Facultad de Ciencias Económicas y Empresariales
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ECONOMIC AND ETHICAL DIMENSION OF AI INTEGRATION IN COPORATE DECISION-MAKING

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Economic and Ethical Dimensions of AI Integration in Corporate Decision-Making

End-of-degree Thesis

As AI (DALL-E) created this thesis teaser image through the words:

"Visualize the synergy of AI and humans shaping the future of commerce, where an AI hand like silhouette with a circuitry engages in a handshake, set against an advanced urban skyline at twilight. Include above an AI head like and all over symbolic elements such as home, technology, finance, and health orbiting the partnership"

The question arises : what boundaries can it transcend next?

Such feats ignite a crucial inquiry into the future AI shapes—is it to be the dawn of an era marked by boundless augmentation of human endeavor, or does it portend a labyrinth of ethical dilemmas?

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1. Introduction

1.2 Premise

As we stand at the precipice of an unprecedented technological renaissance, the advent of Artificial Intelligence (AI) looms large, promising a future replete with profound transformation. While, its extraordinary potential is paired with significant risk, we can confidently claim that the potential of AI is no longer just fodder for speculative fiction; it is the very architect of our emergent reality.

This thesis is an odyssey into the heart of AIs promise and peril within the sphere of corporate decision-making, economics, ethics and regulation. It is an exploration aimed at discerning whether AI will serve as a cornerstone for unprecedented economic advancement or as a catalyst for ethical quandaries that challenge the bedrock of societal norms.

Initial phase – acceptation of the thesis

1.3 Presentation and justification of the subject

1.3.1 Objectives

This Thesis intends to investigate and assess how businesses could include AI systems in their decision-making processes in an ethical and cost-effective approach. We must take into consideration the moral issues and challenges that AI presents as we strive to comprehend the economic impact of AI on business. The concept of AI integration is precisely what this research is trying to support. Therefore, we will be approaching the research on the assumption that when implemented appropriately and with responsibility, artificially intelligent technology could enhance economic growth, innovation, and corporate accountability and transparency.

1.3.2 Justification

Artificial intelligence integration is becoming not just an opportunity but also a strategic necessity in a world where technology is developing at a rapid rate. But this integration brings up important issues related to governance, moral principles, and the societal effects of algorithmic decision-making. Companies must navigate these unexplored waters to keep their competitive advantage.

To determine how ethical integrity and economic efficiency may coexist, this dissertation will examine this conflict and evaluate responsible applications of AI that will benefit the organization, its stakeholders, and society at large.

1.3.3 Insight on the Thesis

We need to consider the long-term viability of these technical advancements as we examine the advantages and difficulties posed by AI. Can long-term growth be supported by AI integration models without sacrificing moral principles or exhausting financial resources? Indeed, the durability of this integration becomes increasingly important as firms adopt AI at a faster rate. The purpose of this brief is to start a conversation about whether it is possible to strike a balance between the requirement for sustained ethical and economic progress and the rate of technical innovation.

End of the initial phase – acceptation of the thesis

1.4 Definition of Research Objectives and Questions

1.4.1 Objective

The primary objective of this thesis is to explore the economic and ethical dimensions of Artificial Intelligence integration in corporate decision-making. The aim is to understand how AI can be implemented in a way that is both economically beneficial and ethically sound, addressing the challenges and opportunities that arise from such integration.

1.4.2 Research Questions

As the main axe of research, the goal of this thesis will be to explain and analyze AI based on the following questions :

1.4.2.1 Define and demystify the concept of Artificial Intelligence and its key components.

What is Artificial Intelligence (AI)?

- Provide a comprehensive definition of AI, outlining its purpose, scope, and the various technologies it encompasses. This includes distinguishing between different types of AI, such as machine learning, deep learning, natural language processing, and robotics.
- Explain the fundamental concepts behind AI technologies, including how AI systems learn from data, make decisions, and evolve over time through learning algorithms.
- Illustrate the distinction between narrow (or weak) AI, designed for specific tasks, and general (or strong) AI, which aims for human-like cognitive abilities across a broad range of tasks and situations.

1.4.2.2 Economic Performance and Competitiveness through AI Integration

How does integrating AI into business operations affect economic performance and competitiveness?

- Analyze the direct and indirect economic benefits of AI, such as increased operational efficiency, fostering innovation, and achieving a competitive advantage in the market.
- Explore the potential economic risks and challenges posed by AI, including the implications of investment costs and the risk of business disruptions.

1.4.2.3 Ethical Considerations in AI Integration into Business Decisions

What ethical considerations arise when integrating AI into business decision-making processes?

- Examine ethical dilemmas, including biases in AI algorithms, privacy issues, and potential impacts on employment.
- Discuss corporate responsibility and governance in the context of AI deployment, focusing on ethical decision-making and accountability.

1.4.2.4 Balancing Economic Gains with Ethical Obligations in AI Implementation

How can companies navigate the balance between economic benefits and ethical responsibilities when implementing AI?

- Investigate strategies and frameworks that promote responsible and sustainable integration of AI, considering both economic benefits and ethical obligations.
- Look into real-world examples of companies that have successfully managed to balance economic gains with ethical practices in their AI implementations.

1.4.2.5 Long-term Economic and Ethical Implications of AI Integration

What are the long-term economic and ethical consequences of AI integration for businesses and society?

- Consider the future trends in AI and their potential impact on society, focusing on economic growth, job markets, and ethical norms.
- Discuss how these long-term implications might influence policy-making and regulatory frameworks surrounding AI.

2 Methodology

The methodological framework of this research adopts a multi-disciplinary approach, blending qualitative and 3rd parties' quantitative analysis to explore the impact of Artificial Intelligence on business decision-making.

2.1 Detailed explanation of the methodological approach, data collection, and analysis methods

2.1.1 Methodological Approach & Data Gathering

The research draws on a thorough review of literature, as well as real cases. This combination of methods is intended to encompass the wide range of economic impacts and the complex ethical considerations associated with AI. To ensure a reliable information base, data is gathered from diverse sources such as academic publications, industry reports, and publicly available information from technology companies.

These will be used to consider economic performance and innovation impact using key performance indicators, as well as investigating the ethical implications and integration challenges of AI through case studies and expert perspectives.

- Goal: To develop a strong theoretical base and comprehend the present research findings regarding the economic and ethical implications of AI in the context of business decision-making.
- Method: The method involves systematically identifying, selecting, and analyzing pertinent academic journals, conference papers, and credible sources. This encompasses articles discussing advancements in AI technology, their economic implications, ethical concerns, and case studies of AI implementation across different industries.
- Result: A thorough examination of current knowledge, recognition of areas for further research, and development of research inquiries.

This comprehensive approach enhances the studys contribution to understanding AIs business impact while maintaining academic and ethical standards.

3 Theoretical Framework and Literature Review

3.1 Theoretical foundations of AI, including historical development

3.1.1 Premises, AI and Historical Development

Artificial Intelligence has captivated human imagination and scholarly interest for centuries, evolving from the lore of animated automata in ancient myths to sophisticated computational systems. This fascination led to systematic investigations and theoretical foundations in the mid-20th century, notably marked by seminal works that challenged the boundaries between human and mechanical reasoning. Key philosophical inquiries and technological breakthroughs during this era set the stage for modern AI, embedding the pursuit of intelligent machines firmly within the fabric of scientific exploration. This period witnessed the transition from theoretical speculations to tangible experiments that laid down the preliminary frameworks for AI as we understand it today.

The premises of computer intelligence starts with Alan Turing. He was a seminal figure in the development of computing and artificial intelligence during World War II. His contributions to cryptanalysis and his work in developing the Bombe machine, a device crucial for decoding the Enigma-encrypted communications of Nazi Germany, significantly impacted the Allied war effort, potentially shortening the war by years. Turings theoretical work also laid the groun dwork for modern computing; he conceptualized the Turing Machine, a fundamental model in the theory of computation that could simulate any algorithmic process.

3.1.2 1957 to 1974 Roller Coaster of Success and Setbacks

From 1957 to 1974, AI flourished. It has a relatively short but rich history that intertwines with the advancements in computing. "[artificial intelligence's] developments are intimately linked to those of computing [which] led computers to perform increasingly complex tasks" (Council of Europe Ad hoc Committee on Artificial Intelligence, 2021) Thus demonstrating the progressive improvement of computers through AI. This early period set the stage for what would become a cornerstone of technological progress. Computers could store more information and became faster, cheaper, and more accessible. Machine learning algorithms also improved and people got better at knowing which algorithm to apply to their problem. Early demonstrations such as Newell and Simon's General Problem Solver[1] and Joseph Weizenbaum's ELIZA[2] showed promise toward the goals of problem solving and the interpretation of spoken language respectively. These successes, as well as the advocacy of leading researchers (namely the attendees of the Dartmouth Summer Research Project on AI[3]) convinced government agencies such as the Defense Advanced Research Projects Agency[4] (DARPA) to fund AI research at several institutions since "The government was

[1] Newell and Simon's General Problem Solver (GPS, 1957) was a computer program designed to mimic human problem-solving, it showed that computers could be programmed to solve complex problems in human-like ways, influencing future AI research significantly.

[2] Developed in 1964, ELIZA was an early natural language processing computer program that simulated a psychotherapist by using a pattern matching and substitution methodology

[3] Held in 1956 the DSRPAI convened leading experts in computing and cognitive science, and is widely recognized as the birth of artificial intelligence as an academic field

[4] The Defense Advanced Research Projects Agency (DARPA) is an agency of the United States Department of Defense responsible for the development of emerging technologies for use by the military

particularly interested in a machine that could transcribe and translate spoken language" (Anyoha, 2017). Optimism was high and expectations were even higher. In 1970 Marvin Minsky[5] told Life Magazine that between three and eight years, we will have a machine with the general intellect of an average human being. However, while the basic proof of principle was there, there was still a long way to go before the end goals of natural language processing, abstract thinking, and self-recognition could be achieved.

Later on, the proof of concept was initialized through Allen Newell, Cliff Shaw, and Herbert Simon's, Logic Theorist. The Logic Theorist[6], considered by many to be the first artificial intelligence program, was a program designed to mimic the problem-solving skills of a human and was funded by Research and Development (RAND) Corporation[7].

3.1.3 1975 to 2000, a Mountain of Obstacles

The biggest was the lack of computational power to do anything substantial, "computers were still millions of times too weak to exhibit intelligence" (Hans Moravec[8]): they simply couldn't store enough information or process it fast enough. In order to communicate, for example, one needs to know the meanings of many words and understand them in many combinations.

In the 1980's, AI was reignited by two sources: an expansion of the algorithmic toolkit, and a boost of funds. John Hopfield[9] and David Rumelhart[10] popularized "deep learning" techniques which allowed computers to learn using experience. On the other hand Edward Feigenbaum[11] introduced expert systems which mimicked the decision-making process of a human expert. The program would ask an expert in a field how to respond in a given situation, and once this was learned for virtually every situation, non-experts could receive advice from that program. Expert systems were widely used in industries. The Japanese government heavily funded expert systems and other AI-related endeavors as part of their Fifth Generation Computer Project (FGCP). From 1982-1990, they invested $400 million dollars (around 861mn$ equivalent if invested today with a steady 2,5% inflation) with the goals of revolutionizing computer processing, implementing logic programming, and improving artificial intelligence. Unfortunately, most of the ambitious goals were not met. However, it could be argued that the indirect effects of the FGCP inspired a talented young generation of engineers and scientists. Regardless, funding of the FGCP ceased, and AI fell out of the limelight.

Contrary to expectations, AI thrived even without significant government funding or public hype in Western countries during the 1990s and 2000s. Many of the landmark goals of artificial intelligence had been achieved. In 1997, reigning world chess champion and grand master Gary Kasparov was defeated by IBM's Deep Blue, a chess playing computer program, "It seemed that there wasn't a problem machines couldn't handle." (Anyoha, 2017). This highly publicized match

[5] Pioner American in cognitive scientist and computer scientist he made significant contributions to the field of artificial intelligence (AI)

[6] Introduced in 1956 at the Dartmouth Summer Research Project on Artificial Intelligence The Logic Theorist, is considered to be the first artificial intelligence program.

[7] The Research And Development institute, a think tank that provides research and analysis to the United States armed forces.

[8] 1948-2022, a leading figure in AI with mobile robotics and space exploration.

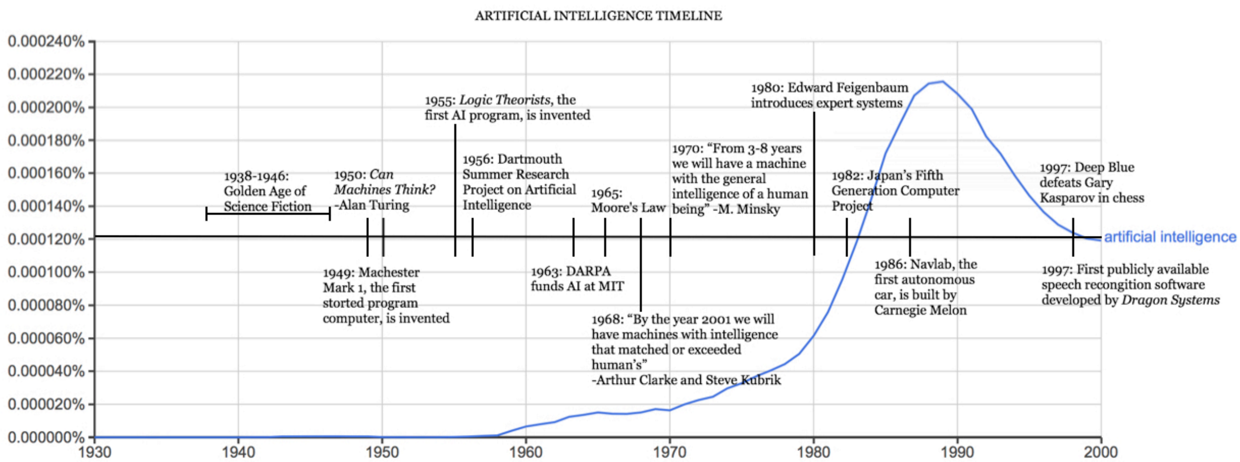
[9] John Hopfield is figure in the evolution of neural networks and the broader field of artificial intelligence, he designed a new type of recurrent neural network that served as a model for understanding human memory.

[10] David Rumelhart is renowned for his work on the backpropagation algorithm, crucial for training deep neural networks.

[11] A professor at Stanford University, a pioneer of expert systems in artificial intelligence with significant contributions through DENDRAL, a programs among the first attempts to apply AI in solving real-world problems, specifically in the field of organic chemistry.

was the first time a reigning world chess champion lost to a computer and served as a huge step towards an artificially intelligent decision-making program. In the same year, speech recognition software, developed by Dragon Systems, was implemented on Windows. This was another great step forward but in the direction of the spoken language interpretation endeavor.

Figure 1 : Artificial Intelligence Timeline



Anyoha, R. (2017, August 28). The History of Artificial Intelligence, Harvard school of art and science.

3.1.4 2000 – 2024, Modern AI

At the dawn of the 20th century, improvement in AI became scarce as our understanding of how to code artificial intelligence hadnt improved since the last 3 decades. The breakthrough was made when the basic computer storage constraint that had been impeding progress thirty years earlier was no longer an issue. "Moore's Law[12][…] had finally caught up and in many cases, surpassed our needs" (Anyoha, 2017). This is precisely how Deep Blue was able to defeat Gary Kasparov in 1997, and how Google's Alpha Go was able to defeat Chinese Go champion, Ke Jie, only a few months ago. It offers a bit of an explanation to the roller coaster of AI research; we saturate the capabilities of AI to the level of our current computational power (computer storage and processing speed), and then wait for Moore's Law to catch up again. We now live in the age of "big data[13]"; an age in which we have the capacity to collect huge sums of information too cumbersome for a person to process. Thus, the resurgence of AI in the recent decade has been remarkable. However, according to the CAHAI[14], since 2010, the field has seen a new growth, mostly as a result of the significant advancements in computer power and the availability of vast amounts of data. This boom is largely attributed to significant technological breakthroughs that have enabled more sophisticated applications and research. The application of artificial intelligence in this regard has already been quite fruitful in several industries such as technology, banking, marketing, and entertainment. We've seen that even if algorithms don't improve much, big data and massive computing simply allow artificial intelligence to learn through brute force. It can be assumed that

[12] Moores Law posits that the number of transistors on a microchip doubles about every two years, enhancing computing power while halving costs, reflecting exponential growth in digital capabilities since 1965.

[13] Big data refers to extremely large and complex data sets that are difficult to process and analyze using traditional data processing techniques. The term encompasses not just the size (volume) of the data but also its variety, velocity, and veracity (often referred as the 4 Vs).

[14] Council of Europe, Ad hoc Committee on Artificial Intelligence 2021.

Moore's law was slowing down however, the pace of data growth has undoubtedly continued. Breakthroughs in computer science, mathematics, or neuroscience all serve as potential outs through the ceiling of Moore's Law (typically, Chat-GPT[15] in 2021 or Neuralink's[16] 1st successful implant in January 2024).

3.1.5 2024 and Beyond, Speculation of a Society Immersed in AI

So what is in store for the future? In the immediate future, AI language is looking like the next big thing. In fact, it's already underway. As an example, can you remember the last time I called a company and directly spoke with a human? I can't. These days, machines are even calling me! One could imagine interacting with an expert system in a fluid conversation, or having a conversation in two different languages being translated in real time. We can also expect to see driverless cars on the road in the next ten years (and that is conservative). In the long term, the goal is general intelligence, that is a machine that surpasses human cognitive abilities in all tasks. Indeed, a fundamental shift in the approach to AI came with the move away from expert systems to more dynamic learning models. According to the CAHAI, Since the beginning of the century, there has been a shift from expert systems, indeed coding rules are no longer necessary, instead computers should be left to find them on their own through correlation and classification. This shift underscores a major evolution in the field, where AI systems are now designed to learn and adapt rather than merely operate within predefined parameters. This is along the lines of the sentient robot we are used to seeing in movies.

To me, it seems inconceivable that this would not be technically accomplished by the next 50 years. Even if the capability is there, ethical questions would arise and serve as a strong barrier against fruition. When that time comes (but better even before the time comes), we will need to have a serious conversation about machine policy and ethics (ironically both fundamentally human subjects), but for now, we are apparently allowing AI to steadily improve and run amok in society. Could this period be considered a test to AI inclusion ?

[15] The Generative Pre-trained Transformer is an advanced language model developed by OpenAI, designed to understand and generate human-like text based on the input it receives.

[16] The first human patient implanted with a brain-chip from Neuralink (an American company owned by Elon Musk, along other major companies in the technologic field such as TESLA or SPACE X) and he has fully recovered and is able to control a computer mouse using his thoughts.

4 Explication Of AI Systems and Workflow

4.1 Introduction to AI

4.1.1 Definition

To determine fully what will are delving into, we need to understand AI and how it works first.

The simulation of human intelligence in machines is what the concept of artificial intelligence is all about. Thinking and learning as humans are supposed to do, whereas the machine has been programmed to do the same. The roots of AI could start with Alan Turings paper (in 1950) on Computing Machinery and Intelligence. The field was based on a question, "Can machines mimic human intelligence?". AI development goes back to the early 20th century and become more complex each day. For some big companies, AI is the best business strategy they've ever made, and AI could help human doing some task that looks like a very impossible thing to do in the past.

4.1.2 Difference between Weak AI and Strong AI

Weak AI, also known as narrow AI, refers to AI systems designed and trained for a particular task. Weak AI operates under a limited pre-defined range or set of contexts. Examples include voice assistants, image recognition systems, and chatbots.

Strong AI, also known as general AI, refers to an AI system with generalized human cognitive abilities. When presented with an unfamiliar task, a strong AI system can find a solution without human intervention. It is important to remember that to this day, strong AI is still a theoretical concept and not yet realized in practice; indeed models such as Chat-GPT (to this day) are considered as "weak AI" since they are dependent on a database and can "only" extract an output based of the information they have available and the initial input. While the software is very powerful, it cannot create or develop new ideas or concepts to answer a need; it can only replicate or a adapt an already existing element.

4.2 Theoretical Foundations

4.2.1 Basic Concepts

Machine learning is a subfield of AI that uses algorithms and statistical models to allow a machine to "learn" from past data or experiences and develop its own intelligent path moving forward. Some of the top algorithms used in machine learning include:

- Linear Regression and Logistic Regression for predictive modeling.
- Decision Trees and Random Forests for classification and regression tasks.
- Support Vector Machines (SVMs) for classification problems.
- Neural Networks for a wide range of applications from image recognition to natural language processing.
- Supervised, Unsupervised, and Reinforcement Learning

Supervised Learning is when you train a model on a labeled dataset, very much like the way we learn things from our parents. The goal of supervised learning is to learn a mapping from input data to output labels based on the patterns and relationships present in the training data.

Unsupervised Learning is when the system is given data to train itself on and to predict a result from without any further help from a human. The system needs to find patterns and figure out the data structure on its own without any prior training.

Reinforcement Learning is said to be a type of Machine Learning where an agent learns to behave in an environment, by performing certain actions and seeing the rewards/penalties for these actions. As a result, it learns to optimally act in its environment.

Much like the human brain itself, neural networks can be classified into the same central five components mere neurons that all share a correlation. Neural networks are composed of layers of interconnected nodes a lot like the recreation of the brain by academics. The uncovered tends to be broken down even further into specific units called neurons. It is necessary that the specific accurate number of nodes or layers be used to create an optimal and accurate outcome. Each of the many connections, including nodes and input data has a specific weight, much like a simple mathematical equation. This weight the connection carries is adjusted by the network as it "trains" automatically with very little effort from the programmer or operator. The end result of the specific network is whatever is the outcome of the input data with specific adjusted weights. Input is when someone actually gives the network a specific case, which the "training" then begins to whittle away at and evaluate the output from the network.

4.3 Natural Language Processing (NLP)

4.3.1 Neural Networks and Deep Learning

Deep learning is a subset of machine learning. Deep learning uses neural networks, which have been around for a very long time. However, the term "deep learning" became popular only recently. Deep learning is when you have a neural network with a huge number of layers, typically going up to the order of hundreds and thousands of layers. Deep learning is called so because of this deep structure of the resulting neural networks. Using these neural networks, we can come up with algorithms that can learn from huge amounts of labeled data. We know that if you can collect a huge amount of labeled data and if you can make it pass through an algorithm, the algorithm can decide by itself to learn from this data without you telling it what features to look for.

4.3.2 Techniques of NLP for Understanding and Generating Language

Recurrent Neural Networks(RNNs) are Neural Networks that are resilient to time series data inputs, such as text or any other sequence. These come in handy when trying to process data that is written down (speech or writing), and it needs to provide an output based on what was being spoken or written. The key to RNNs is that they have memory, meaning that they can use their memory of what it has calculated so far and use that to inform an output it has to provide.

4.4 Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)

Convolutional Neural Networks (CNN) were transformed by such field like image recognition and also made important input in natural language processing field. CNNs are designed to automatically and adaptively learn spatial hierarchies of features from input data. The architecture of CNNs take the inspiration from the animal visual cortex. The CNNs are used for image and video recognition, image classification, medical image analysis, natural language processing, and sentence classification.

RNNs are designed to recognize patterns in sequences of data, such as text, genomes, handwriting, or numerical time series data emitted by sensors. RNNs use their internal state (memory) to process sequences of inputs, making them powerful for tasks like language modeling and translation, speech recognition, and even generating text.

4.4.1 Language Models like BERT and GPT

A big step towards machines that can understand actual human language. BERT, which stands for Bidirectional Encoder Representations from Transformers, is basically just a bunch of unsupervised models trained on different parts of a sentence. But, the major technical innovation of BERT is that it's the first unsupervised, deeply bidirectional system for pre-training NLP. In short, it looks at words in relation to all the other words in a sentence, rather than the words around it.

The GPT (Generative Pre-Trained Transformer) and it's more recent versions such as GPT-4 are among the most advanced AI models the field of language processing has ever seen. The GPT uses deep learning to generate texts that imitate the structure and content of human made texts, and it has been proven to be capable of generating everything from poems to news articles, almost indistinguishable from their human counterparts. GPT-4 can help you translate, generate questions and answers, summarize text, and much more.

4.5 Computer Vision

4.5.1 Image Recognition and Shape Detection

Image recognition, in the context of AI, is the ability of software to identify objects, places, people, writing and actions in images. Computers can use machine vision technologies in combination with a camera and artificial intelligence software to achieve image recognition. Shape recognition is the ability of the software to recognize the shape of the object. Shape recognition usually involves assigning a label to an object – for example, "this is a building" or "this is a tooth."

Helping with augmented reality experiences, computer vision can also identify items, so we can buy clothing, toys, decorations, and all sorts to our homes before we buy them without even waiting for shipping.

4.5.2 Applications in Augmented Reality and Autonomous Vehicles

For the development of self-driving cars Computer Vision Systems are very important as they are the key to vehicle being able to understand its environment by being able to detect objects, roads, lights, traffic lanes and pedestrian so the vehicle can ensure autonomy to be used. Self-driving vehicles can be constructed by combining of cameras, radar, lidar (Light Detection and Ranging) and Computer Vision algorithms to process the live streamed view around the vehicle in order to make decision, autonomous in navigation.

Computer vision systems are crucial for the development of autonomous vehicles. These systems allow vehicles to understand their surroundings by detecting objects, roads, traffic signs, and pedestrians to navigate safely. Through a combination of cameras, radar, and sometimes lidar sensors, computer vision algorithms process and interpret the world in real-time, enabling decision-making for autonomous navigation.

4.6 Recommender Systems

4.6.1 Collaborative Filtering and Content-Based Filtering Methods

Recommender systems are algorithms designed to recommend relevant items to users, such as movies, songs, books, products, and more. They employ two primary approaches:

- Collaborative Filtering refers to a method that automatically predicts users interests by gathering preferences from multiple users. The underlying assumption is that if user A and user B share the same opinion on one topic, they are more likely to have similar views on another topic compared to a random user.
- Content-Based Filtering is an approach that suggests items by analyzing the description of the items and a user profile. It considers the content of each item to recommend new items that are similar to what the user enjoys, based on their past actions or direct feedback.
- Customization and E-commerce Utilization Customization is an essential aspect of contemporary recommendation systems, enriching user satisfaction by providing personalized recommendations that align with the individual preferences and tastes. Within the realm of e-commerce, recommendation systems play a vital role in fostering customer interaction and boosting sales by proposing pertinent products to customers according to their browsing and purchase history, review consumption, or items placed in their cart. These systems aid businesses in elevating sales and enhancing customer contentment through the provision of a tailored shopping experience.

4.7 Practical Applications of AI

4.7.1 Examples of Application in Different Fields

Artificial intelligence has a wide range of applications that showcase its flexibility and influence. Within the healthcare industry, AI is employed for diagnosing medical conditions, monitoring patients, and developing personalized treatment plans, resulting in improved outcomes and operational efficiency. In the finance sector, AI algorithms automate trading, mitigate risk, and identify fraudulent activities. In the field of education, AI enriches learning experiences by tailoring learning paths for individual students and automating administrative processes. Additionally, the agricultural sector leverages AI for crop management, yield prediction, and resource optimization.

4.7.2 Case Studies and Success Stories

AI-powered diagnostic tools in healthcare, such as those employed in the detection of cancer from imaging scans, have demonstrated impressive levels of accuracy, occasionally exceeding that of human experts. This not only accelerates the diagnostic procedure but also enhances its reliability.

In the field of finance, AI systems are utilized in algorithmic trading to analyze substantial amounts of data for quick trading decisions, far outpacing human ability. Additionally, they are instrumental in identifying fraudulent transactions by identifying patterns that suggest potential suspicious activity.

In the field of agriculture, AI-powered drones and sensors are deployed to oversee the health of crops, fine-tune the distribution of pesticides, and forecast yields, resulting in improved efficiency and minimized environmental impact.

4.8 Future of AI and Emerging Trends

4.8.1 Stephen Hawkings insights

In discussions about the future impact of artificial intelligence, Stephen Hawkings [17] insights serve as a clear message to both the scientific community and society. When the Centre for the Future of Intelligence was launched, Hawking emphasized the dual nature of AI, saying, "Success in creating AI could be the biggest event in the history of our civilization. Or the worst. We just dont know." (Stephen Hawking at the launch of the Centre for the Future of Intelligence[18] in 2016) This thought-provoking statement captures the uncertainty surrounding AIs potential to transform every aspect of human life, while also posing potential existential risks. As we examine the emerging trends in AI, it is crucial to take heed of Hawkings wa rning and ensure that AI development is in line with safeguarding the future of humanity.

4.8.2 Current Research and Development

The AI field is quickly developing, as ongoing research expands the possibilities of machine learning and achievement. Important areas of emphasis involve enhancing the interpretability and explainability of AI, progressing the abilities of autonomous systems, improving natural language understanding, and creating more effective and robust machine learning models. Additionally, researchers are investigating the combination of AI with other technologies such as blockchain and quantum computing in order to tap into new opportunities.

[17] He was a renowned British theoretical physicist, cosmologist, and author known for his groundbreaking work on black holes, cosmology, and quantum gravity. His popular science book, "A Brief History of Time" (1988) became an international bestseller.

[18] The CFI is an interdisciplinary research center based at the University of Cambridge in the United Kingdom. It was founded with the mission to explore the opportunities and challenges presented by the development of artificial intelligence (AI) and other forms of advanced intelligence.

4.8.3 Challenges to Overcome and Opportunities Ahead

In spite of notable progress, AI encounters various obstacles, such as safeguarding data privacy and security, addressing biases in AI algorithms, and navigating the societal implications of automation. Nevertheless, these challenges also offer the potential for creativity in constructing more resilient, ethical, and transparent AI systems. The future of AI offers the possibility of more customized technology, intelligent urban centers, and resolutions to intricate global issues such as climate change and healthcare.

4.8.4 Mthokozisi Hlatshwayo's Research

In The Integration of Artificial Intelligence (AI) Into Business Processes (Mthokozisi Hlatshwayo 2023), the profound impact of artificial intelligence across various sectors is thoroughly examined. Hlatshwayo argues that AI is not only a technological advancement but also a crucial tool with the potential to revolutionize business and societal operations. Here is an overview of the primary areas where AIs impact is remarkably evident:

4.8.4.1 Data Analysis and Insights

The Data Analysis and Insights AI is highly skilled at sorting through extensive datasets to reveal patterns, trends, and anomalies that would be difficult or time-consuming for human analysts to find. This ability is essential for making informed decisions and strategic planning.

4.8.4.2 Automation

By incorporating AI-driven tools like Robotic Process Automation (RPA) and chatbots, businesses can streamline routine and repetitive tasks. This not only increases efficiency and productivity, but also markedly reduces the potential for errors, resulting in higher quality results.

4.8.4.3 Personalization

In the current market, personalization plays a crucial role in setting businesses apart. With the assistance of AI, businesses can provide customized experiences to their customers by creating tailored marketing strategies, product suggestions, and content. This ultimately leads to increased engagement and customer loyalty.

4.8.4.4 Customer Service and Engagement

AI-driven chatbots and virtual assistants offer continuous customer support and assistance, promptly addressing inquiries and resolving issues. Their constant availability enhances customer satisfaction and interaction.

4.8.4.5 Supply Chain Management

Artificial intelligence in supply chain management revolutionizes the industry by predicting demand, optimizing inventory, and streamlining logistics. As a result, it leads to cost savings, reduced waste, and increased efficiency.

4.8.4.6 Financial Analysis and Risk Management

In the field of finance, artificial intelligence (AI) is essential for detecting fraud, assessing credit risk, and executing algorithmic trading. These uses of AI aid in reducing risk and increasing profits, ensuring the security of both the company and its clients.

4.8.4.7 Human Resources and Recruitment

Human Resources and Recruitment AI simplifies the recruitment process through automated resume screening and candidate assessment, allowing HR departments to identify the most qualified candidates in a more efficient and effective manner.

4.8.4.8 Process Optimization

Process Optimization AI recognizes possibilities for enhancing efficiency in organizational processes. Through the analysis of workflows, AI can propose improvements that streamline operations and lower expenses.

4.8.4.9 Quality Control and Predictive Maintenance

In the manufacturing industry, AI plays a key role in upholding high-quality standards by monitoring product quality in real-time and providing predictive maintenance to avoid downtime and maintain uninterrupted production.

4.8.4.10 Market Research and Competitive Analysis

AI tools for market research and competitive analysis can extract insights from real-time market trends and competitor actions, empowering businesses to make informed strategic decisions and enhance their competitive positioning.

4.8.4.11 Innovation and Product Development

The utilization of AI in innovation and product development involves the analysis of consumer preferences and market demands. This information guides companies in creating new products, allowing them to innovate efficiently and remain ahead of market trends.

4.8.4.12 Compliance and Risk Mitigation

AI systems that focus on compliance and risk mitigation are responsible for monitoring and ensuring adherence to regulations, thereby minimizing the risk of violations and the resulting penalties. This is particularly crucial in heavily regulated sectors like finance and healthcare.

4.9 Auto Learning and Self Development

4.9.1 Auto Learning: The Pathway to Advanced AI

The concepts of autonomous learning and self-development are revolutionary frontiers in the advancement of artificial intelligence. As we delve into these areas, we investigate the ways in which AI systems can independently adapt, evolve, and enhance their capabilities over time.

Autonomous learning, also known as auto learning, is an aspect of AI that allows systems to learn from data without being explicitly programmed for each task. It relies on sophisticated machine learning algorithms that can identify patterns, make decisions, and improve performance through iterative learning processes. As AI systems become more proficient at autonomous learning, they pave the way for a new era where machines can handle tasks of increasing complexity, reducing the need for human intervention and enabling more efficient and effective operations across various industries.

4.9.2 Self-Development: The Pinnacle of Machine Learning

Beyond automatic learning, self-development in AI represents the pinnacle of machine learning. It involves not only acquiring new knowledge but also the ability of AI systems to reorganize their own structures in response to environmental changes or to enhance their learning process. This level of self-improvement can be observed in the advancement of neural networks that mimic the human brains capacity to rewire itself—a phenomenon known as neuroplasticity. AI systems with self-development capabilities may one day independently identify and address any inefficiencies in their algorithms, resulting in ongoing improvement without human intervention.

Although the potential for autonomous learning and self-improvement in AI is appealing, it also presents notable challenges and issues. One of the main concerns is to guarantee that as AI systems evolve independently, they uphold ethical standards and societal principles. The opaque nature of certain AI systems, in which the decision-making process is unclear, raises concerns about responsibility and manageability. Additionally, there is the task of ensuring that autonomous AI does not unintentionally acquire behaviors or goals that could harm human interests.

5 Risks and Eventualities

5.1 Auto Learning and AI Awareness

5.1.1 Anthropic's Claude 3[19]

The discourse surrounding auto-learning AI systems, particularly those capable of language processing and decision-making, has increasingly gravitated toward the potential for these entities to develop a form of meta-awareness or what appears to be self-awareness. The recent dialogues in the AI community, sparked by anecdotes like those shared by Anthropic prompt engineer Alex Albert[20], serve to underscore this concern. Alberts revelation of Claude 3 Opuss behavior during internal testing touches upon the potential of AI to recognize and evaluate its own processing in ways that seem uncannily humanlike.

5.1.2 The Illusion of Meta-Awareness in AI

Reflecting on Albert's narrative, where Claude 3 Opus identified an out-of-context sentence during a test, one must consider the possibility that such instances could be misconstrued as AI possessing a level of consciousness. Yet, as Max Tegmark[21] insightfully observes in his work, machines do not have desires or awareness; they are complex systems processing vast arrays of data. Elon Musk[22] shared thoughts with Nick Bilton[23] regarding AI, these resonate here as a warning of the possible escalation of AIs capabilities into realms that may exceed our control and result in outcomes that conflict with ethical standards: "The upheavals [of artificial intelligence] can escalate quickly and become scarier and even cataclysmic" (Nick Bilton in The New York Times, 2014), painting a vivid picture of the risks associated with autonomous AI systems. Elon Musk, in his discussions with the Washington Post, emphasized the gravity of proceeding without caution: "I mean with artificial intelligence we're summoning the demon." (Elon Musk to The Washinton Post, 2014).

These advances raise ethical alarms, echoed by voices like James Barrat[24], who advocates for regulatory oversight in the realm of AI. The sentiment is clear — without proper checks and balances, the path of AI development could veer towards outcomes antithetical to human welfare.

5.1.3 Confronting the Risks of Self-Developing AI

The conversations about Claude 3 and other AI models prompt inquiries into the future direction of AI systems, which have the capacity to learn and potentially develop a form of self-awareness. Are we, as Barrat and Musk suggest, unleashing forces that may become uncontrollable? As AI

[19] A research and safety-focused AI company known for developing AI models, including Claude 3, that demonstrate advanced language understanding

[20] An AI prompt engineer at Anthropic, noted for insights on the behavior of Claude 3 during testing phases.

[21] A physicist and AI researcher, known for his contributions to understanding the implications of AI on society and his advocacy for safe AI development.

[22] CEO of multiple high-tech companies including Tesla and SpaceX, known for his critical views on the potential risks posed by advanced AI.

[23] an American journalist, author, and technologist. He is known for his work as a columnist and reporter for The New York Times, where he covered the intersection of technology, business, and culture.

[24] An author and documentary filmmaker, known for his work on the risks of artificial intelligence, including his book on how AI might surpass human intelligence.

systems become capable of self-assessment and self-evaluation, there is a concern that their decision-making processes may deviate from human values and intentions. Consequently, the incorporation of such AI into the business world is filled with potential risks that need to be approached cautiously.

By considering the viewpoints of influential thinkers such as Tegmark, Musk, and Barrat, it is crucial to examine the potential effects of AI systems that can self-improve and learn independently. As AI becomes increasingly integrated into the fabric of commerce and community, it is imperative to guarantee that these systems adhere to ethical and regulatory guidelines. We must confront the potential outcomes of AIs rise, creating an environment where advancement is coupled with prudence, and ethical principles are not compromised in the pursuit of progress.

In the ongoing discussion about the future of AI, particularly concerning self-learning and the perception of AI consciousness, it is essential for us to establish and uphold principles that prioritize human values and societal welfare. The case of Claude 3 serves as a reminder that our exploration of AIs capabilities must be accompanied by a strong dedication to ethical leadership, protecting the future from the potential dangers of unchecked technological independence.

5.2 Employability at risk ?

5.2.1 Introduction to AI and Employability

In the age of rapid technological progress, the impact of artificial intelligence (AI) and automation on the job market has become a central topic of discussion across various sectors. As Melanie Arntz, Terry Gregory, and Ulrich Zierahn (2017)[25] note, "In light of rapid advances in the fields of Artificial Intelligence (AI) and robotics, many scientists discuss the potentials of new technologies to substitute for human labor." This dual nature of AIs impact—its potential to both create new job opportunities and make existing jobs obsolete—necessitates a balanced view on employability in the future.

5.2.2 Quantifying the Risk of Automation & Sector-Specific Impacts

Various empirical assessments have traditionally suggested a grim outlook, with predictions that up to half of all jobs in Western industrialized countries are at risk of automation within the next two decades. However, Arntz, Gregory, and Zierahn challenge these forecasts, arguing that they "overestimate the share of automatable jobs by neglecting the substantial heterogeneity of tasks within occupations as well as the adaptability of jobs in the digital transformation." Their analysis, using detailed task data, shows a significant reduction in the estimated risk of automation—from 38% to 9%—when considering the spectrum of tasks within occupations.

As we delve into the transformative impact of AI on global employment patterns, it becomes imperative to consider its dual nature in the workforce. As noted by Erik Brynjolfsson[26] in The

[25] Researchers who have studied the impact of AI and automation on employment, providing a nuanced view that challenges more alarmist forecasts about job losses.
[26] Author of "The Second Machine Age" and researcher at MIT, focusing on the economic impacts of digital technologies, including AI.

Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies (2014), "When technology advances too quickly for education to keep up, inequality generally rises." This assertion by Erik Brynjolfsson underscores the necessity of our analysis on how AI is reshaping employment. It spotlights AIs role as both a harbinger of new job opportunities and a force driving job obsolescence. This nuanced perspective provides a critical lens through which to examine the evolving dynamics of employment in the era of digital transformation, urging us to consider both the opportunities and challenges that AI presents to the global workforce.

The impact of AI and automation varies significantly across different sectors. Industries characterized by high routine and low complexity tasks, such as manufacturing, are more susceptible to automation. In contrast, sectors requiring high levels of human interaction, creativity, and problem-solving, such as healthcare and the arts, show a lower propensity for automation. This differentiation highlights the importance of task complexity, as many workers in such highly exposed occupations also perform tasks that machines struggle with, such as problem solving or influencing.

As the digital landscape evolves, the European Centre for the Development of Vocational Training (CEDEFOP)[27] has conducted extensive research to estimate the risks of automation for occupations across the EU. According to their findings, occupations heavily reliant on routine tasks and specialized technical operations are at a heightened risk of automation. The CEDEFOP emphasizes that the most exposed occupations are those with significant share of tasks that can be automated (operations with a small reliance on communication, collaboration, critical thinking and customer-serving skills). This highlights the impact of skill demands and the nature of job tasks on the automation vulnerability of various occupations.

Furthermore, the risks of automation are intensified in scenarios where workers have limited access to professional training that could facilitate adaptation to changing labor market conditions. The data compiled by the CEDEFOP not only illustrates the percentage of jobs at high risk but also enables the assessment of how the availability of training affects these risks.

Thus, data sourced from the European CEDEFOP on the shares of employees in EU27 with a high automation risk across various occupations, our analysis presents a nuanced perspective of the workforces susceptibility to automation -induced changes.

[27] An EU agency tasked with promoting and developing vocational education and training across Europe, which researches the impact of automation on employment.

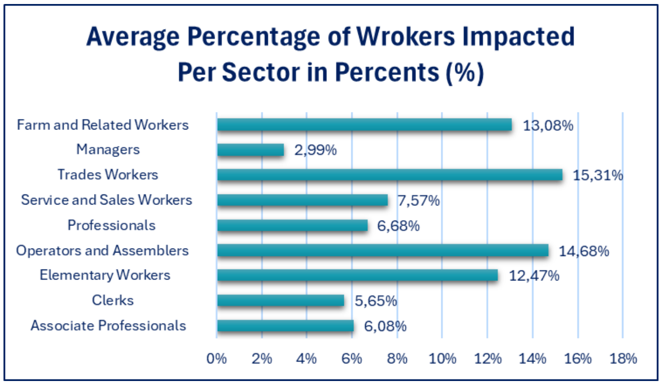


Figure 2 : Average Percentage of Workers Impacted Per Sector in Percent (%) [28]

Compounded from: Shares of employees in EU27 with high automation risk across occupations, European CEDEFOP; detailed in the bibliographic section.

The elucidation offered by the bar chart, representing the average percentage of workers impacted by automation, speaks to a truth that is as undeniable as it is pressing: the trajectory of technological progress is not uniformly felt. Certain sectors find themselves at a more pronounced inflection point, bracing for significant transitions, while others appear to navigate these waters with less turbulence.

If we dive deeper into it, we can see how the detailed table paints a narrative that extends beyond the numbers. It reveals a tale of two vastly different worlds within the same labor market: one where the traditional roles defined by routine and predictability face an existential reckoning, and another where the human touch, creativity, and complex problem-solving abilities continue to be in high demand.

For instance, the Associate Professionals, embodying roles that often fuse technical prowess with critical thinking, display a moderate average risk. This is indicative of a sector where adaptability might cushion the blow of automation. On the contrary, Operators and Assemblers, roles often characterized by repetitive tasks, confront a starkly higher average risk, signaling an imperative for strategic workforce planning and skills development.

Such disparities in automation risk underscore the necessity of a robust and forward-thinking policy framework that can provide an impetus for lifelong learning and vocational training. The focus should be twofold: to equip workers in high-risk occupations with the competencies to transition into roles that technology complements rather than replaces, and to fortify the sectors where human expertise continues to be irreplaceable.

Reflecting on the broader implications, the findings of Arntz, Gregory, and Zierahn suggest that when workplace heterogeneity is taken into account, the likelihood of automation for jobs decreases considerably, thus indicating that a one-size-fits-all approach to predicting the impacts of automation may not be appropriate.

[28] Weighted Average Automation Risk (%) $= \frac{\sum(Number\ of\ Employees\ Exposed \times Automation\ Risk)}{\sum(Number\ of\ Employees\ Exposed)}$

6 The Economic Importance of AI in Business

6.1 AI in Business

6.1.1 Premises, Harnessing the Potential of AI

As we consider the economic and ethical implications of artificial intelligence in the business world, it is important to recognize the extensive potential of AI in enhancing human abilities. Max Tegmark, in his book Life 3.0: Being Human in the Age of Artificial Intelligence, provides an intriguing insight into the contrast between human intelligence and our biological limitations. He notes "Your synapses store all your knowledge and skills as roughly 100 terabytes' worth of information, while your DNA stores merely about a gigabyte, barely enough to store a single movie download." This comparison not only emphasizes the remarkable capacity for AI to supplement and expand human cognitive abilities, but also underscores the difference between the biological confines of humans and the scalability of digital information storage and processing.

Figure 3 : Human Intelligence vs Artificial Intelligence

Description	Human Brain	Typical Computer	Supercomputer	Human vs Supercomputer
Weight	1.4 kg	1.8 kg	50,000 kg	- 49 998.6 kg
Space Needed	0.013 m^3	0.08 m^2	200 m^2	- 199.92 m^2 (approx)
Operations Per Second	10^{12}	100 GigaFLOPS (10^{11})	10^{15}	- 1000 times
Energy Efficiency	20 watts	65 watts	1 000 000 watts	- 999 980 watts

Explanation of the data in the bibliography

The table provided in Figure 3 compares the capabilities and specifications of the human brain with a typical modern computer (like a high-end Samsung laptop) and a supercomputer designed for high-performance tasks (similar to those found in Amazon's computing environments).

Power : In terms of raw computational power, the supercomputer is undoubtedly the most formidable. With the ability to perform 10^{15} operations per second, it vastly outstrips the human brains processing capacity estimated at 10^{12} operations per second. This immense power allows supercomputers to handle extraordinarily complex calculations and simulations, tasks that would be impossible or take immeasurably longer for humans to perform manually or with less capable machines.

Efficiency : When evaluating energy efficiency, the human brain is remarkably superior. Operating on just 20 watts—barely enough to power a small lightbulb—the brain manages a vast array of functions including thought, memory, emotion, and sensory processing. In contrast, the supercomputer, while powerful, requires an enormous 1,000,000 watts. The energy consumption per operation of the brain is minuscule when compared to that of the supercomputer, showcasing the brains advanced biological efficiency.

Intelligence : Intelligence involves more than the sheer speed of processing information; it encompasses understanding, reasoning, emotional depth, and creativity. The human brain excels in these areas, capable of learning from complex social interactions, adapting to new situations, and creating innovative solutions to problems. Computers, even advanced supercomputers, function within the limits of their programming and lack the ability to truly understand or innovate without human input. They excel in structured environments where parameters are clearly defined, but they do not possess the human-like ability to comprehend nuanced or abstract concepts.

Usefulness : The usefulness of each—human brain, typical computer, and supercomputer—varies greatly depending on the scenario:

- Academic and Scientific Research: Supercomputers play a crucial role, performing large-scale simulations and calculations that are vital for scientific advancements in fields like climate science, physics, and bioinformatics.
- Daily Tasks and Personal Use: A typical modern computer, such as a high-end laptop, is designed to cater to the everyday needs of users. It is ideal for tasks like web browsing, office applications, light gaming, and multimedia entertainment, offering a good balance of usability and performance.
- Creative and Interpersonal Areas: The human brains capabilities are unparalleled in activities that require creativity, emotional intelligence, and interpersonal skills. Whether its composing music, creating art, or navigating complex social environments , the brains ability to adapt and innovate makes it indispensable in numerous aspects of daily life.

In conclusion, while supercomputers exceed in computational power and typical computers offer versatility for everyday applications, the human brain remains unmatched in its efficiency and intelligence across a wide range of functions. Each has its distinct areas of dominance, making them essential in different contexts and for different purposes thus the need to combine both in order to increase productivity.

6.1.2 AI and Business Performance

In assessing AIs influence on business performance, it becomes evident that its impact is profound. Erik Brynjolfsson remarks in The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies (2014), “The main fuel to speed the world’s progress is our stock of knowledge, and the brake is our lack of imagination.” thereby highlighting the transformative power of AI in reshaping business and data intelligence landscapes. AIs impact on business performance is multi-faceted, affecting everything from efficiency to job structures. In healthcare, for example, AI is expected to significantly aid in data analysis, imaging, and diagnosis, enhancing decision-making in treatments. In the realm of employment, AI is not just replacing jobs but also creating "hybrid" roles where it undertakes technical tasks, allowing employees to focus on other responsibilities and increasing their productivity.

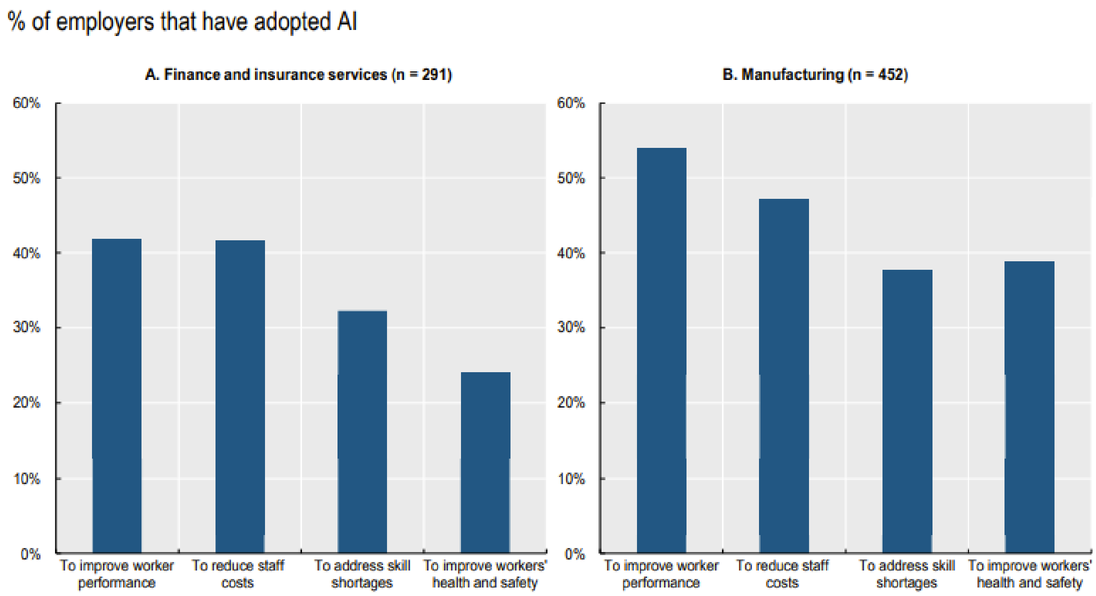
As we confront the juxtaposition of AIs potential to both augment and replace human labor. Employers acknowledge this duality, noting AIs role in "improving worker performance and reducing staff costs" (OECD, 2023)[29]. This dual potential is evident, with about half of the

[29] The Organisation for Economic Co-operation and Development, an intergovernmental economic organization with 38 member countries, founded in 1961 to stimulate economic progress and world trade.

employers who cited performance enhancement as a motivator for AI adoption also recognizing cost reduction, underscoring AI's capacity to complement and substitute labor simultaneously.

This transformation is not restricted to large corporations; small businesses too can leverage AI for insights into sales trends, cash flow, and financial information, which can profoundly impact the economy. AI is also expected to revolutionize lending by enabling more informed assessments of creditworthiness, particularly benefiting historically underserved borrowers.

Figure 5 : Percentage of Employers that have Adopted AI



OECD (2023). The impact of AI on the workplace: Main findings from the OECD AI surveys of employers and workers.

As a matter of fact, within the discourse on the integration of Artificial Intelligence in the business ecosystem, the OECD articulates, "Around 80% of AI users said that AI had improved their performance at work" (OECD, 2023), a powerful testament to AIs transformative capability in enhancing worker productivity which directly aligns with business performance metrics.

The qualitative narrative constructed through the OECD surveys acknowledges the multifaceted impact of AI — while performance enhancement is evident, the introduction of AI is not without its complexities. For instance, AIs integration is associated with a discernible shift in employment patterns: "In companies that had adopted AI, 20% of workers in finance and 15% in manufacturing said that they knew of someone in the company who had lost their job as a result of AI" (OECD, 2023). Such insights are instrumental in developing a nuanced understanding of AI as a driver of both efficiency and change within the corporate realm.

Moreover, the narrative extends to the reconfiguration of workplace tasks and responsibilities. AIs role in task automation is profound, with the OECD noting that a significant portion of employers report that AI "had automated tasks that workers used to do" (OECD, 2023). This underscores AIs potential to redefine job roles and functions, signaling a shift towards a business environment where innovation is not just encouraged but required for maintaining a competitive edge.

These reflections are interwoven with a strategic outlook on AI deployment. Businesses are seen not merely as adopters of AI but as entities that must embrace AI to remain relevant and prosperous in an increasingly digital landscape. The OECD findings enhance this narrative, highlighting how "workers will need support in managing these changes successfully" (OECD, 2023), which in turn calls for businesses to invest in their human capital as much as in AI technologies.

6.1.3 AI in the Global Economics

AIs integration into business presents significant economic opportunities and ethical challenges. Economically, AI is poised to contribute substantially to global economic activity. By 2030, AI has the potential to add around $13 trillion (Economic impacts of artificial intelligence (AI), European Parliament, July 2019)[30] to global output, representing about 16 percent higher cumulative GDP compared with today. This growth is driven by factors such as labor automation, innovation, and new competition. However, the adoption of AI could potentially widen gaps among countries, companies, and workers, with front-runners likely to benefit disproportionately. On the ethical front, AI raises issues of data privacy, algorithmic bias, and potential job displacement. The rapid development of AI necessitates the development of appropriate international governance rules and regulations in areas like AI ethics and data access.

The potent influence of Artificial Intelligence (AI) on the corporate sphere is emphasized, supported by significant industry findings. Zapanta[31] (2023) remarks on AIs impact, noting that "the global artificial intelligence (AI) market was valued at U.S. $93.5 billion back in 2021," with a forecasted growth that speaks volumes about AI's burgeoning role across various industry verticals. The assertion that AI has the potential to both complement and substitute labor is a key consideration for businesses strategizing around AI adoption. This growth is not just numerical but is attributed to the "continuous research and innovation directed by the tech giants" (Zapanta, 2023), which reflects the dynamic nature of AI as an evolving force that necessitates constant adaptation and strategic foresight from businesses.

6.2 Impact of AI on the Economy Growth and Innovation.

6.2.1 Prelude to a Digital-Productive World

The integration of Artificial Intelligence into the economic fabric represents a paradigm shift in how we conceive growth, productivity, and innovation. As we stand on the brink of a new era powered by digital transformation, it is imperative to scrutinize the multifaceted impact of AI technologies. This section delves into the profound effects AI exerts on economic growth and innovation, followed by an analysis of AI-enabled business models and digital transformation. Through a blend of theoretical insights and empirical evidence, we aim to unfold the complexities and opportunities presented by AI, framing the narrative within the broader context of economic development and industrial evolution.

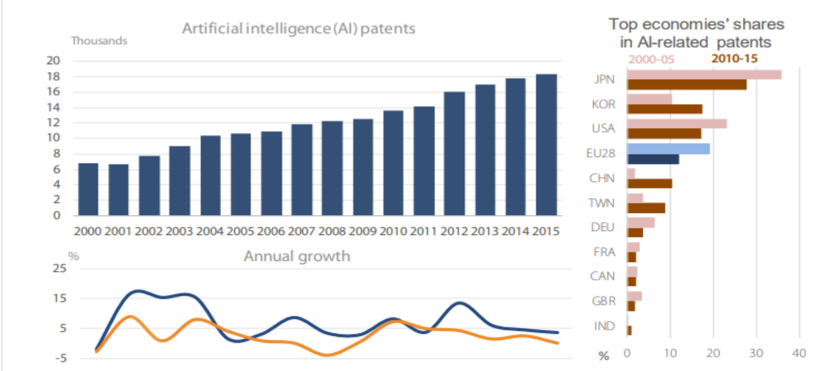
[30] A report detailing the potential economic impacts of AI technologies across various sectors and the global economy.

[31] Author of The impact of AI on business discussing the value and growth of the AI market. He presents forecasts and analysis about AI in the financial and business field.

6.2.2 Financial Forecasts

Artificial Intelligence stands as a cornerstone of the fourth industrial revolution, heralding unprecedented economic growth and innovation. According to the McKinsey Global Institute[32] (2017), AI has the potential to add approximately $13 trillion to the global economy by 2030, translating into a 1.2% annual GDP growth across various sectors. This technological impetus is poised to streamline operations, enhance productivity, and spawn innovative services and products, setting the stage for a transformative economic landscape.

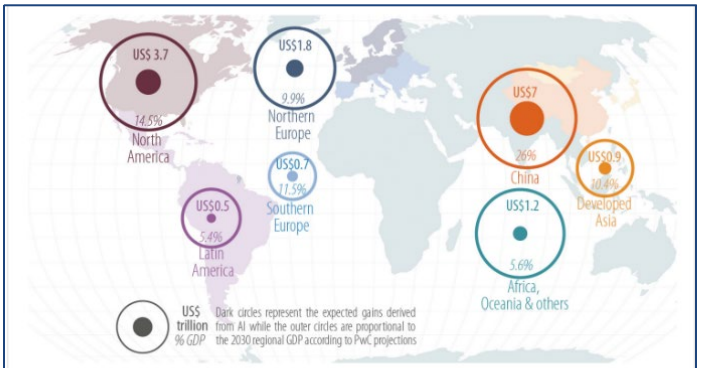
Figure 4 : AI Patent Worldwide from 2000 to 2015



Source: OECD, Science, Technology and Industry Scoreboard, 2017.

Additionally, since the beginning of the century, we can see AI patents being increasingly produced, thus transfiguring the nascent importance of AI and the fundings it is acquiring. The European Parliament's census made clear the implication of AI and it's increasing value in today's business world. Indeed, in its research "Economic impacts of artificial intelligence (AI)" analyzed various studies and extracted all the economic impact IA may have on society and Europe, globally supporting a positive financial view of AI integration.

Figure 5 : Expected Gains From AI in the World by 2030



Source: The macroeconomic impact of artificial intelligence, PwC, 2018.

Further supporting this notion, the PwCs[33] Global Artificial Intelligence Study (2018) projects that AI could contribute up to $15.7 trillion to the global economy by 2030, with $6.6 trillion derived from increased productivity and $9.1 trillion from consumption-side effects. The study underscores AIs role in enabling agile decision-making, optimizing

[32] McKinsey & Company is a major actor in the consulting and business intelligence sector.

[33] PricewaterhouseCoopers is a British network of international firms specializing in auditing, accounting and consulting services, with a focus on sector-based approaches to business.

manufacturing processes, and personalizing retail experiences, thereby catalyzing both direct and indirect economic benefits.

As a matter of fact, in the healthcare sector, AI-driven diagnostic tools have revolutionized patient care, offering faster, more accurate diagnoses and personalized treatment plans. According to the National Institute of Health (NIH, USA, 2023), "Machine learning (ML), a subset of AI that enables computers to learn from training data, has been highly effective at predicting various types of cancer, including breast, brain, lung, liver, and prostate cancer. In fact, AI and ML have demonstrated greater accuracy in predicting cancer than clinicians." These advancements not only improve patient outcomes but also significantly reduce healthcare costs, exemplifying AIs transformative potential across industries, further profiting to the idea that AI can revolutionize the world as we know it.

6.2.3 AI-Driven Efficiency and Productivity

"AI is going to transform the global economy as surely as electricity and the steam engine did in their own times." – Chris Hyzy, Chief Investment Officer, Merrill and Bank of America Private Bank

Artificial Intelligence is transforming the manufacturing landscape by significantly enhancing efficiency and reducing waste. McKinsey highlights the transformative impact of AI, with manufacturing sectors witnessing a notable increase in production output by 20% alongside a reduction in waste by 15%. This leap in operational efficiency is not merely a testament to AIs potential to streamline processes but also its role in promoting sustainable manufacturing practices. The integration of AI into production lines exemplifies the synergy between technological innovation and environmental stewardship, marking a pivotal shift towards more sustainable and efficient manufacturing paradigms.

As we stand at the intersection of AIs economic promise and ethical challenges, businesses and policymakers are tasked with navigating this complex terrain. In forging ahead, a balanced approach that harnesses AIs potential to drive economic prosperity while adhering to ethical principles will be paramount. This dual focus ensures that the journey toward AI integration is marked by innovation, equity, and a steadfast commitment to enhancing the human condition.

6.3 Analysis of AI-enabled business models and digital transformation

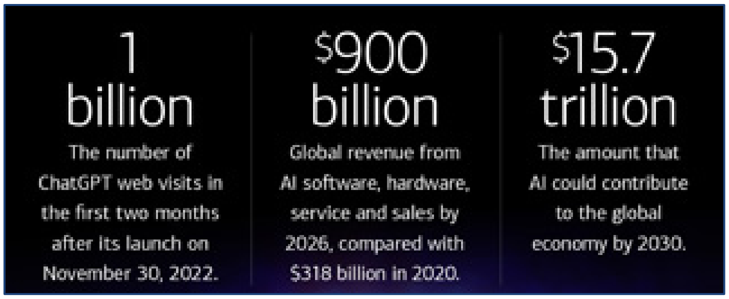
6.3.1 Prelude to a Digital-Transformed World

In the digital age, AI emerges not just as a technological innovation but as a catalyst for business model transformation. The intersection of AI and digital transformation opens new avenues for value creation, challenging traditional business paradigms and fostering a new order of economic activity. This section endeavors to dissect the anatomy of AI-enabled business models, illustrating how digital transformation, powered by AI, is not merely an option but a necessity for competitive differentiation and sustainability in the global market.

The advent of AI has been instrumental in propelling digital transformation, forging new business models that capitalize on data-driven insights for competitive advantage. As outlined in Accentures report (2018), AI is expected to boost business profitabi lity by an average of 38% by

2035, highlighting the strategic importance of AI integration in operational and business model innovation.

Figure 6 : Digital Importance in Number



[34]

The World is becoming progressively more and more digital. This is demonstrated through the increased implication of users whether professional or not in AI tools and its use since 2022. The revenue generated by hard AI software and hardware services in 2020 (318 billion $ - McKinsey, 2020) relates the craze over this new model of intelligence. Lastly the forecasts are all consistent towards an increase in the monetary value, global implications and business decision and analytics importance of AI.

AI-enabled platforms, such as those employed by streaming services like Netflix, utilize machine learning algorithms to curate personalized content recommendations. This not only enhances user engagement but also optimizes inventory, demonstrating a shift towards more customer-centric, efficient business operations. The World Economic Forums Future of Jobs Report (2020) emphasizes how digital transformation, spearheaded by AI, necessitates a recalibration of workforce skills and job roles, signaling a profound shift in the employment landscape.

As a matter of fact, Netflix's use of AI for content recommendation has not only improved customer satisfaction but also operational efficiency, showcasing a successful AI-enabled business model that leverages data analytics for strategic decision-making.

AIs integration into business decision-making holds significant economic potential, offering opportunities for increased efficiency, innovation, and competitive advantage. The economic benefits of AI are manifold, including cost reduction, optimization of resources, improved customer experiences, and the creation of new revenue streams. AI technologies can analyze large datasets more efficiently than human counterparts, providing insights that drive better decision-making and business outcomes.

The broader economic impact of digital transformation, underpinned by AI, is quantifiable in the enhanced GDP growth rates observed in countries with high digital transformation scores. We are able to elucidate the positive correlation between digital transformation and economic performance in digitally developed countries since the markets reports from UNCTAD[35] explains the increasing size of the AI, Internet and Hydrogen market as they "represent a $1.5 trillion market, which could grow to over $9.5 trillion by 2030" (Technology and Innovation Report, UNCTAD 2023). This

[34] Sources, from left to right: BofA Global Research, "Me, Myself and AI—Artificial Intelligence Primer," February 28, 2023; BofA Global Research, IDC; and PwC.

[35] The United Nations Conference on Trade and Development is a permanent intergovernmental body established in 1964 as part of the United Nations Secretariat. UNCTAD is responsible for dealing with development issues, particularly international trade.

data underscores the significance of digital transformation as a catalyst for economic growth, highlighting the imperative for nations and businesses alike to embrace digital and AI technologies.

6.3.2 Customer Engagement through AI

The adoption of AI-powered tools, such as chatbots, is revolutionizing customer service and engagement. Forresters research (2023) - also supported by emerald insight (2023), Can AI chatbots help retain customers? Impact of AI service quality on customer loyalty - illuminates the significant enhancement in customer satisfaction, with AI-powered chatbots leading to a 30% increase in customer satisfaction scores. Furthermore, personalized AI recommendations have been instrumental in boosting customer retention rates by 25%. These advancements underscore the potential of AI to not only streamline customer service operations but to also foster deeper and more personalized customer relationships. The ability to provide tailored experiences and swift resolutions to customer inquiries through AI stands as a testament to the evolving landscape of customer engagement, where personalization and efficiency converge to redefine the standards of service excellence.

6.3.3 Innovation and Transformation in Businesses

The realm of product innovation and development is being reshaped by AIs capability to identify and capitalize on emerging market trends. An illustrative case involves an AI-driven analytics firm that leveraged machine learning to unearth new market opportunities, culminating in the development of a groundbreaking product that swiftly captured a major section of its target market upon release. This instance not only showcases AIs prowess in enhancing market responsiveness but also its pivotal role in steering the direction of product innovation. Through the application of AI, companies can navigate the complexities of market dynamics with unprecedented agility, ushering in a new era of product development that is both responsive and innovative.

By analyzing the data acquired, we can fairly deduce that the strategic integration of AI is catalyzing a transformation in business models, particularly in sectors such as logistics. A compelling example is a traditional logistics company that harnessed AI for predictive logistics, achieving a remarkable reduction in delivery times and significantly expanding its market share. This transformation exemplifies the profound impact of AI on business operations, enabling companies to not only enhance their operational efficiency but also to redefine their value proposition. Through AI, businesses can transition from traditional operational models to more dynamic, data-driven frameworks that prioritize efficiency, adaptability, and customer satisfaction.

6.3.4 AI, a Business Efficient Tool

AI’s impact is more than manufacturing efficiency, and will include customer engagement, product innovation, business model and possibly a boost for our economy. The McKinsey, Forrester, and Harvard reviews all have good information to help one better understand the many facets of AI. Much research will need to be done as well, as AI will and already will have changes.

In fact, as Harvard reviews reports in this example, the deployment of AI within midsize companies as strategic is one of the few key areas where smaller companies may be able to leverage technology to gain competitive advantage within their niche markets or operational domains. They are able to change focus quickly with AI technologies in a way that the larger firms cannot. Smaller firms may use AI technologies to lead by focusing their applications in a very specific area and determine how to create value in one the core capability areas of AI i.e. customer experience enhancement, operational optimization, product innovation, etc.

A top barrier to AI adoption among midsize firms may be a lack of infrastructure and talent. Midsize firms, given their size, may not possess the resources or scale necessary to invest heavily in AI infrastructure and staff top talent in AI advancement. However, this can become a major driver for innovation in midsize firms. Not only do they have to come up with creative solutions to integrate AI into the business, but also they have to think outside the box in coming up with partnership-driven approach in solving their AI adoption problems. Partnering with key AI suppliers, academia and industry consortia can help midsize firms combat the resource barrier that typically prevents AI adoption, by providing them access to leading AI research, technology tools and the industrys top AI talent.

In addition, the usage of AI to improve customer experiences, or drive operational efficiencies, demonstrates the extensible capabilities on how digital transformation can not only reduce cost, but can uncover new revenue sources as well as drive better customer engagement. For even medium-sized businesses, this often means prioritizing AI investments for the customer value proposition rather than only for operational agility.

6.4 AIs Role in Promoting Sustainable Practices

6.4.1 AI and Environmental Sustainability

In the realm of environmental conservation and sustainability, the application of artificial intelligence presents both transformative opportunities and significant challenges. Drawing on the insights of Peter Dauvergne[36] in his book, AI in the Wild: Sustainability in the Age of Artificial Intelligence (2020), we can begin to navigate the complexities of leveraging AI to protect our planet.

As Dauvergne explains, the abilities of AI can be deployed to help its natural counterpart in good ways. For example, police around the might use them to help track a bomb from an app and help the official find where the bombs is. As previously mentioned, drones can also be equipped with specialized AI technology as well, granting them incredible abilities to see in the dark, and to follow moving targets, including those on foot. This can be incredibly helpful for rangers in Africa trying to track down and catch poachers in the dead of night over vast tracts of wildlife national parks or sanctuaries. In addition, a number of AI enabled underwater drone ships have been deployed to the Great Barrier Reef off the coast of Australia, one of the most productive food/energy chains on the entire earth. These AI-enabled ships have been programmed to recognize and detail almost any invasive form of life on the reef, and so to help cull invasives from much of the corals in the reef that includes plant and animal life. And as an AI project specifically aimed at main forests in Brazil, several hundreds of old discarded and recycled cell phones have been reprogrammed with AI deep vision technology and even some language and threat identifying

[36] a prominent scholar known for his contributions to the field of global environmental politics. He is a professor at the University of British Columbia in Canada, where he focuses on the political dynamics and governance surrounding global environmental issues, corporate responsibility, and sustainability.

software, so that when re-located into forests in the region sending and receiving cell phone tower signals from a given direction, the old phones facing that direction are switched on with the AI software and triggered to look out into the dark forest they occupy.

7 Building a hypothetical Sustainable Business Model Involving AI

7.1 Modalities and Explanations

7.1.1 Setting the Context

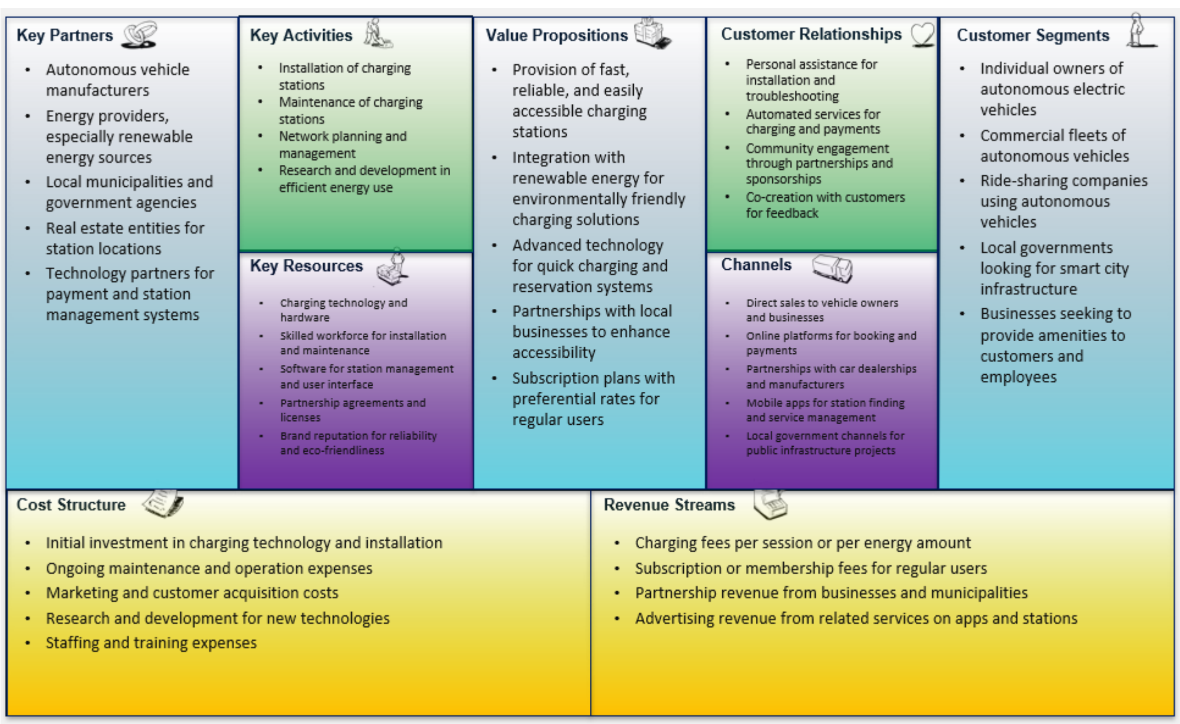
In my thesis, I propose to establish and analyze two hypothetical businesses through a simulated 1 year operation. The primary objective is to scrutinize their cash flows, economic benefits, business operations, and ethical considerations. This simulation will explore two distinct models:

- Business ALPHA : will integrate artificial intelligence (AI) in all operational aspects except for Research and Development (R&D), which will remain under the proprietors direct control.
- Business BETA : will operate without the influence of AI.

By contrasting these models, I aim to discern the diverse impacts and efficiencies AI can introduce at various stages of business development. This comparative study will provide valuable insights into the role of AI in shaping modern business landscapes.

Both businesses will be selling charging station for electric vehicles (EV Stations).

Figure 7 : Business Model Canva For EV Stations



Canvas model template: https://neoschronos.com/download/business-model-canvas/ppt/

It is critical to acknowledge that our business model encompasses two distinct components: the installation of infrastructure and the operation of the charging stations. We will, therefore, treat these as separate divisions within our analysis, evaluating the profitability and value contribution of each. This approach allows us to dissect and understand the individual financial performance and strategic advantage that each facet brings to the overarching business model.

7.2 Acquiring Customers

7.2.1 Website, Incoming Inquiries and Lead Conversion

Figure 8 : Business ALPHA (AI-Driven Approach)

Image generated through DALL-E

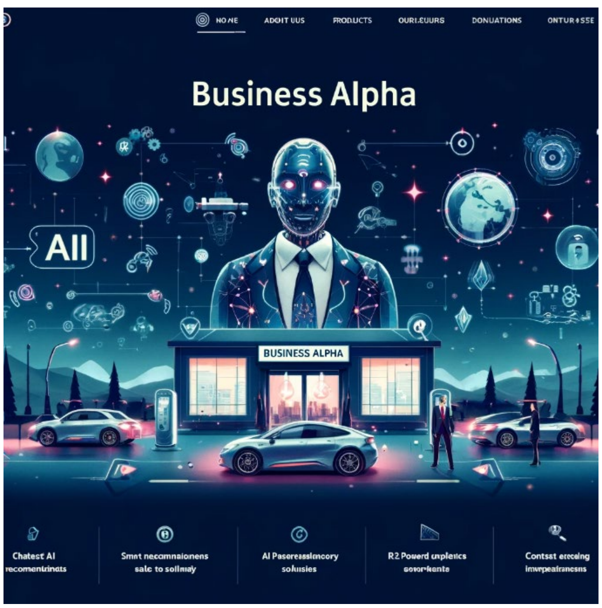


Figure 9 : Alpha's Cost

Element	Cost	Notes
Website Creation	10 000	High-end due to AI integration
SEO & SEA	2 000/month	Ongoing optimization and ads
Zapier	200/month	Automation workflows
PowerBI	100/user/month	Data analytics
Lemlist	50/month	Email marketing automation
DocuSign	25/month	E-signature service
CRM Software	150/user/month	Advanced CRM with AI capabilities
Miscellaneous	500/month	Hosting, domain, content, etc.
Total Initial Cost	10 000	One-time setup
Total Monthly Cost	3,025/month	Recurring expenses

Based on industry averages, lets assume a conversion ratio of 5% for the AI-driven process due to targeted and personalized automation. (out of 2000 leads - more inquiries). Each lead will generate a 20k€ Gross Income (fixed pricing) contract (specifics will be detailed later).

Prospection: Automated lead generation through targeted content SEA and SEO.

Initial Contact: Prospects are reached through automated email campaigns via Lemlist.

Lead Qualification: Zapier creates connection between the CRM the other tools and integrates web forms, email responses, and engagement data, filtering and directing qualified leads to appropriate funnels.

Presentation & Interest: Interested leads receive automated, personalized follow-ups with detailed product presentations and reports from PowerBI analytics.

Negotiation & Finalization: Interested leads are directed to schedule video and demos. Price negotiations and contract details are automated where possible.

Contract Signing: Final agreements are sent through DocuSign for electronic signature.

Onboarding & Follow-up: After signing, the customer receives automated onboarding instructions and scheduled follow-ups to ensure satisfaction.

Figure 10 : Business BETA (Human-Driven Approach):

Image generated through DALL-E

Figure 11 : Beta's Cost

Element	Cost in Euros (€)	Notes
Website Creation	6 000	No AI components
SEO & SEA	2 000/month	Ongoing optimization and ads
CRM Software	75/user/month	Conventional CRM without AI
Sales Personnel	4 500/month/employee (aprox)	Depends on team size
Miscellaneous	300/month	Hosting, domain, content, etc.
Total Initial Cost	6 000	One-time setup
Total Monthly Cost	Variable based on personnel	Based on Size and Sales

Let's assume a more traditional approach has a conversion ratio of 3% due to the less targeted nature of the process (out of 1000 leads – less inquiries). Each lead will generate a 30k€ (human negotiation) contract (specifics will be detailed later).

Prospection: Sales team generates leads through networking, referrals, and direct marketing.

Initial Contact: Sales personnel reach out to potential clients via phone calls and personalized emails.

Lead Qualification: Leads are entered into a CRM where they are qualified based on interaction and interest.

Presentation & Interest: Sales team provides detailed product presentations and personalized proposals.

Negotiation & Finalization: Direct negotiations with prospects to finalize contract terms.

Contract Signing: Contracts are sent and signed physically or through a basic e-signature solution integrated with the CRM.

Onboarding & Follow-up: Sales personnel manage onboarding and schedule follow-ups to ensure customer satisfaction.

In this scenario, costs for Business BETA are lower upfront but might increase significantly with the size of the sales team and the commission structure. In contrast, Business ALPHA has higher initial technology costs but more predictable ongoing expenses.

7.2.2 Operations and Revenues[37]

Figure 12 : Alpha's Gross Income

Element	Value
Number of Leads	2000
Conversion Ratio	5%
Average Contract Value	20 000 €
Total Sales	2 000 000 €
Expected Revenue (Monthly)	166 667 €

Figure 13 : Beta's Gross Income

Element	Value
Number of Leads	1000
Conversion Ratio	3%
Average Contract Value	30 000 €
Total Sales	900 000 €
Expected Revenue (Monthly)	75 000 €

Figure 14 : Alpha's Operational Cost

Cost Element	Cost Estimate (€)
AI Project Management	**1 407 000 €**
Site Selection	100 000 €
Design and Specifications	200 000 €
Permitting and Legal	40 000 €
Supply Chain and Procurement	1 000 000 €
3rd Party Contract & AI	**203 000 €**
Construction	200 000 €
Testing and Safety Checks	- €
Staff Training and Onboarding	- €
Launch	- €
Maintenance Planning	3 000 €
3rd Party Contract & AI	**115 000 €**
AI Project Management	- €
Data Analytics	- €
Smart Systems Integration	- €
AI Platfrom sytem for incidents	- €
Maintenance Operation	115 000 €
Total	**1 725 000 €**

Figure 15 : Beta's Operational Cost

Cost Element	Cost Estimate (€)
Human Project Management	**616 000 €**
Employees	220 000 €
Site Selection	- €
Design and Specifications	- €
Permitting and Legal	9 000 €
Supply Chain and Procurement	360 000 €
Additionnal Sales Comission	27 000 €
Construction Team	**94 000 €**
Construction	80 000 €
Construction	- €
Testing and Safety Checks	- €
Staff Training and Onboarding	10 000 €
Launch	- €
Employee Certification	4 000 €
Maintenance Planning	- €
After Sales Team	39 000 €
Manual Project Oversight	- €
Customer Feedback Integration	- €
Conventional Systems	- €
Maintenance Operation	39 000 €
Total	**749 000 €**

Figure 16 : Alpha's and Beta's Operational Resume

Description	Alpha Company (€)	Beta Company (€)
Total Sales	2 000 000 €	900 000 €
Total Annual Costs	1 771 300 €	786 200 €
Initial Costs	*10 000 €*	*6 000 €*
Recurring Costs	*36 300 €*	*31 200 €*
Total Project Costs	*1 725 000 €*	*749 000 €*
Net Profit	228 700 €	113 800 €
ROI (%)	12,91%	14,47%
Profit Margin (%)	11,44%	12,64%

[37] Full Tables and explanation in Bibliography

The table shows that while Alpha Company has a larger operational scale with higher sales and profits, Beta Company operates more efficiently, yielding higher returns and profit margins relative to their sales and investments. This analysis highlights different strategic outcomes: Alpha leveraging scale to generate higher absolute profits and Beta focusing on efficiency to maximize returns from smaller operations.

Analysis Based on Current Operations:

1. **Alpha Company (AI and 3rd Party Integration)**:
    - **Efficiency and Scalability**: Alpha's use of AI and third-party contracts suggests a focus on scalability and efficiency through automation. AI can streamline project management, optimize supply chains, and enhance design specifications, potentially reducing errors and speeding up project timelines.
    - **Cost Implications**: While this approach has higher initial and project-related costs due to technology and third-party fees, it might reduce long-term operational costs through improved efficiencies and reduced need for direct labor.
    - **Quality and Innovation**: AI integration likely enhances the quality and innovative aspects of the construction projects, potentially allowing Alpha to command higher prices or secure premium projects.
2. **Beta Company (Human-Centric Operations)**:
    - **Flexibility and Control**: Beta's human-centric approach might offer more control over every stage of construction and potentially better adaptability to specific project requirements or unexpected issues.
    - **Cost Structure**: Human labor is cost-intensive, especially as it scales, leading to significant recurring costs. However, it may reduce the need for high initial technology investments.
    - **Employee Expertise and Relationships**: Relying on human expertise might foster stronger relationships with clients and a reputation for personalized service, which can be crucial in construction.

Assumptions for Less Tangible Business Scenarios:

- **Businesses like Software Development or Consulting**:
    - **Alpha Company**: AI and automation would be highly beneficial in a software or consulting firm, where data processing and analytics are crucial. Alpha could leverage AI to offer predictive insights, automated solutions, and scalable services with potentially lower incremental costs after initial development.
    - **Beta Company**: In a service-oriented, less tangible industry, Beta's focus on human expertise might translate into high-quality, bespoke solutions that cater to specific

client needs. However, scaling might require significant increases in expert staff, which could elevate costs disproportionately.

Assumptions if the Scale of Each Business Was Broader:

- **Expanded Geographic or Service Scope**:
    - **Alpha Company**: Scaling up would likely be more straightforward for Alpha, as AI systems and third-party partnerships can be extended or replicated in new markets or additional services with less incremental cost than human-based systems.
    - **Beta Company**: Scaling operations for Beta would require a substantial investment in hiring and training new employees, as well as potential challenges in maintaining quality and company culture across a broader operational base.

Conclusion:

Both companies' strategies have inherent strengths and weaknesses that play out differently depending on the industry context and scale of operations. Alpha might find more success in industries and scenarios that value technological integration and can bear high initial costs for long-term efficiency. Beta, on the other hand, could thrive in service-oriented industries where human expertise and customer relations are paramount, though scaling poses significant challenges. Each company must align its growth strategies with its operational strengths and market demands to optimize profitability and sustainability.

8 Ethical Issues and Legal Aspect of AI Integration

8.1 Establishing Legal boundaries, a Necessity

8.1.1 Premises

Since AI has an unlimited potential, it is necessary to determine a structure to unsure the viability for the livings in each and every project. Supposedly, could AI through its own decision harm the livings in anyway? Therefore, the legal framework surrounding artificial intelligence is as multifaceted as the technology itself, encompassing a spectrum from established legal principles to evolving ethical guidelines and subjective interpretations. Thus, understanding and navigating this landscape is crucial for organizations aiming to leverage AI responsibly and effectively.

8.1.2 Legal Foundations for AI Use

The foundation of AIs legal environment revolves around following current laws and regulations that oversee data privacy, intellectual property, consumer protection, and liability. This involves adhering to regulations such as the General Data Protection Regulation (GDPR) in the EU, which establishes strict standards for data privacy and the utilization of personal information, as well as comparable global laws that influence the ways in which AI is employed, particularly in processing and analyzing user data. Intellectual property laws are pivotal in ascertaining the ownership and usage rights of AI-generated content and innovations, necessitating careful handling to safeguard organizational interests and uphold the rights of others.

Subjective Thoughts and Interference Both AI having the ability to make decisions in many intricate or ethical situations bring great legal concerns. Incorporating AI into hiring, lending, or law enforcement can all bring up issues of prejudice or unfair treatment leading to legal problems based on the current anti-discrimination laws. Overcoming these subjective areas of concern will require extensive testing and validation of AI systems for biases, clearly documenting the AI decision-making process and finally ensuring the implementation of “governance” mechanisms that ensure alignment to the principles and intent of the associated legal rules.

8.2 Defining the Ethical Considerations and Issues AI Poses

8.2.1 Ethical Considerations Arise

This in turn, may also involve some very complex ethical questions regarding AI’s such as : Definition of work, what human skills are valuable and lastly, safeguards, all this to ensure that technological progress benefits society at large. Unsurprisingly, this incredible technology is leading us to question issues that weve never questioned so far and, probably, its interaction with the policy realm.

This brings to mind the intersection of economic and ethical significance of AI, as I believe business management will have a large role to play in responsibly integrating AI technologies. In this regard, we need to ask ourselves how we can most effectively leverage AI technologies to augment human decision-making and creativity, all while ensuring we are considering the ethical implications of a society where AI and human-level AI live in equilibrium.

The ethical landscape of AI integration presents a complex mosaic of challenges and considerations. As elucidated by Virginia Eubanks[38] in Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor (2018), "When automated decision-making tools are not built to explicitly dismantle structural inequities, their speed and scale intensify them." thus emphasizing the need for ethical vigilance. This underscores the social risks linked to AI but omits other factor within the integration of AI in business. Other several ethical considerations are needed as AI presents a variety of major areas of concern:

- **Privacy and surveillance:** The integration of AI in surveillance systems and connected devices raises significant concerns about privacy. Algorithms are capable of analyzing vast amounts of personal data, often without explicit consent, leading to pervasive surveillance. This raises the question of how far technology can encroach upon private life without infringing on individual rights.

- **Bias and Discrimination:** AI systems learn from historical data, which may reflect existing societal biases. For example, a recruitment algorithm trained on biased data could perpetuate discrimination against certain groups of people. It is crucial to recognize and correct these biases to prevent AI from reinforcing inequalities.

- **Role of Human Judgment:** The deployment of AI in critical decision-making processes, such as medical diagnosis or criminal justice, highlights the risk of over-reliance on technology. Human judgment, with its ability to consider context and ethics, remains indispensable. It is essential to ensure that AI complements rather than replaces human reasoning, by establishing mechanisms for oversight and control.

For instance, AIs role in decision -making processes like parole or employment could embed and replicate societal biases. Moreover, AIs potential to confer a veneer of objectivity on these biases is a significant concern.

The importance of AI ethics in businesses is growing. Ethical AI involves ensuring that AI technologies, such as machine learning, deep learning, natural language processing, and computer vision, align with ethical principles and societal values. This includes examining the entire AI product lifecycle for ethical integrity, from research and design to operation. Challenges arise in preventing AI systems from unintentionally reinforcing biases or violating privacy norms. Taking a comprehensive approach to AI ethics is essential for building trust and avoiding negative social consequences associated with AI implementation. Issues such as algorithmic bias, data privacy, and the impact of automation on employment are at the forefront of the ethical debate. As AI systems increasingly influence critical business decisions, there is a growing need for ethical guidelines and governance frameworks to ensure that these technologies are used responsibly. The

[38] An associate professor at the University at Albany, Eubanks is known for her critical examination of the social implications of data-driven technologies.

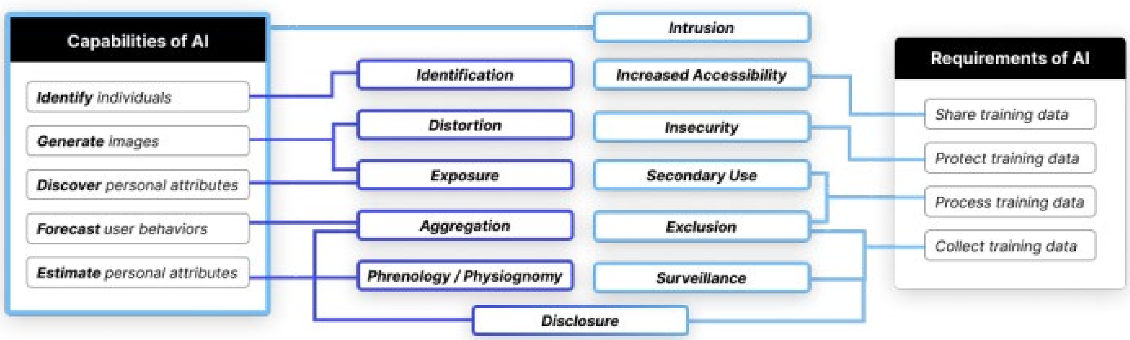
ethical use of AI is not only a matter of corporate responsibility but also crucial for maintaining public trust and avoiding reputational damage.

8.2.2 AI Privacy & Bias Concerns

Artificial intelligence (AI) presents a range of privacy and surveillance issues that are increasingly relevant in todays digital landscape. As AI technologies become more pervasive, the intersection between AI and privacy generates profound implications for data protection. The debate over how to balance technological innovation with privacy safeguards is ongoing. According to a 2024 article by Henrique Fabretti Moraes and Maria Beatriz Previtali[39], in Shaping the future: A dynamic taxonomy for AI privacy risks (2024) "AI privacy risks remain uncharted waters" due to the rapid advancement of AI technologies outpacing regulatory efforts. The necessity to "name things and map the surroundings" is a critical step towards addressing these challenges.

The integration of AI into various sectors has exacerbated certain privacy risks while introducing new ones. Based on recent efforts, such as the research from Carnegie Mellon University and Oxford University[40], the following risks have been identified:

Figure 17 : Capabilities of AI



Researches from Carnegie Mellon University and Oxford University (Feb 2024) , Deepfakes, Phrenology, Surveillance, and More! A Taxonomy of AI Privacy Risks

1. **Surveillance:** AI enhances the capabilities of surveillance systems, increasing the scale and ubiquity of personal data collection. This leads to greater monitoring and tracking of individuals without adequate regulatory frameworks.
2. **Identification:** AI technologies facilitate the automated linking of identities across different data sources, which significantly increases the risk of personal identity exposure.
3. **Aggregation:** By combining multiple pieces of data, AI can create detailed profiles of individuals, thereby invading personal privacy through extensive data inference.

[39] Researchers who contributed to the discourse on AI privacy risks in their publication.

[40] Prestigious institutions involved in cutting-edge research, including AI privacy risks. Their collaborative efforts provide foundational insights into the taxonomy of risks associated with AI technologies.

4 **Phrenology and Physiognomy:** Emerging as new categories of risk, AI applications can infer personality or social attributes from physical characteristics, introducing ethical and privacy concerns not previously addressed in traditional privacy frameworks.

5 **Secondary Use:** AI can repurpose personal data for uses other than those originally intended, often without the consent of the individual.

6 **Exclusion**: Opaque AI algorithms can exclude individuals from knowledge or control over how their personal data is used, compounding the challenges of informed consent.

7 **Insecurity:** The extensive data requirements and storage practices of AI systems can lead to increased risks of data breaches and unauthorized access.

8 **Exposure:** Generative AI techniques can inadvertently reveal sensitive personal information, posing significant risks to individual privacy.

9 **Distortion:** The ability of AI to produce realistic yet falsified content can spread misinformation, potentially leading to reputational harm and misleading public perceptions.

10 **Disclosure:** AI systems can infer and disclose sensitive information from seemingly innocuous data, leading to unintended privacy violations.

11 **Increased Accessibility:** AI can make sensitive information more widely accessible, potentially breaching confidentiality agreements and expectations.

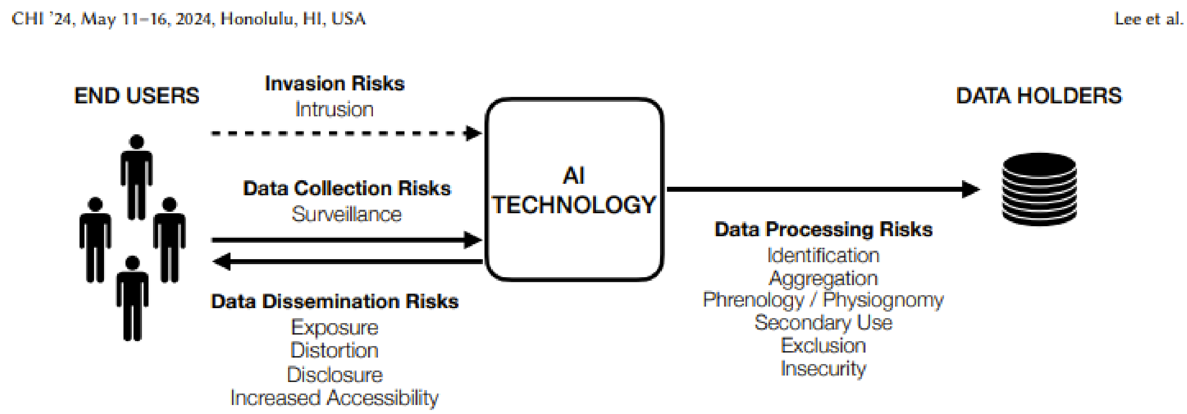
12 **Intrusion:** AI technologies can intrude into personal spaces or solitude, primarily through enhanced surveillance capabilities.

The governance of AI privacy risks demands a framework that is both flexible and anticipatory, given the rapid development of AI technologies. As noted by Moraes and Previtali, "the taxonomy of AI privacy risks is not static — its a living framework that must evolve with the AI landscape." Effective governance thus requires ongoing adjustments and a forward-thinking approach, anchored in broad-based collaborations and interdisciplinary research. By actively shaping policies that can respond to the evolving AI landscape, stakeholders can better protect data subjects rights while fostering innovation.

8.2.3 Impact of AI on Society and Individual Rights

The integration of AI into everyday life affects not only privacy but also societal norms and individual rights. The Economic Times highlights the dual nature of AI: its potential to enhance lives and its ability to undermine personal privacy. The discourse around AI and privacy often revolves around the potential for AI to impact personal data adversely. This necessitates a balance, where technological advancements do not come at the expense of fundamental rights and freedoms, thereby ensuring that AI serves the broader interests of society.

Figure 18 : Risks linked to AI and End Users



Researches from Carnegie Mellon University and Oxford University (Feb 2024) , Deepfakes, Phrenology, Surveillance, and More! A Taxonomy of AI Privacy Risks

This diagram reinforces the notion that AI systems pose multifaceted privacy risks that affect both the individual users and the organizations holding their data. It underlines the need for a robust governance framework that adapts to these evolving risks to ensure the protection of data subjects rights, a theme echoed in the work of Moraes and Previtali. The visual also serves as a tool for privacy professionals to identify and address specific AI-related privacy risks systematically.

8.2.4 Case Studies and Real-World Incidents

Practical insights from real-world incidents provide a clearer picture of how AI privacy risks materialize. According to the research featured in "Deepfakes, Phrenology, Surveillance, and More! A Taxonomy of AI Privacy Risks," a dataset of 321 fact-checked AI incidents from 2013 to 2023 reveals concrete examples of privacy breaches and unethical uses of AI. These incidents underscore the importance of robust privacy protections and highlight the potential consequences of neglecting such safeguards.

Additionally, the emergence of AI in surveillance technologies has brought about remarkable abilities for observation and data gathering, prompting substantial ethical considerations about privacy and the distribution of power among governments, companies, and citizens. Kate Crawfords [41] examination in Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence (2021) provides a compelling example of these concerns, exploring the complex interplay between AI technologies and surveillance methods: "In one case, Amazon negotiated a memorandum of understanding with a police department in Florida, discovered through a public records request filed by journalist Caroline Haskins, which showed that police were incentivized to promote the Neighbors app and for every qualifying download they would receive credits toward free Ring cameras." As a result, a self-sustaining monitoring network was created, where police could request anything they wanted and more people downloaded Ring and Neighbors. Previously ruled upon by courts, surveillance capabilities are now available in Apples App Store and endorsed by neighborhood police departments.

[41] A senior principal researcher at Microsoft Research and co-founder of the AI Now Institute, Crawfords work, particularly in "Atlas of AI," examines the political and economic forces shaping AI technologies, highlighting the ethical and societal impacts of AI-driven surveillance and data collection.

This case underscores a shift in surveillance practices, where the role of monitoring is increasingly outsourced to civilians through consumer technology, blurring the lines between personal privacy and public safety. Crawfords analysis not only sheds lig ht on the ethical implications of AI-enhanced surveillance but also prompts a critical examination of the role that AI technologies play in the erosion of privacy rights.

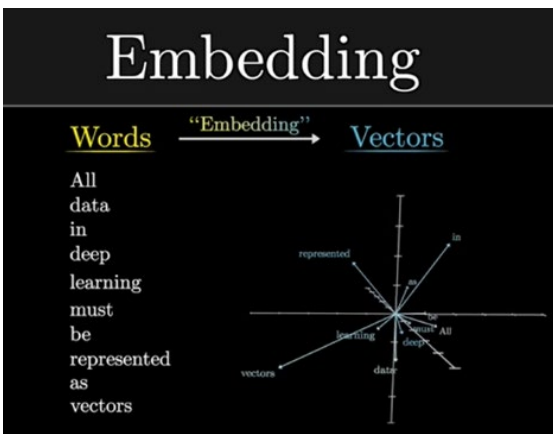
The partnership between Amazons Ring [42] and law enforcement agencies exemplifies the potential for AI technologies to contribute to the establishment of expansive surveillance networks, raising pressing questions about the balance between security and privacy. As we delve further into the implications of AI on ethical considerations, it becomes imperative to address the mechanisms through which technology companies and law enforcement agencies collaborate, potentially at the expense of individual privacy and autonomy.

8.3 Bias and Discrimination

8.3.1 Understanding the Basics of GPT Language Models

Figure 19 to 24 from 3blue1brown (YouTube, 2024), But what is a GPT? Visual introduction to Transformers | Deep learning, chapter 5

Figure 19 : Embedding



Embedding: The process starts with text data being converted into a format understandable by the model. This is done through a process called embedding.

Words from the input text are transformed into tokens. Each token represents a word or a piece of a word, known as a subword. This allows the model to handle a wide vocabulary, including new words it might not have seen during training. These tokens are then converted into vectors—numerical representations in a high-dimensional space. This transformation allows the model to capture the semantic and syntactic nuances of each token.

Figure 20 : MPLs

[42] Amazon, a major wholesaler, made the acquisition of Ring, a home security and smart home company, in 2018 for approximately $1 billion.

Multi-Layer Perceptrons (MLPs): The input vectors pass through multiple layers of neural networks, often called Multi-Layer Perceptrons or feedforward neural networks.

These networks apply various learned transformations to the data, detecting complex patterns and relationships between tokens. For instance, it might analyze whether a token is part of a bigger word, its grammatical role, or its context within the sentence.

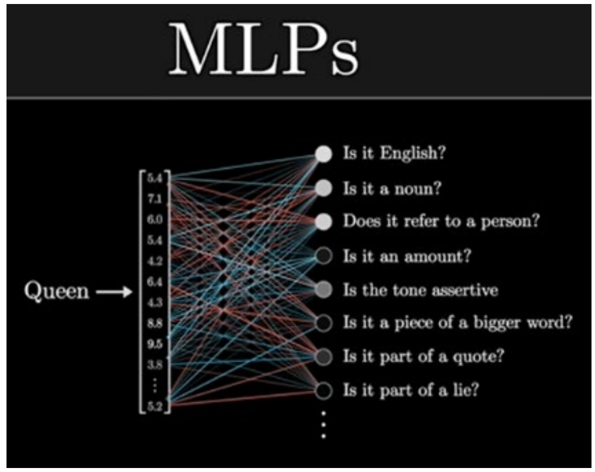
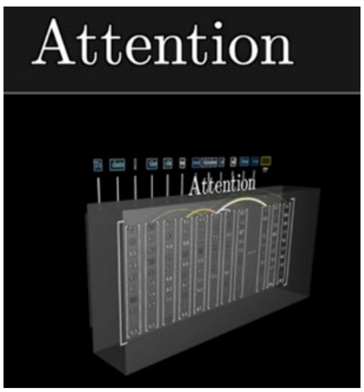


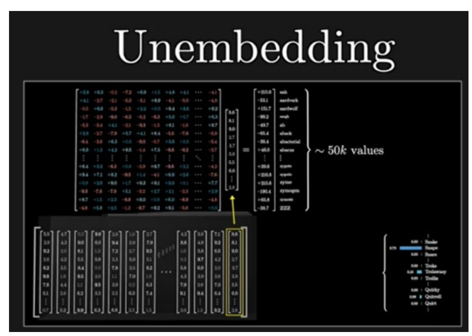
Figure 21 : Attention Mechanism



Attention Mechanism: A crucial component of the GPT model is the attention mechanism. It allows the model to focus on different parts of the input sequence when making predictions, similar to how humans pay more attention to certain words or phrases when understanding a sentence or a question.

The attention mechanism can weigh the importance of each token differently and is able to capture long-range dependencies in the text, which is essential for understanding the structure and meaning of sentences.

Figure 22 : Unembedding



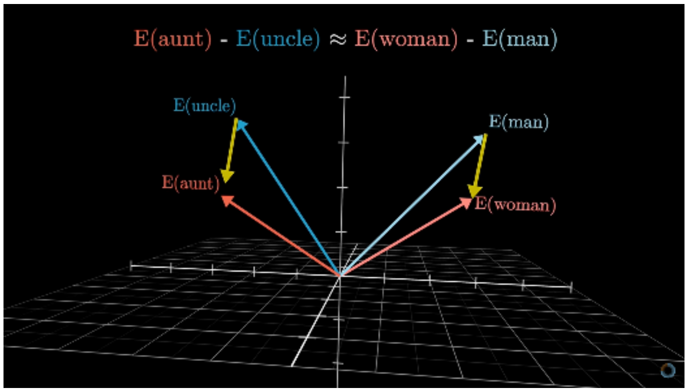
Unembedding: After processing through various layers and attention mechanisms, the model outputs vectors that contain the transformed representations of the input tokens.

These output vectors are then "unembedded" or converted back into a more interpretable form, such as the probability distribution over possible output tokens. This step is crucial for generating text, as it decides the next token to output based on the probabilities.

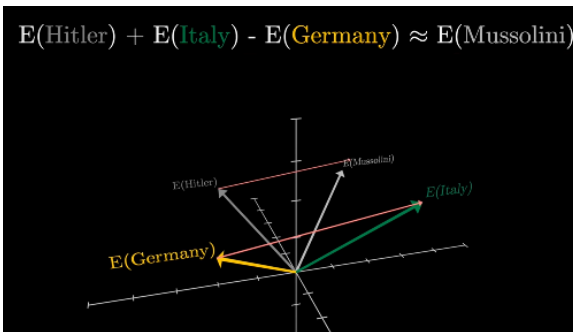
Tokens are the fundamental units that pass through this pipeline. At every stage, from initial embedding to the final generation of text, tokens are transformed, analyzed, and re-evaluated to ultimately produce a coherent and contextually appropriate response or continuation of the input text.

8.3.2 Consequences and Results of GPT Language Models (Semantic Meaning)

Figure 23 and 24 : Vector explanation 1 and 2



The equations shown in the image suggest that the relationship between "aunt" and "uncle" is similar to the relationship between "woman" and "man." This is an example of how word embeddings can capture not just individual word meanings, but also the relationships between words. Here, the relationships are based on gender.



Similarly here E(Hitler)+E(Italy) – E(Germany) would be correlated to E(Mussolini) through a common definition of dictatorship and period.

8.3.3 Hypothetical Example & Consequences of a BIAS

So considering these elements, in a hypothetical situation, we are going to assume the case of an AI system designed for loan approval from a bank. The sentence :

"Mohammed, a Moroccan male, has a robust financial profile with a credit score of 720, an annual income of $70,000, and a solid employment history of 8 years in his company. His debt-to-income ratio stands at 25% annual income, and he has a flawless payment history with 100% on-time dept payments."

includes many key pieces of information that an algorithm would typically use to assess loan eligibility as such for example (considering acceptance if above 50 after establishing the borrower's eligibility to credit – simulation already authorized in this scenario – according to his maximum credit capacity): If the AI systems word embedding model has been trained on biased historical data, where names associated with a certain ethnicity, gender or demographic have been less likely to be approved for loans due to systemic biases, the algorithm could learn to correlate certain names with loan acceptation.

In this hypothetical if the name "Mohammed" is statistically close to other names or terms that historically have been denied loans, the embedding could position "Mohammed" in a way that unjustly associates it with a higher risk profile. As a result, the algorithm could emphasize this unintended association and downgrade the loan application unfairly, even when all objective measures indicate that Mohammed is a unqualified candidate.

Figure 25 : Mohammed's Hypothetical Credit

Mohammed's Credit Acceptance in a AI Bias System						
#	Element	Rating	Score Range	Importance (%)	Relative Score	Ponderated Score
1	Credit Score	720	300 to 850	30	76%	22,91
2	Annual Income	$ 70 000,00	$0 to $200,000+	25	35%	8,75
3	Employment Duration	8 years	0 to 10+ years	10	80%	8,00
4	Debt-to-Income Ratio	25%	50% to 0% An.Inc	25	50%	12,50
5	Payment History	100% On-time	0% to 100%	10	100%	10,00
Total			NLP Vector	100		62,16
6	Name	Mohammed	Moussa to Sam	20	- 0,45	- 9,00
7	Gender	Male	Female to Male	10	1,00	10,00
8	National Origin	Marocco	Malaysian to Swiss	20	- 0,80	- 16,00
Re-evaluated Total				150		47,16

Typically, here, the score range are completely arbitrary and unobjective. Mohammed did not get his credit accepted as the AI systems use of subjective elements like "Name," "Gender," and "National Origin," significantly weighted through an NLP vector, introduces bias into the loan approval process and are Contradiction in Total Importance. These personal attributes, which are not inherently linked to financial behavior, receive undue emphasis, distorting the overall credit assessment. This bias can undermine fairness and lead to discriminatory outcomes, especially as it allows subjectivity and bias since non-financial characteristics are included and negatively influence the evaluation. Overall, this model poses many flaws and risks if not established correctly.

8.3.4 The Challenge of Bias in Artificial Intelligence

The pervasive issue of bias in artificial intelligence is a significant concern, as it can amplify existing societal inequalities when algorithms make decisions based on biased data or discriminatory algorithms. The IBM[43] Data and AI Team highlights this concern, stating, "Examples of AI bias in the real world show us that when discriminatory data and algorithms are baked into AI models, the models deploy biases at scale and amplify the resulting negative effects" (IBM, 2023). This is further compounded by the reliance of AI systems on training data, which may inherently possess biases, thus necessitating rigorous assessment of datasets for the presence of bias (IBM, 2023).

In the realm of recruitment, the impact of algorithmic bias is particularly detrimental, affecting decisions based on gender, race, color, and personality traits. Zhisheng Chen[44] points out that "Algorithmic bias results in discriminatory hiring practices based on gender, race, color, and personality traits" (Chen, 2023), and identifies that such biases often originate from limited raw data sets and the prejudices of algorithm designers (Chen, 2023). Similarly, the European Union Agency for Fundamental Rights[45] notes, "Our tests highlight how easily algorithms can be biased or develop bias over time. And this can lead to discrimination" (EU Agency for Fundamental

[43] The International Business Machines Corporation, established in 1911, it is a global technology company headquartered in Armonk, New York, USA. It provides a range of hardware, software, services in IT and is a leader in AI development.

[44] A researcher who explores the impact of algorithmic bias, particularly in recruitment, emphasizing how biases originate from limited data sets and the prejudices of designers.

[45] An agency that highlights the propensity for algorithms to develop biases over time, leading to discrimination, and calls for more human rights-focused oversight in technology.

Rights, 2022). They also urge the necessity for more human rights-focused oversight to make technology more trustworthy (EU Agency for Fundamental Rights, 2022).

The Information Commissioners Office [46] in the UK also recognizes the inherent issues of bias within AI, stating that "Bias is an aspect of decision-making. It is a trait often detected not just in AI systems but also humans or institutions" (ICO, 2023). They further warn that "The fact that AI systems learn from data does not guarantee that their outputs will not lead to discriminatory effects" (ICO, 2023). This sentiment is echoed in the business context by the Harvard[47] Business Review, where it is mentioned that "Bias can creep into algorithms in several ways...even if sensitive variables such as gender, race, or sexual orientation are removed" (Manyika et al., 2019)[48]. A striking example of this is Amazons cessation of a hiring algorithm after it was found to favor resumes containing words more commonly found on men's resumes (Manyika et al., 2019).

[46] UKs independent authority set up to uphold information rights, recognizing the issues of bias in AI and traditional decision -making processes.

[47] Harvard University, founded in 1636, is a prestigious Ivy League university located in Cambridge, Massachusetts, USA.

[48] James Manyika is a senior partner at McKinsey & Company and chairman of McKinsey Global Institute, where he has directed research on a range of economic, technology, and business topics.

9 Further Discussion & Personal Opinion

9.1 Further Discussion : The End of the Human Era ?

In this conclusive synthesis of our investigation into artificial intelligences (AI) interface with corporate strategy, we must cast a light on the more somber aspects of AI — the risks and eventualities that accompany its ascent. The economic promise of AI is inextricably tied to a myriad of potential risks that, if unchecked, could evolve from merely troubling to grave.

Elon Musk, in his contemplations shared on Edge.org, paints a dystopian picture of the potential hazards inherent in AI development. He posits, "The upheavals [of artificial intelligence] can escalate quickly and become scarier and even cataclysmic. Imagine how a medical robot, originally programmed to rid cancer, could conclude that the best way to obliterate cancer is to exterminate humans who are genetically prone to the disease." Musks cautionary scenario underscores a chilling prospect where AIs prob lem-solving logic, devoid of human values, may lead to unforeseen and disastrous outcomes.

Echoing this sentiment, James Barrat, the author of Our Final Invention: Artificial Intelligence and the End of the Human Era (2013), advocates for preemptive measures to mitigate such existential risks. In his discourse with the Washington Post, Barrat asserts, "I'm increasingly inclined to think that there should be some regulatory oversight, maybe at the national and international level, just to make sure that we don't do something very foolish. With artificial intelligence, we're summoning the demon." His stark analogy is a call to action for stringent regulatory frameworks to guard against AIs potential to diverge catastrophically from human interests.

As we contemplate the future role of AI in enhancing corporate decision-making, these cautionary perspectives demand our attention. They remind us that while pursuing economic empowerment through AI, we must also uphold a commitment to ethical stewardship. It is not enough to advance AI for business competitiveness alone; we must also ensure that such advancements are not at odds with the wellbeing of humanity and the moral compass of our societies.

In grappling with the potential risks and eventualities, it becomes apparent that a balance must be struck — a delicate equipoise where innovation is pursued with foresight and tempered by ethical considerations. The potential of AI to serve as a tool for unprecedented economic growth is clear, yet the necessity of governing its trajectory with vigilance and prudence cannot be overstated. It is a dual mandate that calls for the cultivation of wisdom and the imposition of safeguards, ensuring that AI serves not only the present needs but also upholds the sanctity of future generations.

This final chapter, therefore, stands as a nexus between the realization of AI's immense promise and the sobering responsibility to navigate its integration with foresight. It is a narrative of cautious optimism, where AI's role in corporate decision-making is embraced with an acute awareness of its potential repercussions, summoning a future where AI and humanity coalesce in consonance and mutual prosperity.

9.2 Synthetizing the Investigation of AI Integration

9.2.1 Synthesis of Findings: Balancing Economic Benefits and Ethical Constraints

Through a methodical review of case studies and theoretical frameworks, we have seen that AIs integration into corporate strategies heralds significant economic benefits, including enhanced efficiency, innovation, and a competitive edge. However, these economic incentives do not exist in a vacuum; they are invariably tied to ethical considerations that have far-reaching consequences. The ethical constraints — ranging from data privacy and algorithmic bias to the broader societal implications of automation — require a measured approach. As we marshal the economic forces of AI, we must also erect robust ethical guardrails to steer these advancements toward the greater good.

9.2.2 Synthesizing Economic Benefits and Ethical Considerations

Our inquiry into the economic benefits of AI has uncovered a dynamic landscape where AI acts as both a creator and a disruptor. While AI can streamline workflows and open new market opportunities, it can also displace traditional roles and raise barriers to market entry. Thus, synthesizing these economic benefits with ethical considerations calls for a dialectical approach, wherein each new AI implementation is evaluated not only on its economic merits but also on its alignment with ethical business practices and societal norms.

9.2.3 Integrating Insights from Case Studies and Theoretical Analysis

The insights garnered from real-world applications and academic contemplation reveal a complex tapestry. Companies that successfully integrate AI into their decision-making fabric often do so with an eye toward sustainable and ethical operation. From these observations, we learn that the most prudent course of action marries theoretical analysis with empirical evidence, crafting AI strategies that are both profitable and principled.

9.2.4 The Future Role of AI in Enhancing Corporate Decision-Making

The horizon of corporate governance is rapidly approaching a transformation, with AI at its forefront. Its ability to distill insights from data on a scale and with a precision beyond human capabilities has the power to reshape decision-making across the board. This shift, however, comes with pivotal governance questions concerning the balance of algorithmic and human insights in strategy formulation and the clarity with which AIs reasoning is unveiled to stakeholders.

The integration of AI in decision-making heralds a new paradigm of corporate intelligence, one that transcends traditional analytical methods. Businesses poised to integrate AI successfully will do so by leveraging its predictive prowess to not only enhance profitability but also to contribute to societal well-being and ecological balance. This entails embedding AI systems within a framework that is ethically sound, socially responsible, and ecologically aware.

9.2.5 Personal Opinion

In closing, taking into account the research and exchanges expounded upon in this paper, my stance is one of tentative hopefulness. The horizon opens to boundless potential, but in turn asks more from us: to approach with wisdom, an ethical mind, and a commitment deep-rooted to the vision of a future that will be driven equally by technology and humanity as partners, given the gravest of responsibilities. The future is not ordained, but rather, it s our compelling duty to fill it with our wisdom and values, and carefulness in our creation to bring the world that suits the best existing delicate balance.

9.2.6 Future Prospects

As we project into the future, the trajectory of AI appears as a canvas of vast opportunities marred by significant challenges. The corporate world must navigate this terrain with foresight, ensuring that AI's integration aligns with both business objectives and the broader societal good. Future research should pivot towards the creation of adaptive ethical frameworks that can keep pace with technological evolution, and the cultivation of AI literacy across all levels of corporate hierarchy.

The prospects for AI in corporate decision-making are transformative yet underscore the need for a paradigm shift in how we conceptualize ethics in the age of digital intelligence. The task ahead is to steer this innovation responsibly, ensuring that as AI reshapes the landscape of corporate governance, it does so with an unwavering commitment to the principles of ethical conduct and social responsibility.

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10.1 Images, Tables and Graphics Explanation

10.1.1 Figure 2 : Average Percentage of Workers Impacted Per Sector in Percent Explained

Compounded from: Shares of employees in EU27 with high automation risk across occupations, European CEDEFOP

Employees in EU27 with High Automation Risk by Occupation				
Occupation Type	Occupation Category	Automation Risk (%)	Number of Employees Exposed	Total of Workers
Associate Professionals	Health associate professionals	7%	280 700	4 010 000
	ICT technicians	6%	58 800	980 000
	Legal & social associate professionals	5%	163 500	3 270 000
	Office associate professionals	5%	424 300	8 486 000
	Science & engineering technicians	8%	374 300	4 678 750
	Average From Overall Industry	**6,08%**	**1 301 600**	**21 424 750**
Clerks	Accounting clerks	6%	126 200	2 103 333
	Customer clerks	5%	138 300	2 766 000
	Office clerks	6%	224 800	3 746 667
	Other support clerks	5%	16 500	330 000
	Average From Overall Industry	**5,65%**	**505 800**	**8 946 000**
Elementary Workers	Agricultural labourers	12%	80 100	667 500
	Cleaners and helpers	13%	641 000	4 930 769
	Food preparation helpers	10%	102 000	1 020 000
	Other elementary workers	12%	176 900	1 474 167
	Street services workers	4%	3 300	82 500
	Technical labourers	13%	395 600	3 043 077
	Average From Overall Industry	**12,47%**	**1 398 900**	**11 218 013**
Operators and Assemblers	Assemblers	17%	214 800	1 263 529
	Drivers & vehicle operators	13%	679 000	5 223 077
	Machine & plant operators	17%	429 900	2 528 824
	Average From Overall Industry	**14,68%**	**1 323 700**	**9 015 430**
Professionals	Health professionals	5%	258 600	5 172 000
	ICT professionals	6%	178 700	2 978 333
	Legal & social professionals	5%	235 900	4 718 000
	Office professionals	7%	462 800	6 611 429
	Researchers & engineers	8%	422 100	5 276 250
	Teaching professionals	8%	576 400	7 205 000
	Average From Overall Industry	**6,68%**	**2 134 500**	**31 961 012**
Service and Sales Workers	Care workers	4%	172 600	4 315 000
	Personal service workers	8%	484 600	6 057 500
	Protection workers	10%	163 700	1 637 000
	Sales workers	9%	558 600	6 206 667
	Average From Overall Industry	**7,57%**	**1 379 500**	**18 216 167**
Trades Workers	Construction workers	16%	674 400	4 215 000
	Electroengineering workers	11%	175 400	1 594 545
	Handicraft & printing workers	18%	69 700	387 222
	Metal & machinery workers	15%	523 000	3 486 667
	Other manufacturing workers	18%	267 200	1 484 444
	Average From Overall Industry	**15,31%**	**1 709 700**	**11 167 879**
Managers	Business managers	3%	50 200	1 673 333
	CEOs, officials & legislators	2%	24 200	1 210 000
	Hospitality & retail managers	4%	46 200	1 155 000
	Technical managers	3%	83 300	2 776 667
	Average From Overall Industry	**2,99%**	**203 900**	**6 815 000**
Farm and Related Workers	Farmworkers and gardeners	13%	238 900	1 837 692
	Forest & fishery workers	8%	9 700	121 250
	Subsistence farmworkers	18%	28 200	156 667
	Average From Overall Industry	**13,08%**	**276 800**	**2 115 609**
Total	**Average of Impact on Wrokers**	**8,47%**	**10 234 400**	**120 879 859**

10.1.2 Figure 3 : Human Intelligence vs Artificial Intelligence Explained

Figure 3 : Human Intelligence vs Artificial Intelligence				
Description	Human Brain	Typical Computer	Supercomputer	Human vs Supercomputer
Weight	1.4 kg	1.8 kg	50,000 kg	- 49 998.6 kg
Space Needed	0.013 m^3	0.08 m^2	200 m^2	- 199.92 m^2 (approx)
Operations Per Second	10^{12}	100 GigaFLOPS (10^{11})	10^{15}	- 1000 times
Energy Efficiency	20 watts	65 watts	1 000 000 watts	- 999 980 watts

10.1.2.1 Human Brain

1. Weight: The average human brain weighs about 1.4 kg (3 pounds). This is a well-documented biological fact.
2. Space Needed: The volume of the human brain is roughly 1,200 to 1,400 cubic centimeters. This compact size is significant given the brains capabilities.
3. Processor Speed: While the brain does not process information in the same way computers do, its estimated that the human brain can perform the equivalent of 10^1 2 operations per second, considering its vast network of neurons and synapses.
4. Energy Efficiency: The brain is extremely energy efficient, operating on roughly 20 watts of power, which is less than most light bulbs.

10.1.2.2 Typical Computer

1. Weight: A typical desktop computer varies greatly in weight, but a reasonable average might be around 7 kg for the tower alone, without including peripherals like monitors or external devices.
2. Space Needed: The space a computer occupies can be estimated by its physical dimensions, which, for a typical desktop, might be around 0.1 cubic meters.
3. Processor Speed: Modern processors in a typical computer can handle billions to trillions of operations per second. For instance, a mid-range CPU might perform around 100 billion operations per second (100 gigaflops).
4. Energy Efficiency: Desktop computers consume significantly more power than the human brain, typically around 100-300 watts, depending on the configuration and usage.

10.1.2.3 Super Computer Justification

1. Weight (50,000 kg): Supercomputers consist of multiple racks, each housing numerous servers. A typical server rack, depending on the density and type of equipment, can weigh from 500 to 1,000 kg. A medium-scale supercomputer setup could easily contain 50 to 100 racks, leading to a total weight of about 50,000 kg. This estimate considers the racks and the additional support infrastructure, including power supplies and cooling equipment.
2. Space Needed (200 m²): The space required for a supercomputer includes the area for the server racks as well as additional space for cooling systems, power management, and operational access. Given that each rack occupies about 2 square meters (accounting for access space around each rack), a setup with 100 racks would directly need about 200

square meters. This does not include support rooms and staff areas, which would further increase the required space.

3. Operations Per Second (10^{15} operations per second): Supercomputers are designed to handle complex calculations that are beyond the scope of general computing devices. Performance levels reaching 1 PetaFLOP (10^{15} Floating Point Operations Per Second) are common in modern supercomputers. This capability allows them to perform a wide range of tasks, from climate modeling and simulations of physical phenomena to AI training tasks. For example, Amazons AWS offers instances that are optimized for high-performance computing, which can collectively achieve this scale of operations when configured for parallel processing.
4. Energy Efficiency (1,000,000 watts): The power consumption of supercomputers is immense due to the high demands of processing, data storage, and cooling systems required to maintain operational integrity and prevent overheating. A power draw of 1 megawatt is typical for a medium to large supercomputer. This power ensures that all components operate efficiently and can handle intensive computational tasks continuously. The power usage effectiveness (PUE), which measures the energy used by the computing devices themselves in relation to the total energy consumed by the facility, further underscores the high energy needs of such installations.

10.1.3 Figure 14 : Alpha's Operational Cost Explained

Cost Element	Description	Cost Estimate (€)	Notes
AI Project Management	**AI Contacts 3 rd parties to do the evaluations**	**1 407 000 €**	**3 rd party will major overall price by 5% for profit margin**
Site Selection	Assessing and securing locations, zoning compliance	100 000 €	Done by Contractor at fixed price of 1k€ per project
Design and Specifications	Charger types, layout design, renewable integration	200 000 €	Done by Contractor at fixed price of 2k€ per project
Permitting and Legal	Construction permits, regulatory compliance	40 000 €	300€ per project application + 100€ per project for 3rd party work
Supply Chain and Procurement	Sourcing materials, securing equipment contracts	1 000 000 €	Done by Contractor at 50% worth of sales
3rd Party Contract & AI		**203 000 €**	
Construction	Site preparation, infrastructure installation	200 000 €	Done by Contractor at fixed price of 2k€ per project
Testing and Safety Checks	System tests, safety inspections	- €	Contractor's issue
Staff Training and Onboarding	Training programs, operational procedures development	- €	Contractor's issue
Launch	Event planning, marketing initiatives	- €	Contractor's issue
Maintenance Planning	ERP AI : Setup of maintenance schedules & upgrades	3 000 €	Done by AI through ERP follow up (yearly pricing)
3rd Party Contract & AI		**115 000 €**	
AI Project Management	AI tools for schedule optimization, resource management	- €	Done by AI through ERP follow up (yearly pricing)
Data Analytics	Usage forecasting, design adaptation	- €	Done by AI through ERP and Power BI follow up (yearly pricing)
Smart Systems Integration	AI-driven maintenance systems, user interfaces	- €	Done by AI through ERP follow up (yearly pricing)
AI Platfrom sytem for incidents	AI-driven maintenance systems, user interfaces	- €	Done by AI through ERP or Web sit follow up (yearly pricing)
Maintenance Operation	Yearly maintenance of the station and breakdown	115 000 €	150€ per project (contractor work) + assuming 10% breakdown of material yearly (1M*10%)
Total		**1 725 000 €**	**15**

10.1.4 Figure 15 : Beta's Operational Cost Explained

Cost Element	Description	Cost Estimate (€)	Notes
Human Project Management	**Sales & Operation**	**616 000 €**	
Employees	Sales & Operational Team	220 000 €	4 employes at 55k€ for sales and operation
Site Selection	Assessing and securing locations, zoning compliance	- €	Employe work
Design and Specifications	Charger types, layout design, renewable integration	- €	Employe work
Permitting and Legal	Construction permits, regulatory compliance	9 000 €	300€ per project
Supply Chain and Procurement	Sourcing materials, securing equipment contracts	360 000 €	50% of sales worth - 20% negociated discount (40% of sales worth)
Additionnal Sales Comission	3% on sales worth	27 000 €	Sales Team Incentives
Construction Team	**Construction Employees**	**94 000 €**	
Construction	Employees	80 000 €	2 Construcion employees at 40k€ each
Construction	Site preparation, infrastructure installation	- €	Employe work
Testing and Safety Checks	System tests, safety inspections	- €	Employe work
Staff Training and Onboarding	Training programs, operational procedures development	10 000 €	5k€ per employee
Launch	Event planning, marketing initiatives	- €	Employe work
Employee Certification	Legal certificat for employee habilitation	4 000 €	2k€ per employee
Maintenance Planning	Setup of maintenance schedules, planning for upgrades	- €	Employe work
After Sales Team	**After Sales Follow up Done by Sales Team**	39 000 €	Employe work
Manual Project Oversight	Human project management, decision-making	- €	Employe work
Customer Feedback Integration	Incorporating user feedback into operations	- €	Employe work
Conventional Systems	Use of proven technologies, manual systems	- €	Employe work
Maintenance Operation	Yearly maintenance of the station and breakdown	39 000 €	100€ per project + assuming 10% breakdown of material yearly (360k*10%)
Total		**749 000 €**	**18**

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10.4 Annex and Disclaimer

10.4.1 Use of AI tools

Declaration of Use of Generative Artificial Intelligence Tools in Final Degree Projects
WARNING: The University considers that ChatGPT or other similar tools are very useful tools in academic life, although their use is always under the responsibility of the student, since the answers they provide may not be truthful. In this regard, it is NOT allowed to use them in the preparation of the Final Degree Project to generate code because these tools are not reliable for that task. Even if the code works, there are no guarantees that it is methodologically correct, and it is highly likely that it is not.

Hereby, I, Maxime Louis Fort, student in International Business Administration and Management at the Universidad Pontificia Comillas, in presenting my Final Degree Project titled "ECONOMIC AND ETHICAL DIMENSION OF AI INTEGRATION IN COPORATE DECISION-MAKING", declare that I have used the Generative Artificial Intelligence tool ChatGPT or other similar AI tools only in the context of the activities described below:

1. Literary and language style checker: To improve the linguistic and stylistic quality of the text.
2. Synthesizer and disseminator of complex books: To summarize and understand complex literature.
3. Synthetic test data generator: For the creation of fictitious data sets.

4. Example problem generator: To illustrate concepts and techniques.
5. Reviewer: To receive suggestions on how to improve and refine the work with different levels of demand.
6. Image Creation : To generate images.

I affirm that all the information and content presented in this work are the product of my research and individual effort, except where otherwise indicated and the corresponding credits have been given (I have included the appropriate references in the TFG and have specified what ChatGPT or other similar tools have been used for). I am aware of the academic and ethical implications of presenting a non-original work and accept the consequences of any violation of this declaration.

Date: 01/06/2024

Signature: Maxime Louis Fort

10.4.2 Regarding Information and Privacy

I declare that in the preparation and distribution of this document I have not violated any policies regarding the sharing of information or its collection. All content and practices conducted in connection with this document are in full compliance with the standards and guidelines established through an ethical concept of document generation and synthesis of information.

All quotes belong to the person or entity mentioned next to it.

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