

Artificial Intelligence in Innovation Projects

Artificial intelligence as a tool for improving the innovation process in projects.

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Sammendrag

Denne masteroppgaven utforsker samspillet mellom fagfelter som kunstig intelligens (KI), innovasjon og prosjektledelse. På bakgrunn av kunnskapshull og teknologiens raske utvikling var formålet med oppgaven å finne ut hvordan KI kan brukes som et verktøy til å optimalisere innovasjonsprosessen i innovasjonsprosjekter. Først ble det identifisert utfordringer som er med på å hindre innovasjon i prosjekter med hjelp av kvalitative intervjuer. Disse intervjuene bidro i sammenheng med relevant forskning til å svare på hvordan KI kan brukes for å forenkle eller løse utfordringene som ble identifisert. Oppgaven bunnet til slutt ut i et konseptuelt rammeverk som ved hjelp de empiriske funnene integrerer KI inn i en optimalisert versjon av den generelle innovasjonsprosessen.

Intervjuene bidro til kartlegging av ulike utfordringer derav idé-generering, idé-konvertering, ressursallokering, kommunikasjon, markeds og teknologisk innsikt, læring, og bortvelging av ideer. Funnene i forskningen viser at ulike KI modeller kan brukes for å håndtere disse problemene. Statistiske modeller kan være et effektivt verktøy for å håndtere utfordringer slik som mangel på ressurser og bortvelging av ideer. Dyplærings modeller kan bidra til å effektivisere idé-generering, bortvelging av ideer, gi markeds og teknologisk innsikt, og hjelpe organisasjonen med utfordringer innen læring. Til slutt viser funnene at store språkmodeller kan hjelpe til med å forenkle flere utfordringer, inkludert idé-generering, idé-konvertering, kommunikasjon, og markeds og teknologisk innsikt.

Denne oppgavens bidrag til litteraturen handler om å se på potensiale som ligger i bruk av kunstig intelligens i arbeid med innovasjon i prosjekter. Dette bidraget kommer i form av en konseptuell modell av en optimalisert innovasjonsprosess. Denne innovasjonsprosessen har fem faser, hvor hver av fasene har et bidrag av kunstig intelligens. Dyp-læring, store språkmodeller, og statistiske modeller kan alle gi ulike bidrag for å effektivisere og optimalisere innovasjonsprosessen i de ulike fasene. Til slutt er den generelle innovasjonsprosessen blitt forlenget med en fase som er blitt definert som en etter-lanserings evaluering som fungerer som en læringsfase inn mot nye prosjekter. I videre forskning ville det vært interessant å gjøre objektiv testing av denne modellen, som blir underbygget av kvantitative resultater. Det finnes fortsatt kunnskapshull i samspillet mellom kunstig intelligens, innovasjon og prosjektledelse. Det anbefales derfor sterkt å utforske dette videre.

Abstract

This master's thesis explores the interaction between research fields such as artificial intelligence (AI), innovation, and project management. The purpose of the study was to investigate how AI can be used as a tool to optimize the innovation process in innovation projects. There were identified knowledge gaps in the literature on the topic, which provided a basis for the research along with the rapid development of the technology. Firstly, challenges that can hinder innovation were identified with qualitative interviews. These interviews contributed in combination with relevant literature to explore how AI can be used to solve or simplify the challenges identified. Lastly, the thesis concluded its empirical findings with a proposed conceptual framework that integrates the use of AI into an optimized version of the innovation process.

The interviews contributed to mapping a set of challenges including generating ideas, idea conversion, resource constraints, market and technology knowledge, learning, and exiting. The findings presented shows that different AI models could be effective for aiding the different challenges. Statistical models can be effective regarding challenges such as resource constraints and exiting. Deep Learning models can contribute to aiding idea generation, exiting, providing market and technical knowledge, and aiding learning difficulties within an organization. Lastly, Large Language Models (LLM) can contribute to solving challenges such as idea generation, idea conversion, communication, and market and technical knowledge.

The main contribution of this thesis to the literature is exploring the potential of AI in work with innovation in projects. This contribution is conceptualized in a proposed framework of an AI integrated optimized innovation process. This innovation process consists of five phases, including an added phase of post-launch evaluation. Statistical models, Deep learning models, and LLMs can all contribute to effectiveness in the innovation process and have been added in each of the phases. In further research, it would be interesting to test this conceptualized framework with independent testing. Testing the framework with quantitative evaluation metrics would provide a basis for evaluating the framework, and further developing it. There are still unexplored gaps in the interaction between AI, innovation, and project management. Thus, further research on the related fields is highly recommended.

Keywords

Artificial Intelligence (AI)

Innovation

Innovation process

Innovation projects

Machine Learning

Deep Learning

Large Language Models (LLM)

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1. Introduction

1.1 Background

Ancient Greek philosopher Heraclitus observed that the world is always evolving, and presented the statement “The only constant in life is change” (Arapahoe, 2020). In an era with technological advancements at its centre, or Industry 4.0, the evolution of artificial intelligence (AI) is crucial for the enhancement of traditional business processes (McKinsey, 2022). Industry 4.0 refers to the next phase in the digitalization of the manufacturing sector, where smart technology and AI are integral components for driving efficiency, creativity, and sustainability.

AI is increasingly being used around the world, and according to a survey from Microsoft’s Work Trend Index, 71% of the respondents said that their companies are already using AI, and another 22% are planning to do so within the next 12 months (Taylor, 2023). This aligns with a survey done by McKinsey in 2019, where 70% responded that their company is using or implementing new technology (McKinsey, 2022). The integration of AI within different organizations is undeniably on an upward trajectory. On the other hand, the interesting part of this survey is that 52% of the respondents identified the main obstacle as lack of skilled workers required for implementing and scale AI initiative across business functions (Taylor, 2023). The enthusiasm for adopting AI-technology reflects on its potential to improve different aspects of the business process. At the core of this transformative wave lies the interaction between AI, innovation, and product development. As organizations strive to get ahead of the competition, the integration of AI in the innovation process is potentially a crucial move for sustained relevance and competitiveness.

As we transition into the era of Industry 4.0, the integration of advanced technologies such as AI, develops unseen opportunities to enhance the innovation process in projects. Innovation has long been a pinacol for organizational success and competitiveness. The essence of innovation projects is their ability to transform new exiting ideas to value-creating products, service, or process (Filippov & Mooi, 2010, p. 5). Projects can serve as vehicles for innovation in

organization (Filippov & Mooi, 2010, p. 3). There are many benefits by implementing a project in an organization, like quality improvement, error rate reduction, production cost reduction, a higher level of customer service and increased customer retention rate (twproject, 2020). On the other hand, a survey done by Wrike shows that only 64 percent of projects meets their goals (Guest, 2021). The competitiveness in the product development branch is enormous which reinforce the importance of successful innovation.

1.2 The purpose of the study

There is still unexplored potential on how AI could optimize the innovation process in projects. Mariani et al. (2023) identified gaps in the literature when investigating AI's role when innovating. This includes questions that emphasizes on how AI could specifically improve R&D activities or development of new products, service or process, and how AI could potentially influence firm's innovation productivity (Mariani et al., 2023, p. 22). Aligned with our interest in the topic and what further research is recommended, the master thesis will try to investigate the use of AI in the innovation process and how it can effectively enhance the productivity and effectiveness of innovation in projects.

In the light of this challenge, there will be conducted qualitative interviews with 3 different companies, and 8 interviewees. The reason for choosing qualitative data is to gain first-hand experience and knowledge about the subject in this thesis. This thesis aims to answer how AI can be used as a tool for innovation in projects by answering these questions:

1. *Which challenges hinder the optimization of innovation projects?*
2. *How can AI be used to solve or simplify these challenges?*
3. *How can AI be utilized to optimize the innovation process?*

These questions will aspire to contribute with valuable insight into how AI can strategically be utilized for making the innovation process more effective. The first question will identify the most common challenges that hinder the innovation process. By understanding these challenges, the study can further establish which of them has the potential to be simplified by AI. The second question will determine which machine learning model is most suited for each challenge and how they can specifically simplify the identified challenges. This involves a comprehensive analysis of current machine learning models, and the specific ways they could be utilized for enhancing innovation. The study will evaluate both theoretical and practical

aspects of AI integration. The last question will assess how AI can be used to improve the current traditional innovation process. This thesis will not only to provide theoretical insight but also to offer actionable recommendations to the innovation manager, and to bridge the gap between AI's potential and its practical implementations.

Due to the large size of the research fields, this thesis is limited to identifying how AI can contribute to established innovation challenges in projects. Every project is unique, which mean that the variety of projects is significant. Thus, this thesis is limited to innovation projects that focus on creating a new or improving a product, service, or process. The thesis also focuses on established AI models that is proven to be effective. Because of the time constraint of the thesis, we are not able to test or update ourselves for every new contribution to the field of AI. This technology is developed rapidly with a significant increase in a short amount of time in the availability of products in the market. Based on these limitations, the focus will be on established AI models and technology in combination with innovation projects. The challenges identified have also been assessed based on relevance and with the ability of AI to aid in solving or simplifying the challenges. The challenges identified in the literature with AI having no ability to assist in solving, have been excluded from the research.

1.3 Structure of this thesis

This thesis will unravel the potential of AI as a tool for enhancing innovation in projects. Following the introduction, the theoretical background will first elaborate on AI's historical development, machine learning models, and innovation in projects. Innovation in projects will consist of a typical innovation process and why innovation projects fail. Thereafter an explanation of the innovation manager and why it is not the same as a project manager. The body of language will end with ethical and practical use of AI in projects.

The methodological section will first explain our research design and approach, and the justification for the choices made. Thereafter there will be a presentation of the way the findings were collected, literature search strategies, and data analysis. Lastly, an evaluation of the methodological choices will be discussed. The result section will demonstrate the data collected. It consist of the informant definition of innovation and their use of AI. Then a presentation of the identified challenges, and how AI can specifically aid in simplifying them. Thereafter an explanatory section of the ethical aspect of implementing AI. Lastly, it will be

presented a framework for AI's role in the innovation process. Finally, the conclusion will summarize key insights, contributions to the field, and potential directions for further research.

2. Body of knowledge

The body of knowledge explores research fields such as Artificial Intelligence, innovation, and project management. It has been based on relevant literature and provides a basis for knowledge in the thesis. Different aspects within the field of AI such as various types of AI models and practical use of AI will be presented. Additionally, relevant research on innovation and innovation management will be addressed.

2.1 Historical Development of Artificial Intelligence

AI has had a rapid advancement in the last few years. The first occurrence of what can be regarded as “intelligent machines”, is dated back to the 1950s with the work of Alan Turing. In the following decades, an immense development has happened in the field, dating all the way to the present day. The historical development with certain highlighted milestones and the literature used for gathering the information is provided in Figure 1.

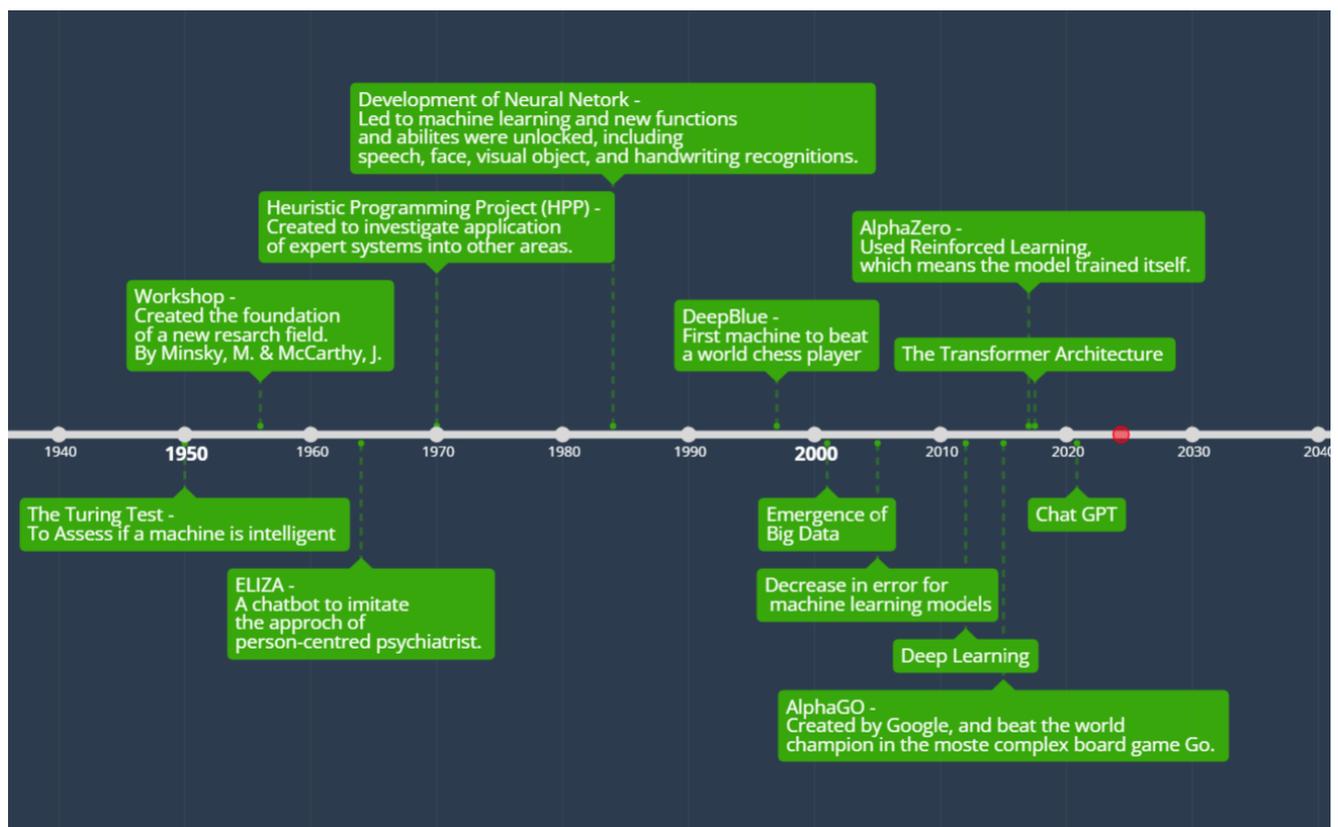


Figure 1: Presenting AI development with milestones (Deng, 2018; Haenlein & Kaplan, 2019; Russell & Norvig, 2022; Strümke, 2023).

2.2 Artificial Intelligence

This section will provide a general description of Artificial Intelligence and how it works. However, this topic is regarded as an entire field of research and require a deep understanding of several complex phenomenon. With this issue in mind, this thesis will only provide a short and shallow explanation of theoretical perspectives on AI and relating topics. The following sections will include a short understanding of AI and different types of AI models.

Artificial Intelligence can be described as a machine with human capabilities and intelligence (Deng, 2018). The field of AI is an integration of several fields of science, including philosophy, mathematics, economics, psychology, neuroscience, computer engineering, control theory and cybernetics, and linguistics (Russell & Norvig, 2022, p. 24). For a machine to be classified as intelligent, it needs to pass what is defined as the “Turing test”. It was designed in 1950 by Alan Turing, and the machine needs to have the following capabilities to pass (Russell & Norvig, 2022, p. 20):

- Natural language processing (NLP): Communication in human language. Natural computer language is binary numbers, consisting of 0 and 1 in sequences.
- Knowledge representation: The ability to store what it knows or reads.
- Automated reasoning: Answering questions and providing conclusions.
- Machine Learning: Adapting to new circumstances and the ability to learn patterns.

Computer vision, speech recognition, and robotics to manipulate object and move in space, can also be classified as intelligent in combination with the other capabilities. These are all subsections within the field of AI.

Algorithms drive the behaviour of AI models and can be described as mathematical instructions or actions for a machine to compute (Deng, 2018). Starting from input, the algorithms describe the computational steps, for then to produce an output. An AI model requires an extensive set of algorithms to perform intelligent tasks, especially regarding perception and cognition tasks that involve learning. Algorithms can be used for automatically training other algorithms when classifying the machine as intelligent (Deng, 2018). The basis for training algorithms in an AI model is the use of datasets.

The emergence of Big Data has been a big part of the development of AI. Big Data is classified with the 5 V's: volume, variety, velocity, veracity, and variability according to Herschel & Miori (2017, p. 31). The development of Big Data has led to an extensive amount of training data for AI models, which has contributed to improving the models. Big data has created significant opportunities for technological advancement, and the emergence of this data is key for Industry 4.0, which was formerly mentioned in the thesis.

Following this section of AI, there will be provided a deeper explanation of the subfields of AI, including machine learning and statistical learning models. Further, a deeper explanation of subsections within machine learning will be provided including neural network and deep learning.

2.2.1 Machine Learning

Machine learning is a subfield within the field of AI and is described as a computer which uses statistical methods to learn patterns and observe data. Continually, the computer builds a model based on the data. This means that the model uses the data for problem-solving, as well as perspective on the world. By continuing to input data in the computer, the model can be developed and the machine is learning (Russell & Norvig, 2022, p. 669). When using machine learning algorithms, the machine can adapt to changing and flexible environments, which makes the model more suitable to understand real-world situations. When training a machine learning model there are various forms of training, including supervised learning, unsupervised learning, and reinforcement learning. These types of learning lead to different forms of feedback from the input and can determine the model's behaviour.

- 1. Supervised learning** is learning functions that directly corresponds inputs and outputs. The output is called a label, and the model predicts the label that suits the input. E.g. The input is camera images and the label is "bus" or "car" depending on the image (Russell & Norvig, 2022, p. 671). This model typically uses smaller amounts of data sets and is used to solve specific problems. This is the most common form of machine learning (LeCun et al., 2015, p. 436).
- 2. Unsupervised learning** happens when the model is learning patterns in the input data, without feedback. This method of learning is dependent on a large amount of data. A typical unsupervised learning method is clustering, where the system identifies clusters

in the datasets that can be compared or categorized. Clustering can be described as a pattern or grouping of data.

- 3. Reinforcement learning** is learning from reinforcements, which refers to rewards and punishment (Russell & Norvig, 2022, p. 840). The aim is for the model to reinforce behaviour that leads to reward and avoid behaviour that leads to punishment. The Alpha Go model in 2017 was trained with this type of machine learning method. The chess games that were won led to reward, while loss led to punishment.

Reinforcement learning with human-feedback is an emerging topic, which has been criticized by Professor Yann LeCun. He is a highly regarded professor who jointly won the Turing Prize in 2018 for his work on Deep Learning. Reinforcement learning with human-feedback (RLHF) is a method of training an AI model to produce results that align with human objectives (Casper et al., 2023, p. 2). This method has been effectively used to train LLMs and was used as a fine-tuning strategy before the deployment of ChatGPT. The prevalent use of this training method is because of the need for regulation and safety for the AI models. The results produced replicate good behaviour and are aligned with the wanted human output. Although it has been effective as a fine-tuning strategy, Casper et al., (2023, p. 3) have identified several shortcomings when using this training method, including challenges with human-feedback, the reward model, and policy. This criticism aligns with the perspective of Yann LeCun who chose not to include this training method in his work when discussing the future of autonomous machine intelligence. Some of the criticism includes the vast majority of data needed for training, in addition to LLMs lacking memory and internal models of the world (Mialon et al., 2023, p. 18). Although there are different opinions on the topic, it remains an area of interest that can potentially provide advances in the field (Casper et al., 2023, p. 19).

2.2.2 Statistical Learning Models

Statistical learning models are models that use methods of probability and decision theory for learning and handling uncertainty (Russell & Norvig, 2022, p. 772). Statistical models are efficient when investigating relationships between specific variables. Bayesian networks are the primary method for learning probability models, and Bayesian learning calculates probability of each hypothesis for then to make predictions based on the probability. Different types of statistical learning models include linear regression, logistic regression, decision trees, naive Bayes model, and generative and discriminative models (Russell & Norvig, 2022, p. 774).

When dealing with real-world problems not all variables are known or observable in the data. Russell & Norvig (2022, p. 788) refers to these variables as “hidden” or “latent” variables. Real-world problems can therefore be classified as uncomplete datasets. Thus, certain algorithms to uncover the hidden variables need to be included in such a statistical model. A typical method to use is the expectation-maximization algorithm (EM). The application of this algorithm includes unsupervised clustering, learning Bayesian networks and learning hidden Markov models (HMM). HMM has been extensively used in different fields including speech recognition and digital communication (Schuster-Böckler & Bateman, 2007, p. 1). The model’s ability to recognize words and sounds have led to the extensive use within engineering. The model predicts future occurrence and classify data based on hidden variables that generates the data.

2.2.3 Neural Networks and Deep Learning

Neural Networks (NN) originated from early work within AI, where researchers tried to model networks to resemble neurons in the human brain (Russell & Norvig, 2022, p. 801). This type of model has information flowing through networks of nodes from input to output. This means that the different variable interacts with each other in a complex environment.

Neural networks are separated in two different structures: Feedforward networks and recurrent networks. Feedforward networks are simple neural networks which have connections in one direction. The network of nodes is connected from input to output, without loops or intersection. Recurrent network on the other hand, have intersecting nodes with outputs leading back to the inputs. This looping mechanism make the system more dynamical with internal state and memory. These kinds of systems are continuous adjusting and developing the parameters in the network and the system have continuous learning with the data inserted.

When training a NN, the model is shown several input values \mathbf{x} and corresponding output values \mathbf{y} . While processing the input, several computations is needed for producing output. Each computation represents a layer in the network. When forming these layers in the computation path from input to output, the model starts to interpret and uncover context in the data. These internal layers help the model to detect details in the data, for example: identify colours, shapes,

corners in an image. These internal layers are formed within the model, and would therefore not provide meaning for humans, even when the output is correct (Russell & Norvig, 2022, p. 810). These hidden layers are internal computations that is often referred to as “black box”, with the only available information for humans is input and output.

Deep learning is a recurrent network and described as machine learning that use multiple layers of simple and adjustable computing elements by Russell & Norvig (2022, p. 801). Visual object recognition, machine translation, speech recognition, speech synthesis and image synthesis are typical applications that deep learning is used. It is dependent on large amount of training data, because of the organization in many layers from inputs to outputs. The different layers make the computation path longer from input to output, which means that the variables can interact in more complex environment than with a shorter computation path. By adding this kind of complexity to the machine learning model, real-world data can be captured more comprehensively. Figure 2 shows a graphical representation of a Deep learning model (c), compared to simpler models with a smaller number of layers. (a) represents a linear regression model and (b) is a decision list network, which can be classified as neural network. However, this model has mostly short computation paths compared to a deep learning model.

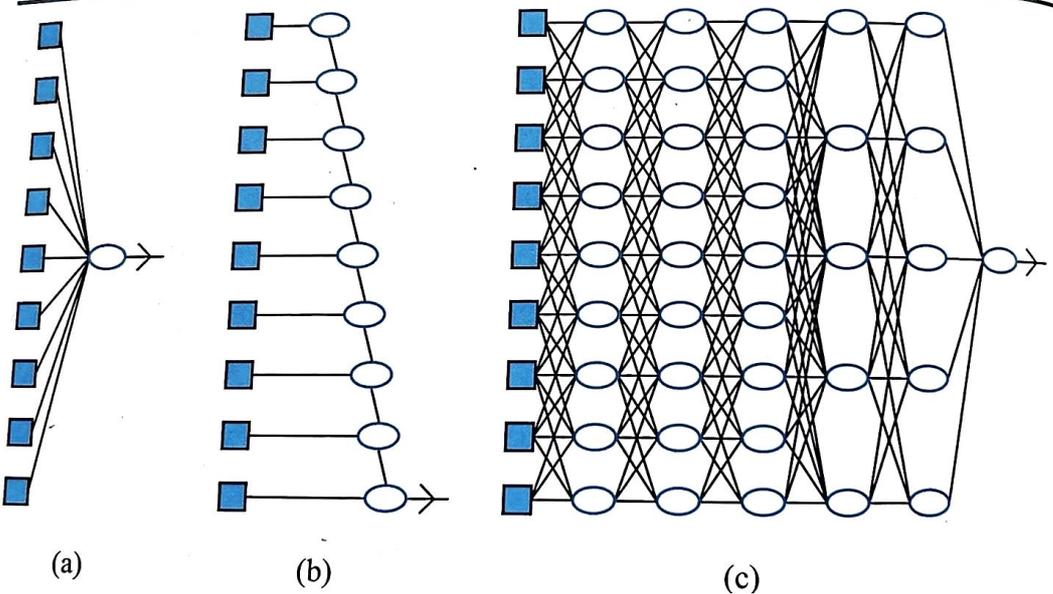


Figure 2: Representation of Deep learning network compared to simpler models (Russell & Norvig, 2022, p. 802).

2.2.4 Natural Language Processing (NLP) and Large Language Models (LLMs)

Natural Language Processing was developed for three reasons according to Russell & Norvig (2022, p. 874):

1. For machines to communicate with humans.
2. To learn and writing down knowledge.
3. To advance scientific understanding of language and language use.

A language model can be described as probability distribution that calculate the likelihood of a grammatical string. This means that a language model is predicting what word that is most likely to occur next in a text. A typical way of categorizing words is by part of speech (POS) tagging. This method classifies the language into categories such as noun, verbs, adjective. These classifications provide the statistical model with generalized rules such as adjectives generally comes before nouns in the English language. A typical model for this method is the HMM, as mentioned earlier in **section 2.2.2**. This is a generative model that don't consider the context of the language. The model bases the prediction on a state and then make two choices: 1. What word that should be emitted from the state and 2. What state comes next. Some of the main tasks of a language model is speech recognition, text-to-speech synthesis, machine translation, information extraction, information retrieval, and question answering (Russell & Norvig, 2022, p. 900).

A recent development in the NLP field have produced models that combine the statistical model of typical language modelling with deep network modelling. This combination has led to significant advances for language models. The amount of available machine-readable text has provided a huge amount of training data for machine-learning models within language models. This recent development can be dated back to 2017, with the development of the transformer architecture. This architecture uses a self-attention mechanism that can model the long-distance context of language without sequential dependency (Russell & Norvig, 2022, p. 919). This means in simple terms, that the language model has the ability to correct itself depending on the context, without being dependent on the language order. In the transformer architecture self-attention is built in the first layer. Residual connections are added to the self-attention layer to avoid issues. Then, the output is fed through a feedforward layer with belonging residual connections. The feedforward layer is, as mentioned earlier, a simple neural network. The transformer architecture is presented in Figure 3 below.

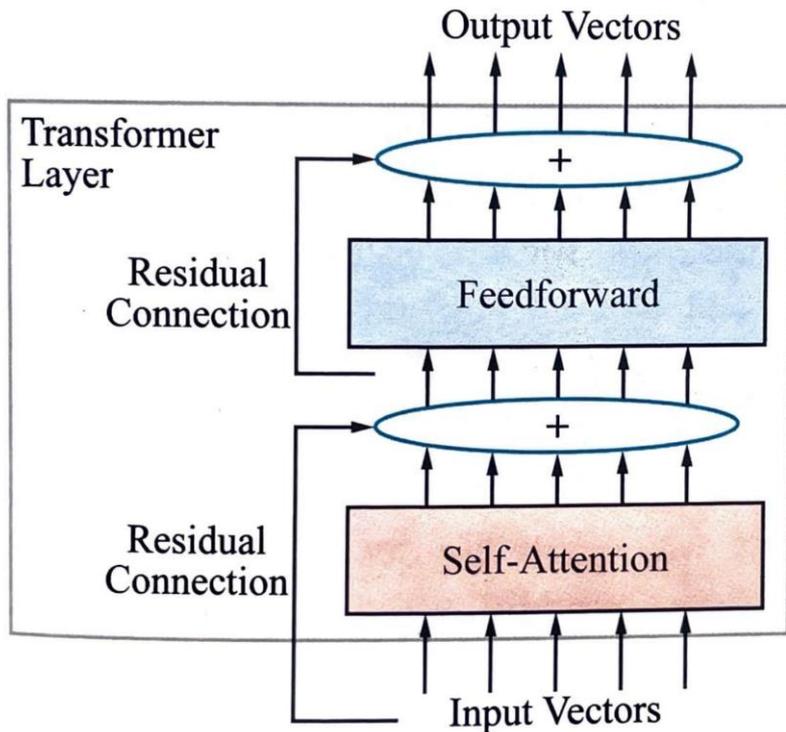


Figure 3: The transformer architecture in ML (Russell & Norvig, 2022, p. 921).

Open AI's language model, Chat GPT, have become one of the main talking points in the last few years. This model is dependent on a combination of transformer architecture with generative and pre-trained. This means that the model is pre-trained on large datasets of text and can perform a range of different language tasks (Zhu & Luo, 2022, p. 1825). The generative part of the model means that the model can generate and produce natural language text based on the input provided. Combining these technologies has led to a powerful large language model with the ability to change behaviour based on the input and the large amount of data that was used to train the model. Radford et al., (2019, p. 5) tested the zero-shot GPT-2 model, which scored 7 out of 8 for performance in a variety of language modelling tasks, when training on a diverse and large dataset.

2.2.5 Machine-learning Model Overview

There is a vast amount of different machine learning models. Following the brief explanation of different ML models and subsections, an overview of the described models, as well as the most occurring models has been provided in Table 1.

Table 1: Overview of ML models

Machine Learning branch	Specific machine learning models
Statistical model	<ul style="list-style-type: none"> - Linear regression - Logistic regression - Linear discriminant analysis (branch of logistic regression) - Naive Bayes - Support Vector Machines (SVM) - K-nearest neighbour (KNN) - Hidden Markov Model (HMM)
Neural Network and Deep Learning	<ul style="list-style-type: none"> - Deep Neural Networks - Learning Vector Quantization (LQM) - Decision Trees - Decision List
Natural Language Processing (NLP) and Large Language Models (LLMs)	<ul style="list-style-type: none"> - Generative, pre-trained, transformer (GPT) - Zero-shot - Fine-tuned - Language Representation - Multimodal

2.3 Innovation in Projects

In this master thesis we will unravel the potential to utilize AI models to enhance innovation in project. For this to be possible, we will further define what innovation project is, how a typical innovation process in project is, and why innovation projects fail.

2.3.1 Project as a Phenomenon

To develop a more comprehensive understanding of what an innovation project is, it is important to first define what a project entails. According to PMI (2013, p. 3), a project is a series of tasks, activities, and deliverables that are executed to deliver a specific outcome,. It represents a temporal state and an effort to create value through services, processes, or products, and usually goes through various phases from start to end. The outcome of a project could be a specific product, service, process, or result and is always unique. The outcome could also be tangible or intangible. Project can be executed at all organizational levels, and the main goal of executing a project is to deliver value to the organization (Martinsuo et al., 2019, p. 631). This value can be both immediate outputs of the project and long-term outcomes for the organization. Martinsuo et al. (2019, p. 631) describe project success as the time of goals reached in combination with benefits compared to costs, and value achieved. The cost can include investments, as well as resources used, and time spent on activities. As no two projects have the exact same circumstances, each could therefore be classified as unique.

2.3.2 What is innovation?

Innovation has been defined in a variety of different ways and is a term that has been widely discussed. This thesis has based its definition of the term from the perspective provided Organisation for Economic Co-operation and Development (OECD & Eurostat, 2018, p. 20):

“An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).”

As OECD emphasizes it is not only referring to new or improved product when taking about innovation, but also the improvements of a process or service. Innovation is key for all growth and companies must innovate to be competitive and thrive.

Innovation is usually divided into two main forms, *radical* and *incremental* innovation. Radical innovation represents completely new product, process, or service, while incremental represents the continuous development or improvement of the innovation (Yusof et al., 2023, p. 1). Tidd & Bessant (2020) describes incremental innovation as a more adaptable and flexible approach to the constant changing world. Incremental innovation refers to small deliberate steps towards the organizations goals and evaluate them ongoing (Tidd & Bessant, 2020). Radical innovation has higher reward and can provide long-term solutions, but they are at a higher risk (Yusof et al., 2023, p. 2). There are some uncertainties to this approach, and often arises in projects with uncertain technology and customer requirements. However, incremental innovation is particularly beneficial for small and medium-sized organizations due to its lower cost and risk (Yusof et al., 2023, p. 3).

2.3.3 Innovation project

For the rest of this thesis, it is important to define what “innovation project” entails. Innovation project is a combination of innovation and traditional project. Walas-Trebacz & Bartusik (2023, p. 75), explain that “innovation project” is a distinct, temporary effort with a separate organizational structure. It follows a planned set of activities, based on allocate resources, and aims to successfully bring an innovation to market or applying it effectively within the organization. An innovation project is distinguished by a higher degree of difficulty and an

increased chance of achieving the projects goals and products (Walas-Trebacz & Bartusik, 2023, p. 75).

2.4 Innovation process

There are several ways innovation can occur in projects, and the innovation process is unique for every organization, Nevertheless, Salerno et al. (2015, p. 61) have presented a generic linear framework that gives an insight into how the innovation process usually takes place in organizations. The framework presented in Figure 4 gives the users structured guidance on how to move forward when developing innovation projects in an organization.



Figure 4: Traditional linear framework: From idea to launch (Salerno et al., 2015).

Although the innovation process presented in Figure 4 seems quite simple, the complexity of each step is not presented. This study will further elaborate on the different phases and activities utilized in them.

Idea generation:

Idea generation is the start of any successful innovation process. Presenting the right idea for the specific market the organization is operating is very difficult. This phase is characterized as creative chaos because there are so many uncertainties about the market, technology, and required resources (Dorner et al., 2009, p. 202). It is becoming more challenging for a single person to have the knowledge and skills necessary for innovating (Dorner et al., 2009, p. 203; Flocco et al., 2022, p. 397). Hence, it is essential to establish a multifunctional team with different skills and knowledge to succeed in the ideation phase.

There are several ways of generating new ideas. On one hand, ideas can arise spontaneously and informally, while on the other hand it can happen intentionally through formal and organized initiatives (Flocco et al., 2022, p. 397). The first formal initiative is top-down or market-driven, and the other is bottom-up or technology-driven (Flocco et al., 2022, p. 398; Mandal, 2022, p. 3). *Top-down* ideas may be generated by making a thorough examination about the market to identify exiting opportunities. This method demands a greater

understanding of the market, if there're any lacks or a significant need that hasn't been met yet. The goal is to solve a crucial problem for potential customers more effectively than any other existing solution (Mandal, 2022, p. 3). *Bottom-up* idea generation gets its inspiration from technological advancement. The main essence of this approach is using new technology to invent a new product, service, or process. Thereafter analysing the market to see if it can satisfy any unmet market need (Mandal, 2022, p. 4). Both methods are applying different principles, and organizations needs to employ the method that is most suited for their strategy. These methods are structured guidelines for companies to develop innovative ideas. Lee et al. (2023, p. 4) presents a couple of ideation tools that can be utilized to promote quantity, creativity, and diversity. Examples of these tools are Brain-writing, IDEO cards, Morphological Analysis, TRIZ and Worldtree Design-by-Analogy. Table 2 presents descriptions of the ideation tools.

Table 2: Description of ideation tools.

Tool	Description of the tool
Brain-writing	Is a technique where the participants start by working alone and write down ideas towards the organization's objective. Thereafter the participant passes their ideas to the next person and they either write new ideas or continue to work on those who were already shared. Brainwriting is a solution against brainstorming who typically enables the loudest people to share their view (Gilmartin et al., 2018).
IDEO cards	IDEO cards is meant to encourage the participants to try new approaches for meeting the customer needs and wants. It's a "How do we get from here to there" kind of problem (IDEO, 2003).
Morphological Analysis	It's a problem-solving method used for exploring all possible relationships in a given complex problem. First, the participants list the properties and modifications of a design. Thereafter they develop solutions for each of the properties. Lastly, they combine the solutions to generate fully functional concepts that meet the customer needs and properties wanted (Rakov, 2024).
TRIZ	TRIZ refers to theory of inventive problem-solving and is a systematic approach to generating solutions for technical problems across branches. Through the technical solutions presented by TRIZ, the application of the concept gives great improvements to existing product. TRIZ identifies the fundamental technical issues with different products and suggest new and innovating solutions (Santoso et al., 2024).

WordTree Design- by-Analogy Method	Designing new ideas through mapping attributes, relations, and purpose that fits the existing key functions and customer needs (Linsey et al., 2008).
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By understanding how the different tools work and are being utilized, it is possible to be more specific about how AI could potentially aid these tools and further enhance innovation in projects.

Screening and selection:

The first phase contains a list of ideas but is typically only a one-line description. Whereas the second phase include an intense analysis of the most promising ideas to gather as much information before selecting the best solution. Like the first phase it's complex and uncertain, though Dorner et al. (2009, p. 203) moves this phase from creative chaos to a goal-oriented way of working. The complexity of this phase lies in the completion of ideas. There are many aspects with the ideas that needs to be elaborated on, which is hard to fulfil. The intensive analysis consists of requiring more information about (Dorner et al., 2009, p. 203):

- **The core product:** This implies details of all the technical aspects of the product. E.g. the supplies needed, the overall cost, design, time, and resources.
- **Service offering:** For the invention to be considered, there must be an explanation of which customer need the invention fulfil.
- **Target market:** What is the market the invention is being brought to, and what requirement are in this sector. Market requirement varies from sector to sector, e.g. emissions and safety regulations in the transportation market, quality and ethical standards in the fashion market, and copyright, user privacy and data security in the digital market.
- **Positioning strategy and business plan:** A risk assessment and an explanation of the feasibility of the invention is carried out.

The goal of this phase is to complete the rough ideas generated in phase one. Through this comprehensive analysis, the project manager can execute a more thorough selection. To further help the project managers during the idea selection phase, there are some methods that have been developed and utilized. The methods are Analytics Hierarchy Process, Pugh's evaluation method, and Utility theory (Lee et al., 2023, p. 4). These methods compare the assigned characteristics of design options to find an optimal solution. Another benefit of idea selection

tools is that they tend to remove biases as the group evaluates the ideas (Lee et al., 2023, p. 4). Table 3 represents descriptions of the selection tools.

Table 3: Description of the selection tools.

Tool	Description of the tool
Analytic Hierarchy Process (APH)	APH is a general theory of measurement, usually used in multi-criteria decision making in planning and resource allocation, and in conflict resolution (Ramanathan, 2004; Saaty et al., 2022). The method establishes the importance of the associated criteria. The criteria's is set towards the overall goal, and the ideas generated are evaluated after their importance. AHP uses redundant judgments for checking consistence. This is often a tiresome exercise for the decision maker.
Pugh's Evaluation method	Pugh's evaluation method is a matrix used to compare and evaluate multiple design options against a set of criteria (Frey et al., 2007). With this method it is possible to break down complex design options against customer needs to find the best solution. For this method to be successful it is essential to develop a list with functional and non-functional criteria. This method removes bias in the decision-making.
Utility Theory	The utility theory refers to the ability a utility has to satisfy a person needs of goods and service. The project manager set a list of criteria and compare the ideas against how well they satisfy customer needs (Akkaya, 2021).

Development:

The third phase involves both the technical development of the product and preparation for launch (Dorner et al., 2009, p. 203). The production phase is strictly planned by the project manager, with the time and resources needed. Tariq (2010, p. 287) explains that this phase starts with “alpha testing”, which includes testing of the prototype for its level of function. There has only been a description of the idea in a theoretical form until this stage. Gutterman (2023, p. 6) presents different activities in the next stage which concerns the manufacturing considerations. The activities include the construction of manufacturing facilities and related equipment, procurement of parts and raw materials, quality control procedures, development of a distribution system, and creation of customer assistance schemes. Lastly, product testing will be executed, and the potential customers get to test the product and assess their reactions (Tariq,

2010, p. 287). Consequently, modifications to the innovation may be implemented to fulfil the requirements of the customers.

Diffusion/Market/Sales:

The last phase contains bringing the invention to the market. Although the product has been tested in the previous phase, there are still uncertainties on how the customers are going to react to the real innovation (Dorner et al., 2009, p. 204). There are many strategies that may be utilized before a complete launch of the product. Diffusion of innovation is one of them and seeks to explain individual adoption or intention to adopt new inventions (García-Avilés, 2020, p. 1). The four main elements in the diffusion of innovation are the innovation, communication channels, time, and the social study (Rogers, 1983, p. 11). This implies that the process of diffusion is when an product, service or process has been communicated through different channels over a specific amount of time to members of a social system (García-Avilés, 2020, p. 1). The developers can use the diffusion process to learn more about the market and the potential customer, and then use the information to improve their invention (Gutterman, 2023, p. 25). Other aspects to use this concept is through predicting the adaptation rate of the invention based on relative advantage, compatibility with existing products, simplicity and ease of use, and observable results.

Another strategy is test marketing, and it consists of small-scale test with customers (Tariq, 2010, p. 288). In this strategy, the product is brought to a small group of potential customers and analysed thereafter. The innovation is evaluated among many activities like salesmanship, advertising, sales promotion, distributor incentives, and public relations. The last stage of this phase consist of decisions such as when, where, how and to whom to launch the innovation (Tariq, 2010, p. 288). These decisions are based on the information collected this far, and launch strategy includes advertising and necessary trade promotions. The intention is to reach the potential “early adopters”.

A thorough explanation of the innovation process allows us to be specific in where the AI tools could help. Some AI tools may be more suited in the idea generation phase, while other fits the last phase. This will be further explored later in the thesis.

2.5 Why does Innovation Fail?

In an innovative project, many challenges may occur in different phases. Prior research defines innovation failure as an innovation project not reaching the desired goal (McCarthy & Freisinger, 2024, p. 3). Innovation can fail for a variety of reasons, reflecting the complexity between obtaining and selecting a good idea, developing the product, and launching to the market. Around 40 to 90% of innovation projects partly or completely fails (Wang, 2023). Some of the primary factors that can contribute to the failure of innovation in projects are:

- **Resource constrains:** Resource constrains can affect innovation projects in many different aspects. E.g. financial constraints can hinder the project's completion or quality (McCarthy & Freisinger, 2024, p. 8), time constraints can reduce innovative problem solving activities which can lead to less optimal solutions (Bayer & Gann, 2006, p. 13), and material and supply chain issues can hinder the innovation process.
- **Generating ideas:** Generating the right ideas is not an easy task. A known problem is quantity over quality. If one company focus too much on generating enough ideas, it can be difficult to differentiate the potential value between them. Another problem with idea generation is in group brainstorming sessions. There's a risk of group thinking, where the desire for harmony and consensus leads to poor decision-making (Gutterman, 2023, p. 69; Hansen & Birkinshaw, 2007).
- **Idea Conversion:** When selecting and screening new ideas, the main problem is obtaining enough and the right information about the idea. Insufficient information about the product, service, or market analysis can lead to poor "decision-making"(Gutterman, 2023, p. 69). Another problem is organizations with a too strict regime. Most of the ideas will eventually be shut down because of tight budget, strict funding, and conventional thinking (Hansen & Birkinshaw, 2007).
- **Market and technology knowledge:** With lack of knowledge about the market and technology, it can result in the company's failure to align innovation and marketing strategies with consumer needs. E.g. setting the wrong price, requirement, lack of product uniqueness, poor quality, or bad timing of new product release (Gutterman, 2023, p. 69; Hassan, 2018, p. 39; McCarthy & Freisinger, 2024, p. 8).
- **Communication:** Weak communication in between the company can lead to misinformation. E.g. wrong orders, delivering wrong requirements, or misinformed description to the sales division of the function of the innovation, leading to misguided marketing and sales strategies. Another problem with lack of communication is that it

will lead to more time used, which will eventually affect the resources and can hinder the project's success (Dorner et al., 2009, p. 200).

It is essential to be aware of the challenges innovation projects meet. By identifying them it is possible to present solutions with how AI can help enhance innovation success in an organization.

2.6 The innovation manager

Although some of the responsibilities of a project manager and an innovation manager can overlap depending on the organization's structure, they are not the same role. The project manager is essential for the completion of the project. The project manager has a lot of areas of responsibility, including delivery of successful projects, meeting project targets, fostering productivity, controlling financial and physical resources, risk management, understanding the needs of the team members, and leading the team for better productivity and culture (Hassan, 2018, p. 24). The traditional role of a project manager is strict and ensures that the project is completed on time, within budget, and according to specification (Khafri et al., 2023, p. 6). On the other hand, an innovation manager has been argued to have different responsibilities. Davies et al., (2023, p. 6) highlight the key differences in innovation and project management literature in six points. The points are presented in Table 4.

Table 4: Six differences in innovation and project management (Davies et al., 2023, p. 6).

Key differences	Innovation research	Project Management Research
Theoretical foundation	Contingency theory	General systems theory
Approach	Adaptive	Optimizing
Emphasis	Strategy and Opportunities	Control and deviations
Managerial level	Top management	Middle management/ Project management
Uncertainty and risk	Focus on opportunities, positive risk, risk willingness	Focus on negative risk, risk management, risk aversion, control progress, and avoiding deviation
Management focus	Designs and structures	Tools and techniques

Hassan (2018, p. 29) believes the role of the innovation manager is finding the balance between stimulating, supporting, controlling, and setting directions for innovation projects. Lavalle & Casale (2020, p. 54) identifies three main innovation manager features as the enabler, explorer and evangelizer. As the enabler, the innovation manager facilitates for idea generation, helping the project manager in the selection process, and deals with the introduction of new technologies within the organization. The explorer deals with scouting and assessing new opportunities. The innovation manager himself generates new ideas and have an active role as the project manager. Lastly, the evangelizer favours the introduction of agile methodologies, and arranges for a more productive and agile environment. The role is less strict than a project manager and encourages taking more chances in new and uncertain projects. Although the role involves risk-taking, the potential benefits are essential for obtaining competitive advantage.

While project manager and innovation manager are two different roles, an innovating technique mentioned in recent studies is agile project management (APM) as a solution for traditional project management (Khafri et al., 2023, p. 6). This allows the project manager to engage in added-value activities without the need for both formal and administrative requirements. Khafri et al. (2023, p. 6) believe it will result in a more efficient and seamless production process, while at the same time considering product functionality and implementation goals.

By understanding the role of the innovation manager, we can be more specific on how the innovation manager could apply the different AI tools in the innovation process.

2.7 Practical Use of AI

There are three main use-cases where AI is relevant within business processes and projects according to Marr & Ward (2021, p. 14):

1. Customer: Structuring information from unstructured data is one of the main responsibilities of AI in business. Customer data and profiling, prediction of trends, products and demand, and more personified customer interactions are typically an area where the company have access to a large amount of unstructured data and AI is impacting these kinds of operations.
2. Products and services: The products and services that are being sold is more intelligent and can offer intelligent solutions to different problems with AI technology.

3. Automized and improved processes: Efficient use of AI can help improve the different processes within the company. With improved processes, the company can save time, costs and resources and further developing their business operations and projects.

Table 6 shows a collection of use-cases and domains that AI technology is presently being used in business operations and projects. The specific use-cases are collected from different literature including Marr & Ward (2021).

Table 5: Collection of practical use-cases for AI (Barro & Davenport, 2019; Borges et al., 2021; Deng, 2018; Haenlain & Kaplan, 2019; Marr & Ward, 2021; Russell & Norvig, 2022; Verganti et al., 2020).

AI domains	Specific Use-cases
Productivity and automation	<ul style="list-style-type: none"> - Automation of single tasks. - Automation of reporting and standardization. - Productivity in low-risk, time- consuming tasks. - Personal assistants for supporting tasks such as translation, idea generation, coding, text search, text generation, summarize text. - Virtual assistants can schedule meeting, answer queries, and provide updates. - Distribution, automatic warehouse, and packaging. - Package deliveries.
Analysis and calculation	<ul style="list-style-type: none"> - Costs and control. - More accurate analysis of time-use, costs, and the use of resources.
Forecasts and predictions	<ul style="list-style-type: none"> - Market trends. - Market demands. - Risk assessments.
Decision-making	<ul style="list-style-type: none"> - Collection of relevant information. - Availability of information and real-time insights. - Company and sector specific experience and corporate memory. - Generate performance metrics.
Product testing	<ul style="list-style-type: none"> - Idea and product testing before development, from a customer and market perspective. - Quality check before delivery.
Customer segmentation	<ul style="list-style-type: none"> - Customer profiling. - Testing of product based on customer profile.
Integration of data and digital tools	<ul style="list-style-type: none"> - Collection and structuring of unstructured data. - ERP system. - Flow of communication. - Integration of single systems into common platform.
Personified marketing and customer experiences	<ul style="list-style-type: none"> - Collection of data from customers - Personalize marketing based on previous purchasing and customer data. - Adaptation to external environment that can further influence customer behaviour, such as seasons, weather, culture etc.
Integrated services or products	<ul style="list-style-type: none"> - AI based products and services. Smart technology integrated into product or service.
Idea and design generation	<ul style="list-style-type: none"> - Generation of ideas in design and innovation tasks.

	<ul style="list-style-type: none"> - Text and language generation. - Code generation and issue identifying. - Reduction of defects and error. - Sentiment analysis.
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2.8 AI Implementation and Challenges

Data ethics is an important consideration when discussing AI. Jobin et al. (2019, p. 20) identified 84 reports on AI ethics guidelines, with 88% published after 2016. The emergence of ethical issues regarding data privacy, governance, and collection has been fuelled by the development of AI. Data is the basis for AI and ML models, and ethical considerations for processing data is key to successfully implementing an AI model within a company. Floridi & Taddeo (2016) are separating ethical challenges within data science into three parts. 1. Ethics of data, 2. Ethics of algorithms, 3. Ethics of practices.

2.8.1 Ethics of Data

Ethics of data focus on ethical challenges when collecting and analysing datasets (Floridi & Taddeo, 2016, p. 3). There are different challenges when considering data ethics. Herschel & Miori (2017) identified issues that have risen from the emergence of Big Data, including:

- Unintended use paradox: Datasets that previously were not considered as a risk for data privacy implications, but are combined in ways that threaten privacy.
- Autonomous data collection: Data collection without human involvement can lead to a collection of data without individual consent. Maintaining confidentiality, protecting privacy, and removing identified information can be an issue with automated data collection.

A framework for evaluating data ethics is provided by McCoy et al. (2023), which includes three substantive principles with three additional procedural principles

1. Minimizing Harm
2. Fairly distributing burdens and benefits
3. Respecting individual autonomy.

The proposed procedural principles are 1. Transparency, 2. Accountability, and 3. Inclusion (McCoy et al., 2023).

2.8.2 Ethics of Algorithms

Ethics of algorithms is described as issues posed by increasing complexity and autonomy of algorithms. These issues include responsibility and accountability of both designers and data scientists that creates and implement the algorithms used. Assessment of unforeseen consequences, bias and discrimination, and how to change the algorithms needs to be conducted (Floridi & Taddeo, 2016, p. 3). When creating a system with internal algorithms, trust is an important part. Russell & Norvig (2022, p. 1047) separates trust into a V&V process: verification and validation.

Verification can be explained by the satisfaction of product compared to specifications. A way to verify this is by achieving certification. IEEE is an organization which have working AI ethics certificates, which can help build trust to the AI model. Another part of trust is validation, which refers to ensuring specification meet needs of customer and other parties. Transparency is an important part of validation and achieving trust. Transparency has been an issue when regarding AI, because of the hidden layers that produce internal computation (Russell & Norvig, 2022, p. 1048). Still, there are advances in the field regarding transparent AI models. The Tsetlin machine presented in 2018 at CAIR in Kristiansand is regarded as a transparent AI model, which shares computations in a different way from typical black box of deep neural networks, while remaining to match or surpass deep learning accuracy in a number of applications (Abeyrathna et al., 2023).

2.8.3 Ethics of Practices

Ethics of practice is described as addressing questions of ethics regarding the processing of data. This refers to the accountability and liability of the people involved in storing and using the data within the organization. Floridi & Taddeo (2016, p. 4) describe three issues that are central to this topic. 1. Consent, 2. User privacy, and 3. Secondary use. Standards and regulations internal to the organization are key to ethically processing the data.

2.8.4 Building and Implementing a Fair System

Unfairness and bias are factors that can impact the computation and output of AI models negatively. There are different ways of explaining and evaluating fairness, Russell & Norvig (2022, p. 1043) mention 6 common principles of fairness:

1. Individual fairness: Similar treatment between individuals, regardless of class.
2. Group fairness: Similar treatment between class.
3. Fairness through unawareness: A concept that leaving out gender and race attributes from a dataset will lead to lack of discrimination. However, a ML model can predict latent variable such as race and gender by demographic statistics.
4. Equal outcome: Demographic class gets same results.
5. Equal opportunity: Equal ability to choose actions regardless of demographic class.
6. Equal impact: Same expected utility from people with same likelihood, regardless of demographic class.

Data and algorithms are created by humans, and humans can create bias in the datasets. These sets of data are the foundation of AI and ML models. Training on datasets containing bias, can lead to biases in the outcome of the models, as well as biases in the connecting algorithms. When using algorithms to train other algorithms, bias can be further rooted and amplified in the ML model (Mehrabi et al., 2022). To limit bias in the ML models, Russell & Norvig (2022, p. 1046) propose four strategies. 1. Understanding the limitations of datasets and including annotations. 2. De-bias the data. 3. Invent new machine learning models and algorithms that are more resistant to bias. 4. Let a system make initial recommendations that may be biased, but train a second system to de-bias the recommendations of the first system (Russell & Norvig, 2022). Although a current system may be biased, there are important steps to ensure a fair system, when building and implementing an ML model. An 8-step framework has been proposed by Russell and Norvig (2022, p. 1047) to avoid bias and ensure fairness in the system.

1. Ensure communication between designers, social scientists, and domain experts to understand issues and perspectives.
2. Define groups the system will support, including different language speakers, age groups, abilities etc.
3. Optimize objective function of system.
4. Examine data for prejudice and bias.
5. Understand design goals and use human annotation.
6. Track subgroups with metrics that may be victims of bias.
7. Include tests that reflect experience of minority group users.
8. Include feedback loops that tracks and deal with fairness issues.

When using a such framework when building and implementing a ML model, bias can be limited and the system has a higher chance of achieving fairness (Russell & Norvig, 2022, p. 1047).When using a such framework when building and implementing a ML model, bias can be limited and the system has a higher chance of achieving fairness (Russell & Norvig, 2022, p. 1047).When using a such framework when building and implementing a ML model, bias can be limited and the system has a higher chance of achieving fairness (Russell & Norvig, 2022, p. 1047).

2.9 Synthesis of Body of Knowledge

Table 6: Synthesis of body of knowledge

Topic	Brief Description	Relevance
2.1 Historical Development of AI	Several milestones have occurred from the course of the 1950s until the present day. Including the AI workshop in 1956, The ELIZA program in the 1960s, DeepBlue in 1997, and AlphaZero in 2017. The transformer architecture released in 2017 led to developments in the field and contributed to the release of Chat GPT in 2020.	Historic development is the foundation for the current and future use of AI.
2.2 Artificial Intelligence	<p>Artificial Intelligence is described as a machine with human intelligence. To be described as intelligent, the machine needs the following capabilities:</p> <ul style="list-style-type: none"> - Natural Language Processing. - Knowledge Representation. - Machine Learning. - Automated Reasoning. <ol style="list-style-type: none"> 1. Machine Learning uses statistical modeling to observe patterns and learn from datasets. 2. Statistical models use probability and decision theory for learning. It is effective when investigating the relationship between variables. 3. Neural Network has information flowing through networks of nodes from input to output. These networks have hidden computations or layers, which make the variables interact in a complex environment. 	Different AI models can be used as different tools for simplifying challenges.

	<p>4. Language models are probabilistic distributions of grammatical strings. The models predict the likelihood of the next word and context in a text.</p>	
2.3 Innovation in Projects	<p>An “innovation project” is a distinct, temporary effort with a separate organizational structure. It follows a planned set of activities, based on allocated resources, and aims to achieve this through successfully bringing an innovation to market or applying it effectively within the organization.</p>	<p>It is important to define what an innovation project is to understand the research field.</p>
2.4 Innovation process	<p>The innovation process consists of four phases:</p> <ol style="list-style-type: none"> 1. Idea Generation – generating enough and quality ideas. 2. Screening and Selection – Developing the rough ideas to complete concepts and choosing which to go further with. 3. Development – developing the ideas. Making prototype and making them ready for launch. 4. Diffusion/Market/Sales – Gathering information about market and making a launch strategy. 	<p>Understanding the innovation process makes it possible to be more specific in where the challenge occurs and what it affects.</p>
2.5 Why Innovation Fail	<p>Reasons for why innovation fails:</p> <ul style="list-style-type: none"> - Resource constraints - Generating ideas - Idea Conversion - Market and technology knowledge - Communication 	<p>Identifying the reasons why innovation fails makes it possible to present solutions to how AI can help enhance innovation success in an organization.</p>
2.6 The innovation manager	<p>The innovation manager:</p> <ul style="list-style-type: none"> - Enabler: Facilitates idea generation, helps the project manager in the selection process, and controls the progress of the project. - Explorer: he himself generates new ideas or has an active role as the project manager. - Evangelizer: introduce agile methodologies and arranges for a more productive and agile environment. 	<p>By understanding the role of an innovation manager, the researcher can be more specific on how the innovation manager could apply the different AI tools in projects.</p>
2.7 Practical Use of AI	<p>There are three main contexts that AI is being used in practice.</p> <ol style="list-style-type: none"> 1. Structuring of unstructured data and customer segmentation/ profiling. 	<p>Current use of AI and specific use cases.</p>

	<ol style="list-style-type: none"> 2. Intelligent products and services 3. Automation and improvement of processes. 	
<p>2.8 AI Implementation and Challenges</p>	<p>Ethics regarding data collection, algorithms and data processing is an important consideration when implementing AI in working practice. Ensuring an unbiased and fair system can be achieved with the 8-step framework.</p> <ol style="list-style-type: none"> 1. Communication between designers, domain experts and scientists. 2. Define groups being supported by the system. 3. Optimize objective function. 4. Examine data for prejudice and bias. 5. Understand design goals and include human annotations. 6. Track subgroups with metrics, that may be victims of bias. 7. Include tests with the experiences of minority groups. 8. Include feedback loops with tracking of fairness issues. 	<p>AI provides risks regarding data privacy and ethics, which require considerations when implementing a model.</p>

3. Methodology

Aiming to develop a deeper understanding of the potential of AI in enhancing innovation in projects, this thesis will further adopt a comprehensive methodological framework. Within this selection, we will detail the methodological choices in our investigation. By systematically outlining our choices and their rationale, this section aims to provide a clear overview of the research process to reinforce our research.

3.1 Research Philosophy

This paper is engaging in a pragmatic research philosophy. Pragmatism is a philosophical development that focuses on the practical understanding of real-world issues (Kelly & Cordeiro, 2020, p. 2). The paper illustrates three principles that build on this statement and are essential for a pragmatic inquiry. The reason for choosing this research philosophy is how well it suited the research question and how the data was collected. (Kelly & Cordeiro, 2020, p. 2).

The first principal emphasis on actionable knowledge, and ensures that the research is practical relevance and focus on problem solving (Kelly & Cordeiro, 2020, p. 3). This thesis seeks to identify challenges that innovation in projects faces and explore how AI practical use can be used to solve or simplify such problems. The second principle recognizes the interconnectedness of experience, knowing, and acting, and encourages the researchers to analyse organizational practice through experience as well as action (Kelly & Cordeiro, 2020, p. 3). The data collected in this thesis is by performing qualitative interviews with different companies and positions to explore their experience with innovation, different problems and how the interviewees believe AI could be integrated. This method combined with relevant and exiting theory will give an improved understanding on how AI can be utilized as a tool for enhancing innovation in projects. The third and last principle relates to how research and evidence-based practice are not separated, but rather intertwined processes where research informs actions, and actions generate new insight (Kelly & Cordeiro, 2020, p. 4). By following these principles, it allows the thesis to present solutions that are both feasible and useful, which will help this thesis contribute to direct improvement of how AI can enhance innovation in projects.

3.2 Choice of Reasoning

The research approach that is chosen for this master thesis is abductive analysis. Abductive analysis is a strategy of developing new theory based on qualitative data (Johannessen, 2022, p. 2). For this approach to be utilized correctly, we must have general knowledge and be familiar with specific theories related to the topic of the thesis (Johannessen, 2022, p. 4). This is essential for conducting a good and effective data collection. The essence of abductive analysis is using the theory to analyse the data, while the data serve to evaluate and refine the theory (Johannessen, 2022, p. 6). Abductive research approach is well suited for this thesis where there are no clear answers on the research questions and the goal is to understand complex problems.

3.3 Strategies

Phenomenology is the philosophical approach that is applied in this thesis. Phenomenology seeks to understand human experience and focus on subjective, first-point of view of meanings and structures of experience (Qutoshi, 2018, p. 215). The core of phenomenology is trying to understand what is the experience of a particular phenomenon from the perspective of those who experience it on a daily basis (Qutoshi, 2018, p. 219). This philosophical approach will guide this thesis to comprehend a subjective point of view about the challenges faced for innovation in a project, and how the informants believe AI can help solve or simplify them. Combining this with the existing literature will provide a more holistic view on the subject.

3.4 Research Approach

The method used for collecting data in this research can be defined as “Methodologic Triangulation” (Thurmond, 2001, p. 254). This method is also described as “mixed methods” and refers to the combination of multiple data collection methods. Thurmond (2001, p. 254) further classifies triangulation into two categories: “within-method triangulation” and “across-method triangulation”. This means either a combination of data collection procedures within a specific data collection method, e.g. qualitative or quantitative data collection. Or the combination of data collection procedures across different data collection methods, e.g.

qualitative and quantitative data collection. In this research, an across-method triangulation has been conducted for the collection of data. (Thurmond, 2001, p. 254).

Mariani et al (2023) identified that qualitative methods would better capture processes of AI adoption and should therefore be used more widely when assessing the literature on Artificial Intelligence in innovation. Secondly, Mariani et al (2023) argue that mixed methods could be suitable for researchers to gain a more comprehensive understanding of the phenomena in relation to artificial intelligence and innovation. It was therefore decided early in the research process of this study, that a triangulation with a combination of qualitative and quantitative data collection methods could be suitable.

“Researchers should use triangulation if it can contribute to understanding the phenomenon” (Thurmond, 2001, p. 253). This study aims to understand the phenomenon of artificial intelligence and how it can be used to solve certain challenges in the innovation sector. When using an across-method triangulation of interviews in combination with a questionnaire, the aim was to identify personal insights and experiences from individuals within the sector. Additionally, supplementing this unstructured data from the qualitative method with patterns and statistical trends that are measurable could add quality to the findings.

Nevertheless, there are discussions whether a combined method of interviews and questionnaires is appropriate. Harris & Brown (2019, p. 1) argue that the consistency between the methods is weak and should not be used as confirmatory. However, when analysing a questionnaire and interview data separately and using methods suitable, a deeper and more nuanced understanding of the data can be achieved when comparing results of the datasets, according to Harris & Brown (2019, p. 12). The data collected with the triangulated study is therefore not used as confirmatory in this study, but rather as supplement to gain a more comprehensive understanding of the topic. More specifically, the empirical data collected from the interviews is the main dataset that this study investigates. The data collected by the questionnaire is used for mapping expectations and competency of artificial intelligence in general. This supplemental data is analysed separately from the qualitative data and compared to the results. The integration of the specific data collection methods and the specific use of the methods will be further explained in the following sections.

3.5 Research Design

3.5.1 Selection of Informants

The selection of informants was affected by different factors. Firstly, availability of informants is a considerate factor. There were made numerous approaches to different companies and private persons with experience and knowledge on the area of research. To make contact, it was executed in the form of text-messages and e-mails. The informants used in the study were selected by the available selection.

Criteria were pre-set before making contact to the informants. These criteria were determined to:

- Relevant knowledge and experience in the field of innovation or project management.
- Working in a technologically advanced company with knowledge of AI.
- Variation of working positions in the same company to provide different perspectives on the same topic.

Due to the limitations of the study, including time horizon and accessibility to informants, the required number of informants was determined to be around eight. The method selected provides a large quantity of data, and limiting the number of informants would increase our ability to work with the data more thoroughly. Skilbrei (2019, p.174) describes the point where the empirical data no longer provides variation or leads to new discoveries as a saturation point. The saturation point became evident in some of the categories that were discussed in the interviews, with repetitive answers from different informants. However, in other categories, new discoveries were found in the last interviews. This could mean that the study could benefit with insights from more informants on certain topics. Eventually, we decided to prioritize the quality of the data analysis. Thus, limiting the data collection were decided to ensure quality of the findings and avoid negative impact of excessive data material. Table 7 shows an overview of the informants that were chosen and accessed in the study.

Table 7: Overview of Informants

Company	Number of informants	Relevancy
Stimline Digital AS	4	Technological advanced company that specializes in software development in the oil and energy sector. The software is mainly a planning and automation software that has integrated AI solutions.
ÅEnergi	1	Large national energy company with operations across different sectors. Innovating practices and products throughout the value chain are an important part of the company.
ABB	3	Large global company which specializes in product development and project management. AI and smart technology are included in several products the company develops.

ABB is a leading technology driver within electrification and automation which prioritize facilitating a more sustainable and resource effective future (*About ABB*, n.d.). *Stimline Digital AS* is a relatively new company developed in 2011. Their expertise is in the fields of software development and energy and service companies, specifically drilling and well operations. Stimline has successfully provided digital service and tools to improve the existing workflow (*About Us | Stimline Digital*, n.d.). *Åenergi* is a leading energy company in Norway with operations throughout the value chain. Their main goal is to increase the production of renewable energy and delivering clean energy to the Nordic people (*Om Å Energi*, n.d.). *ABB* is a leading technology driver within electrification and automation which prioritize facilitating

Each of the informants provided valuable information regarding first-hand experience about working in projects, containing challenges faced, how they worked with artificial intelligence and their view on the future. The different companies provide expertise in different section, like project management, product development, AI/digitalization, and innovation.

3.5.2 Semi-structured interviews from a phenomenological standpoint

Semi-structured interviews were chosen as the main source of empirical data in this study. An interview is a qualitative method used to understand phenomena or situations that occur in the informant`s everyday life (Brinkmann & Kvale, 2015, p. 31).

As previously explained the interview follows a phenomenological standpoint. Brinkmann & Kvale (2015, p. 32) characterize semi-structured interviews with 12 key points. By following these 12 key points, the goal is to explain the aim of the interviews, how the interviews were conducted, and how this data collection method can affect the empirical data.

1. Life world: The informants explain situations and experiences in their daily lives. This also means that their answers are clouded by their perspectives and interpretations. The topic of the interviews is the informants` daily lives and specific situations that can occur.
2. Meaning: Interviewing means that the empirical data is collected in the form of interpretations of meanings from the informants` answers to the questions. The questions can also be answered in a non-verbal manner. We also need to register and interpret the body language and non-verbal cues. Non-verbal cues can be a difference in body language or tone of voice, and the ability to interpret and collect these cues can improve the quality of the empirical results from the qualitative interviews. However, misinterpretations of non-verbal cues can lead to errors in the data. Thus, we tried to reduce this error, by asking follow-up questions to the informants, when registering such a difference in behaviour. By formulating and asking the informants of the “hidden” meaning, confirmation or disconfirmation could be achieved.
3. Qualitative: The interviews aimed to seek a deep understanding of how the informants work with innovation, and what type of challenges they are facing in their everyday lives. The informant`s perspective is a key part of the research due to the aim of understanding their environment and circumstances, as this is a vital part of understanding their challenges. The interviews provided different aspects and perspectives on the same phenomena. The everyday work of innovation is a complex and nuanced process, which can be perceived differently, by different people. With this

aim in mind, the methodological choice of a qualitative approach rather than a quantitative one was decided as appropriate.

4. **Descriptive:** The informant`s experience is the primary target for the interviews. It was therefore necessary to ask descriptive questions and structure the interviews in a way that the informant could talk freely. We wanted to understand different perspectives to gain a more nuanced understanding of complex situations. We developed an interview guide, which provided a basis for the themes discussed in the interviews. We then prepared certain areas that were focused on during the interviews, but let the informant talk freely and was allowed to direct the conversation. If we felt the interview went off the track, a choice to proceed to the next topic or steer the question back to the pre-generated topics were made. The qualitative method used can therefore be defined as a semi-structured interview.
5. **Specificity:** We asked the informants about specific situations and circumstances. When asking questions of general opinions, and not specific situations, we asked the informants for their views or perspectives before the question was asked. E.g. When asking the informants about their general view on innovation, the informants were first asked about how they would define the term innovation. When asking for their definition of the subject, a misinterpretation of a general term could be avoided, and the informants could explain the term from their perspective. In a qualitative interview, generalized terms should not be generalized as public opinion and by asking the informants for their definition, we were able to compare the informant`s definitions.
6. **Deliberate naiveté:** Although an interview guide and areas of exploration were prepared, we remained open to unexpected perspectives. We experienced learning maturity in the interview situation and topics that were discussed, throughout the research period. Questions asked in the earlier interviews were slightly changed due to the continuous evaluation of the interview situation and our role and quality as researchers. However, the topics of the research were not changed throughout the study. Based on the experience of the earliest informant`s, some questions were added to ensure comparability between the selection and generated quality of the empirical data in the study. Due to the choice of an abductive research design and lack of specific knowledge

in the field, development in learning maturity and openness to the perspectives of the informants were natural in the study.

7. Focus: The focus of the interviews was to collect empirical data on experiences of individuals connected to challenges that is faced when working with innovation. The aim of the research was to gather information from individuals who face these challenges on a daily basis. The role of artificial intelligence in the same context was discussed with different perspectives, as well as other topics such as project management and innovation management, the role of innovation in projects and everyday work, and how AI can be used within these topics.
8. Ambiguity: The informants answers was recalled from their own memory, and the experiences were interpreted by themselves. By not being able to prepare for the questions asked, conflicting answers and ambiguity can affect the course of the interview. Our role was to investigate and interpret the answers of the informants. Obscurity and ambiguity were attempted to be clarified by asking questions such as “What did you mean by that?” and “Can you explain a bit more?”. By clarifying the informant’s answers, miscommunication or misinterpretations can be avoided. We decided to record the interviews to ensure that data is not lost in the process and that we can validate the data from a different source than our memory.
9. Change: In the course of an interview the informant could experience change in answers or experiences while talking about a subject. It became apparent when we challenged the informant by asking why, when giving an answer. This made the informant see a situation from a different perspective in certain moments. We used questions like “Is this a right interpretation of your answer?” and “Is it right to say that this is your standpoint?” and continued to explain the interpretation of the answer given. By using these techniques, we gave the informants get the opportunity to change their answers and ensure clear communication between the parties.
10. Sensitivity: Different researchers and different informants can produce different interpretations of the same phenomena. Informants, as well as researchers, don’t have the same background and competency in the field of study and will therefore produce different evaluations on the same questions or empirical data. To raise the quality of the results, we individually analysed and interpreted the empirical data. The interviews were

conducted together with two researchers and one informant. The interviews were as mentioned recorded and analysed individually. After analysing, we compared the results and interpretations. We then continued to compare the empirical data to relevant literature on the field of study, before presenting it.

The competency and background of the informant selection were also assessed, which was formerly explained. Topics of questions were slightly changed due to the expertise of the informant. The informants provided a variety of competency depending on the research area, with different level of experience on the topics such as innovation, AI, and project management. We decided to focus the interviews on the area of expertise of the informant. However, all topics in the interview guide were asked upon during all interviews.

11. Interpersonal Situation: The interpersonal situation consisted of two researchers and one informant who interacted over the digital platform Teams. We divided the interview questions into separate areas of responsibility, but followed up with questions throughout the interview. Skilbrei (2019, p. 71) explains that the advantage of interviews over digital platforms is to access informants and materials that normally would be unavailable. A more diverse set of informants was achieved by using this method of interviewing.

Another consideration is a reduced ability to register non-verbal cues. Skilbrei (2019, p. 71) explains that this consideration can include both advantages, as well as disadvantages. The ability to focus on what matters can enhance the quality of the interview and can be easier when interviewing over digital platforms. However, important information can be lost when not having the ability to get a full picture of non-verbal cues and body language. A different way of preparation is important when conducting the interview in this way. Making sure that the informants are comfortable using the platform, and ensuring clear sound, reduction of noise, and appropriate lighting can be important factors in conducting a successful interview (Skilbrei, 2019, p. 70).

12. Positive experience: We started the interview started with small talk to limit nervousness and provide a positive experience for informants. We then experienced an

eagerness to share from the informants, and let the informant talk freely most of the time. The interviews lasted between 35 and 60 minutes depending on experiences and knowledge on the area of research. In the end, we ended the interview when questions regarding all topics within the interview guide were answered.

3.5.3 Interview Guide and Test Interview

An interview guide was developed for the interviews. Questions and topics were based on theoretical knowledge and literature. The guide was developed to provide guidelines for a semi-structured interview situation. Tjora (2021, p. 167) explains that an interview guide is an effective method for structuring and providing guidelines for the interview. However, the questions don't need to be fully formed, in some cases, keywords in certain topics are enough to provide structure (Tjora, 2021, p.167). The interview guide in this study was separated into three parts, a beginning, a main part, and a finishing part. The beginning section of the interview was focused on making the informant comfortable, in combination with a mapping of the competence and experience of the informant. This included questions such as: "Can you tell us about your background and current working position", and "Can you guide us through a typical workday". Kvale & Brinkmann (2015, p. 152) argues that the first minutes of the interview are decisive. It must be established good contact to further help the informant become comfortable in the situation (Brinkmann & Kvale, 2015, p. 154). The main part of the interview consisted of investigating the main topics in the study. The topics were separated into six parts:

1. Personal perspectives on innovation and definition of the term.
2. Identifying challenges the informants face when working with innovation, in projects in general, or other challenges the informants find considerable.
3. Map personal expectations regarding AI, current use of AI in the company and how it potentially can be used within the company.
4. Whether or not AI can be used to simplify some of the challenges presented by the informants.
5. Organizational or structural barriers to innovating or management of projects.
6. Risks and challenges regarding implementation of AI in working practice.

The amount of time spent on each topic was dependent on the experience and competence of the informant. The last part of the interview consisted of an ending part, where the informants

were asked if there was something they wanted to clarify or add to the interview. The interview guide is added to this thesis under the attachments section.

In the preparation phase of the interview guide, a test interview was conducted. The test interviews were used as a means to assess the quality of interview performance, as well as testing the interview guide. This provided valuable feedback and showed weaknesses and strengths in the former interview questions. The test informant also provided feedback and criticism of our role as researchers in the interview situation. The changes made during this phase of the study gave us insights to reflect upon and provided additional quality to the study.

3.5.4 Questionnaire

A questionnaire can provide patterns, trends, attitudes, or opinions from a population by receiving quantitative descriptions from a sample of the population (Rowley, 2014, p. 3). In this research, we designed a questionnaire to supplement the qualitative data. The questionnaire was based on general questions regarding the expectations of AI, the widespread use of AI in working practices, and general thoughts on the topic. The questionnaire was shared on our social media, allowing everyone to respond. This thesis used the questionnaire to compare numbers with other relevant surveys, including the Microsoft Work Trend Index (Taylor, 2023). Thus, this questionnaire did not impact the main empirical findings in the study, but rather provided a basis for general public expectations on an emerging topic.

3.6 Data Analysis

This section will consider how the data was analysed and interpreted in the research. The method used for analysing the data collected with qualitative interviews is thematic analysis. With the openness of qualitative data collection, it can be difficult to find measurable results. Thematic analysis (TA) is a typical method to analyse qualitative data (Castleberry & Nolen, 2018, p. 808). The nature of TA can be broken down into three sections, identifying, analysing, and reporting the patterns in the data. The data used in this thesis is mainly sound recordings of conducted interviews. Castleberry & Nolen (2018, p. 808) outlines TA in five steps. These steps were used as a basis for our data analysis.

Compiling refers to the usability of the data and means to compile the data into a usable form. We chose to transcribe the interviews from the sound recordings. As mentioned, the transcription method we used was the database “Nettskjema”. This database transcribed the interviews automatically and structured the sound recording into a written document. The written document was then manually analysed and compared to the sound recordings to validate the transcriptions and correct the errors. The transcripts were then read and reread to familiarize ourselves with the data. This step of the process is about organizing and familiarizing with the data to provide a basis for the next step.

Disassembling is the next step, and it involves taking the data apart and breaking it down into groupings. This step aims to identify similarities and differences between the informants in the data. The interesting quotes, themes, and ideas discussed were tagged as codes. The interview guide consisted of general themes addressed in the interviews, and the codes were based on the discussion of these themes. However, ideas that were considered interesting outside of the selected topics were also tagged as a code. The codes were tagged with personal notes that elaborated on why the codes were considered relevant and additional information for us to consider.

Reassembling is the step where the codes are thematized into a category. The common themes and concepts were discussed and decided after familiarizing ourselves with all the transcripts and observed in the context of the codes selected. The concepts were established as

1. Perspective on innovation.
2. Current use of AI.
3. Challenges in innovation.
4. How AI could aid in simplifying challenges.
5. Risks when implementing an AI model.

We then grouped and thematized the data into these categories separately to find commonalities in the data. By thematizing the codes, a basis for comparison was created. This provided a more holistic understanding of the discussed topics. When grouping, we used tables and matrixes for categorizing the codes. This method provided a more visual representation of the codes and with an opportunity to compare codes and separating the informants from each other. A table was created for each of the five themes selected. Figure 8 shows a representation of how the codes was thematized and grouped.

Table 8: Example of thematizing in tables

Informant (x)	Codes	Personal notes
Informant 1		
Informant 2		
Informant 3		
Informant 4		
Etc		

Interpreting is a critical step of the process. Castleberry & Nolan (2018, p. 812) argue that interpretation is not only happening during this stage, but throughout the entire process. The main goal of interpreting the data is to correct and transparently represent the raw data in the context of the literature. In the former sections, we have explained what methods we used in the interview situation to avoid ambiguity and ensure clear communication of meaning. However, there are always interpretations of data in qualitative research. The identifications of patterns in the themes selected were interpreted and discussed in the context of the literature on the topic. Throughout the study, we have been vigilant of and discussed personal biases on the topic. Thus, we have based our interpretations and statements on the findings and the literature in relation to the research questions. These interpretations have provided the basis for our conclusions.

Concluding is the last stage of thematic analysis. This is the final response to the research questions and the purpose of the study. This response is based on the findings collected, in relation to relevant literature. In this study, we have provided a detailed description of how we have collected the data, analysed the data, and interpreted the data to form our conclusions. We have also provided a discussion of why the conclusions are generally difficult to generalize and transfer to other contexts than those discussed in this study. However, there are findings we believe are contributing to the literature and could be useful for both project managers and innovation managers in the future.

3.7 Evaluation of Methodological Choices

To evaluate the methodological choices made in this study, different perspectives are needed for assessment. These perspectives include the reliability, validity, and generalizability of the empirical findings. Data privacy and ethics are an important part of a study consisting of qualitative interviews and data collection, and a description of ethical considerations has been provided in this section. Lastly, a section that discusses a critical perspective on the methodological choices is included.

3.7.1 Reliability

Reliability is a term that describes the consistency and trustworthiness of the findings in academic research (Brinkmann & Kvale, 2015, p.281). The collection of empirical data with qualitative interviews may have risks related to the reliability of the findings. Considerations to ensure reliable findings have been taken into account in this study. In the context of this study, the reliability of findings refers to how the interviews were conducted, the researcher's ability to reflect on their role, and how the data was interpreted and analysed.

As formerly mentioned, a test interview was conducted, after developing the interview guide. This test interview provided valuable feedback based on the interview situation. Different choices regarding questions to be included in the interview were made, with a focus on open questions. Giving the informant the ability to define their perspective and understanding of certain terms and situations, helped the researchers to provide directions for the interview without influencing the answers given. A typical pitfall regarding reliable findings in qualitative interviews is to ask leading questions (Brinkmann & Kvale, 2015, p. 281). A strategy for avoiding this pitfall was to permit the informants to talk freely about a subject and ask follow-up questions. Another strategy to ensure the reliability of the answers given was to ask questions about the same topic in a slightly different way to see if the informant would change their answer. If then, the informant had corresponding responses to similar questions, reliability was considered achieved.

Noble & Smith (2015, p. 35) recommend a set of strategies to ensure the credibility of the study findings. The researchers adopted some of these recommended strategies and adapted the

strategies to increase suitability to this study. These strategies include: Account for personal biases that may influence findings.

1. Acknowledge bias in sampling and ongoing critical reflection of methods regarding data collection and analysis.
2. Establish comparisons or differences in perspectives and circumstances for informants.
3. Separated data analysis and transcriptions between researchers ending in mutual engagement and comparisons of findings to avoid personal bias.

The aim of adopting these strategies is to minimize the negative impacts of preconceived ideas and bias on the topic, as well as ensure the credibility of the findings.

3.7.2 Validity

Validity refers to the extent to which the study accurately reflects the concept intended to be investigated (Thagaard, 2018, p. 189). Validation is not only limited to the empirical findings but is a measure of quality throughout the study. Thus, a combination of the quality of our ability as researchers, the relevance of the selection of the informants, and the interpretations of findings need to be assessed to evaluate the validity of the study.

Firstly, we as researchers, had some general knowledge and were familiar with specific theories in the field of study. However, a lack of experience and expert knowledge can lead to gaps in the study. To avoid these gaps, we chose a triangulation of methods to strengthen the validation of empirical data. When gathering related theories and relevant literature, we made continuous assessments of the selected literature. All relevant articles were checked with the database Kanalregister, which is a database that evaluates journals from a bunch of criteria. Kanalregister provides a score on the quality of the journal from 0-2. A journal with a score of 1 needs to fulfil criteria such as: 1. Scientific editors, 2. Peer reviewed, 3. National or international writer`s circle, 4. Approved ISSN. To ensure the quality of the literature selected in the study, all journals have been checked and scored 1 or 2.

An important part of the validity of the findings is the selection of informants. Interviews are based on subjective experiences and are recalled from the informant`s own memory. However, the experience and variety of the selection of informants strengthen the validity of the findings in this research. The informants consist of experts in the field of AI and professionals with

specific experiences in project management and innovation. The method for accessing information from the informants was selected as semi-structured interviews with considerations taken to ensure validation of findings, as formerly explained. These subjective experiences collected in the interviews were further compared and analysed, and compared to relevant literature on the field.

To supplement the data from the interviews, a questionnaire was used. This supplementation of empirical data can be assessed as both strengthening and weakening the validity of the data. The questionnaire can provide a triangulation and verification of findings gathered during the interview. However, using random sampling in a questionnaire can lead to incomplete data (Rowley, 2014, p. 18). This type of sampling can impact the validity of findings negatively. Thus, we needed to make steps to minimize this impact. The questionnaire was chosen to supplement and compared to specific findings collected in the interviews. This way of using of adding the quantitative approach can bring valuable insights to the study, while minimizing the negative effect on the validity of the findings.

In **section 3.5.2**, we explained how we ensured transparency and clarity in the interview situation with the informants. When analysing the data, we made considerations to ensure the validity of the results. Firstly, when transcribing the interviews we used an automatic transcription in the database. Then we manually checked for errors and validated them by listening to the sound recordings and checking the transcripts for errors. We also spend time familiarizing ourselves with the transcripts to avoid misinterpretations or unclarity. We then coded the transcripts separately to avoid personal biases in the interpretations and validate the relevance of the codes with each other. We had several discussions about how we could present the data in a way that is well-linked to the categories of the body of knowledge. We reassembled the codes and chose the categories that were considered the most fitting in the context of the research questions, the similarities in the codes, and the related literature. The categories provided a basis for comparison between the findings. The findings and quotes that were chosen in the conclusions have also been translated from the original language, which was Norwegian in this study. The quotes in the original language are placed in the attachment section of this thesis.

3.7.3 Transferability

Generalizability refers to the question of whether the study can be transferred to other contexts, subjects, or situations (Brinkmann & Kvale, 2015, p.295). Generalizability in the context of the study, can be discussed with different factors. Firstly, the number of informants can impact the generalizability. In this study, eight informants shared personal experiences and situations. A higher number of informants would beneficially strengthen the generalizability. However, the variety of working positions and experiences add different perspectives to general questions. When comparing work across different sectors, situations, and responsibilities, general conclusions to specific questions can be more generalized. One can therefore argue that the findings can apply to other situations than those discussed in the interviews. On the other hand, this transferability is highly specific to the theme of innovation in projects. With every project being unique, the findings in this study are therefore limited to the researched field and would not be transferable to other contexts than working with innovation. With the uniqueness of projects, there are difficult to transfer specific situations or learning. Thus, the findings represented in this thesis can provide valuable insights into sector-specific projects, but are difficult to apply directly in a new project.

3.7.4 Ethical Considerations and Data Privacy

It is important to consider the ethical perspective of the interview situation, as well as considering privacy of data. Brinkmann & Kvale (2015, p. 93) address four fields of ethical guidelines. 1. Informed consent, 2. Confidentiality, 3. Consequences, 4. The role of the researcher. The following section will address how the ethical guidelines were considered and the necessary steps to ensure ethical data handling were taken.

When contacting the informants, an additional document was included in the inquiry. The document consisted of a description of their rights regarding attending the interview, the purpose of assignment, why the informant is contacted, and what it means for the informant to attend. Confidentiality and who have access to the data is another important aspect, which is included in the document. The document also provide explanation how the data are going to be processed and stored, and who to contact if the informant wants to complain or withdraw in the study. This document was sent over before the interview were conducted, and a signature by the informants were secured. This signature provided a documentation of consent and is proof

that the informants have received the document. Transparency regarding the informants role in the study and ethical implications is important to avoid ethical issues and unwanted consequences (Brinkmann & Kvale, 2015, p. 96).

The study with the informative document was first sent for approval by SIKT. SIKT have requirements regarding ethics data processing, data collection and privacy of data. SIKT uses a private database for storing and processing of data when using a qualitative or quantitative method called Nettskjema. This database has the ability to transcribe sound recordings and store both the transcripts and sound recordings in a secure location. Nettskjema can be downloaded to the smartphone, using an app that connects to the database. When starting a sound recording, the phone needs to be put on “Airplane mode” and the internet must be disconnected to ensure no other applications interact with the sound recording. When finished, it is sent straight to the database, without the ability to store the sound recording on the personal smartphone. Transcriptions are developed automatically based on the sound recording, with the researchers manually processing and cleaning the transcriptions.

Confidentiality is an important aspect and how confidentiality were ensured were explained to the informants in the document. In this study, only the researchers and supervisor had access to the data, and only for the purpose of this study. Confidentiality was achieved by not disclosing names for informants from all aspects of the research. When storing the data, the working company and the working title were the only identifying factors. Working title were also removed when presenting the data in the thesis.

Consequences is another aspect of considering ethical guidelines. This study can be classified as a low-risk study, with a small amount of sensitive information, as mentioned by SIKT. However, consequences and how to deal with complaints or withdrawal is important to communicate with the informant. The informants have the ability to change or discuss their answers within the interview. The finishing part of the interview consisted of clarifying topics and asking whether or not the informants wanted to change or discuss any of the answers given. They were also given the option to add or discuss topics on their own premises.

By generating transcriptions of the conducted interview, a more comprehensive analysis and interpretation can be achieved. The role of the researchers is to analyse and interpret the empirical data in a way that ensure quality to the study. Brinkmann & Kvale (2015, p. 95)

describe ethical requirements regarding scientific quality, which includes publishing findings that are accurate and representative of the field. The reported results should also be checked and validated, with an effort towards transparent procedures (Brinkmann & Kvale, 2015, p. 96). Further descriptions of how this study has validated its results are formerly described in **section 3.7.2.**

3.7.5 Method criticism

To end the evaluation of methodological choices, criticism of the methods used in the study will be provided. This section will also discuss potential areas where the study could be strengthened and how the empirical findings can be further validated.

Although there are limitations in the study such as time horizon and informant availability, different measures could further strengthen the study. Firstly, increasing the number of informants could provide additional findings or separate viewpoints from the informants chosen. Brinkmann & Kvale (2015, p. 106) argue that a typical dilemma is when there are too few informants to be able to generalize. It is difficult to determine what the right number is, but a reasoned judgment about the extent of the findings can be used as a guide for determining transferability to other situations. Thus, one can argue that increasing the number of informants could lead to a higher degree of transferability and reliability of findings. This can better the ability to compare the findings. However, concerning the time horizon of the study there was a limited amount of time to access, evaluate, and choose informants. Preparing, conducting, and analysing the qualitative interviews were also considered time-consuming factors. On this basis, we chose to prioritize the quality of analysing and representing the findings from the 8 interviews conducted, rather than drop the quality of the findings and informants to increase the number of informants.

Another aspect that could further strengthen the study is the use of quantitative data that can verify or deny the responses of the informants. This type of triangulation would provide additional insights and a higher degree of validation of the findings. Appropriately triangulation can enhance completeness and confirmation of data gathered in qualitative findings (Thurmond, 2001, p. 257). Although using this type of data was investigated, it was difficult to access. Observation could be an effective method of collecting quantitative data. Another method is using internal company data that has already been collected. Due to the mentioned limitations,

the collection of this data was chosen to not be prioritized, but it could potentially provide valuable insights if chosen as a method in future research. Thurmond (2001, p. 256) argues that a disadvantage of using triangulation is the increased amount of time needed compared to single strategies. With the time constraint of the study, increased time spent on gathering and analysing data was determined to potentially decrease the quality of the data and interpretation of data that has been gathered.

This study eventually concludes with a proposed framework for integrating AI into the existing innovation process. Although this is a conceptual framework, a more optimal solution would be to internally test the framework before proposing it. With an expanded time horizon, it would be interesting to conduct tests on the effectiveness of the framework. By conducting preliminary tests, gaps or errors in the framework can be identified and improved. Testing the framework in different contexts, companies and projects could provide additional insights. Lastly, due to the limitation of time horizon, a higher degree of familiarization with the AI tools and the innovation approaches could lead us to identify limitations and opportunities when using the tools more effectively. With a higher degree of background knowledge on the topic, less time could be spent on familiarization and exploring the tools, which could lead to a more effective research process. A more effective research process could then lead to more accurate initial results and reduce the need for iteration.

4. Results and Discussion

This section will present and discuss the empirical findings of the thesis. Firstly, it will explore different perspectives on the term ‘innovation’ and how these could influence the responses of the informants. The result and discussion will then shift to current and general use of AI in working practices. Second, this thesis will identify several challenges that can hinder innovation in projects and investigate how AI can be used to simplify or address these challenges. Findings related to the ethical implementation of AI models and the potential risks of using these models will also be presented. These findings will be discussed in the context of creating a fair and unbiased model. Lastly, the section will propose a framework for enhancing the innovation process through AI integration.

4.1 Definition of Innovation and Differences in Perspectives

Understanding innovation through the informant’s beliefs and definitions is important for contextualizing the groundwork for this thesis. By clearly defining the various perspectives of innovation, the analysis can be more accurately targeted. The informant’s definition of innovation is presented in Table 9.

Table 9: Perspectives on innovation from informants

Definition	
Informant 1	<i>"Innovation can indeed be at many different levels and in many different directions. But at least when it comes to project execution and such, it's somewhat new. So I think it's at least about how one can improve some processes related to project management."</i>
Informant 2	<i>"I don't know, it's just something that is innovative, like groundbreaking, new, something that hasn't been done before. Or using things that have been done before in a new way, possibly. Something that adds value, then. New."</i>
Informant 3	<i>"When I think about innovation, I actually think of renewal and changes. For the better, really."</i>
Informant 4	<i>"So innovation for me means just coming up with new ideas, new things, new functions we can sell, new ways to solve things. That type of thing, yes."</i>
Informant 5	<i>"For me, innovation happens as part of project work. Innovation occurs without you knowing it's happening. You don't sit down to say that you're going to innovate something. Innovation happens as a side effect after you're set to solve a problem and then you come up with novel ideas. And then it's almost</i>

	<i>afterwards that you realize, wow this was new."</i>
Informant 6	<i>"So innovation is something I cannot define it like in actual terms, but for me, it's like creating something that can be useful, that can be used by many like the creation of GPTs, for example."</i>
Informant 7	<i>"I haven't thought about it much, but for me, innovation often seems like you're doing something quite new and like, when the iPhone was introduced to the market, it was kind of like, this was innovation."</i>
Informant 8	<i>"For me, innovation is about everything from the incremental and improvement of processes, until the disruptive innovation, where gold is found in stuff that has not been invented yet"</i>

A general view amongst the informants was that innovation means to create something new or improve something. On the other hand, there was some disagreement on how radical the idea must be, to be categorized as innovation. Some believed the idea must be groundbreaking, e.g. with informant 7 definition explaining that the introduction of the iPhone to the market is an innovation. On the other hand, a few others believe that innovation is not only radical, but also incremental. As informant 3 explains innovation is just about renewal and improvements for the better. All these different definitions enhance the belief that there is no "one size fits all" when working with innovation as explained in the body of knowledge **section 2.4**. Every organization has its unique way of working with innovation.

However, a general dissensus became evident when discussing the informant's perspective on the term innovation. Specifically, there was disagreement about whether the informants were working on innovation in their daily work. A common definition amongst the informants was that innovation means to create something new or improve something, as stated by informant 2. When asked if there have been any elements of innovation in the projects the informants have worked on, the responses varied.

"There are always elements of innovation in the projects we are doing" (Informant 2, 2024),

"And we are constantly trying to improve our processes, but we probably haven't thought very innovatively. I think we have thought of slightly more traditional solution methods." (Informant 1, 2024).

This thesis bases its view from OECD & Eurostat (2018, p. 20) definition, that innovation is the improvement of either a process or product. Informant 2 believes that there are always elements of innovation in the projects they are doing, while informant 1 states that they are working on improving their processes but do not acknowledge that they are working enough on innovation. When asked if they worked in innovating projects, their definition on innovation will directly influence their answer. This is why the informant's definition are included, so that further analysis can be based on their view on innovation.

Davies et al., (2023, p. 9) argue that innovation research view projects as vehicles of change, while project management research described innovation as a planning problem and ignoring the potential role of creativity and experimentation in projects. This view of separating innovation from the discipline of project management was shared by some of the informants in this study. The perspective on the role of innovation in projects will determine how the organization works on the subject. An organization that believes innovation has no role in projects will not focus on the innovative aspect of a project. Informant 5 believes innovation is not something you work on specifically but is something that just happens as a result on when you are working on a problem. And later states that it is only after the new product is invented, we know it's innovation. Whether the organization work on innovation specifically or not, it is essential to create think new and create new things to stay relevant. Nevertheless, it is important to state the size of the company.

With smaller companies and flat hierarchy, it is possible that the roles could potentially overlap, and it is not suitable to have both an innovation manager and a project manager. Which would only lead to cost additions to the overall budget. For smaller companies, agile project management (APM) as proposed by Khafri et al. (2023, p. 8), could be a solution. On the other hand, with larger companies that have many different and complex project going on simultaneously. It can be difficult for a project manager to have more responsibilities other than the technical like ensuring the project is completed on time, within budget and according to specifications (Khafri et al., 2023, p. 6). In these cases, there are many potential benefits by obtaining an innovation manager. An approach described by informant 8, was to obtain a centralized team that specifically focuses on the innovation process of a project, in combination with decentralized, domain-specific competence that follows up the phases of the projects, in collaboration with a project team. Either the innovation manager or the APM has an essential role when implementing AI tool in projects. There are a lot of different aspects AI can improve

the current innovation process which will be elaborated on later. However, for AI tools to successfully improve current innovation project, the implementation must be handled correctly.

4.2 Current and General use of AI

Having established the diverse definitions of innovation provided by the informants, we will further elaborate on their practical use of AI. The elaboration does not only reveal the extent of AI integration, but also shows its potential to help the challenges identified. The rapid advancement of AI technologies was reflected in the interviews, with most of the informants currently using AI in their daily work. While some elaborated on which AI tools they used and how it affected their work, other explained how AI was integrated in their company. As explained in body of knowledge **section 2.2**, AI can be described as a machine with human capabilities and intelligence (Deng, 2018).

AI integrated in the company:

“But in the automated storage room, there are some artificial intelligence, in there.”

(Informant 3, 2024),

“There are already products we sell with AI. Smart building, KNX-control and building automation.” (Informant 2, 2024),

“We also did an integration with ChatGPT where you can get summaries. In the software, we have a number of text fields where we fill inn some text. Then we can... we added that you can press a button and then you can get a quick summary.” (Informant 4, 2024).

The survey conducted by Microsoft’s Work Trend Index revealed that 71% of the respondents used AI (Taylor, 2023). McKinsey (2022) reported nearly the same findings with 70% of participant used AI. In this thesis, the informants from technology-driven companies indicated a use of AI either on a personal or organizational level. However, each of these companies are technology-driven companies, which makes it more natural to incorporate AI in their work.

To further test the results reported by Microsoft and McKinsey, we performed a questionnaire on whether AI was integrated in their company, their perspective on AI, and their industry sector. The questionnaire was shared on social media to encourage broad participation, resulting in 32 responses across 8 different sectors. The findings from the questionnaire revealed a

general positive attitude towards AI integration, with 84.4% responded very or a little positive to the use of AI in their daily work. Nevertheless, only 28.1% used AI in their daily work. The interview done by Microsoft on the other hand where carried out for leaders and decision makers from around the world (Taylor, 2023). This is most likely the reason for the different use of AI. However, the questionnaire revealed another 21.9% with desire to incorporate AI in their work in near future. With this in mind, AI is undeniably on an upward trajectory and it's crucial to incorporate AI as soon as possible to gain a competitive advantage.

Informant 3 explained that their company does not place focus on artificial intelligence. Nevertheless, informant 3 also elaborated on their new automated storage room, which consists of multiple machines that possess human-like capabilities and intelligence. The usage of AI, as described by the informants, depends on their perception of AI. This is why we state that most informants have integrated AI into their company, even though some responses contradict each other.

AI tools used in daily work:

There are a lot of different AI tools made, and AIXploria lists over 4,000 free AIs (Aixploria, n.d.). The general tools used by the informants were ChatGPT, GitHub Copilot, Microsoft 365 Copilot, and Gemini.

“Yes, we use ChatGPT a lot and that type of things for texts and stuff. I also see some developers use it for coding, and we have this GitHub Copilot which help with coding.” (Informant 4, 2024)

“So I use a lot in everyday life. But it's just plain ChatGPT.” (Informant 5)

“Yes, we actually use like various form of like AI... Let's say like Microsoft Copilot, GitHub Copilot that is like help with coding and sometimes the formatting thing in coding” (Informant 6, 2024)

“Chat GPT. I've tested a bit of Gemini, Google's. But, no, I don't know, it was chat-gpt then. Another tool I think I used a bit like that, where we, that is, for image generating.” (Informant 7, 2024)

The current use of AI already serves a lot of positives in their daily life. The tools utilized in their daily work are LLMs and serves several ways of potential benefits. The way current use

of AI most affected the informants was with time usage. Informant 7 highlights the importance of time generally and compare time usage with overall cost.

“Time is really the equivalent to cost.” (Informant 7, 2024)

Time constraints is a challenge identified by several informants and is under resource constraints in body of knowledge **section 2.5**, and is a complex problem to potentially simplify. Time constraints can affect every part of the innovation process, from idea generation to the development phase. Here are a few ways the informants explained how AI have helped them in their daily work considering time usage:

“So I’ve made a presentation, it was totally amazing. It could structure me like, chapters and titles for each slide. I have to summarise like, or key notes, like that. It is really nice, I save a lot of time on it, so, yeah. ChatGPT.” (Informant 7, 2024)

“I used AI to make 30 role descriptions. So instead of using a week to make to role descriptions, I used two minutes on each of the roles descriptions. Right?” (Informant 5, 2024)

“So the first, I think it would benefit like time-wise. You don’t have to spend more time on doing things. You can just ask chatbot and it would generate nice, neat and clean things for you. And then obviously like it would save time, it would save computation for every time you want to do that thin. And overall like it would impact on budget too, right? So if everything is going on pace, then it would obviously for big companies, like it would obviously save a lot of money.” (Informant 6, 2024)

Informant 6 reinforces the point Informant 7 states that time is the equivalent to cost. Specifically for projects, increased time spent is equal to increased costs. Thus, implementing an AI model for low-risk, time-consuming activities can lead to long-term benefits. Marr (2021, p. 14) argues, as formerly mentioned, that AI can be used for three segments. 1. Customer, 2. Smart products and services, 3. Improved and automatized processes. By improving and automatizing internal processes, time spent from the starting point to the ending point in a project can be reduced. One can therefore argue that the choice of not investing in AI technology for improving processes and increasing effectiveness can lead to a competitive disadvantage compared to competitors. Borges et al. (2021) argue that automation of processes can create a

competitive advantage if used to automate tasks faster than competitors and complete a larger number of tasks in a shorter time. The main value generated in a project is usually generated from the output (Martinsuo et al., 2019). Thus, shortening the time and cost from input to output would generate more value from the project. Informant 6 reinforces the point Informant 7 states that time is the equivalent to cost. Specifically for projects, increased time spent is equal to increased costs. Thus, implementing an AI model for low-risk, time-consuming activities can lead to long-term benefits.

In innovation projects, there is always a competition against the clock to be the first with a new product release. As explained by the informants AI contributes to time-consuming exercises, which result in reduced time usage. If a competitor beats your company at the finish line, the whole project will lose a lot of value. Eventually, the discussion of the implementation of artificial intelligence does not revolve around whether the business should invest in this type of technology. The discussion consists of whether the business can afford not to invest in the technology due to the major disadvantage the choice of not investing can lead to, compared to competitors. In today's business world, there are major investments across different sectors regarding the implementation of AI technology, which can lead to broad differences in the effectiveness and automation of companies. Following this we will first state the challenges identified before exploring the potential enhancements AI could bring.

4.3 Challenges in Innovation

There were a lot of different challenges presented by the informants in the interviews. The challenges will be analysed against the ones that are presented in the theory section. The challenges presented in body of knowledge **section 2.5**, are resource constraints, generating ideas, idea conversion, market and technology knowledge, and communication. Figure 5 represents the challenges presented by the informants.

Challenge	Informant 1	Informant 2	Informant 3	Informant 4	Informant 5	Informant 6	Informant 7	Informant 8
Resource constraints	x	x	x		x			x
Generating ideas		x		x		x		
Idea Conversion						x	x	
Technical challenge		x	x		x			
Learning			x					
To big teams				x				
Time constraints	x	x	x		x			
Development phase						x		
Adoptation to new products							x	x
Exit								x
Communication	x		x					

Figure 5: Challenges identified by informants.

The challenges presented in Figure 5 represent the challenges each of the informants identified in their previous work. Some of the challenges were the same, like resource constraints, generating ideas, idea conversion, and communication. These challenges will be considered when discussing how AI could enhance innovation in projects. However, new challenges were also reported, such as technical difficulties, learning, managing to big teams, time constraints, development phase, adaptation to new products, and exit. For further research, some of the challenges will be categorized under the challenges identified in body of knowledge **section 2.5**.

The first challenge that can be categorized as the same as market and technology knowledge is technical challenge. The rationale behind this is because the technical challenges explained by informants 2, 3, and 5, are all about optimizing their product and satisfying customer needs and requirements. E.g. informant 2 describes technical challenges as:

“The problems is, it is often the technical issues of course. The development department get demands from customers, or the project management. The customer has some wishes, and the global product group has some demands... And we try to make a product that satisfies all of these demands. That is a challenge” (Informant 2, 2024)

The same will be done with the development phase. When informant 6 elaborate on the challenge it comes down to obtaining a working model/product which can be referred as a technological knowledge. Adoption of new product, which was acknowledge by informant 7 and 8, concerns topics like willingness to pay and how the early adopters are going to react to

a new product being introduced to the market. This challenge will also be categorized under market knowledge.

There are also challenges that have not been elaborated on in the body of knowledge, such as size of team, learning and exit. The size of the team plays an important role in determining the efficiency and effectiveness of the development process. Informant 4 believed that working in larger teams (did not specify amount) could hinder the natural progression of innovation when there are too many developers to deal with. This is due to complexities in coordination and communication between the developers.

Flocco et al. (2022, p. 397) believes it is essential to establish a multifunctional team and learn from one another. Learning from experience is essential in traditional project work, with reflections on time consumption, resource allocation, and budgets. However, the literature has not elaborated enough on how these learning processes could be applied to innovation projects. For innovation context, the lessons learned are often more specifically towards product development. For instance, during the idea conversion phase, are there any missing components that could help enhance the innovations success. Additionally, incorrect pricing or suboptimal timing of product release are common pitfalls that could offer valuable learning. This would not only prepare teams for innovation failure but also encourage proactive thinking and strategic planning (McCarthy & Freisinger, 2024, p. 41).

Another challenge identified by informant 8, involves exiting. Informant 8 describes it as “*Kill your darling*” and elaborates on the challenge of starting over and dumping an idea you have worked hard on when it lacks business value. For many people, an idea is like ‘your baby’, so when you have nurtured and developed it over a certain amount of time, it is hard to acknowledge there is no business value. The new figure showing the identified challenges is presented in Figure 6.

Challenge	Informant 1	Informant 2	Informant 3	Informant 4	Informant 5	Informant 6	Informant 7	Informant 8
Resource constraints	x	x	x		x			x
Generating ideas		x		x		x		
Idea Conversion			.			x	x	
Market and Technology		x	x		x	x	x	x
Learning			x					
To big teams				x				
Time constraints	x	x	x		x			
Exit								x
Communication	x		x					

Figure 6: New figure with challenges identified.

Although all of these challenges are important, not every challenge will be considered and elaborated on when looking into how AI could aid the potential problem. For the problem to be considered it has to be relevant to innovation projects and relatively new on how AI could help the problem. Time constraints will not be included as a challenge that is to be solved later in the proposed framework. The reasoning for this is that time is such a complex problem that is not easy to contextualize. As explained under **section 4.2**, there are several ways AI already helps with time constraints.

To big team will also not be included in how AI can help simplify the challenges mentioned. Although containing the right team size could potentially increase effectiveness and efficiency, we believe AI may not fully understand the personal dynamics between teams that contribute to synergy. Innovation often requires deep understanding, trust, and collaborative problem-solving, which are aspects that AI currently struggles with. Teams and leaders might resist AI-driven decisions, particularly if these suggestions conflict with expert opinions. This could hinder the acceptance of AI recommendations.

4.4 How AI can be used for Simplifying Challenges

To investigate how AI can be used to solve the identified challenges, we asked the informants about their views on the subject. In combination with these perspectives a systematic review of the literature was done. This combination provided the basis for empirical findings in this section and will be discussed during this chapter. The expressions from the informants on how AI could aid the innovation process is shown in Table 10.

Table 10: How the informants expressed how AI could aid the innovation process.

How AI could aid in the innovation process	
Informant 1	<i>"Input and output for a project that touches a bit on what defines success for how an input to a project should look. Where one can imagine that it will be a successful project."</i>
Informant 2	<i>"But certainly, because what it is, is that we sit on a lot of information, and then it's about using that information well enough. And artificial intelligence could surely help us there. Often it happens that people sit with a lot of experience and expertise, and they can't quite get it out in a way."</i>
Informant 3	

Informant 4	<p><i>"But it can be very good in relation to brainstorming-type tasks. And if you don't exactly know what you are looking for, then you get some ideas and then you get some points from there that you can research further.</i></p> <p><i>"As naturally, I mean Natural Language type questions where you can write text and such. Understanding text, extracting keywords and such things, you can't do that easily without AI."</i></p>
Informant 5	<p><i>"But we see that AI has already helped us in projects. For example, in the coding side, AI has helped optimize code that we might have had issues with. So there have been some 'aha' moments where we can paste in a lot of code and explain what the problem is, and then it comes back with improvements."</i></p> <p><i>"So AI in project work, absolutely. It is something tremendous that can be utilized."</i></p> <p><i>"And the last thing I can mention also, we have many fewer hours that we send to our lawyer now. Because we actually check some simple documents with Chat-GPT, like non-disclosure agreements that we get from others and all that. So we actually get advice back, check this and that and that. This paragraph seems a bit weak, you can add this and that and that. It is fantastic, instead of paying 2500 kroner per hour for the lawyer now in Stavanger. So for low-risk things, we save money on that."</i></p>
Informant 6	<p><i>"So it can be used in planning. It can be used in different operations. So the model we have is kind of universal. So you can use that model in any sort of event prediction or any sort of data prediction. So let's say like we have like this sensor data coming in and then we can predict the outcome of any like faults or like anything that can happen in the future. So yeah, that we can do. Like it's pretty transferable"</i></p>
Informant 7	<p><i>"Let's say you have your building blocks, so you get the job, so you have ten building blocks, five of them get canceled, almost every project, what is the reason for that? Is it that we don't really need them in it, or do we need a building block in it, or something like that, or is the information not quite right, simply. And then I feel we have a chance for AI to be able to automate, in a way, find out. With the users and like. No, this happens, this happens almost in every operation, whether you need to edit something, or you need to remove something, add something."</i></p>
Informant 8	<p><i>"Use AI for all it's worth in all phases. Now it's required that you don't think more or do anything more. It's a bit like feeding things into different tool models. So it changes a lot. It is very much changing. To work creatively with an idea and a thought. Now you can feed a lot in and then you will just get help to move forward."</i></p>

There was a general positive view among the informants on the role of AI in aiding in innovation and operational challenges. Most informants expressed that AI could directly impact and solve specific challenges mentioned. That AI will be a vital part of almost all operational and project work in business was a general agreement among the informants.

“AI is fantastic, but people don’t understand how much it can help just yet.”

(Informant 5, 2024)

This thesis will elaborate on three different AI tools that would potentially help innovation in projects and explain which challenges they could potentially help simplify. The machine learning models that will be the basis of our answers are each from a machine learning branch. The specific machine learning models that will be elaborated on in this thesis are Statistical models, Deep Learning models, and Large Language Models (LLMs). The challenges that will be categorized under a machine learning model are resource constraints, generating ideas, idea conversion, market and technology knowledge, learning, exit, and communication.

Statistical Models: Statistical models are used for probability and decision theory for learning and handling uncertainties (Russell & Norvig, 2022, p. 772). These models are efficient when investigating relationships between specific variables and predict future trends, making them suitable for:

- *Resource constraints:* Statistical models can optimize resource allocation by predicting resource needs for the project. Informant 5 believes AI could enhance general project work. The model can provide information about costs, time needed, and allocating the right team members for the innovation project. As the definition of an “innovation project” is bringing innovation to the market or applying it effectively within the organization, the AI aid on resource constraints lays the groundwork for a smooth and effective development process.
- *Exit:* A statistical model can be beneficial for risk assessment. By providing a comprehensive analysis of the idea, the statistical model can predict the potential of the idea to meet the specific customer need. This can make it easier for the decision-making people to execute an unbiased decision on whether to exit or follow through with the idea.

Deep Learning (DL): The model is shown several input values x and corresponding values y . When forming these layers in the computation path from input to output, the model starts to interpret and uncover context in the data (Russell & Norvig, 2022, p. 801). DL are powerful tools for handling complex, nonlinear problems that require pattern recognition, classification, or feature detection, making them suitable for:

- *Generating ideas:* Deep learning can analyse diverse data sources to generate new ideas. By giving information about customer needs and requirements, the deep learning machine can contribute novel ideas and creative solutions by identifying patterns. Informant 4 also suggested this, believing AI could be great in brainstorming activities when the solution is not clear. Then AI can help to suggest different ideas to a distinct problem. Mandal (2022, p. 3) present the two ways of ideas generating through either *bottom-up* or *top-down*. Top-down analysis consist of a thorough analysis of the market and identifying opportunities. The DL model can interpret the information and uncover potential opportunities.
- *Exit:* As informant 6 suggested, a DL model can be used for any type of event or data prediction. DL can contribute to prototyping or simulating outcomes of innovative ideas, providing early feedback on their feasibility through predictive analytics and scenario modelling (Russell & Norvig, 2022, p. 801).
- *Market and Technology knowledge:* By providing market trends and customer requirement, the machine learning model can aid the project adapt more quickly by identifying new pattern. This will ultimately help with handling uncertainties around product development, providing with the best alternative.
- *Learning:* There are different aspects where DL model can aid. First suggestion is proposed by informant 3, by suggesting AI could potentially aid with structuring historical data to enhance data flow. With pattern recognition, deep learning models can analyse historical projects to detect patterns associated with successes and failures. For this to be possible success and failure needs to be defined for the DL model, so that the analysis is correct. By identifying what went wrong the DL machine can suggest measures to avoid these failures in future projects. Deep learning models can also learn along the way, making them able to update and improve their predictions (Russell & Norvig, 2022, p. 827). For instance, if a new product does not meet customer needs as expected and does not meet its objective, relevant data about the project's process and outcome can be fed back into the model to gain more knowledge. This information can also reinforce its future predictions and

decision-making processes. With all the information given from past innovation projects, it can work as a proactive measure and simulate potential risks and mistakes before they occur based on historical data.

Large Language Models (LLMs): LLMs are skilled at processing and analysing large volumes of data (Russell & Norvig, 2022, p. 900), making them suitable for:

- *Generating ideas:* As explained in **section 2.2.4**, some of the main tasks of a LLMs is to extract information extraction and retrieval. Therefore LLMs can be utilized to scan large volumes of data, extracting potential customer needs, trends, and market opportunities. This can be particularly valuable for ensuring that the new suggested ideas are relevant to the current market. LLMs provide quick responses on wanted information, making them useful for vague ideas that are not fully developed.
- *Idea Conversion:* As explained, LLM are excellent at obtaining a large amount of data. In the idea conversion phase, that main goal is to obtain as detailed information about the idea to make it a whole concept. The language models can aid by providing the needed information quicker than without it. For the model to be as optimal as possible, the information stored in the model must be relevant for the sector the organization is operating in. And the questions need to be as specific as possible for the machine to give the best answers.
- *Communication:* Another main task explained in **section 2.2.4** is speech recognition and text-to-speech synthesis. With this, the LLM can enhance communication within the organization and across projects by providing translation services, generating reports, and summarizing discussions. Informant 4 underpins this statement, by suggesting that LLMs is good at understanding text and extracting keywords from unstructured data.
- *Market and technology knowledge:* An iterative chat with an AI bot, can provide information about the latest technological innovations, market trends, and customer needs. Thus, combining this with a DL model, an LLMs can provide the information about the customer while the DL can recognize possible patterns. Therefore, by integrating DL in the company the NLP-driven dashboard can give information about emerging technology making it possible for the company to align their strategy accordingly.

All the models have each of their own specialities and can aid in different ways. However, there are tools currently being utilized both in the idea generation phase and in the screening and

selection phase. AI has the potential to enhance their productivity and effectiveness. More specific details will be presented further.

AI to aid current tools in the idea generation phase:

Idea generation problem-solving tools are essential for companies struggling to generate ideas. All these tools have their own way of working towards generating the best ideas. However, there are potential ways AI could help increase their productivity and effectiveness.

Brain-writing sessions are already working well. Nevertheless, for smaller groups or individuals who don't have available colleagues. An LLMs could work as a sparring partner. By providing your ideas to a possible solution to current customer needs, an iterative chat with LLMs could help with explaining market needs and the feasibility of a potential idea. Similarly, TRIZ is a systematic approach to generate solution for technical problems across branches. TRIZ can either generate new ways to utilize a current product or give improvements to them. A suited machine learning model to integrate in this tool would also be LLMs. LLMs process large volumes of data making it possible to connect solutions across branches, suggesting hybrid solutions.

Morphological analysis, explained in table x, is a problem-solving method used for exploring all the possible relationships in a given complex problem. For this tool, we believe DL model would enhance the problem-solving efficiency. By providing a full list of properties and modifications of a design (\mathbf{x}), the DL model could provide a few possible solutions for each of the properties (\mathbf{y}), and thereafter combine the solutions to create a fully functional product. As with WorldTree Design-by-Analogy, which focus on generating ideas by mapping each of the properties and thereafter generating an idea suited for the properties. A DL would be most suitable for this approach, due to the model expertise in pattern recognition.

AI to aid current tools in the screening and selection phase:

Analytic Hierarchy Process (APH) and Pugh's Evaluation method are both tools for selecting the best idea against the organization's overall goals. The machine learning model that would excel for this type of tasks is DL. DL are excellent at breaking down and obtaining patterns in complex problems (Russell & Norvig, 2022, p. 801). Another machine learning model that would fit in these types of complex problems are statistical models. By providing all the

information gathered in the screening phase, the statistical model can investigate the relationship between these variables and predict a possible future for the product.

For utility theory, the main outcome is to see if the innovation satisfies a specific customer need. The project manager set a list of criteria and compare the ideas against customer need. To remove any possible bias and aid in the decision-making process, a statistical model or LLMs could be useful.

4.5 Risks and Challenges with AI Implementation

The risks of implementing AI technology have been focused on risks with general use of AI. Thus, the focus is not solely on the use of AI in projects, but rather general concerns of implementing and working with this technology. With the emergence of GDPR regulations, the focus on ethical processing of data and data privacy has increased massively. This topic was also frequently mentioned by the informants when discussing the risks of implementing AI within a business.

“I think in Europe, and even in Norway, we are prioritizing a transparent AI model and rules based on GDPR, these data rules in Europe” (Informant 6, 2024).

The theoretical background of AI risks in this thesis was separated into three sections: 1. ethics of data, 2. ethics of algorithms, and 3. ethics of practice. An additional aspect to consider is the mitigation of risk and how to handle errors. Most informants are currently in internal discussions of how to implement AI technology ethically in combination with withholding GDPR. Thus, the risks mentioned by the informants generally consist of concerns related to data processing or risks related to the implementation of an AI system.

“Safety, data, and storage. Where does it go? So, that is of course a big issue for us. We are looking into the topic of data privacy. If we are going to have a personnel handbook, and help to employees more available. It is a lot of things regarding ethics and safety, which we must consider. It is a way to go, in parallel.” (Informant 8, 2024).

According to the informants, successful implementation of an AI model needs to include addressing a set of concerns and risks. The risks mentioned by the informants are separated into two categories, risks regarding data, and risks regarding implementation. These risks are presented in Table 11.

Table 11: Data and Implementation risks

Data risks	Implementation risks
Data privacy. Sharing of confidential data.	Using the right data for training. Data quality and bias.
Data access and availability.	AI model needs to fit the amount of data needed.
GDPR regulations and rules regarding ethical use of AI.	Trust and verification of the work provided by the AI model.
Data processing and storage.	Negative and unwanted consequences.
Lack of data and knowledge sharing between companies.	Hidden computation and lack of information provided by the model of how the output was calculated.
Lack of access to domain-specific data.	Needless complexity of tools for easy tasks.

Most of the informants have a more practical view of the risks related to AI. Natural risks to be mentioned were connected to data processing, gathering, and privacy. An ethics-by-design approach with a focus on how to build AI systems ethically was not the main focus point when discussing the risks related. The ethics of algorithms presented by Floridi & Taddeo (2016) is important to consider when building a system and training a model, but it is more important to prioritize a mitigation strategy for handling errors. Ethics of data and ethics of practice are important issues when building, implementing, and also using AI technology.

Although AI can be an effective tool in business and projects, the risks and consequences connected are significant. A general view among the informants is that AI is a tool and should therefore be treated with caution. By not completely trusting this kind of model and cross-checking the output, unwanted consequences can be avoided. This perspective on AI technology was shared by the majority of the informants and remembering this perspective

could be an important strategy for avoiding unnecessary risk and major unwanted consequences.

“AI is a tool, it is not the solution to all the world problems. It is a tool, and that is what I consider is important. We need to look at the opportunities and challenges in the same level that we assess other types of technology or things. To find out and find good solutions.” (Informant 8, 2024)

Another aspect that needs to be considered is the suitability and the benefits of implementing such a model. Implementation can lead to significant costs, in terms of time, resources, and investments. The implementation risk of using needlessly complex tools for easy tasks can lead to high investment costs and low benefits.

“I would say using AI in every problem is not a smart solution. So sometimes it has to be in Excel. Like if you want to just do basic analytics, then Excel is enough. You don't want to spend like coding things and doing fancy UI for the basic analytics.” (Informant 6, 2024)

Evaluating the specific tasks, processes, or activities for using an AI model can be important for mitigating risks and determining the benefits. The use of complex systems and AI technologies includes risks and potential consequences. Evaluation of risks versus rewards is important when deciding to implement this technology.

From the body of knowledge **section 2.8** an 8-step framework was presented to ensure unbiased and fairness when building an AI model. This framework was proposed by Russell & Norvig (2022). Bias and data quality were a reoccurring risk mentioned by the informants. The quality of the AI model is based on the quality of the training data (Deng, 2018; Floridi & Taddeo, 2016; Herschel & Miori, 2017; Jobin et al., 2019; Russell & Norvig, 2022; Strümke, 2023). This means that a lack of an accurate or complete dataset will lead to an inaccurate or incomplete AI model. Bias is another topic that can lead to inaccuracies and needs to be considered when developing and training the AI model.

Although ensuring an unbiased and fair system can prevent some of the risks mentioned above, it will not prevent all risks or potential unwanted consequences. Mitigation of risks is a critical component and an ongoing effort when working with AI in company operations. A deep

understanding of the related risks is important to ensure a safe, transparent, and positive technological environment. A strong technical defence is needed to be able to handle unintended situations and minimize harm when an error occurs. Having an effective strategy to limit unwanted consequences and minimize harm is necessary to achieve the benefits of an effective AI system. The AI system also needs to uphold the GDPR and ensure trust and transparency of ethical data processing within the organization.

4.6 Proposed Framework for AI Integrated Innovation Process

The proposed framework for enhancing the innovation process with AI integration is presented in Figure 7. The framework includes each of the phases in the innovation process with a new post-launch evaluation phase added. Under AI integration is the preferred AI model for the specific phase. This framework can serve as a guide for innovation managers who are struggling to create successful innovation projects. The innovation manager could identify the specific problem in their project and use the suggested AI model to solve or simplify it. The added innovation phase is because learning after innovation projects is an essential part of proactive thinking. Thus, we concluded it as an added phase, instead of integrating learning into other phases. Implementing the right AI model for the specific innovation process phase could enhance innovation productivity and the overall quality of the innovation.

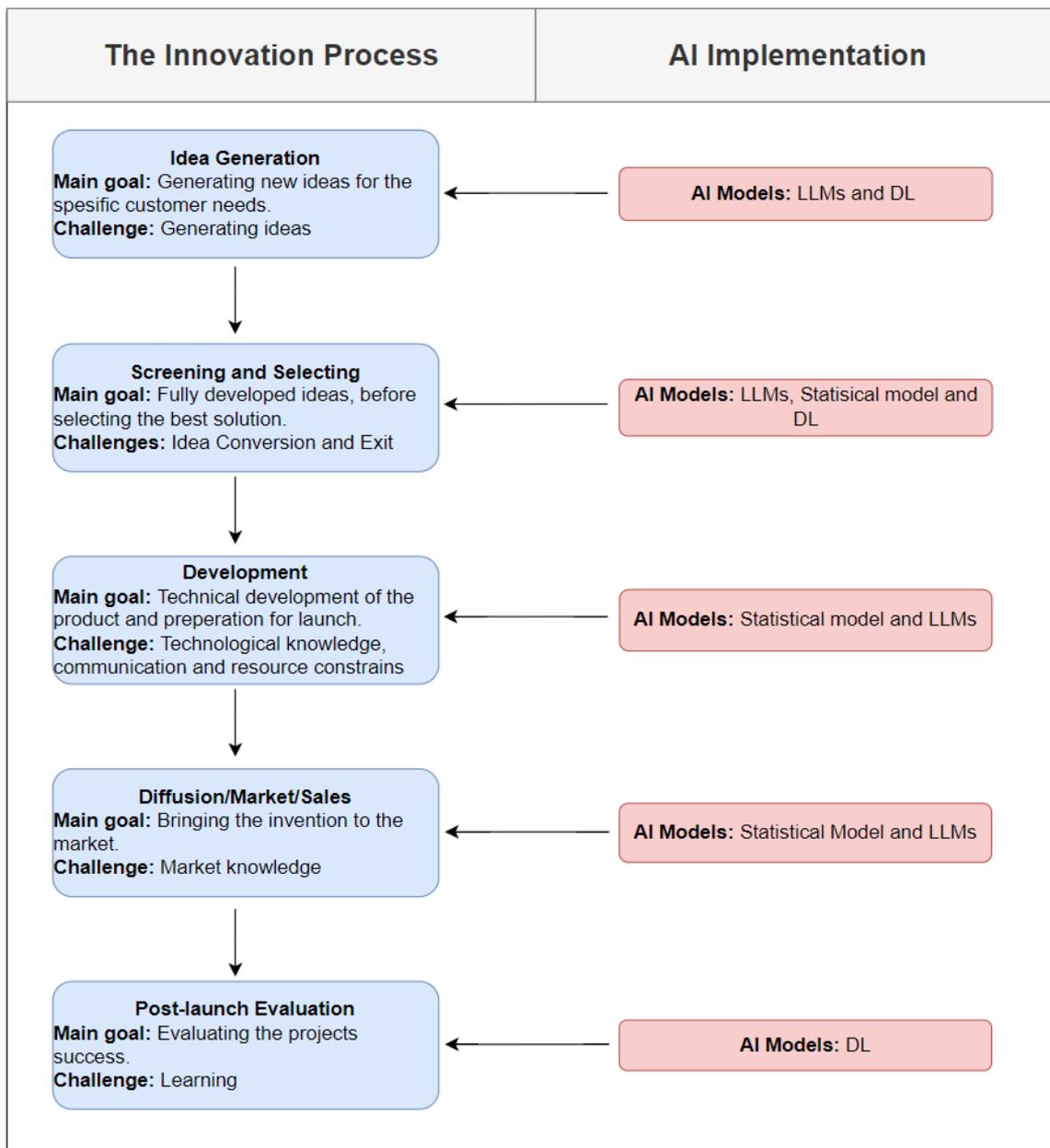


Figure 7: Proposed framework of AI integrated and optimized innovation process.

How each of the AI tools would specifically aid the innovation process:

Idea Generation: Both DL and LLMs can aid the idea generation process in two different aspects, depending on the problem the organization is trying to solve. LLMs can be used to extract potential customer needs, trends, and market opportunities, to generate more ideas that are relevant to the current market the organization is operating in. DL is particularly good at identifying patterns and presenting several solutions to a specific customer need.

Screening and Selecting: In this phase, there are two challenges that the innovation manager meets. These are idea conversion (the screening) and exit (selecting). The projects that are struggling to screen their ideas, LLMs can provide quick and accurate information about the idea. After the idea is developed and the information needed is gathered, the selection of the best idea is the next step. Here either an DL or Statistical model would fit, for their expertise at analysing data and predicting possible futures. The machine learning models can give information about the feasibility of the fully developed idea.

Development: There are several challenges in this phase, like resource constraints, communication, and technology knowledge. For resource constraints, a suitable model would be a statistical model. The statistical model can aid in decision-making for handling uncertainties. And by analysing earlier similar projects, the model can predict the potential resources needed for completing this specific project. For the two other challenges, an LLM would fit. The LLM could aid by providing relevant information concerning the latest technology and presenting possible solutions to the innovation. By knowing what the market needs, the model can present the best solution.

Diffusion/Market/Sales: Information about the market is the most crucial part in this phase. Knowing when, where, how, and to whom to launch the innovation. Combining a statistical model with an LLM can provide essential information about the market and predict how the launch would potentially occur.

Post-launch Evaluation: A post-launch evaluation regards learning from the project. DL can identify the successes and failures of the previous project. Eventually, the DL model could work as a proactive measure and simulate potential risks and mistakes from past projects.

5. Conclusion

This thesis has identified and answered the following research questions.

RQ1: Which challenges hinder the optimization of innovation projects?

RQ2: How can AI be used to solve or simplify these challenges?

RQ3: How can AI be utilized to optimize the innovation process?

The challenges were identified by interviewing a set of informants who provided perspectives and experiences in the field. Their perspective was then compared and discussed based on relevant theories and literature. Furthermore, the challenges identified were evaluated in the context of different Artificial Intelligence models. Our conclusion, based on the empirical findings and literature, is that multiple AI models can aid challenges that innovation in projects faces. By using the tools recommended in this thesis, we believe that working with innovation can be improved. Integration of AI can effectively improve the innovation process in a number of ways. We have explained how each phase of the innovation process can be improved when integrating the right AI models. Additionally, we have identified risks and challenges when designing, implementing, and using an AI model. This is a topic that is dependent on a large amount of consideration if a company decides to apply any of the recommended strategies and tools.

5.1 Practical Implications

In the era of Industry 4.0, AI has brought immense opportunities regarding project management and working with innovation. It has become crucial for the enhancement of business processes (McKinsey, 2022). This thesis has demonstrated some of the capabilities AI models could have for streamlining innovation project execution. These capabilities include automizing routine tasks, enabling creative problem-solving, and accessing information that can help project planning. Additionally, we have elaborated on how AI can be used effectively for strategic decision-making. By integrating AI tools, companies can gain deeper insights into market trends, customer preferences, and improved processes. These insights can lead to well-informed decisions to optimize resource allocation and planning of projects. It can also reinforce the effectiveness of the innovation process.

Lack of learning from worked projects can lead to making the same errors in future projects. Learning and post-work evaluation can be a proactive measure to improve planning and efficiency in future work. Using AI as a learning tool can be an effective strategy for providing a basis of information to help guide future work. This can also help identify mistakes and non-optimal solutions to problems, and it can store the information in an accessible location. Furthermore, AI adoption can lead to improved product development. Predicting project outcomes, optimizing designs based on simulation tests, and facilitating quicker iterations are benefits that can increase organizational yield. This could potentially reduce time-to-market and costs, thereby enhancing product competitiveness and innovation capacity.

Lastly, the integration of AI can lead to a competitive advantage with increased effectiveness and reduced costs. As mentioned, the interaction between AI, innovation, and product development is crucial for gaining a competitive advantage over competitors and achieving success in business. In this thesis, we have provided a framework for integrating the use of AI into the innovation process. We have also explained what type of AI models can be integrated and in which context. Such a framework could be a strategy for making the innovation process more effective. AI could be an effective tool for enhancing innovation in projects when utilized in specific contexts.

5.2 Future Research

The model created for the AI-integrated innovation process is a highly conceptualized model, without the necessary practical testing. It is based on the collection of qualitative findings, compared with relevant theories and literature. Thus, the model is dependent on testing and collection of quantitative measures to verify the effective use of the model. For future research, it could be interesting to test the framework and generate quantitative data to evaluate the performance. Exploring the interactions between AI and innovation is a topic that has been often discussed, but has a low level of measurable research. The implementation of hybrid frameworks that combine the potential of AI with established methods within innovation and project management could be a field worth exploring. Innovation and project management are at the heart of product development businesses and higher effectiveness will lead to gains compared to competitors.

This research has been limited to the interaction between challenges that occur when working with innovation in projects, and how AI can be used to solve or simplify these challenges. Innovation, project management, and artificial intelligence are huge fields of research, and a ton of different factors could have been explored in the research. Project management and innovation sectors are closely related, yet have a lot of differences in established methods. The definitions established in this thesis of the term innovation and the phenomenon of projects are quite similar. However, innovation has a tiny part in the project management literature and vice versa. Thus, we recommend further research on the similarities and differences between the sectors with the potential of combining methods from both sectors to further enhance effectiveness in projects and innovation capacity.

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Attachments

Attachment I

Interview Guide

Introduction

Mapping the interview subject

1. Can you tell us a bit about your background, what position you currently hold, and what that position entails?
2. Are you currently involved in any projects, and can you provide examples of the types of projects?
3. Can you describe a typical workday for you?

Main Part

Mapping challenges within projects and innovation in projects:

4. What is your understanding of innovation and the innovation process?
5. Are there elements of innovation in the projects you have been a part of, and what experiences do you have with this?
6. Can you describe challenges that you face in relation to innovation, and are there recurring challenges you encounter?
7. Are there any cultural or organizational barriers that hinder innovation (progress) in projects? Considering your strategy, management, etc.

How AI can contribute:

8. How does your company utilize artificial intelligence, and how do you assess the company's technological maturity in terms of integrating AI solutions?
9. In what way do you see AI being able to solve or simplify the challenges mentioned earlier?
10. What are the potential risks or disadvantages of relying on AI as a tool in the innovation process in projects?

Efficiency:

11. Do you follow any project management methods, and if so, which ones?
12. How do you work to improve and make the innovation process more efficient?
13. What tasks do you think could be made more efficient with the help of artificial intelligence, and are there other tools besides artificial intelligence that could help make the innovation process more efficient or improved?
 - Are you working with LEAN?

14. Do you believe artificial intelligence will be useful as a tool in project improvement efforts in the near future?

Conclusion

15. Is there anything you would like to add that we have not covered or that should be specified further?

16. Finally: Would you be open to being contacted at a later date for follow-up questions or another interview?

Attachment II

Vil du delta i et forskningsprosjekt som omhandler

KI som verktøy innen prosjektledelse?

I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål

Formålet med studien er å få mer kunnskap om bruk av kunstig intelligens som verktøy innen prosjektledelse. Ulike utfordringer knyttet til innovasjon i prosjekter vil undersøkes, og det vil kartlegges hensiktsmessig bruk av KI i forbedringsarbeid av innovasjonsprosesser.

Hvorfor får du spørsmål om å delta?

Bakgrunnen for å få spørsmål om å delta er at du jobber i selskap som arbeider med prosjekter og har kunnskap og erfaring om prosjektledelse, innovasjonsprosesser og utfordringer innenfor tematikken.

Hva innebærer det for deg å delta?

Hvis du velger å delta i prosjektet innebærer det at du deltar i et intervju. Det vil ta rundt 30-60 minutter. Det vil handle om spørsmål rundt dine tolkninger, holdninger og erfaringer rundt tematikken. Dato og tidspunkt avtales i samråd med deg. Det vil bli gjort et lydopptak av intervjuene.

Det er frivillig å delta

Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykket tilbake uten å oppgi noen grunn. Alle dine personopplysninger vil da bli slettet. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger

I dette forskningsprosjektet er det kun studenter og veileder som vil ha tilgang til opplysningene. Opplysningene vil bare brukes til det formålet som er beskrevet i dette skrivet. Dine personvernopplysninger, som kommer frem i lydopptak og transkripsjoner, vil bli behandlet konfidensielt og i samsvar med personvernregelverket. Anonymisering vil foregå ved å benytte titler eller roller istedenfor navn.

Hva skjer med personopplysningene dine når forskningsprosjektet avsluttes?

Prosjektet vil etter planen avsluttes 20. Juni 2024. Etter prosjektslutt vil lydopptaket fra intervjuene bli slettet, og skriftlig materiale vil være anonymisert.

Dine rettigheter

Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke opplysninger vi behandler om deg, og å få utlevert en kopi av opplysningene
- å få rettet opplysninger om deg som er feil eller misvisende
- å få slettet personopplysninger om deg
- å sende klage til Datatilsynet om behandlingen av dine personopplysninger

Hvem er ansvarlig for forskningsprosjektet?

Hvis du har spørsmål til studien, eller ønsker å vite mer om eller benytte deg av dine rettigheter, ta kontakt med:

Universitetet i Agder ved

Knut Erik Bonnier (veileder), E-post: knut.e.bonnier@uia.no, Tlf: 91334380

Sander Barstad Bergan (student), E-post: sanderbb@uia.no, Tlf: 99115717

Håvard Meinseth (student), E-post: haavardm@uia.no, Tlf: 47523510

Vårt personvernombud: Trond Hauso, Tlf: (+47) 93601625, E-post: trond.hauso@uia.no eller personvernombud@uia.no

Hvis du har spørsmål knyttet til Sikts vurdering av prosjektet, kan du ta kontakt på e-post:

personverntjenester@sikt.no eller på telefon: 73 98 40 40.

Med vennlig hilsen,

Knut Erik Bonnier

Sander Barstad Bergan
(Veileder)

(Student)

Håvard Meinseth

(Student)

Samtykkeerklæring

Jeg har mottatt og forstått informasjon om prosjektet «KI som verktøy innen prosjektledelse», og har fått anledning til å stille spørsmål. Jeg samtykker til:

- å delta i intervju

Jeg samtykker til at mine opplysninger behandles frem til prosjektet er avsluttet, rundt 20. Juni 2024

(Signert av prosjektdeltaker, dato)

Attachment III

Quotes in their original language

4.1 Definition of innovation and differences in perspective

Definition

Informant 1	<i>«Innovasjon kan jo være på mange forskjellige nivåer og mange forskjellige retninger. Men i hvert fall når det gjelder prosjektgjennomføring og sånn, så er det litt nytt. Så jeg tenker det er i hvert fall å ha med hvordan man kan forbedre noen prosesser som har med prosjektledelse å gjøre.»</i>
Informant 2	<i>«Jeg vet ikke, det bare er noe som er nytenkende, altså banebrytende, nytt, noe som ikke har gjort før. Eller bruke ting som har gjort før på en ny måte, eventuelt. Noe som gir noe, da. Nytt.»</i>
Informant 3	<i>«Hvis jeg tenker på innovasjon, så tenker jeg egentlig fornyelse og endringer. Til det bedre, egentlig.»</i>
Informant 4	<i>«Så innovasjon for meg betyr det bare å komme opp med nye, finne på nye ideer, nye ting, nye funksjoner vi kan selge, nye måter å løse ting på. Den type ting, ja.»</i>
Informant 5	<i>«For meg skjer innovasjon som en del av prosjektarbeid. Innovasjon skjer uten at du vet at det skjer. Du setter deg ikke ned for å si at du skal innovere noe. Innovation skjer som en side effect etter at du skal løse et problem og så kommer du opp med novel ideas. Og så er det nesten i etterkant at du skjønner, jøss dette var nytt.»</i>
Informant 6	<i>“So innovation is something I cannot define it like in actual terms, but for me, it's like creating something that can be useful, that can be used by many like the creation of GPTs, for example.”</i>
Informant 7	<i>«Jeg har ikke tenkt så mye på det, men for meg, innovasjon virker jo ofte at du gjør noe ganske nytt og liksom, akkurat når iPhone blir introdusert til markedet, så var det litt sånn, dette var innovasjon»</i>
Informant 8	<i>«For meg handler innovasjon om alt fra det inkrementelle og forbedring av prosess til disruptiv innovasjon. Helt det å finne gull i det som ikke har funnet opp enda.»</i>

«Det er jo alltid elementer av innovasjon i prosjektene vi gjør.» (Informant 2, 2024)

«Og vi prøver jo hele tiden på å forbedre de her prosessene våre, men vi har nok ikke tenkt kjempeinnovativt. Jeg tror nok at vi har tenkt litt mer tradisjonelle løsningsmetoder.» (Informant 1, 2024)

4.2 Current and General use of AI

AI integrated in the company:

«Men i det automatiske varelaget er det jo delvis noen kunstig intelligens-inni der da.»
(Informant 3, 2024)

«Det er jo allerede produkter som vi selger med AI. Smart building, KNX-styringer og byggautomasjon.» (Informant 2, 2024)

«Vi gjorde også en integrasjon med chat-GPT hvor du kan få oppsummeringer. I softwaren så har vi en del tekstfelder hvor vi fyller inn en del tekst. Da kan vi.. la vi inn at du kan trykke på en knapp og så får du en kjapp oppsummering.» (Informant 4, 2024)

AI tools used in daily work:

«Ja, vi bruker jo mye chat-GPT og den type ting til tekster og sånt. Jeg ser noen utviklere bruker det til koding, og vi har denne Github Copilot som også hjelper til med koding.» (Informant 4, 2024)

«Så jeg benytter meg veldig mye av det i hverdagen. Men det er bare vanlig Chat-gpt.» (Informant 5, 2024)

“Yes, we actually use like various form of like AI... Let's say like Microsoft Copilot, GitHub Copilot that is like help with coding and sometimes the formatting things in coding.” (Informant 6, 2024)

«Chat-GPT. Jeg har testet litt gemini, Google sitt. Men, nei, jeg vet ikke, det ble chat-gpt altså. Et annet verktøy jeg tror jeg brukte litt sånn, der vi, altså, for image generating.» (Informant 7, 2024)

«Tid er egentlig tilsvarende kostnad.» (Informant 7, 2024)

«Så jeg lagde en presentasjon, den var helt amazing. Kunne strukturere meg liksom, chapters og titles for hver slide, jeg skal jo oppsummere gjerne liksom, eller key speaker notes, sånn altså. Det er jo ganske fint, jeg sparer mye tid på det, så, ja.»
(Informant 7, 2024)

«Jeg brukte AI til å lage 30 rollebeskrivelser. Så i stedet for å bruke en uke på å lage rollebeskrivelser, så brukte jeg da to minutter på hver rollebeskrivelse. Ikke sant?» (Informant 5, 2024)

«So the first, I think it would benefit like time-wise. You don't have to spend more time on doing things. You can just ask chatbot and it would generate nice, neat and clean things for you. And then obviously like it would save time, it would save computation for every time you want to do that thing. And overall like it would impact on budget too, right? So if everything is going on pace, then it would obviously for big companies, like it would obviously save a lot of money.» (Informant 6, 2024)

4.3 Challenges in Innovation

«Problemet er jo, det er ofte tekniske utfordringer selvfølgelig. Utviklingsavdelingen får jo krav fra kundene, eller product management. Kundene har jo noen ønsker, og global produktgruppen har jo noen krav... Og så sitter vi og prøver å få et produkt som tilfredsstiller de kravene. Det er jo en utfordring.» (Informant 2, 2024)

4.4 How can AI be used for Simplifying Challenges?

Hvordan KI kan brukes for å fremme innovasjon

Informant 1	<i>«Input og output for et prosjekt som er litt innen på hva er suksessen for hvordan skal en input til et prosjekt se ut. Hvor man kan tenke seg at det blir et suksessfullt prosjekt.»</i>
Informant 2 Informant 3	<i>«Men helt sikkert, for det som er det er at vi sitter jo på veldig mye informasjon, og så er det det å på en måte bruke den informasjonen bra nok da. Og der kunne sikkert kunstig intelligens hjulpet oss. Ofte så blir det sånn at folk sitter med mye erfaring og kompetanse, og så får de det ikke helt ut på en måte. »</i>
Informant 4	<i>«Men den kan være veldig god i forhold til litt sånn brainstorming-type oppgaver. Og hvis du ikke helt vet hva du ser etter, så får du noen ideer og så får du noen punkter derfra som du kan researche videre.»</i> <i>«Som naturlig, altså Natural Language type spørsmål som du kan skrive tekst og sånn. Forståelse av tekst, trekke ut nøkkelord og sånne ting, det får du ikke til så lett uten AI da»</i>

Informant 5	<p><i>«Men vi ser jo at AI har hjulpet oss i prosjekter allerede. For eksempel på kodingsiden har jo AI hjulpet med å optimalisere kode som vi kanskje har hatt problemer med. Så det har vært noen aha-opplevelser hvor vi kan paste inn en god del kode også forklare hva problemet er, og så kommer det tilbake med forbedring.»</i></p> <p><i>«Så AI i prosjektarbeid, absolutt. Det er noe vanvittig som det kan bli tatt til bruk.»</i></p> <p><i>“Og siste ting jeg kan nevne også, vi har jo mange færre timer som vi sender til advokaten vår da. Fordi vi sjekker faktisk litt sånn enkle dokumenter med Chat-GPT, sånn non-disclosure avtaler som vi får fra andre og alt sånt. Så får vi faktisk råd tilbake, og sjekk det og det og det. Denne paragrafen virker litt sånn, er litt svak, du kan legge til det og det og det. Det er jo fantastisk, i stedet for å bruke 2500 kroner timer for advokaten nå i Stavanger. Så for low risk ting så sparer vi penger på det.»</i></p>
Informant 6	<p><i>“So it can be used in planning. It can be used in different operations. So the model we have is kind of universal. So you can use that model in any sort of event prediction or any sort of data prediction. So let's say like we have like this sensor data coming in and then we can predict the outcome of any like faults or like anything that can happen in the future. So yeah, that we can do. Like it's pretty transferable”</i></p>
Informant 7	<p><i>«La oss si at, så du har byggeklossene dine, så du får jobben, så du har ti byggeklossene, fem av dem blir kansellert, nesten hvert prosjekt, hva er grunnen til det? Er det sånn at vi ikke trenger de egentlig inn i det, eller må vi ha en byggekloss inn i det, eller noe sånt, eller er det informasjon som ikke er helt riktig, rett og slett. Og da føler jeg vi har sjanse for AI å kunne automatisere, på en måte, finne ut. Med brukerne og liksom. Nei, dette skjer, dette skjer nesten i hver operasjon, enten du må redigere på noe, eller du må fjerne noe, legge til noe.»</i></p>
Informant 8	<p><i>«Bruk AI for alt det er verdt i alle faser. Nå er det jo trengs at du ikke tenker mer eller gjør noe mer. Det er litt sånn å fore ting inn i ulike verktøy modeller. Så det endrer seg jo. Det er veldig i endring. Å jobbe kreativt med en idé og en tanke. Nå kan du fore masse inn og så vil du bare få hjelp til å komme videre.»</i></p>

«AI er jo helt fantastisk, men folk skjønner enda ikke hvor mye det kan hjelpe.»
 (Informant 5, 2024)

4.5 Risks and Challenges with AI Implementation

“I think in Europe and even in Norway, we are like prioritizing this transparent AI and rules based on like GDPR, like these data rules in Europe.” (Informant 6, 2024)

“Sikkerhet og data og lagring. Hvor forsvinner ting? Så det er selvfølgelig et stort issue for oss. Vi ser jo gjerne på dette med personvern. Skal vi begynne å drive, ha denne personalhåndbok og ting for ansatte, litt lettere tilgjengelig. Det er mye greier rundt etikk og sikkerhet, som vi kjenner veldig på. Det er et løp vi må gå på parallelt.» (Informant 8, 2024)

«AI er et verktøy, det er ikke løsningen på alle verdensproblemer, det er et verktøy, og det er jeg jo utrolig opptatt av, at vi må se på muligheter og utfordringer, og hvor kan det være et verktøy på lik linje med annen teknologi eller andre ting, for å på en måte finne ut og komme med gode løsninger.» (Informant 8, 2024)

«Yes, I would say like using AI in every problem is not like kind of smart solution. So sometimes it has to be in Excel. Like if you want to just do like basic analytics, then Excel is enough. You don't want to spend like coding things and like doing fancy UI for the analytics.” (Informant 6, 2024)

Attachment IV

Chat GPT log

In this thesis, Chat GPT have been utilized in some aspect. This attachment will show the different aspects Chat GPT have been utilized and how.

In the start of the thesis, we used AI as a sparring partner when there where a lot of uncertainties in how we would structure the thesis, and which was the optimal research method for the questions we wanted to find out about. Chat GPT gave some generic answers, but not any revolutionizing. We understood early that it is not suited for our type of use, and found out more in scientific articles about limitations in the research field etc. However, there are some aspect AI have helped us in our thesis. E.g. For writing: For providing synonyms to gain a more coherent text. Also for better sentence structure.

 **You**
Kan du gi meg engelske synonymer for ordet "øke"?



 **ChatGPT**
Engelske synonymer for det norske ordet "øke" kan inkludere:

- Increase
- Boost
- Raise
- Enhance
- Grow
- Expand
- Elevate
- Amplify
- Augment
- Escalate

 **You**
Kan du gi meg engelske synonymer for ordet "presentere"?



 **ChatGPT**
Engelske synonymer for det norske ordet "presentere" kan inkludere:

- Present
- Introduce
- Display
- Show
- Exhibit
- Demonstrate
- Reveal
- Unveil
- Announce
- Feature

Later in the thesis, we were unsure if the structure of our theory section was the optimal solution. We then asked Chat GPT if it had any suggestions. We then did some tweaks to the suggestion and used it as an example.



You

Hi. Can you help me optimize the structure of my thesis. I am not sure that I have the optimal order for my theory section. This is my order now:

2. Body of knowledge
- 2.1 Project as a Phenomenon
- 2.1.1 Differences in Project management and innovation literature
- 2.2 Innovation in projects
- 2.3 Innovation Process
- 2.4 The innovation manager
- 2.5 Why does innovation fail?
- 2.6 Historical development of Artificial intelligence
- 2.7 Artificial intelligence
- 2.7.1 Machine learning
- 2.7.2 Statistical models
- 2.7.3 Neural network and deep learning
- 2.7.4 Natural language processing (NLP) and Large language models (LLMs)
- 2.7.5 Machine-learning model Overview
- 2.8 Practical use of AI
- 2.9 AI implementation and challenges
- 2.9.1 Ethics of data
- 2.9.2 Ethics of algorithms
- 2.9.3 Ethics of practices
- 2.9.4 Building and implementing a fair system
- 2.10 Synthesis of body of knowledge

Are there any suggestions you have on restructuring the order?



Master Professor

Certainly! Structuring the theory section of your thesis effectively is crucial for building a coherent narrative that logically progresses from general concepts to specific details, making it easier for your readers to follow and understand. Based on the topics you've listed, here are some suggestions to optimize the structure:

1. **Body of Knowledge:** Start with a broad introduction to the field.
2. **Project as a Phenomenon:** It's a good starting point to define what constitutes a project within the context of your research.
3. **Historical Development of Artificial Intelligence:** Move this section up to provide a foundational understanding of AI, its evolution, and its relevance to innovation and project management. This sets the stage for deeper discussions on more specific AI technologies and their applications.
4. **Artificial Intelligence:**
 - **Machine Learning**
 - **Statistical Models**
 - **Neural Networks and Deep Learning**
 - **Natural Language Processing (NLP) and Large Language Models (LLMs)**
 - **Machine-Learning Model Overview**

This restructured sub-section on AI maintains a logical flow, beginning with general AI concepts and gradually moving into more specific technologies and models.

5. **Innovation in Projects:** After establishing a grounding in AI, discuss how innovation specifically applies to projects. This creates a thematic link between the technology (AI) and its practical applications in project management.

6. **Innovation Process:** Follow this by detailing the process of innovation itself, which can now include references to AI technologies where relevant.

7. **The Innovation Manager:** Discuss the role of the innovation manager in guiding the innovation process within projects, possibly integrating AI tools and methodologies.

8. **Why Does Innovation Fail?:** Analyze common pitfalls and challenges in innovation, potentially highlighting how AI can either help to mitigate these failures or how it might introduce new challenges.

9. **Practical Use of AI:** Transition into specific applications of AI within projects, providing concrete examples and case studies.

10. **AI Implementation and Challenges:**

- **Ethics of Data**
- **Ethics of Algorithms**
- **Ethics of Practices**
- **Building and Implementing a Fair System**

Detail the ethical considerations and challenges of implementing AI, which ties back to earlier discussions on innovation failures and the role of the innovation manager.

11. **Synthesis of Body of Knowledge:** Conclude with a synthesis that ties all sections together, emphasizing how AI impacts project management and innovation.