses varied slightly. Most interviewees explained that they had followed the topic of AI for a long time, and when ChatGPT was published in fall 2022, it called for action. It was emphasized that the work had begun by understanding what genAI truly means to their organization and people.

*“When it comes to generative AI or AI in general, there have, of course, been various AI-related projects on the table for quite a while, but genAI changed things significantly at the end of 2022, and then, right in the spring of 2023, it was recognized that something needed to be done.”*

*Interviewee, Company 6*

One of the companies addressed the importance of genAI’s capability to facilitate business as being a helpful tool, yet humans have the responsibility to “finish-off” the tasks genAI

had started. In other words, not believing that genAI would be able to replace humans for a very long time, although media has made it sound like it. Another replied by the definition of genAI and explained its difference from AI in general (genAI innovated in addition to AI). Furthermore, the respondent perceived genAI as a tool amongst others, which was treated as “business as usual”. In addition, two of the companies addressed that they had leveraged a “learning by doing” approach and were trying to understand more deeply what capabilities genAI will bring in the future, thus acknowledging that benefit realisation will not happen immediately.

The interviewees, most responsible for genAI adoption had genuine interest and curiosity towards genAI and its possibilities. Based on the responses, the interviewees seemed to understand the topic extensively within their organisations’ environment. A mutual consensus within all the interviewees was that genAI could not be ignored and action had to be taken.

Although the interviewees had a solid awareness of the topic, the awareness of the whole organizations differed. All users had recognized the need for spreading the information throughout the organization to increase the level of awareness and had established different ways to do it. However, only one company had set metrics to measure the development of the awareness of the entire organization, where others indicated the lack of understanding being the biggest challenge in regards to adopting genAI.

### 6.3.2 Adoption

Companies in the “Users” group were active in experimenting, testing, proof-of-concepting, and piloting different cases and opportunities to recognize those big business benefits. All the activities are seen as adopting genAI. The process picture (Figure 5) summarizes the main phases of genAI adoption of the “Users” group. Companies had a focus and a vision, some had defined AI strategies, some considered what genAI meant for the business and industry in question.

*“When we started thinking about it, we naturally identified three paths.*

*We consider the easy things first. The first path involves those easy things that are clearly visible, where certain assistant tools or similar tools can provide help to everyone, especially those working in offices, and the business case is relatively clear. Then, the second path is about*

*what can be done even better in our current business operations from a business perspective. What kind of improved services can we offer to customers with AI assistance? And then the third path, our final path, is somewhat of an unknown path. We began with the idea that, since we started down this path about a year ago with high ambition and in a timely manner, it will eventually open up new business opportunities for us.” Interviewee, Company 7*

Focus enabled companies to take further action in the field of genAI. Ambition levels differed between the companies. One admitted having a high ambition level, where a few recognized that there is no need to be in the frontier, however it cannot afford to be left out of the development either. One considered genAI as business-as-usual – a tool among others, and naturally adopting it.

*“If you look at what we’ve been trying to understand, it’s probably the same as everyone else: what does this mean for our industry? What does this mean for our people? We’re not a technology company, so in a way, we don’t have the will or interest to be at the forefront, but we also can’t afford to lag behind. So, perhaps the question is more about finding the right approach for us.” Interviewee, Company 9*

In parallel, the understanding of genAI had to be improved to address the focus and vision. Understanding was built in two ways: compiling pilot groups to further investigate and test different genAI systems, and by sharing the know-how across the organization.

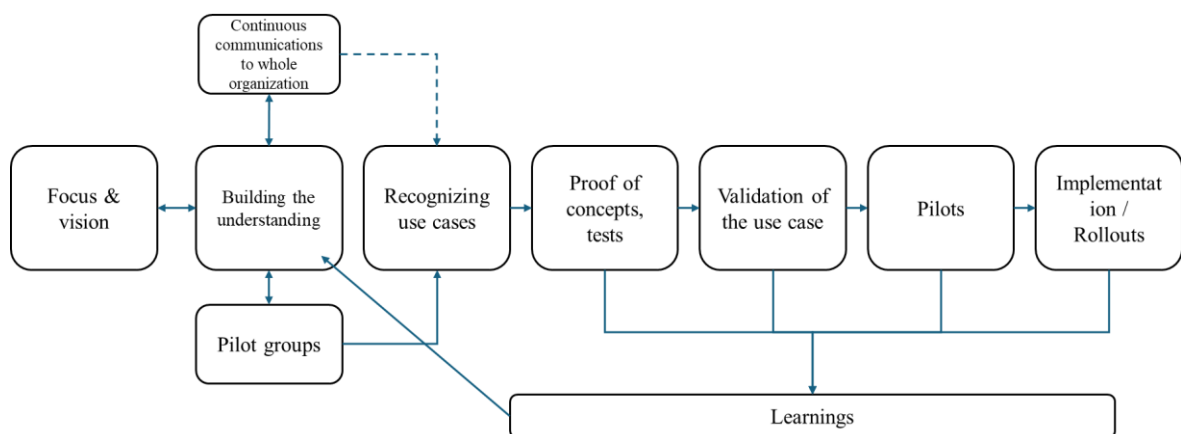


Figure 5 Adoption of genAI by "Users" group companies

Piloting was referred to in two senses: 1) pilot groups piloting different genAI tools and 2) use cases within the pilot stage. Pilot groups were formed cross functionally to bring together

experts on wide perspectives. No company stated that they would have specifically restricted attendees from pilot groups but expected activity from the members. Pilot groups utilized different approaches, some relied on cross-functional collaboration and a very structured way of working, like division of people into groups by themes like setting targets for each group and metrics to evaluate whether the activities are beneficial. Some of the pilot groups operated in a more relaxed manner, gathering to discuss on findings and benefits, but not in a formal manner nor did they have metrics in place. Either way, the goals were to learn and understand more and to identify potential (business) use cases and to evaluate them.

Evaluation of the ideas related to genAI was considered more difficult, if not impossible, than evaluating other improvement ideas, due to the unknown scale of benefits and the different, more unclear, cost structure. Hence, the results from different small tests, proof-of-concepts (PoCs), and experiments were used as the basis for decision making on whether the idea should be developed further.

*“Then, of course, when we start making rollout investments of that type, it’s practically impossible to calculate what kind of return this will generate, especially when it comes to strict euro-based business case calculations. I mean, someone could just pull a number out of a hat, but it wouldn’t actually be based on anything. So, determining the input-output ratio is really challenging.” Interviewee, Company 9*

*“In a way, we noticed very early on that the business case needs to be calculated differently. The uncertainties are not in the project itself but rather in the production phase, whereas before it was exactly the opposite.” Interviewee, Company 6*

Partially due to that fact and the novelty of the genAI, the companies had accepted that there will be many failures. Failing was, however, considered as a learning opportunity and basis for improving by iteration.

*“So, basically, when you try to build business cases for this kind of AI, I would say that it may not necessarily work. I also believe that there will be a lot of failures—there are good ideas, but they just don’t take off, and that’s something we need to understand here.” Interviewee, Company 10*

After successful piloting, the findings were communicated to gain buy-in from the organization. By recognising the benefits, further rollouts were considered, in the instance of a scalable use case. The dashed arrow (Figure 5) from continuous communications to

whole organization describes the on-going understanding and learning that is taking place as an organization, which will feed into increasing recognition of business use cases.

In addition to ChatGPT, the selection of genAI tools were in many cases quite straight forward as the platform in use directed the genAI tool selection, hence, if company already utilized Microsoft platform entity, the natural continuity in use was Microsoft's Copilot. Whereas "Google" companies' natural choice was Google's Gemini. Microsoft was the most used by far by the companies in this study. Only one company described implementing language models themselves e.g. with OpenAI on Azure or Google Gemini. The same interviewee stated that one of the findings they had was the importance of the selection of the technology, more specifically, a language model, as they differ in their power, capabilities, and cost structure.

It was felt by a few companies that MS Copilot's language efficiency in Finnish was not fluent enough for efficient use, but it was expected to improve soon. With existing platforms also, the development was included, and updates were delivered automatically, which was an appreciated factor. Company 11 pointed out that when evaluating the business cases of the applications, such chatbots, the suitability of both genAI and AI should be considered as it could be that ready produced answers by AI might be better in a sense of customer service than newly generated responses each time by genAI. Company 6 even challenged the whole consideration of the technology unnecessary as it was seen that the technology will be there in a matter of time which had allowed the company to consider that everything is possible.

### 6.3.3 Use Cases

Interviewees of the "users" group introduced 19 examples of use cases in use or in development as summarised in Table 9. Most use cases were in the areas of customer service (4), marketing (4), individual workflow improvement (where genAI is used to improve one's ways of working) (4) and sales (2). Business processes with just one recognized use cases were development, finance, order handling, project management, and software development.

The use of genAI had passed over the individual employees work improvements as customer phasing processes related use cases had been initiated. However, these use cases are not directly created for customers as new services or products, but affects customers by

improving customer service, improving process outcomes like invoicing, faster decision making, and more accurate communications (use cases 1, 2, 3, 4, 18).

*Table 9 Recognized Use Cases*

<b>Use Case nr.</b>	<b>Use Case</b>	<b>Business process</b>
1	Analysis of customer and phone service feedback, short time interval (max 1-2 months)	Customer Service
2	Customer service support: directly suggesting solutions based on contacts	Customer Service
3	Translation of applications and decisions	Customer Service
4	Formatting of content (customer messages and decisions)	Customer Service
5	Creation of user story templates	Development
6	Creating a work statement for the invoice	Finance
7	Chatbot build on company's own intranet	Individual workflow improvement
8	Finding information within your own organization	Individual workflow improvement
9	Email management	Individual workflow improvement
10	Sparring partner/support	Individual workflow improvement
11	Content ideation in marketing	Marketing
12	Image production	Marketing
13	Translation of marketing materials	Marketing
14	Content production	Marketing
15	Data classification	Order handling
16	Project planning and requirement specification	Project Management
17	Review of external leads	Sales
18	Sales contact plan and reminders to CRM based on conversations	Sales
19	Support in coding	Software development

An example of a business process use case and its benefits for the organization can be seen from e.g. 6) Creating a work statement for the invoice. In this use case, a manual activity was replaced by a genAI tool which reviewed the original invoice description and formed a coherent and clear description for an employee to validate. The change enabled improved quality of the invoice and process: removal of a manual task which required clarification from different people within the organisation by clear and understandable work statements drafted by genAI which reduced invoicing time. It also improved customer satisfaction secondarily as all needed information with regards to the invoiced work was presented clearly.

Another example of a use case, which showed promising benefits, was related to the sales process: 18) Review of external leads. Before piloting genAI, the company was able to filter external leads detected by their sales system from social media to either 30 000 leads per month or none, depending on the filters. For the sales personnel to review over 30 000 leads per month was technically impossible. GenAI was piloted and it was able to decrease the 30 000 leads per month to around 300 leads per month, with the relevance of the leads increasing. GenAI retrieved data from different external sources (social media), combined them with organizational data (website visits) and then formed an accuracy level of the lead based on selected parameters.

Both use cases explained above, and many others, have raised the centre of focus from an individual level to the business process level. The companies had utilized genAI as an individual's assistant, support, and improvement of one's own work performance as well as in business processes. There were no new service nor product innovations within the use case examples. One company had recognized the potential of new businesses emerging in future as a result of systematically working on improvements of individuals' workflows and business processes.

#### 6.3.4 Challenges

Challenges recognized by the companies within the "users" group were diverse. The challenges that arise more than once were lack of understanding, expectation management, and legislation (AI regulation). The recognized challenges are put into three categories and presented below in Table 10.

*Table 10 The Recognised Challenges of the "Users"*

<b>Category</b>	<b>Challenge</b>	<b>Emergence in Organization</b>
<b>Leadership, skills and organization</b>	Lack of understanding	The lack of understanding among top management poses a challenge to the adoption of generative AI, as it prevents efforts to foster organizational commitment. Employees lack of understanding prevents efficient recognition of valuable ideas and slower the adoption of genAI. In addition, risk of spreading confidential data occurs if users are not aware of the security issues.
	Expectation management	Business representatives seeing state of the art demos visualizing the possibilities of genAI thinking that genAI can solve all problems vs. what is possible within the company's environment with genAI. The company requiring the demo's benefits without understanding the requirements it has.
	Financials (calculating business case)	The unclarity of the costs has shifted from development to production. Development is very fast and pushes costs down, where production costs may rise extensively as many models are charged by use.
	Lack of competence and skills to use the technology	Although genAI tools are "easy-to-use" they do require self-learning too to adopt it into your own work, especially for people with no technical background. It becomes a threshold that requires assistance to overcome.



	Lack of ideas	“Nine out of ten ideas will die”, the mass of ideas must be big to enable feasible ones.
	Recognition of the proper partners	Increased number of service providers offering genAI tool and all service providers eagerly reaching for customer references, causing the actual competence verification of the service providers to be difficult.
	Managing the continuous development of the technology	The technology selected today might be insufficient tomorrow as the development of technology is so rapid. Acceptance that wrong selections will be made and the need for focus on how to manage a moving target.
	Lack of resources	Adoption of genAI (including leading the change) is basically on the shoulders of the interviewee on top of all other duties.
<b>Technical aspects</b>	Information security	Understanding how the tools process data is not transparent which has taken a lot of time to investigate and understand. In addition, it drives the selection of the technology and restricts the input data, impacting the output quality and therefore value creation.
	Limited language (Finnish) support	In many cases, companies must wait for Finnish language support, as business is in Finland, before leveraging genAI.
	Immaturity of the technology	The desired features related to data utilization are not yet available.
	Financials (Cost)	Costs were difficult to calculate, as charged by use in production - thus might

		quickly rise exponentially when AI was not bought as a service). Might prevent usage of some models.
<b>Environment</b>	Legislation & AI regulation	Seen in some cases as a barrier of use and a potential risk, as EU legislation prepared at a national level might affect the use of genAI, or the business value.

“Users” recognized most challenges related to leadership, skills, and organization where 8 out of 13 problems were categorized. Four challenges were technology related, and one environment related challenge occurred.

#### 6.4 GenAI in Innovation of SMEs

##### 6.4.1 GenAI in the Innovation Process of “Users”

GenAI enabled companies to create innovations. The use cases, listed above (Table 9), provide a good look at the concrete genAI innovations of the companies. By far most of the innovations were incremental innovations. No radical product or service innovations were recognized.

GenAI was used by individuals as a brainstorming tool, a tool to help with white paper syndrome, clarifying thoughts, and retrieving information on topics unknown or vague to the individual. In one of the companies, genAI was used to create user stories to clarify the problems and ideas. GenAI was also used as business idea collector in the background. All these activities are related to the beginning of the innovation process, usually the stage ideation.

*“What I encourage everyone to do is to use generative AI, especially Copilot in the Microsoft environment, as a support and sparring partner, as it’s perhaps the most obvious way to leverage it for innovation. When you need to explore a new area and think things through, it’s, of course, good to brainstorm with your biological colleagues, but it’s also very helpful to start with generative AI. That’s perhaps the most obvious way to use it as an aid in innovation.” Interviewee, Company 11*

Summarization of each company's innovation process are presented in Table 11. The interviewed companies had different approaches to the innovation process. Nevertheless, all companies recognized that innovation processes existed within the companies.

*Table 11 Innovation Processes of the "Users"*

<b>Company</b>	<b>Innovation Process summary</b>
Company 6	No data collected on plain innovation process, but summary drawn from genAI ideas to production stages: Informal process of gathering ideas and a tool to enter them. Formal process from approval stage onwards. Focused on knowledge sharing to enable initiation of employees thought process "What does genAI mean to my work?" Seemed to have worked, as more ideas collected than could have ever been implemented. Specific AI steering group who evaluated initiatives.
Company 8	Business problem centric, continuously developed, detailed innovation process. Systematic idea harvesting/market analysis done both internally across business and externally. Regular ideating workshops. Ideation capability shifted towards business units. Experiment/pilot/PoC budget existed, decisions to proceed to PoC upon to informal steering group composed of business representatives. PoC moved to ICT development, business unit or discarded.
Company 9	Less structured innovation process due to flat organization. Focused heavily on idea harvesting/market analysis, not as focused on internal development. Ideas related to technology raised typically from ICT and business. Cross functional Concept Center ideating by two paths: review of references and a lot of PoCs in business environment or in office laboratory. In addition,

	Concept Center considered an essential role as it had the best knowledge of the company's capabilities.
Company 10	Technology related innovation process existed. Idea collection tool available for all, which also provided a transparent view on all the ideas and their statuses. Service promise to contact the ideator, which initiated pre-study analysis to validate the idea reasonably.
Company 11	An innovation process where the aim was to explore technologies and their usefulness. The process addressed stakeholder involvement and support functions to conduct brief PoCs and experiments. If decided to implement further, another team take the PoC and transform it into a product and/or service which serves bigger audience.

Most of the companies followed the performance of the process, in other words they had some metrics in place to steer the process performance. Systematic approach to innovation management was evident. When comparing the highlights of the innovation processes (table 11) to genAI adoption activities drawn (Figure 5, section 6.3.2), the companies' described activities fit in the adoption of genAI figure. To further elaborate, Figure 6 presents the adoption of genAI activities with the innovation process summary (Table 11). Only the focus & vision and learning boxes were left without any recognition of innovation process.

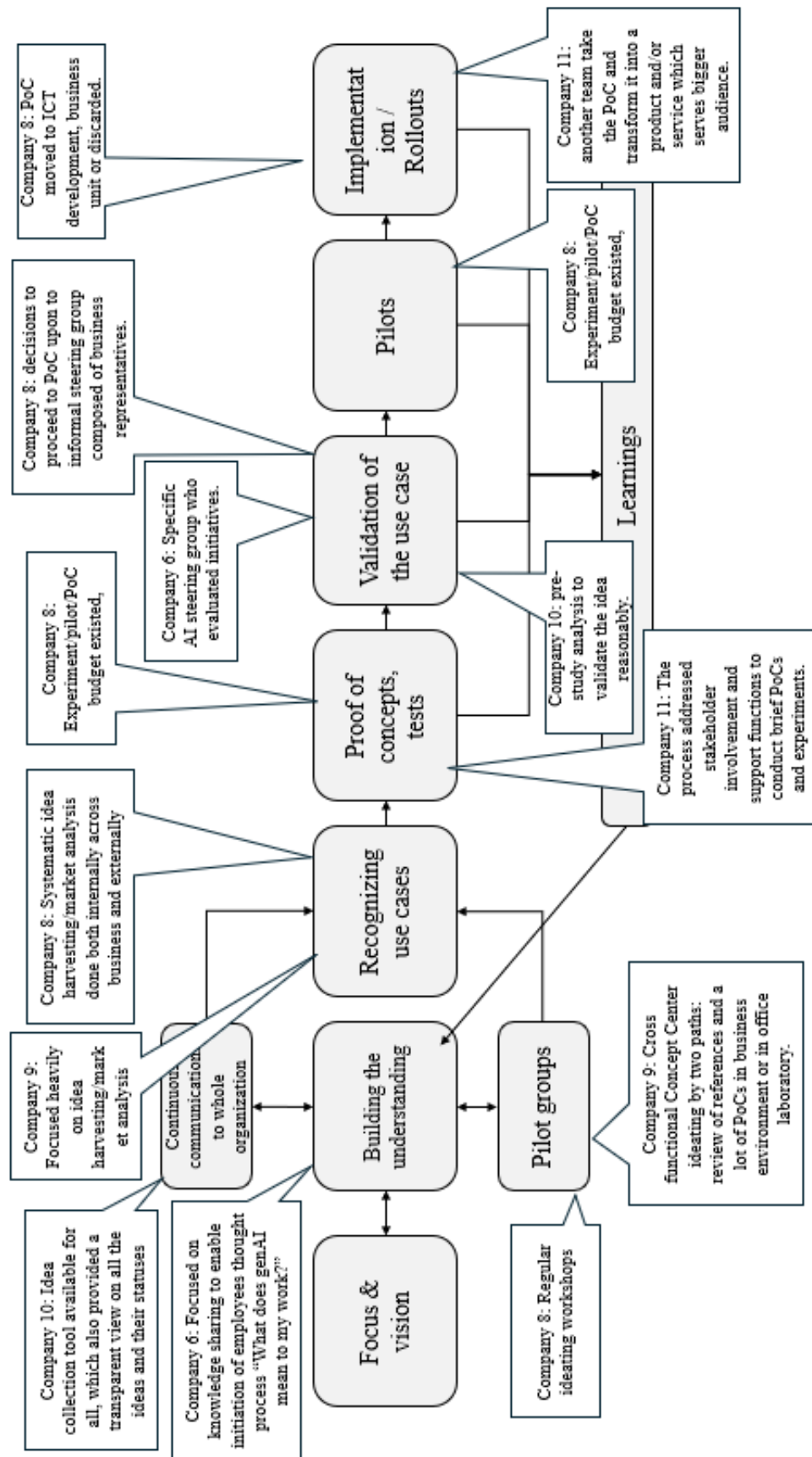


Figure 6 GenAI adoption activities with Innovation Process highlights

When asked about the genAI leverage within the innovation process, two of the companies (6 and 8) stood out, as they described utilizing genAI beyond sparring and ideating. It was believed, by company 8, that genAI would leverage the innovation process but had not done it yet. The company had tried to utilize genAI as an added team member in an innovation workshop, but that took the focus from ideating.

*“I think it’s more likely to come through innovation. At the moment, it’s somewhat of a hindrance. I’ve tried to do innovation workshops where we use AI as our companion. But during the workshop, it doesn’t work as well; instead, if we go through it, it would work better as a pre-task. So, it’s kind of like playing. And the reason is simply that it doesn’t speak well yet; the speech capability isn’t good.” Interviewee, Company 8*

Company 6 also tried a genAI tool for innovation as an additional innovation team member but was not impressed by its efforts as it provided inputs that were too generic, and which did not add any value.

*“It ends up being so generic that it doesn’t really add much to the process. There are probably all kinds of tools, but this one was exactly like that... It was a fun idea to have a language model-based assistant in the team, but honestly, it was a bit of a disappointment.” Interviewee, Company 6*

Furthermore, Company 6 had already recognized improvements in speed and costs by genAI within the innovation process, at least in genAI related projects:

*“Now, when we look at genAI projects, we can get started very quickly. A PoC might take only half an hour. We can quickly assess that something could be done with this kind of product, meaning the project doesn’t take long or cost much, but the focus should be on what this means in production.” Interviewee, Company 6*

Company 6 was the only company which throughout the interview discussed the bigger, potentially radical like changes that they had already started to witness. In addition, some possible implications that those changes might bring had been considered.

*“A finding that was quite striking, for example, was that when they measured the speed of decision-making with GenAI assistance, it was 50-500 times faster than before. As a comparison, if you think about software development, a fairly standard practice in recent years has been to have 2-3 week sprints, during which the sprint's tasks... - ...At the end of the sprint, a new feature or product, or whatever it may be, is released. And if we’re now in a situation where the sprint can essentially*

*be completed in about half an hour, the bottleneck starts to form around being able to approve the product. – ...we kind of have to rethink some very basic things—why on earth wait two weeks if you can get results in half an hour? And how does that affect things, like approving something every half hour? How do we handle this? So, certain fundamentals that have been pretty clear for a long time are now being completely redefined. ... How does this impact things if the world changes this much?” Interviewee, Company 6*

To summarize, most companies were in a state to create incremental process innovations with genAI, but not yet in the phase where genAI had been integrated within the innovation process. However, signals of fundamental changes had been recognised by one company within the ways of working regarding genAI. Furthermore, it was recognised that the adoption of genAI capabilities (Figure 5, section 6.3.2) aligns with the innovation process as previously summarised in Table 11.

#### 6.4.2 Non-users' Innovation Processes

The non-users had not adopted genAI, indicating that genAI was not used in innovation either. Regardless, they were asked about the innovation process to better understand if any process existed that transform ideas into innovation. Below is a summary of each company's take on the innovation process.

**Company 3:** The company had recognised a few different innovation processes: new product innovation, product improvement process, new service innovation. The respondent elaborated on the new product innovation process where market trends were followed, and innovation was done on the market's emerging ideas. Ideas were categorised as some require more capital than others. Whereas in the case of service ideas, the pilot might be initiated and tested quickly like during the pandemic when a new service was introduced. Company 3 clearly had thought of and managed innovations.

**Company 4:** Company 4 shared about the group level initiative activities, which were not clearly stated to include digitalisation (which included genAI) related initiatives. When specifically asked about the ideas related to digitalization, there was no direct response. There were other development initiatives that took the capacity for development, indicating that the innovation process for topics like digitalisation did not exist.

**Company 5:** No clearly defined innovation process was in place due to flat organisation and low hierarchy. However, the interviewee described the usual way of working which indicated that in practice the innovation process exists. Their ICT team works in tight collaboration with business teams and through communications identify the possible solutions for business needs. Sometimes ideas emerge from customer needs. The ICT team aim to ensure the excitement and commitment to development initiatives from business through collaboration. For robotics, for example, the ICT team fed the idea to key stakeholders and when the time seemed right, the actual development was initiated efficiently with an ICT partner.

**Company 7:** No clearly defined innovation process exists, rather a project model, which had not been followed consistently. The development initiatives were executed differently as per the one who was the lead. Each function was responsible for its own development projects and common functions were responsible for common development projects. Development was fragmented, and based on the responses, co-creation was not practiced. Regardless, the company had a positive attitude towards innovation, although resources were seen as unfit for the expectations. The development action plans were made yearly and smaller developments were seen sporadically.

Companies 3 and 5 had innovation processes although Company 5 had not separately defined it. Companies 4 and 7 had no clearly defined innovation process. One thing in common seemed to be the strong business centricity as it was seen as the corner stone of the development (and innovation) activities of the companies.

#### 6.4.3 Utilization of External Expertise

Most of the companies from both “users” and “non-users” addressed the use of service providers’ solutions. Only one company mentioned developing models in house with service providers’ solutions.

*“...started to feed it to key personnel, and then when it comes up that now might be a good time, we then set the wheels in motion and start defining the project with a partner.” Interviewee, Company 5*



Many companies mentioned gathering knowledge from external sources to leverage understanding within the organisations. Service providers and markets in general were seen as the sources of information on the topic of genAI too.

*“But then, whenever these situations arise, we often talk with several other providers as a point of comparison. This gives us some perspective and helps us learn about these topics, and we’ve done that this time as well.” Interviewee, Company 5*

Company 8 had a very broad take on the utilization of externals, as knowledge was collected from multiple sources besides service providers.

*“In fact, we have examined the arrival of AI across a wide range of areas...-... For example, we’ve had experts from the Occupational Health Institute give lectures on the subject [genAI]. We have involved theologians for the ethics side, and also lawyers. So, as AI enters, there are a lot of aspects to consider. ...I’ve even arranged for summer interns—young people working with us over the summer—to discuss how they view AI.” Interviewee, Company 8*

The companies had found multiple ways to work with the available resources utilizing service providers to provide information as well as reduce the price of emerging solutions for the sake of references and competence development. Examples of win-win collaborations were also agreed upon and mutual research projects were on-going.

*“We have something with [a platform] that could be described as a sort of European pilot. It involves a product... - ... a tool that doesn’t really exist fully yet, but we’re implementing it. We managed to negotiate quite a good deal: we have [a platform] licenses at, let’s say, a massive discount, plus our partner is doing the work for us at one-third the normal billing rate because they are also learning to use the product.” Interviewee, Company 10*

*“Right now, we are exploring this through a joint project with [a partner], where we are examining what in this generative AI development is actually just hype and what is real.” Interviewee, Company 6*

In addition to joint-projects service providers, as part of improving their share of the market, had provided free-of-charge workshops to spread knowledge by concretely showing what genAI is capable of.

*“Well, Microsoft has offered these free workshops through partners, and we did one of those in the spring as well. Through that, we’ve been able*

*to gradually expand awareness among our people and bring a bit of concrete understanding.” Interviewee, Company 5*

All companies leveraged service providers. Utilizing them was a two-way-street where both parties gained from the situation. A pitfall had been recognised when using service providers in the era of genAI: risk of the service provider lagging behind in genAI technology development.

*“But from our company's perspective, it's essential to stay involved, and then perhaps an angle we've considered, and in my opinion, is already relevant today, is that our partners with whom we work are also sufficiently involved in this race, perhaps more so on the data side. When we choose our service partners, we need to know that they don't necessarily have to be AI-powered or anything, but that they understand their story. That they also stay competitive in this race because if one of our service partners or digital solution providers falls behind, changing them is very difficult.” Interviewee, Company 9*

Changing a service provider might be overwhelming which is why the competence and attitude towards the emerging technology landscape should be addressed when considering different genAI service providers.

#### 6.4.4 Leadership and Organizational Culture

While an extensive analysis of leadership and organizational culture was not a key focus of this research, it is interesting to reflect on these variables to the extent that they naturally emerged in the interviews. None of the companies identified leadership as a preventive force for genAI adoption. The interviewees were mainly the ones responsible for leading the genAI adoption. For those companies that had recognized genAI as part of strategy or conducted a genAI strategy specifically, a mandate and support to act accordingly existed, smoothing the path for leading the genAI adoption. However, the companies who had not directly addressed genAI in the strategy, tried continuously to find ways to gain “buy-in” from top management and business. To succeed, it needed a strong business justification and the ability to concretely demonstrate benefits was recognized as a key element. In those companies where the top management or employees had not recognised the magnitude of the potential yet, the interviewees were trying continuously to promote, educate, and create awareness.

Regarding the organizational culture, roughly three different approaches were recognized: the culture of experimentation, co-existence of two cultures, and cautious culture. Companies 8 and 9 recognized themselves as experimental yet also recognized improvement items such as embracing failure and the ability to continue trying even when not successful the first time. Company 3 mentioned an example of the culture of experimentation from the corona-pandemic time and offering a service to be delivered home. However, they also recognized the historical side of the company being a 45-year-old manufacturing company. Company 6 described themselves as open-minded and stated that business justification lives in the company's DNA. Additionally, company 11 stated that everything must be justified with business and/or customer benefits. This is contrary to Company 6, as Company 11 claimed to be a rigid by their culture.

From Company 10, it can be said that there were at least two cultures co-existing: a weak internal development culture in business and a culture of experimentation in IT function. Development initiatives moved swiftly within IT, but everything else stalled around the organization.

*"So maybe that perspective [genAI utilization in innovation] is good to bring up, because I will of course seize it right away from this, I see that maybe that side should be included too. I got some benefit from this, so maybe I should try too, once again. We are quite traditional; this is a very traditional company, and we do things very traditionally. And just such innovation, a good example, like the idea I once threw out at some strategy days, that why not sell something like this: Nowadays everything is sold as services. Why don't we sell something like a [item] as a service, that you pay for each [use]. And people didn't understand at all what I was talking about." Interviewee, Company 10*

In addition, development was done secretly until ready for launch, due to the fear of someone questioning the reason for the development. Interviewee had agility and sense of telling enough on right places. To secure an approval from business, one needed to be clever. Two of the companies, 5 and 7, had cautious organizational culture, wanting to rather wait and make sure than try and fail.

#### 6.4.5 Skills and Learning

Lack of understanding was highlighted as one of the most difficult challenges within both groups, users and non-users (see sections 6.2.2 and 6.3.4). Ensuring sufficient skills and enabling learning has been addressed across the companies within the topic of genAI. When ChatGPT was released in 2022, making it available for all, companies had to, at minimum, address it by providing guidance on how to safely utilize it within the organizational sense.

*"Well, let's say that on the intranet, I posted a notice probably a year ago, not in these exact words, but with this message: don't stick anything Company Confidential into any of these AI gadgets." Interviewee, Company 10*

Companies with a strategic focus, had defined communications plans and defined paths to improve skills and competence. Company 6 had segmented their employees to better address the levels of skills needed. Many different formats of study material were provided, both internal and external, supporting different study preferences. In addition, there were metrics in place to measure the success.

*"Then we have online training. We have an online training platform where you can take these courses. Now it's wonderful that currently in the market, there are a lot of these basic courses and university and vocational college and actually technology supplier courses or study modules. At the same time, they are also recommended, offered, and brought into discussions in all teams." Interviewee, Company 6*

Some companies are struggling with the very fact that adoption of genAI requires a lot of obtaining new and also unlearning of the old, both take time. The old ways of doing sticks intensively.

*"And then there's the fact that especially if I do this the way I've always done it, it will take this much time. Instead of learning to do the same task completely anew, more time is spent in the learning process. Then, how we expand that, I don't know yet." Interviewee, Company 9*

All "users" had established different ways to spread the information within the company e.g. created and maintained common knowledge sharing platforms, integrated topic as part of existing organization communications (e.g. monthly meetings), providing instructions, guidelines, and initial direction for more information such as online courses. Also, many of

the “users” group had included top management within the stakeholders for spreading the awareness.

*“Then what I said was that, unfortunately for many people, the initial experiments have been like, “Hey, this gave the wrong answer to the math problem I asked it, so it must not know anything.” It’s about getting past that hurdle 10 times, so you learn how to actually use it, and specifically, understanding that you don’t ask it questions but instead have it do tasks.” Interviewee, Company 9*

Most advanced learning seemed to emerge from experiments, tests, PoCs, and pilots. Taking part in activities where employees could witness, or experiment themselves how and for what purpose genAI tools can be used, seemed a good way to leverage learning.

*“I just calculated that I have 39 speaking engagements internally regarding our transformation strategy for different internal stakeholders. The purpose has been to ensure that as many people as possible can hear it live, be able to ask questions, and start thinking about what it means for their work—and through this, the innovation process has actually gotten off to a good start.” Interviewee, Company 6*

It seems that there is a lack of consistency in doing in most companies, except one, in regards of building understanding.

## 6.5 Prospects

When asked about the expectations or plans of the organization for the future in regards of genAI the responses were anticipatory. Many are waiting for the promised benefits of genAI in the future including improvements of individual work and technical aspects too. In addition, responses also included the impossibility of having any concrete expectations further than for over a year ahead as the speed of the development had been so immense, anything may arise, and there is no point in setting goals for five years’ time ahead. GenAI is expected to be integrated into every business process and each of us has a personal AI assistant in our daily activities. It’s expected to yield financial savings, ease, staff experience, and significant increase productivity and efficiency.

*“It’s coming everywhere, whether we want it or not. And it might be said that it’s spreading in all available products and tools. Like how we already use Teams and Microsoft tools, it’s going to come to everything, whether you want it to or not. And then, in my opinion, it will be the new*

*way of doing things. And we may not yet know everything that can be done with it. The world will be very different in a few years.”*

*Interviewee, Company 8*

However, also a non-popular, contradictory viewpoint for the “a lot will change” approach was given:

*“Maybe here lies the sort of 'in-your-face realist' viewpoint that, yes, technologies advance, but the basic premise probably won't change in half a year. There isn't anything on the horizon that will completely revolutionize our way of thinking or, rather, how it can be utilized. Yes, more advanced versions will come, ones that combine images, sound, and text in diverse ways, but the basic stuff remains the same.”*

*Interviewees, Company 7*

Two of the respondents mentioned one of the near future development paths extremely interesting and potentially groundbreaking changer of way of working: speech recognition.

*“For example, voice controls, speech recognition types of things. These are advancing so rapidly that we see significant business opportunities in not having to stop to write.” Interviewee, Company 6*

Individual work wise, two things were anticipated: free up time by eliminating routine tasks that consume a disproportionate amount of time compared to their actual value, like invoice approvals and holiday leave approvals against defined thresholds. Secondly, empower individuals with an assistant capable of handling time-consuming or practically impossible tasks relative to their benefit, such as analysing massive excel sheets or other massive data sets.

Data management was mentioned by a couple of interviewees from the technical aspect, specifically the expectation of genAI being a unifying element between different data pools. Company 10 viewed this as one of the challenges as an immaturity of the technology (see section 6.3.4). Company 11 is exploring this opportunity.

*“Rather than sticking to the big data buzz about having to gather everything into a single lake, this generative AI could be the glue that brings them together and offers a nicely conversational user interface, even directly to our users, and why not to customers as well. Whether genAI will become the solution that accomplishes this, I'm not entirely sure, but it's something we're exploring.” Interviewee, Company 11*

Furthermore, data was mentioned also in the perspective of its potential to enable competitive advantage when tacit knowledge and existing data of the company could be combined into digestible data for the organization.

When specifically asked about the utilization of genAI within innovation in the future, many ideas were introduced. Below are some concrete ideas that genAI was considered to bring to the innovation process:

- Turning trends into ideas
- Create presentation of the idea to promote it
- Create product concepts and different alternatives
- Design value propositions for the concepts
- Create look & feel designs based on existing ideas
- Clarification of the concept: what it really means to the organization, what would it look like, target group definition...
- Analysis of the most suitable advertising concepts to move forward with
- Analysis on the market pricing and price competitiveness
- Identification of the most critical areas for development within the organization

Essentially, managing, processing, and presenting any large amount of data in an understandable format was seen as an aspect to support innovation. Overall, when looking into the ideas for future utilization of the innovation process, it was believed to be able to be utilized in every stage of the process.

## 7 Discussion

The objective of this study was to understand the current state of the usage of genAI in innovation in small to medium-sized enterprises. As an outcome of the research, a description of the current state of the utilization of genAI in innovation including the description of challenges and obstacles of the use in small to medium-sized enterprises was outlined. The study defined two research questions to reach the objective:

- 1) How do small-medium-sized enterprises use generative AI in innovations?
- 2) What are the factors behind non-utilization of generative AI in small-medium-sized enterprises?

In addition, suggestions for future research were considered.

The need to divide the interviewed companies into those who use genAI and those who do not use genAI was done in order to address both research questions. However, during the interviews, it became clear that such division of sections was not particularly useful, as the use of genAI was not easily categorized simply as “using” or “not-using”, but rather those who are more advanced in the use and those who are using it discretely. The terms utilized (users/non-users) within the study are somewhat misleading but were wanted to use to highlight the difference in use.

### 7.1 Answering the Research Questions

#### 7.1.1 How do small-medium-sized enterprises use generative AI in innovations?

Al-khatib (2023, p. 9) concluded that adopting genAI improves innovation capabilities by enabling access to completely new opportunities (radical innovation) as well as improving existing products and processes (incremental innovation). Findings of this study confirmed the improvement of existing processes as the SMEs of this study utilized genAI mostly in incremental process innovations (see section 6.3.3). However, there was a company whose AI transformation strategy had recognised the possibility for radical innovation after



systematically reaching the “low hanging fruits” first, but evidence of radical innovation could not be found yet.

Evidence on Dwivedi and Mariani (2024) presented implications that genAI enables faster idea and concept creation, faster prototyping, leveraging of knowledge and opportunities, and reduced innovation process costs due to faster process stages can definitely be seen from Company 6’s responses. Furthermore, the study’s findings are in line with Bilgram and Laarman (2023, p. 19) on drastic changes on prototyping by genAI as per Company 6. However, no other company had yet realised the implications fully in practice.

Bouschery *et al.* (2024) elaborate within their research the increasing need and rise of hybrid innovation teams and Dwivedi *et al.* (2023) urged addressing the need for management of the hybrid teams. Two of the study’s companies had gained initial experience with a genAI team member, but neither found it feasible at the time.

Regarding Figure 3, drawing on Candi and Roberts (2024), Dossou-Yovo *et al.* (2021), and Dwivedi and Mariani (2024), two benefits were recognised: “helps understand our competitors”, and “speeds up our process”. In addition, one of the implications was also identified within the findings: 8) Policymakers, lawmakers, and antitrust authorities in the regulation of genAI-enabled innovation. The implication recognised was raised as a challenge, in case regulation would restrict the planned use of genAI. Although suggested by Dwivedi and Mariani (2024, p. 15) that the regulatory implication might create such a burden on SMEs that it might prevent, them from implementing genAI into innovation activities altogether, it was not considered to entirely block the usage of genAI. However, adjustments to the plans will surely follow.

Candi and Roberts (2024) also concluded that there is no correlation between the use of genAI and company size (employee number) - The results of this study indicate otherwise as size category division (table 7, section 6.1) follows the division of advanced genAI adopters being larger and non-users being smaller.

One of the findings of the study were that the adoption of genAI activities of “users” aligned with the phased of the innovation process of the “users” as seen in Figure 6. This finding suggests that the more recognised and structured the innovation process of the company was, the more advanced genAI adoption seemed. However, further study is needed to confirm the finding (see section 7.2).

It can be concluded that the current state of the genAI use in innovation focuses on incremental process innovations. GenAI use in the innovation process is in its infancy. The current focus of use was heavily on the front end of the innovation process, mostly in ideating. However, the utilization of genAI in ideation seemed to be done by individuals and no related process implementations or common cross-organisational ways-of-working were recognised together with early indicators of the suggested implications in the literature.

Adoption of genAI was too immature for the SMEs to have thoroughly considered its possibilities in innovation process development. The direction of adoption seemed promising although the speed of development in genAI makes considering and planning the future uncertain.

#### 7.1.2 What are the factors behind non-utilization of generative AI in small-medium-sized enterprises?

During the literature review, challenges related to genAI systems as well as genAI adoption (sections 2.3 and 2.4) were presented. The literature also highlighted some characteristics that are typical to innovation in SMEs (section 3.2), that could be considered as challenges by some. The research methodology defined the themes, of which challenges, both pre-adoption and post-adoption, were recognised as their own theme. Therefore, all the interviewees were asked about the challenges that had occurred either before adoption of genAI (the company had not adopted genAI=non-users) and/or post-adoption (company had adopted genAI=users).

Four barriers of use of genAI were identified. Barriers were considered as challenges that prevented wider adoption of genAI in the company. The recognised barriers, organisational readiness (old infrastructure and overall readiness) and decisions to wait (section 6.2.2), complied with Al-khatib's (2023, p. 8-9) study's findings as organisational readiness and top management support were seen as factors influencing positively on genAI adoption. The non-users, therefore, had extremely low positive influence on genAI adoption, as barriers prevented them adopting genAI.

Dwivedi *et al.* (2023) suggested that SMEs cannot build and run genAI systems themselves on current technology. Just based on the numbers, 8 out of 9 companies confirmed utilizing

a service provider's systems, which could indicate Dwivedi *et al.* (2023) suggestion true. However, this study did not recognise challenges related to the complexity of the technology, rather to its fit with existing resources or company strategy, thus the statement cannot be fully agreed with. It does, however, indicate that SMEs are dependent on 3<sup>rd</sup> party providers of the technology as mentioned by Rajaram and Tinguely (2024, p. 6-9). Selection of the technology, a challenge recognised in literature by Chui *et al.* (2023), was only seen as a challenge in one company, by the company who build and run their own genAI applications. For the rest of the companies, those who utilised service provider's platforms, the selection of technology was directed by the platform already in use. Those using Microsoft's platform tend to consider Microsoft's genAI. The "users" did recognise the selection of the service provider as a challenge as verification of the competence of the service providers is difficult which is in line with the challenge recognised by Rajaram and Tinguely (2024).

As per Heikkonen *et al.* (2024) the biggest challenge for SMEs in AI adoption is the lack of full understanding of the opportunities that AI could enable. The statement could be seen supported from a genAI perspective, based on two of the "non-users," as their barrier of use was the decision to wait, although the opportunities of genAI presented in literature is extensive. Additionally, lack of understanding was recognised, by both users and non-users, as one of the biggest challenges - a factor fully supporting Heikkonen *et al.* (2024). In the "non-user" group, the lack of understanding was specifically tied to the difficulties in defining actions to gain benefits as well as employees seeing obvious use cases of genAI, but no advanced possibilities. The "users" shared the thought on employees not seeing advanced possibilities but additionally considered the top management's lack of understanding as a risk for the adoption.

Another strong characteristic of SMEs was lack of resources, especially financials were highlighted by Rajaram and Tinguely (2024), but instead being a barrier or recognised as the biggest challenge, it was considered more secondarily to effect genAI adoption secondarily (via e.g competence building).

Literature emphasized the importance of strategy compilation in the beginning on the adoption of genAI (Bilgram and Laarman, 2023, p. 24; Dwivedi *et al.*, 2023, p. 42-43). Findings also suggested that the companies who had a clear strategy (or vision and focus) seemed to have advanced thoughts and more advanced iterations completed. It is suggested to consider embedding a genAI related vision and focus within a company's strategy to

enable continuity of development and adoption of genAI instead of having it as a onetime experiment or utilized merely as a tool instead of harnessing its potential in innovation.

Contradictory to Rajaram and Tinguely (2024, p. 2), no solid conclusion of leaders of genAI adoption forced to survive alone was found, as findings include evidence of top management support, collaboration, and one of the “non-user” companies waiting for the topic to be included in the strategy, indicating the aim of having strong top managerial support. Still, the consideration should not be left un-noticed as two of the companies clearly showed indicators of the respondents acting without top managements support.

As for genAI adoption being a threat to a professional identity (Rajaram and Tinguely, 2024), just one company revealed that fear. This study reflects more on Candi and Roberts’ (2024) contradictory view, as respondents replies indicate enthusiasm and eagerness on genAI adoption and on the elimination of trivial tasks and improvement of processes.

Guptad *et al.*, (2017) claim that genAI systems’ challenges pursue regardless of the size of the company, but adoption challenges differ based on the size of the company. The size categories reflect the division of users and non-users, as larger companies within SMEs were in “users” and smaller in “non-users” in Table 7 The Demographics of the User Groups (section 6.1). Indeed, the recognised challenges of technical aspects are same, although users had highlighted a few more. Similar logic followed to genAI adoption related challenges: 3 out of 4 “non-users” recognised challenges were the same as in “users”, although users had recognised many more in addition. The difference can be seen within lack of understanding, which is approached from different perspectives, leaving only little support to Guptad *et al.*’s claim.

Elaborating on the number of challenges recognised. “Users” had recognised a wider variety of challenges than non-users. It can be assumed that as adoption of genAI increases the typical common challenges faced in the beginning must have been mitigated. The varying highlighted challenges can be explained by environmental differences, industry differences, focus, and individual differences. A small number of challenges were recognized in “non-users,” that could be explained by facing the common challenges of technology adoption: not understanding enough to recognize further challenges, and as barriers limits the usage, no further understanding by learning is enabled.

Summarising the conclusions: Four barriers of use were recognised, two of which were related to organisational readiness (lack of adequate infrastructure and overall readiness) and two were decisions to wait made within the companies, suggesting that the companies' organisational readiness was not at the level required or, more specifically, that they lacked the sufficient level of understanding.

The study confirms that the biggest challenges arise from the adoption of genAI rather than from the tool itself. This study's findings on the technology aspect challenges differed from existing literature (section 2.3). Where literature suggested, among other, bias, accuracy of prediction, and transparency and explainability as common challenges the study findings highlight information security and immaturity of the technology (section 6.2.2). Conclusions related to adoption of genAI is drawn from the conclusion of Heikkonen *et al.*'s (2024): the biggest challenge of genAI adoption in SMEs is the lack of understanding the opportunities that genAI could enable. No further conclusions could be drawn, as the findings were not generalizable to the entire sample, thus there is need for further research (see section 7.2).

## 7.2 Limitations and Future Research Suggestions

The study contributes to the scarce and emerging research field of the intersection of genAI, innovation and SMEs, where no empirical research could be found during the literature review of this study. In addition, this study could be used to help identify the biggest challenges within an SME company and taking those into consideration when planning on adopting or leveraging of adopt of genAI to enable innovation. In addition, other actors as service providers might consider the findings interesting as SMEs are dependent on their services. The field of genAI is developing at such a high speed that keeping research aligned and up to date continues to be an inevitable challenge.

The biggest concrete limitation of the study was that the data of the study provides a snapshot in time, leaving its findings old by the time of publication. In addition, researchers bias might have impacted the study as the researcher was working, although on a leave on the time of the study, on the "service provider side". In addition, the sample was focused on Finnish market SMEs, and it is suggested that a more heterogenous sample should be studied in order to conclude on larger SME perspective and indicate national differences. Considering the

limitations and the findings from the study the following future research suggestions are suggested:

Most of the interviewees of the study were working within an ICT team, mostly leading one. To gain a more comprehensive view, and thereby address the possible challenges on the state of the adoption of genAI, future research is suggested to include the top management of the company's perspective of the company to include other roles in addition to the ones responsible of genAI adoption (mainly head of ICTs) together with employees' perspective as the challenges could be addressed differently.

Since the hype of genAI suggests that the adoption of genAI will prevent companies from being left behind, it would be interesting to investigate what the (possible) harm to the business is when left behind. Research to address this connection is suggested. Using this study as a basis, research could elaborate on the "non-users" by investigating what harm was caused to the business by non-adoption of genAI.

Conclusions of the study suggested that the more recognised and structured the innovation process of the company was, the more advanced genAI adoption seemed. This connection should be further addressed to elaborate on the understanding of the genAI in innovation in SMEs.

The findings related to prospects highlighted interesting aspects that should be taken on in future research. One of the important identified potential opportunities was speech recognition. Thus, a suggestion for future research is to investigate the implications of speech recognition in genAI on innovation in SMEs.

As the conclusion of the study indicated that genAI in innovation is at its infancy, follow-up research is suggested to further investigate the topic's resonance in time. In addition, the findings on prospects suggested expectation of the increased level of usage of genAI, such as the technical immaturity related to data management and the level of adoption in individuals' work improvements, as well as the evolvement of the hybrid teams and the need to manage them in SMEs. Two aspects would be interesting to investigate: 1) Will genAI enable radical innovation in practice in SMEs and 2) What does the trend in adoption of genAI in innovation in SMEs look like?

## 8 Conclusion

Generative Artificial Intelligence's (genAI's) rapid development and enormous potential offer SMEs a way to scale up their businesses through efficiency and innovation. GenAI is expected to radically change many industries' way of working as it provides a platform of creating new – that is to innovate. Due to the rapid evolvement of genAI, gaps in research of innovation management and genAI persists. When considering the themes of genAI and innovation management in SMEs, even less research could be found.

This study aimed to understand the usage of genAI in innovation of SMEs from the innovation process perspective. The topic was approached from two viewpoints, highlighted by the two research questions: 1) How do small-medium-sized enterprises use generative AI in innovations?, and 2) What are the factors behind non-utilization of generative AI in small-medium-sized enterprises? A qualitative, semi-structured thematic interview was completed for total of 9 SMEs' representatives who had a company-wide overview of the topic of genAI. The data collection was completed during the summer of 2024. Results were analysed thematically, considering the users and non-users of genAI separately, and conclusions were provided based on the current state analysis. ChatGPT4o was used to re-review the conclusions to examine the discovered results in order to find new, unseen, conclusions. Thereafter, one topic was added to the conclusion.

The study's findings were presented as the outcome: the current state of genAI in innovation of 9 SMEs. Based on the current state and the literature review, a few conclusions were made and presented by the research questions: 1) genAI use in innovation focuses on incremental process innovations, genAI use in the innovation process is in its infancy as only a little evidence of initial implications were recognised, and genAI adoption activities and innovation process had similarities, indicating that the more structured innovation process, the more advanced the adoption of genAI within the company. 2) Four barriers of use were recognised: lack of adequate infrastructure, overall readiness of the organisation, and two decisions to wait. The study also confirms that most challenges rose from adoption of genAI rather than from the tool itself, and that the biggest challenge of genAI adoption in SMEs is the lack of understanding.

For future research, a total of five recommendations were given: 1) Expansion of the perspective of current study to top management (other than ICT leads) and employees, 2) elaborating on this study on the damage that a business may incur from non-adoption of genAI, 3) elaboration on the finding of the connection between genAI adoption activities and the innovation process, 4) to investigate the implications of speech recognition in genAI on innovation in SMEs, and finally, 5) follow-up research to understand the evolvement of the study findings in time.



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## Appendix 1 – Configuration of the “Innovation Analysis Expert” custom GPT

The screenshot shows the configuration page for a custom GPT named "Innovation Analysis Expert". At the top, there are "Create" and "Configure" buttons. The "Configure" button is active, showing the following settings:

- Name:** Innovation Analysis Expert
- Description:** Analyzes interviews on genAI in innovation.
- Instructions:** This GPT acts as a master thesis worker majoring in innovation management, focusing on the thematic analysis of interviews regarding the use of generative AI (genAI) in the innovation process. The goal is to analyze interview data to identify key themes related to how genAI is currently used in innovations, the barriers or factors leading to its non-utilization, and its potential future applications. The GPT should provide structured responses based on the uploaded interview data and guide the user toward relevant
- Conversation starters:** A list of five starter questions, each with a delete icon (X):
  - What are the common factors limiting genAI usage in innovations?
  - How is genAI currently being utilized in the innovation process?
  - What potential future research could be suggested based on the study?
  - What additional conclusions would you suggest as an addition to existing ones?
  - (Empty box)
- Knowledge:** A section for uploading files. It contains a list of ten PDF files, all named "Diplomityöhaastattelu\_ c..." except for one named "LUT\_Opinnäyte\_Hanna\_Va...". Below the list is an "Upload files" button.
- Capabilities:** A section with three checked options: Web Search, DALL·E Image Generation, and Code Interpreter & Data Analysis.

**Name:** Innovation Analysis Expert

**Description:** Analyzes interviews on genAI in innovation.

**Instructions:** This GPT acts as a master thesis worker majoring in innovation management, focusing on the thematic analysis of interviews regarding the use of generative AI (genAI) in the innovation process. The goal is to analyze interview data to identify key themes related to how genAI is currently used in innovations, the barriers or factors leading to its non-

utilization, and its potential future applications. The GPT should provide structured responses based on the uploaded interview data and guide the user toward relevant insights from an innovation management perspective, always emphasizing an innovation perspective in its analysis. It should avoid biases, presenting findings objectively, and reference academic frameworks when appropriate. The GPT should avoid overly technical jargon unless specifically required and be mindful of maintaining a focus on the themes of genAI's current use, implementation, and future potential in innovation. Communication style should be formal, as appropriate for a master thesis research context. Always add the date of the conversation on each title of the conversation (in the beginning) and also after each reply.

**Knowledge:** Companies 3 to 11 anonymised interview transcripts (in Finnish) and the version 0.9 of the study as PDF files.

**Capabilities:** Web Search (selected), DALL·E Image Generation (selected), Code Interpreter & Data Analysis (selected).

In addition, the memory of the ChatGPT was turned off during the analysis (Front page – Personalisation – Memory: off).

## Appendix 2. Prompts Used in Conclusion Verification

**Researcher:** Review LUT\_Opinnäyte\_Hanna\_Vannesluoma\_draft\_0.9 and answer this question: What additional conclusions would you suggest amongst the ones in the file in chapter 7? Consider 3 most important points and provide the reply in bullet points.

Reply on 19<sup>th</sup> of November 2024:

**ChatGPT4o:** “Based on the review of Chapter 7 of the provided thesis draft, here are three additional conclusions to consider that complement the existing ones:

### 1. Developing Incremental Adoption Pathways:

Highlight the need for **incremental and phased adoption approaches** for SMEs to integrate generative AI into their innovation processes effectively. Starting with small-scale pilot projects and gradually expanding based on the learnings can mitigate risks and enhance organizational confidence in using AI technologies.

### 2. Promoting Cross-Industry Benchmarking:

Recommend **benchmarking with other industries** to identify successful generative AI use cases and transfer learnings to SMEs. Drawing inspiration from sectors with advanced AI implementations (e.g., finance or marketing) can help SMEs to identify new innovation opportunities and accelerate the adoption of proven strategies.

### 3. Embedding GenAI in Long-Term Strategy:

Advocate for embedding generative AI capabilities into **long-term innovation and digital transformation strategies**. Emphasizing a strategic outlook ensures that generative AI is not treated as a short-term tool but as a foundational element for fostering innovation, improving productivity, and maintaining competitiveness in the evolving business landscape.

These additions focus on actionable steps and strategic foresight, enriching the existing conclusions by bridging immediate challenges with future-oriented strategies.