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Application of the Latest Generation of AI in New Product Development Process

Archival Research based on Secondary Data in the form of Relevant Publications

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Description

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Abstract

Artificial Intelligence (AI) refers to a disruptive technology that aims to reproduce human-like intelligence companies' purpose is to be used as an assistant in day-to-day tasks in order to save time and resources. This technology tends to be more and more used by companies, especially for marketing purposes. This study aimed to see how the last generations of AI technology could be used for each step of the New Product Development (NPD)'s process. It based itself on a framework that defined NPD in 8 steps: idea generation, idea evaluation, concept development, marketing strategy, business analysis, product development, test marketing, and commercialization. To reach its goal, this study used a qualitative analysis through Archival research based on secondary data from relevant sources. The analysis is based on a review of both academic and non-academic sources like research papers, case studies, journal articles, etc. The results proved that AI already is useful and will tend to be even more useful in the future for product development. But it also showed that marketing strategy and commercialization are areas where there is for the moment more development than for the other steps of the NPD process. The results have also shown that nowadays, AI seems to be more powerful while being used as an assistant than when it is working on its own.

Keywords/tags (subjects)

New product development, artificial intelligence, generative AI, idea generation, idea evaluation, concept development, marketing strategy, business analysis, test marketing, commercialization

Miscellaneous (Confidential information)

No confidential information was disclosed in the thesis.

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1 Introduction

Artificial Intelligence, or AI, is a field that incorporates various technologies and methodologies to replicate human intelligence in machines. The definition of AI remains unclear and varies from one source to another. This versatility of definitions is mainly due to the multiple ranges of applications that AI encounters. The concept of AI has different interpretations among experts. Some such as the European Parliament define it as machines imitating intelligent human behavior, while others highlight its ability for “learning, understanding, estimating, problem-solving, suggestion, and decision-making in various disciplines” (Khaleel et al., 2023).

The fascinating journey of AI dates back to the mid-20th century, when multiple brains such as Alan Turing paved the way for its conceptualization. They laid a solid foundation for machine intelligence, which has revolutionized the modern world. The 1950s and 1960s saw remarkable advancements in AI with the creation of pioneering systems like the Logic Theorist and General Problem Solver.

Throughout the evolution of AI, we’ve witnessed both groundbreaking advancement and stagnation phases. These so-called "AI winters" emerged when expectations outpaced the technology's capabilities. The interest in AI has increased during the last decades due to exciting advancements in machine learning, neural networks, and deep learning.

Significant advancements in the field of AI have been made in the last few years, showing its immense potential in solving difficult problems. One such landmark moment was when Deep Blue, created by IBM, triumphed over a chess grandmaster. This groundbreaking achievement demonstrated how AI can excel in strategic problem-solving. Another notable milestone was AlphaGo's remarkable victory against human champions in the ancient game of Go.

The world of AI is constantly evolving and transforming various industries and everyday lives. With applications going from natural language processing to computer vision while possibly being for autonomous vehicles, there is a giant possible field of application available. Artificial intelligence is for example being widely integrated into retail and E-commerce. Oosthuizen pointed out that “AI is transforming how retailers operate. AI shifts retailers to move away from the traditional way of doing business and opens up new opportunities within the value chain” (Oosthuizen, 2021) and Zhiwei explained that AI was becoming “increasingly prevalent in ecommerce” (Zhiwei, 2023).

Walmart has for example utilized an AI tool and an augmented-reality app to better manage their restocking whereas AliBaba has implemented it in their marketing strategy. On the other hand, some promising papers have shown the possible applications of AI. Jarek and Mazurek presented that with the help of the information gathered by a chatbot, new beer recipes could be developed and launched while Daqar showed that AI could be utilized to detect the spread of deadly infectious diseases.

To sum up, the definition and historical evolution of AI portray a rapidly evolving field that has transitioned from theoretical concepts to tangible applications.

1.1 Background, motivation, and purpose

The ever-changing landscape of business and technology, coupled with the indomitable entrepreneurial spirit, has piqued the curiosity and captivated the attention of the authors both being business students. The rapid evolution of artificial intelligence has emerged as a fascinating subject that authors are eager to explore and delve into further. As these innovative technologies continue to shape the world, the intrigue surrounding their impact on various industries fuels a desire to uncover new insights and shed light on their transformative potential.

The shared interest that the authors have in technology, startups, and the ever-evolving business environment serves as a powerful motivator for their research. Their curiosity is fueled by the profound impact that artificial intelligence has been making in the world of new product development. By studying the changing role of AI in this field, they aim to stay ahead of the curve and unlock innovative strategies that can propel businesses to new heights of success. The dynamic nature of technology and startups provides them with an exciting landscape to explore, as they uncover groundbreaking insights that pave the way for future advancements and transformative growth. Their shared fascination with artificial intelligence is not just limited to mere curiosity, but it also reflects a deep understanding and nuanced perspective. They approach this revolutionary technology with a delicate balance of optimism and caution, recognizing its immense potential while acknowledging the possible risks and challenges that it might bring. This thoughtful approach ensures that they harness the power of AI while being mindful of its ethical implications and potential societal impact. They see AI not only as a productivity tool but also as a creative catalyst that can usher in an unprecedented era of ideation, design, and go-to-market for startups. Their

enthusiasm is based on the belief that artificial intelligence offers companies the door to sustainable, scalable, and disruptive entrepreneurship. But while they acknowledge the transformative potential of AI, they also view AI's interest in the new product development process from a more moderate perspective. Their concerns center around the unintended consequences and ethical implications of artificial intelligence. They remain concerned about potential impacts on society, including job losses, difficulty making ethical decisions, and maintaining human-centered behavior in an increasingly artificial intelligence environment. Their cautious approach is driven by a conscious need to integrate technology while adhering to sustainable and ethical business practices.

Their collaboration on this thesis is rooted in their desire to navigate the complex and multifaceted relationship between artificial intelligence and the emergence of new products. The primary objective of the authors is to meticulously identify, diligently analyze, and comprehensively elucidate the multifaceted impacts of artificial intelligence throughout the entire spectrum of new product development. By harnessing the power of cutting-edge technology, they skillfully delve into every stage of the process, shedding light on how AI influences each step of new product development. The authors of this study aim to deliver a comprehensive and nuanced perspective that goes beyond the surface-level discussion of AI's potential in new product development. They aim to shed light on the immense possibilities AI holds for revolutionizing this field, while also delving into the crucial examination of its potential pitfalls and behavioral considerations. By presenting a multidimensional analysis, they ensure that readers gain a well-rounded understanding of both the promises and challenges associated with integrating AI into product development processes.

Moreover, the authors see an interest in this subject due to AI’s interest in business. AI can have an impact and change almost all areas of a business such as decision-making, automation of some tasks, increased productivity, and many more applications. “The Big-Data along with Artificial Intelligence is becoming the new “mother of innovation”, allowing businesses to strategically make decisions considering the business analytics to align with their business goals, gain competitive advantage and, continually assess what improvements to be incorporated to ensure its success.” (Chaveesuk et al., 2019). Not only exists the possibility of improved decision making but there is also a possibility to create automation in factories. “AI can streamline operations through automating

manual tasks" (Oosthuizen, 2021). What is stated here means that AI not only can automate some manual tasks but also that AI can play a general role in the streamlining of operations. Therefore, AI will majorly change business functioning and forms in the next years, engaging interests and reasons to study this subject for the authors.

The primary objective of this thesis project is to present a variety of available AI tools and applications that could help businesses in their decision-making processes as well as their time-to-market. The authors are committed to offering invaluable insights that embrace the latest technological advancements. By doing so, they aim to equip readers with actionable strategies that have the potential to revolutionize various industries and pave the way for unprecedented success. By combining their different perspectives, they hope to give readers a deeper understanding of the possibilities for applying artificial intelligence to new product development and encourage discussions regarding this subject.

1.2 Research objectives, questions, and approach

This study has a goal to define the way artificial intelligence can be used for each step of a new product development. To realize this task, the following research objective:

(RO1) Find out how the new generation of AI can be used to help decision-making in the different steps of new product development through archival research based on secondary data in the form of relevant publications.

To accomplish this task, we have settled on one main research question and eight sub-questions:

RQ1: How the new generation of AI can be used to help decision-making in the different steps of new product development?

RQ1.1: How the new generation of AI can be used to help decision-making in the idea generation stage of new product development?

RQ1.2: How the new generation of AI can be used to help decision-making in the idea evaluation stage of new product development?

RQ1.3: How the new generation of AI can be used to help decision-making in the concept development stage of a new product development?

RQ1.4: How the new generation of AI can be used to help decision-making in the marketing strategy stage of new product development?

RQ1.5: How the new generation of AI can be used to help decision-making in the business analysis stage of new product development?

RQ1.6: How the new generation of AI can be used to help decision-making in the product development stage of new product development?

RQ1.7: How the new generation of AI can be used to help decision-making in the test marketing stage of new product development?

RQ1.8: How the new generation of AI can be used to help decision-making in the commercialization stage of new product development?

1.3 Thesis structure

This thesis will be divided into six different chapters. This first introduction chapter presents the topic and introduces the authors' backgrounds, motivations, and purposes for doing this paper as well as introducing the research objective, questions, and approach. It is followed by a literature review in chapter two to introduce each concept of this thesis for them to be understandable for the reader as well as explain the research framework. The third chapter has a goal to describe the study approach. The fourth chapter will present the secondary data we collected in accordance with the research objective and question. The fifth chapter will look into the main findings and evidence of the usage of AI in each step of product development. Chapter six will be a conclusion with a summary of the key findings.

2 Literature review

2.1 Artificial Intelligence

2.1.1 History

Verma stated that “Artificial intelligence is that human intelligence can be transferred to machines to execute tasks from the simplest to the most complex. The objective of artificial intelligence is to learn, do reasoning & execute the activities.” (Verma et al., 2021)

Although the attention toward artificial intelligence (AI) has drastically increased in recent years, AI has been around for quite some time. Salesforce (2022) provided an overview of its history:

- In 1950, Alan Turing proposed a test of machine intelligence in his publication called “Computer Machinery and Intelligence” which enticed future authors and scientists to delve into this topic.
- John McCarthy was the first scientist to use the term “artificial intelligence” in 1955 and from there on, a rapid growth was launched on the subject of AI.
- In 1961, the world witnessed the appearance of the first industrial robot Unimate, and in1965 the first “expert system” was created. It was a form of AI developed to replicate the thinking and decision-making abilities of human experts. This system was presented to the market and made public in 1980 under the name XCON.
- The first driverless car was proposed by Ernest Dickmanns and his team at Bundeswehr University of Munich in 1985.
- In 1997, Windows released a speech recognition software.
- In 2003, NASA landed two rovers on Mars that navigated the surface without human intervention.
- In 2006, entertainment and communication companies such as Netflix and Facebook started utilizing AI in their daily activities.
- In 2016, a robot named Sophia was created by Hanson Robotics. It became the first “robot citizen” as it possesses a human appearance, and the ability to replicate emotions and communicate.

- 3 years ago, OpenAI started testing GPT-3. By using Deep Learning, it is capable of creating content almost indistinguishable from the one created by humans.

As stated by Ruiz-Real et al. AI is not anymore used for limited applications and being restricted by hardware limitations as it used to be in the past century, but as turned to being a “vital element for the development of industry and services of 21st-century society.” (Ruiz-Real et al., 2021)

2.1.2 Definition

We are now able to find multiple definitions of artificial intelligence that each resemble one another:

“Artificial intelligence is the name used for systems which may have similar reactions as intelligent behavior of human beings” (Soltani-Fesaghandis & Pooya, 2018).

“Artificial intelligence (AI) is the system's ability to interpret data and leverage computers and machines to enhance humans' decision-making, problem-solving capabilities, and technology-driven innovativeness” (Haenlein & Kaplan, 2019).

“Artificial intelligence (AI) is a disruptive technological development that, together with robotics, is changing the operating model in companies in each and every one of its basic functions” (Choy & Ozkan, 2019).

“AI can be defined as a set of methods enabling to reproduce human behavior to solve high complexity problems, such as speech recognition, linguistic translation, and image analysis” (Trinh et al., 2021)

“AI refers to computer algorithms that mimic cognitive processes or activities observed in living organisms. AI can be utilized in tasks such as learning, understanding, estimating, problem-solving, suggestion, and decision-making in various disciplines, including the engineering design process.” (Aattouri et al., 2023). “Modeling of an artificial intelligence-based enterprise callbot with natural language processing and machine learning algorithms,” (Aattouri et al., 2023)

Based on these definitions, the authors were able to create a more general one that is better suited for the new product development process:

Artificial intelligence is a disruptive technology that aims to reproduce human-like intelligence. Nowadays, companies utilize it as an assistant in each stage of the new product development to save time and resources.

2.1.3 Some of the most popular AI

As more and more AI tools are being developed and offered to the public, several are becoming increasingly popular.

ChatGPT was offered to the public by Open AI in November 2022. It's based on their GPT3.5 implementation but it was not the first version usable. Earlier versions of GPT were already utilized but they were only accessible through an API. ChatGPT is an AI-powered chatbot that relies on constant evolution. GPT-4 was released in March 2023 and enabled the chatbot to become even more performant. Microsoft made a significant investment in Open AI and now owns 49% of its stock. This allows users to generate automated responses based on a prompt.

Dall-E was also developed thanks to Open AI's GPT implantation in 2021. It's a system that was trained on a large set of images and their description (Kerner, 2023). This gave it the capacity to make connections through different mediums. Its first version was capable of connecting words to visuals. In 2022, Dall-E 2 was launched and provided the public the opportunity to create images based on a prompt, a sentence, and a description.

Adobe Podcast AI was launched in the end of 2022 and has for objective to help individuals create "high-quality podcasts and voiceovers that sound professional" (Abode, 2023). The most important feature of this AI is this speech enhancing tool that removes background noise automatically. This tool is great for any company that what to reduce their time on editing.

Very recently, on the 9 of December, Google released a new AI system called Gemini AI. The objective of this AI is to be a multimodal system "from the ground up" (*Gemini: Google's latest and greatest AI model*, 2023). Normally a multimodal is put together by connecting single models such

as text, audio, and images as a secondary stage. Every model is created independently from the other and then they are all connected. What Gemini has launched is a multimodal that is connected from the start. It gives it the ability to make connections between each dimension and provide the best possible response. This has brought AI a step closer to having human-like intelligence as it can understand the environment and the world like humans do. This system will come into action on the 13 of December 2023 and might be a game changer for organizations.

2.1.4 Generative AI

One of the primary types of AI today is called Generative AI. It can produce various types of content such as text, images, audio, etc. It has been creating a certain kind of buzz thanks to the user-friendly interfaces it can offer while still creating and offering high-quality content in a matter of seconds according to a prompt. This type of AI has a very particular feature, it can learn and improve over time. As the AI's capacity to create is based on the data it is given, the more data it possesses, the more accurate and refined the recommendations and answers become. Generative AI is very valuable in the creative field as its core objective is to mimic the creativity and productivity of human beings, but it’s not limited to that. Here are some of the used cases of Generative AI.

Generative AI, as Lawton (2023) explained, can automate some of the business functions such as the writing of content, summarizing complex information, offering personalized assistance to customers with chatbots, writing reponses for emails, improving the video presenting a product and so one. This helps enhance the productivity of a company by reducing time and minimizing risks.

2.1.5 Its AI models

Generative AI relies on some technological assets such as natural language processing (NLP), machine learning, deep learning, and so on.

NLP “refers to the branch of computer science—and more specifically, the branch of artificial intelligence or AI—concerned with giving computers the ability to understand text and spoken words in much the same way human beings can.” (IBM, 2023) This system breaks down the sentences grammatically and structurally to be able to recognize the semantic meaning of words. This helps the program to possibly understand emotions conveyed in a sentence. Hirschberg &

Manning, 2015 explained that NLP can be utilized in a range of different situations “including machine translation, sentiment analysis, information extraction, speech recognition, and conversational agents” (Khaleel et al., 2023)

This enables the computer to understand human speech and be able to respond and therefore communicate. Frontier pointed out that “Natural language processing (NLP) tools allow companies to obtain incomparably more detailed information about the opinions associated with the words in the text and the emotions of consumers hidden in it.” (Gerlich et al., 2023).

NLP is for example used as a chatbot by companies to provide a more personalized customer experience and therefore offer a 24/7 virtual assistant to the customers. This also helps companies gain a significant amount of data to better their marketing strategies. Nestle is a great example of this. They use NLP to generate personalized content for each of the targets which leads to an increase in sales. Moreover, NLP is considered a great tool for spam detection which can help companies eliminate risk and have better returns as all the data they will be working with is considered clean data.

Machine learning is an AI tool that uses existing data to make predictions and inferences without rely on a fixed program. Instead, this capable of analyzing data sets to recognize patterns and similarities (Salehi & Burgueño, 2018). Machine learning devices can analyze big data[1] and therefore inform marketers about the correct course of action to take. This leads marketing strategies to be more efficient and effective as well as not repeating the same mistakes.

2.1.6 Other AI models

Other technological assets exist and are being used very frequently for different types of AI including generative. The authors also wanted to point out a few that they thought were interesting to know the context of this thesis.

ANN: Artificial Neural Networks are created to mimic the biological neural network. It uses incoming data to learn to make decisions like humans over time.

CNN: Convolutional Neural Networks is used to mimic the animal visual cortex thanks to its multilayer neural network. This system is used to detect simple structures in an image to form a more complex image.

RNN: Recurrent Neural Networks can analyze sequential data. It can remember past inputs and therefore provide output based on temporality and context.

GANs: Generative Adversarial Network is based on 2 neural networks: the generator, whose role is to create data samples, and the discriminator, whose role is to evaluate the authenticity of the samples. Together they are capable of creating high-quality content such as images and 3D models.

Transformer models: They rely on a self-attention mechanism that gives the possibility to train bigger models without having to label all the data before importing it. It's capable of recognizing connections between words across a large amount of information.

2.1.7 Limitation of artificial intelligence

AI has its limitations that are very important to take into account. First of all, AI requires a large amount of data to function and give good-quality results (Kunerth, 2023). This can be a limit if the subject that is to be analyzed is quite new and information is lacking. Moreover, AI is only as good as the data it is given. Therefore, to provide effective outputs, the data need to be of good quality. Of course, the need for clean data is also very important (Oehm & Som, 2023). “When machine learning algorithms learn from biased historical data, there is a danger of perpetuating and magnifying those biases” (Farzan, 2023). This could exacerbate stereotypes and discrimination. The need for all this data and the complexity of this system also means that it requires a lot of energy to function, and it therefore contributes to pollution. Schwad pointed out in 2018 that the generative model to create an image uses as much energy as the average American household would use in approximately six months.

A certain aspect of the lack of security also needs to be pointed out about cybercrime, respect for privacy, leaking data, and confidentiality and all associated with AI. Nowadays, artificial intelligence is a field that still lacks a lot of legal regulations.

Although artificial intelligence can help in automating tasks and with personalized customer experience, the human touch remains very important to create strong connections with a customer (Farzan, 2023). Some customers fear AI as they believe they are being “watched” or that their privacy will be in jeopardy if they agree to use AI. This could lead to companies losing important numbers of clients.

Artificial intelligence can also be used to create fake information and therefore manipulate the behavior of humans (Korinek & Stiglitz, 2021). As anyone can use AI to create new content or modify existing content, more and more fake information is circling on social media. If fake information about a sensitive subject reaches a person who is very invested in this said subject, it might create a reaction in this person that would not have appeared without the piece of news.

Finally, the limitation of AI is its cost and the complexity of its technology. As it’s constantly going through developments the cost rises and complexity rises at the same time (Tiwari, 2022).

2.2 Artificial Intelligence in New Product Development

2.2.1 Idea Generation for New Products based on AI

The first stage of new product development is called idea generation. El Haiba has defined idea generation as “the process in which creative thinking based on knowledge and learning from prior experience is used to individually or collectively produce novel ideas adapted to the context wherein they are spawned” (El Haiba et al., 2017). This stage is essential to the launch of a new product development where new ideas and/or new opportunities emerge from individuals to promote growth in the business. Toubia stated that "the stage of idea generation, also called "ideation", whose objective is individual or collective identification of new ideas or opportunities, is often recognized as one of the highest leverage points for an organization" (Toubia, 2006).

This phase is at the center of 4 dimensions that are key concepts to increase the “organization’s ability to generate and develop a high-quality stream of ideas” (El Haiba et al., 2017).

- Creativity

  Each new creation needs a key amount of creativity to flourish. Titus has defined creativity as “the birth of imaginative new ideas” (Titus, 2000) and Muirhead defined creativity as “the ability to produce novel work that is high in quality and is appropriate (useful)” (Muirhead, 2007). Creativity gives the capacity to an individual to adapt to changes and new situations. But creativity is also influenced by previous experiences as it finds one of its origins in knowledge.

- Knowledge.

  Working on a new product project or a new idea requires knowledge of former experiences as well as knowledge of the environment. As noted by Buchanan (2001), background knowledge is an essential element that distinguishes deliberate acts of creation from “accidental creativity”. Moreover, as explained by El Haiba et al., “knowledge gives the person the ability to explore a rich domain much more efficiently, and therefore imagine new things” (El Haiba et al., 2017). Without knowledge, individuals will not be able to understand and analyze the problem they are trying to solve. Prior experience and the knowledge built upon it become an asset in this phase as individuals are capable of making connections and using them to their advantage. New product development should be based on a problem or a need that society is facing, if an individual tries to enter the process of idea generation without a clear understanding of the market and environment they are trying to develop in, we can for sure assume that the creativity will not be appropriate and therefore the idea will be inconclusive. Knowledge and creativity are also increased in an environment where multiple individuals gather to share their competencies.

- Collaboration

  Great ideas are rarely created by a solitary genius. More often, innovation comes from the right network of people and teams bringing disparate ideas together” (Kasper & Clohesy, 2008). Each individual will have a different idea, a different way of viewing the issue, and a different background they can work with. “Collaboration nurtures emergence, which can often lead to unexpected opportunities” (Kasper & Clohesy, 2008). Therefore we can view working as a team and in close collaboration in this stage as a winning factor. However, the managing team needs to set the correct environment and promote creativity to increase the

"diversity and collective intelligence of all its members" (El Haiba et al., 2017), to obtain ideas that will suit their goal.

- Learning

  According to Schank, "One can only learn from experience if the experience one is having is strongly related to an experience one has already had" (Schank, 1995). Learning can therefore be viewed as the process of adapting to new situations, "to combine multiple existing ideas into a new concept, to try new things, and to acquire, create, share knowledge and transform it into valuable insight that accelerates innovative thinking and thus generates new ideas" (El Haiba et al., 2017).

To summarize, we note that each of those 4 concepts has somewhat similar points, and those similarities are the key aspects that lead to idea generation and innovation. Moreover, we can add that a flourishing environment, the right individuals, and good management of the idea generation sessions are needed at this stage and therefore, for the launch of a new product.

As Artificial Intelligence has drastically improved throughout the years, we have now access to a new kind of AI chatbot: the Generative Pretrained Transformer (GPT) by Open AI. This type of platform can be considered an added player in the process of idea generation. If the tool is given enough information about the market, the environment, and the problem or need the company is trying to solve, it will have the capacity to generate ideas and therefore contribute to the brainstorming stage of idea generation and new product development. As Memmert and Tavanapour have explained, "the AI would not act as a facilitator but in the role of a peer/expert or creator, contributing ideas similar to a human" (Memmert & Tavanapour, 2023). Moreover, different types of AI might be capable of helping and guiding individuals throughout the 4 different dimensions that were explained above and therefore be a tool in the stage of idea generation.

2.2.2 Idea Evaluation based on AI

Once the stage of idea generation is done, the company must move on to evaluating the proposed options. As Gurbuz explained, the goal of this stage is to limit ideas to a manageable number with the only the most useful ones in order to "ease new product development process in later stages

and reduce costs and time spent for not useful ideas." (Gurbuz, 2018) Idea evaluation can be viewed as the first "stage-gate" (Cooper, 1988) in the new product development process:

- the stage is the different step that a company needs to take in the process of new product development.
- the gates reference to the different points of evaluation in this process. Cooper states "In order to weed out poor projects early in the process, there is a clear need for project evaluation points or "gates" (Cooper, 1988).

This process can be held through different methods that are more or less suitable for projects. We can find for example:

- The SWOT which will analyze the Strengths, Weaknesses, Opportunities, and Threats of the idea.
- Idea Checklist Evaluation which is based on evaluating an idea on a checklist of requirements that fit the market.
- Delphi Technique which is a systematic forecasting based on the opinions of experts.
- A Decision Tree is "a decision support tool that uses a graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility." (Bradač & Rebernik, 2008).

Maher and Fisher (2012) developed an AI-based system that could evaluate an idea based on three different criteria:

- Novelty: An idea is most novel if nobody has expressed it before.
- Degree of unexpectedness
- Value of the idea

Finally, thanks to algorithms that automatically analyze collected data, AI-based approaches for novelty detection which can filter novel contributions from large sets of ideas is rapidly gaining interest (Just et al., 2023).

2.2.3 Concept Development based on AI

The third stage of a new product development is called Concept Development. Gurbuz (2018) defines concept development as the step where the product idea will be detailed and presented as a product concept before testing it with a selected group of customers and choosing the product with the best results will be developed. This step is of huge importance because it will be the first time a product will be introduced to potential customers. Therefore, it is important to present them in a meaningful and clear way to the customer group.

Perttula and Sääskilahti also defined the product concept as a "visualization of a product that has a statement of customer needs and benefits, and a translation of those needs into functional features and requirements" (Perttula & Sääskilahtl, 2004). Therefore, generating a product concept during the concept development stage must emphasize this double description of customers' needs and benefits on one side, and how to answer those needs and give them those benefits by features and requirements. It is important to have a clear meaning of the four elements of a product concept, customer needs, customer benefits, product features, and product requirements.

- Customer needs

  According to Maslow (1943), human needs are divided into 5 hierarchical levels that are physiological; safety and security; love and belonging; self-esteem; and self-actualization. Therefore, a product, to attract customers, needs to answer at least one of those needs. In a more detailed way, this means that customer needs are about:

  - biological requirements for human survival
  - experience of order, predictability, and control
  - interpersonal relationships, affiliating, connectedness, and being part of a group
  - self-worth, accomplishment, and respect
  - realization of a person's potential, self-fulfillment, seeking personal growth, and peak experiences.

- Customer benefits

  According to Homburg et al. (2005), customer benefits are "the positive outcomes of a relationship for a customer" (Homburg et al., 2005). Other said customer benefits represent any subjective outcomes from the use of a product that a customer will perceive as positive.

It is strongly intricate with the customer needs because the benefits are the way the customer will perceive their needs fulfilled. For example, a product that answers the physiological need of eating will have, for the customer, the benefit of making him not hungry anymore.

- Product features

  Berger et al. (2015) define two types of features: typical and atypical/outlier. For them, typical features "represent core functionality of the domain and are, thus, a prime prerequisite for a company's business" (Berger et al., 2015) or features that are "generally demanded by the market or requested by a specific customer" (Berger et al., 2015). On the other end, they define an outlier feature as a feature that "does not provide a core functionality for customers" (Berger et al., 2015), or that is only "optimization of non-functional aspects" (Berger et al., 2015). In simple words, a product feature is a functionality of a product or an optimization of preexisting functionalities. It can either be a main aspect of the product or a secondary one. An interesting fact is that during the concept development stage, the testing phase of the product will allow customers to propose new typical features that may be implemented into the product.

- Product requirements

  "At the beginning of a product design process, based on a request made by customers, designers start to identify the customer's real intent in order to gather all explicit and implicit requirements that the product has to satisfy" (Chen et al., 2007). This quote allows to perceive a definition of product requirements as every implicit and explicit demand that the customer would like to be fulfilled by the product.

. To summarize, concept development involves creating and testing a product concept, which is a representation of the potential finished product. It must satisfy consumer needs, provide advantages to the customer, and respond to their requests through feature presentation.

According to Bertoni (2020), there is already a strong use of AI for concept development. He states that data-driven design are already used to ensure the generation of a qualitative product concept and its testing. He states that usage of mining techniques is predominant over social media and

online reviews as this allows to “identify customers’ needs, and a variety of approaches applied in the other stages of concept development” (Bertoni, 2020).

2.2.4 Marketing Strategy based on AI

As Fifield (2012) explained, marketing strategy means different things to different organizations as it will fulfill different needs both within the organization and in the marketplace. As he explains, it is best to look at the marketing strategy as what it does instead of what it is. Business strategy could consider:

- Environmental factors
- Business factors
- Business units
- Target market strategies
- Product market
- Market entry
- Market positioning
- The marketing mix
- Product positioning
- Branding and Positioning

On that aspect, he concluded that “marketing strategy is the process by which the organization translates its business objective and business strategy into market activity” (Fifield, 2012).

Gurbuz (2018) develops this 4th stage in 3 points:

- Identify in which market[2] the new product concept will be sold, how much profit[3] is targeted from the new product concept, and what its planned value proposition[4], sales, and market share[5] for the first few years.
- Identify the price[6] at which the new product concept will be sold, how it will be distributed in the market, and what will marketing budget[7] be for the first year.

- Identify the price at which the new product concept will be sold in the long term, how much profit is targeted from long-term sales, and what be long-term marketing mix strategy[8].

To summarize, we can argue that a marketing strategy holds different dimensions, and each company will need to identify the different aspects that function for their new product. However, the most common step could be:

- Target market segmentation: defining the target will help to customize the different marketing messages to the specific customer service. To be able to produce an accurate customer segmentation, the companies need to gather a lot of data. AI can provide help by organizing the clients per category (Mileva, 2023).
- Value proposition development: this will help to create marketing campaigns and follow a leading theme through the different channels. AI can help analyze the data more accurately and "identify patterns and trends that humans may overlook" (Dasha, 2023)
- Branding and Positioning: most of the time, customers connect with stories which is why branding and positioning are key. The potential customer will create a bond with that image and be therefore more compelled to buy the product of one specific company. In the same way, Artificial Intelligence can utilize the data to help extract valuable insight and provide crucial information for businesses to make decisions (Hyscaler, 2024).
- Choosing market channels and tactics: Having the appropriate medium of diffusion is essential to reach an audience. Depending on the demographic aspect of the target, they will be more present on one channel and not the other. This will also affect the tactics chosen to promote the product such as social media advertising, content marketing, influencer partnerships, or traditional methods like TV commercials or print ads. Artificial intelligence has a predictive ability thanks to the data analyzed which can help "marketers can make informed decisions on channel selection and optimisation, ensuring their products reach the right audience through the right channels" (Slevin, 2023).
- Setting up marketing performance measurements: lastly having KIPs and metrics to analyze the performance of the marketing strategies. This will help to track effectiveness and make any changes based on the correct data if needed.

AI holds so many different forms that we can imagine it will be able to help the process of marketing strategy. Flinders in an article for IBM defined the use of AI in marketing thanks to “the process of using AI capabilities like data collection, data-driven analysis, natural language processing (NLP) and machine learning (ML) to deliver customer insights and automate critical marketing decisions” (Flinders, 2023). This complete definition allows to show that AI in marketing already is present in multiple areas.

2.2.5 Business Analysis based on AI

The fifth stage of a new product development is called business analysis. “Business analysis is the set of tasks and techniques used to work as a liaison among stakeholders in order to understand the structure, policies, and operations of an organization, and to recommend solutions that enable the organization to achieve its goals.” (Brennan, 2009).

Gurbuz (2018) defines it in the following two steps:

- The projection of a new product concept sales by market research or the review of similar product data in the past. Then, the business can calculate risk with an estimation of minimum and maximum sales.
- The projection of cost and profits. The costs are all that are involved in new product development (investments, operation, marketing, R&D, etc.). Those estimated costs and profits coming from the sale of a new product will indicate the financial attractiveness of the product.

If the product’s projections are compatible with the business objectives, the product development will be moved to the next stage.

Business analysis is also considered by Cooper as the third “stage-gate” of product development. Such as the other gate, four main questions must be asked before moving to the next stage of product development: (Cooper, 1988)

- Does the project continue to make economic and business sense?

- Have the essential steps been completed—those steps or activities necessary to pass through the gate? Is the quality of execution of these activities adequate?
- Is the project on time and budget? Have the milestones been hit?
- What steps or tasks need to be undertaken in the next phase or stage of the project? What milestones, dates, and budgets should be attached to these tasks?

Cooper (1988) also states that the answers to those questions will define if the project should continue, be forgotten, or if the business analysis needs more time to be fully developed.

Henriques has proven that “the implementation of intelligent stakeholder analysis systems in organizations would be pretty valuable” (Henriques Montez, 2022). She states that the use of this type of AI would help companies to optimize time, make more efficient decision making and in general that this would translate into better strategies. As we will later see, AI usage regarding Business Analysis revolves around three main areas. The first one being risk mitigation as “supporting the innovation process with AI could generate real value for firms by reducing [...] the riskiness [...] of innovation processes” (Haefner et al., 2021). The second area of AI applications for Business analysis reside in its interest for financial projections. And finally, the third area for each AI could be used regarding Business analysis is for SWOT analysis.

2.2.6 Product development based on AI

Product development is the sixth stage of a new product development. It is defined by Bhuiyan as the stage where “business case plans are translated into concrete deliverables” (Bhuiyan, 2011). This means turning the current product concept into something usable whether by creating a physical representation or a virtual model of it.

Gurbuz also adds that “Several tests are made to samples to ensure the safety, attractiveness, and effectiveness of new product concept; therefore, the test process may take a while to choose the most suitable sample. Businesses either do tests themselves or get a service from another business.” (Gurbuz, 2018). This stage will be the last one where the company will work on the product in itself. Therefore, teams must take a deep focus on the three main points he mentions: safety, attractiveness, and effectiveness.

Safety, because no one would like to buy a dangerous product. According to Maslow (1943), safety need is the second most important need for a human being. Therefore, it is one of the first, if not the first things that customers will take into account while deciding on buying a product. For Ringle et al., “perceived safety does positively influence the satisfaction” (Ringle et al., 2011) of the customers. This means that the safety factor should not be overlooked during the product development stage because it will play a huge role in product sales and feedback.

Attractiveness, because they need to attract customers for it. Moreover, product effectiveness is defined by Husein and Nuryakin as defined both from the customer and company point of view as they stand “Product attractiveness viewed from the company’s side is considered as the superiority value relatively retrieved towards competitors’ products. However, from the customers’ side which refers to their need, product attractiveness is the benefit received by customers from a product” (Husein & Nuryakin, 2018). This double definition is important as it shows how the company has to look to the advantages, they offer face to their competitors which is their attractiveness, but that they also need to look at the fact that they need to offer a real benefit, whether it is beauty, number of features, easiness to use or anything that can come to its mind.

Effectiveness is important because for a product to be sold in the long term, it needs to present a use to its customer. Balaban and Weiss define product effectiveness as “the overall capacity of a product to meet customer requirements” (Balaban & Weiss, 2009). They also define it in a more formal way as “a measure of the extent to which a product may be expected to achieve a set of specific application requirements in terms of availability, dependability and capability” (Balaban & Weiss, 2009). They therefore see the product effectiveness as the use customers can make for it, the dependence customers have for it, and the capacity for it to be acquired.

AI proves itself to be efficient in improving product safety, attractiveness, and effectiveness during its design. As Bailey stated, AI algorithms could be used to predict material-based performance by analyzing their strengths and fatigue resistance. By analyzing data regarding customer reviews and what attracts them regarding a product, AI algorithms are also able to support the overall attractiveness of the product as “AI can assist designers in making informed decisions about design choices by analyzing data and providing insights into the design process. AI algorithms can analyze design data and provide recommendations based on previous design outcomes.” (Khaleel et al.,

2023) AI could also be used to improve a product's effectiveness, for example by testing components of codes like "Applitools" or "Testigma AI" does.

2.2.7 Test marketing based on AI

Test marketing is the seventh stage of a new product development. "Test Marketing is an experimental strategy by which the entire product and/or service is tried out for the first time in a small number of well-chosen and authentic sales environments; the location for this activity is usually referred to as a test market. This location can be physical or virtual. While the former deals with direct interaction and contact with the interested populace (prospective customers), the latter has to do with an abstract or intangible market; in which case involves the use of electronic platforms like; television, radios, mobile phones, and the social media etc" (Umuemufo et al., 2023). In other words, test marketing is a stage where the product will be tested in its final form including all the final aspects of its marketing strategy such as costs, packaging, etc. It will allow companies to see if the final product still engages customers' interest or if it needs to be reworked or forgotten. As Umuemufo et al. state, marketing tests will either be made on prospective customers or an abstract/intangible market, those two areas of testing which are quite important are defined as follows:

- Prospective customer: a potential customer that matches the criteria defined by the company is more implied to be interested in the company's business offering
- Intangible market: a market that can be reached physically (like a store) but that is more likely to be accessed virtually (like with a computer, phone, or television)

For Gurbuz test marketing also has a goal to define "all marketing elements such as but not only product concept's target market, position in the market, advertisement, distribution, packaging, costs" (Gurbuz, 2018). He also states that skipping test marketing to go directly to the commercialization step may make a business find itself with unexpected costs which could turn dangerous. Therefore, the test marketing stage is not only one stage with its proper goal but a stage that has for goal to wrap up all of the previous stages and verify that they are still accurate and in accordance with the "gate N" of Cooper (1988) "stage-gate" which is "the final gate—the pre-commercialization gate—the decision to move to full production and market launch" (Cooper,

1988). This step represents therefore a decision to go forward with the project, forget it, or keep working on it to upgrade it until it is ready to move to the next stage, in this case, commercialization.

AI is already usable and used for test marketing, with for example Sentiment that has been used by Euler Hermes and that allows them to "gain insights of their customers' feelings about their brand and product" (Devang et al., 2019). This is interesting because that means they can use those data to improve their marketing strategy based on those. Moreover, platforms like AI simulator which is a simulated AI environment with Angel Investor. It is used for market simulations to see how some business decisions could affect a company.

2.2.8 Commercialization based on AI

Commercialization is the last stage of new product development. The first aspect to consider while moving on the commercialization is the "When":

When will the product be launched to the market?

When will it be available to potential users?

In addition to the "when" the business will have to define the "where" that will then help to define the scale of the launch: "at a small scale such as a city, medium scale such as a region, or at a big scale such as the national market, or the international market" (Gurbuz, 2018). It is important to note that "commercialization is typically the costliest stage of the new product development process. Its costs will often exceed the combined cost of all previous development stages" (Cooper, 1988).

Commercialization requires a few steps beforehand to announce to the market and potential customers that a new product will be launched. These steps are called pre-launch activities. They gather things such as:

- Teaser campaigns to promote the product to the audience, awaken curiosity, and create interest in the product. These teasers a mostly held online such as on social media, websites, television, etc.
- Creating a landing page to give information to the potential client beforehand. It should be designed in a way that will capture the attention of the future user.
- Having email subscriptions to newsletters. If the landing page of the product realizes its objective and captures the customers' opinion, is it good to have a subscription offer to an email list to keep the individual informed about future events around the product, such as the launch.
- In some cases, having pre-launch offers will help your business to start gaining a market share before the product is even released.
- Production of a certain quantity of the product defined in the business strategy phase is to be ready to sell for launch day.

Once the pre-launch activities are all set, the launch execution is put in place. It refers to “the implementation of your product launch plan and the actual release of your product into the market” (Hilgenfeldt, 2023b). The company will have to set a launch date by considering market trends, customer behaviors, and seasonal opportunities if applicable. The next step will be putting in place the different marketing channels and tactics that have been chosen in the previous steps. Announcing the launching event through those means of communication will be the official start of the product. This launching event can be done in physical, virtual, or hybrid format according to the type of product being launched and lastly, the customer support will need to be up and running to support any inquiry or potential issue that the customer might face.

Artificial intelligence will be able to provide a significant amount of help on the different dimensions of this commercialization stage. Different AI programs have been proven helpful in the creation of projects and creativity such as for the creation of a landing page or the teaser campaigns. AI can also help to handle a large number of entering information and store it accurately such as for email subscriptions. Legget (2017), using quantitative data from Forrester’s 2016 global state of AI online survey has for example highlighted that customer support is ace of the leading areas in the investment and adoption of AI systems. We also know from Weber and Schütte (2019) that AI can

be used at the point of sale to replace workers and automate some activities. “AI applications related to serving customers have particularly been developed for POS digitization, automation and advertising.” (Weber and Schütte, 2019)

2.3 Identified Research Gap

Before this paper, the authors have found much research about the use of new generations of AI to help with decision-making in the different steps of new product development:

Multiple researchers have revealed important information about Artificial Intelligence usage or potential implementation, but a few gaps have been pointed out. Primarily Füller et al., in their research on How AI revolutionizes innovation management, stated that “there is a lack of understanding about the necessary changes and impact of AI-based innovation management, as well as a surplus of perception-based rather than fact-based interpretations of the potential of AI in the innovation context” (Füller et al., 2022). Secondly, Feyzioglu and Büyüközkan have presented a glimpse of AI implementation in New Product Development process however, they pointed out in 2006 that “a long period of time is always necessary to observe the results of such a strategic level decision” (Büyüközkan & Feyzioglu, 2006). At the end of their paper about Artificial Intelligence in Engineering, Khaleel et al. pointed out that to reinforce their research a potential future axe of research should “ focus on AI systems that aim to enhance designs by improving their form, function, and behaviour” (Khaleel et al., 2023). Finally, Baqi et al. Stated that while studies on AI and marketing were strongly present, “It would also be highly beneficial to assess the effects of embracing the notion of Artificial Intelligence (AI) as an essential component of future marketing” (Baqi et al., 2022) and that it would therefore be interesting to encompass the importance AI could have.

These researchers have pointed out gaps or axes of improvements for future research to delved on. Moreover, the authors have highlighted the lack of information regarding the full process of new product development using AI.

2.4 Research Framework

For this thesis, the research framework was based on Gurbuz (2018). “Theory of New Product Development and Its Applications”.

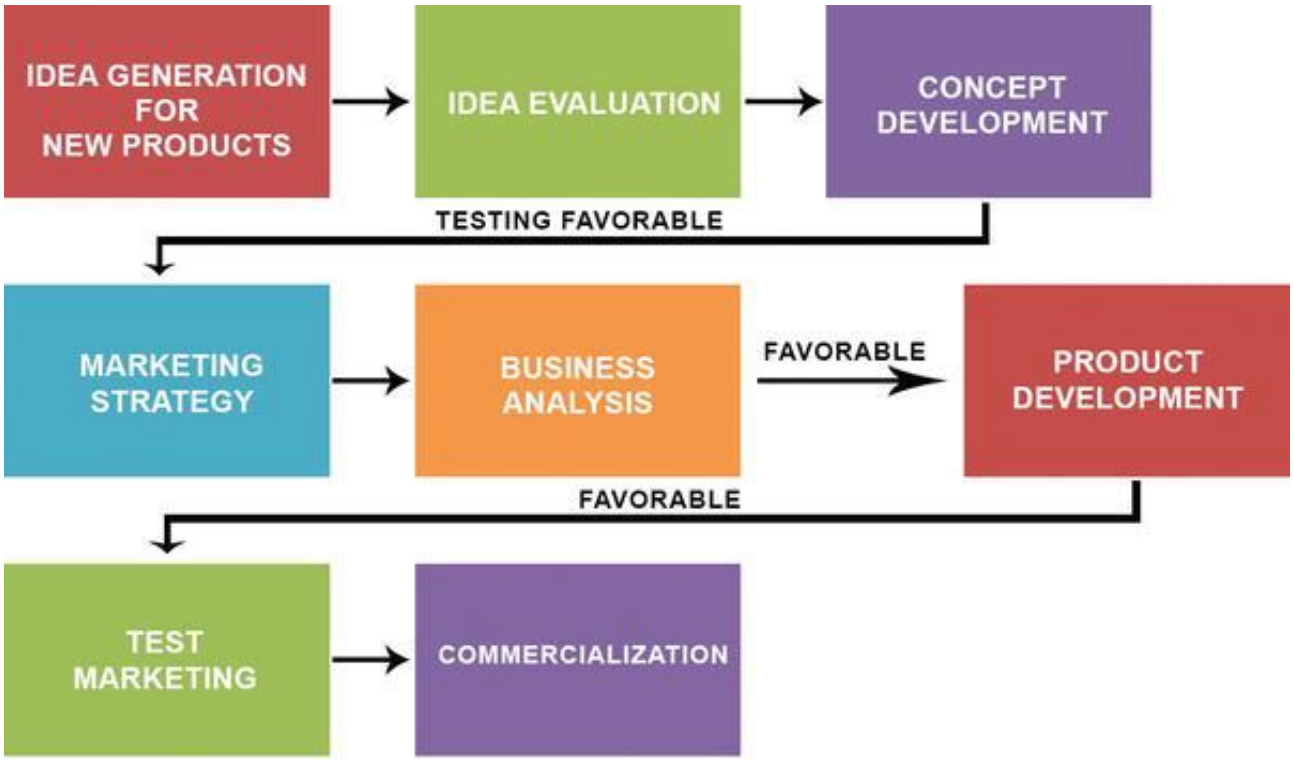


Figure 1. Research framework based on Gurbuz’s (2018) New Product Development process

This framework represents the new product development as a process of 8 different steps that need to be followed by any individual or organization that wishes to innovate. The 8 steps are presented as follows : Idea generation, Ideaevaluaution, Concept Development, Marketing strategy, Business Analysis, Test Marekting and Commercialization. Each of these step was defined in the litterature reviewed and a connection was made to the potential usage of AI. Gürbüz also pointed out that “business should make a decision, continue to the next stage, leave to develop products or look for extra information.” (Gurbuz, 2018). The authors choose this framework because it allows them to encompass all aspects of new product development in chronological order which helps for readers comprehension. Additionally, the chronological aspect of this framework makes it particularly well

suited for AI applications, as it allows to see progressively how much AI can be implemented in a step by step process that could guide readers searching to use AI for the development of a product.

3 Research methods and implementation

3.1 Research context

We have recently seen major improvements regarding AI development illuminated by the increasing number of accessible powerful ones (mainly pushed by OpenAI with ChatGPT). Better accessibility to AI technology now available to individuals through Internet connection from smartphones or computers, once reserved for large corporations and research institutions. It resulted in an era where the benefits of artificial intelligence could be utilized by both the general public and professionals, with little to no prior knowledge.

This democratization had a huge impact on the barriers to entry in using AI for professional usages, allowing individuals, entrepreneurs, and businesses, to take advantage of the potential applications of AI with the same tools. The impact of AI technology is present in an array of industries, including but not restricted to healthcare, finance, business, and technology. This not only improves decision-making and data analysis as many think, but also opens up new opportunities for new product development.

The goal of this thesis is to review and explain the strategic integration of AI in each phase of the new product development cycle. This research aims to provide a clear representation of how AI can transform new product development by exploring the impact of AI on idea generation, idea evaluation, concept development, marketing strategy, business analysis, product development, test marketing, and commercialization. This research aims to provide practical applications and advice for entrepreneurs who want to use AI to innovate and succeed in today's dynamic business environment.

3.2 Research design

The authors have chosen to refer to the “onion” research design of Saunders et al. (2009, p. 108)

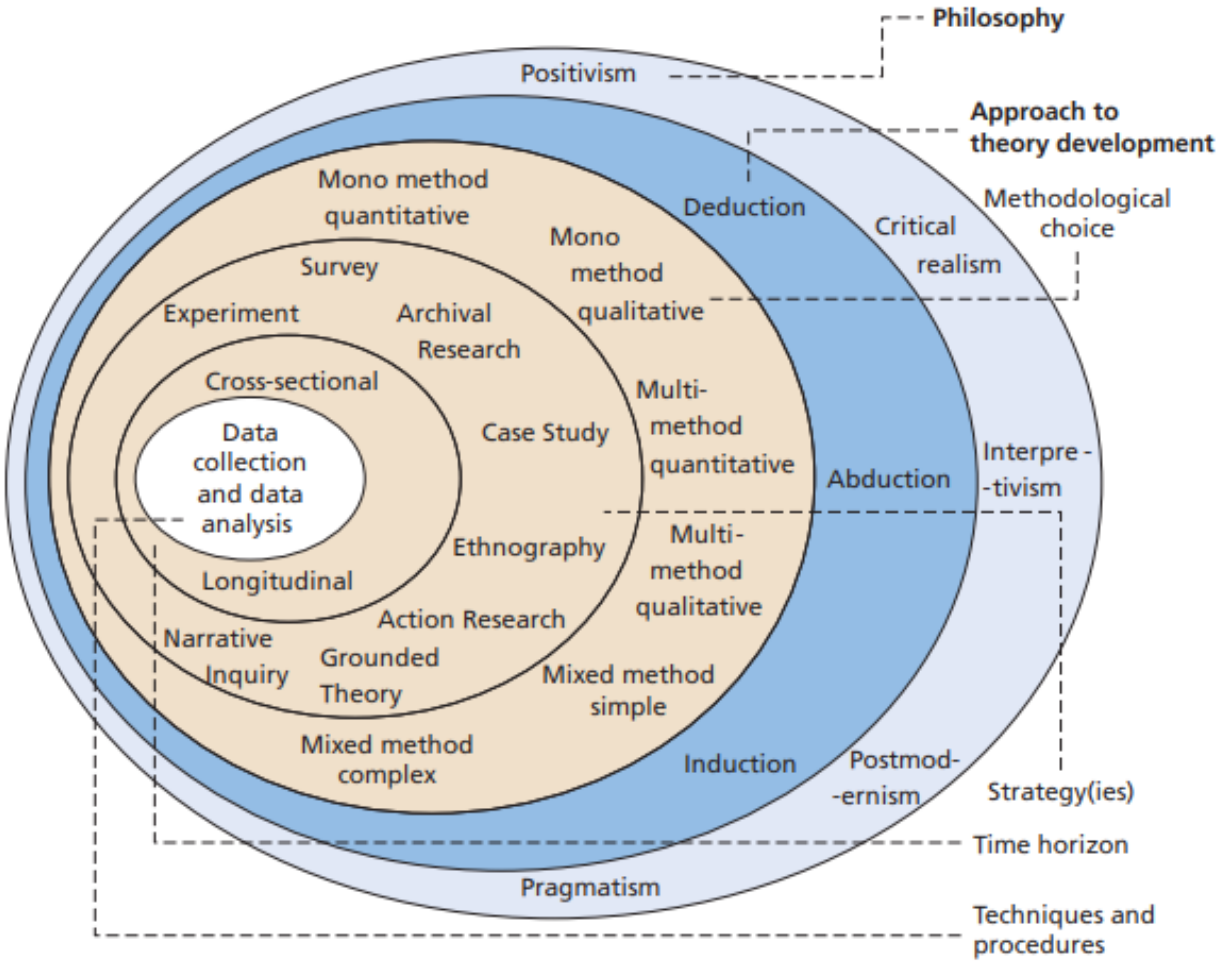


Figure 2 Research Onion (Saunders et al. 2009)

The authors chose to refer to the research onion as the “peeling” of its different interrelated and interdependent layers allows to develop a research method with quality and sense. Moreover, the choice of the research onion ensures that each layer of the research method (Philosophy, approach, methodological choice, strategy, time horizon and techniques/procedures) are all coherent within each other and make sense for a clear and effective research methodology.

3.2.1 Research purpose

“Descriptive research is essentially a fact-finding procedure with an interpretation of how the facts relate to the problem under investigation.” (Espenschade & Rarick, 1973). It defines research which plans to answer research questions by finding facts that can be related to it and used to answer them. It is used to reinterpret current data for a new problem or theory. Moreover, Robson has stated that the point of this approach is ‘to portray an accurate profile of persons, events or situations' (Robson, 2002).

On this basis, the authors have decided to opt for descriptive research as the goal of this paper will be to present, explore, and define the potential usage of AI in each step of new product development. This will give the authors the possibility to use current technologies and data available on this subject rather than researching and/or developing a new concept.

Moreover, as business and not engineering students, the authors do not want to create a new way of using AI for product development but rather inform on the way it can be used today and potentially an accurate portrait of future usages presented by researchers to prepare and inform potential users.

3.2.2 Research philosophy

The authors have chosen to follow the “realism” philosophy. As this research is based on facts independent from human experiences and it “assumes a scientific approach to the development of knowledge” (Saunders et al., 2009), this philosophy was the best suited. For Saunders et al., realism “underpins the collection of data and the understanding of those data” (Saunders et al., 2009). Moreover, this philosophy is appropriate for qualitative study.

Based on those ideas, the authors have decided to opt for realism as it will allow them to picture an accurate portrait of the use of AI in each step of new product development with all the different potential uses of AI but without stating a particular method to be used. As the authors' goal is to inform and not experiment, realism will be the best suited for them.

3.2.3 Research approach

“The primary purpose of the inductive approach is to allow research findings to emerge from the frequent, dominant or significant themes inherent in raw data, without the restraints imposed by structured methodologies” (Thomas, 2003). It's an appropriate approach for research based on a large quantity of data, as it allows one to conclude without needing to elaborate a new methodology that would force one to prove each finding, but rather use the existing data to highlight recurrent themes or patterns.

The authors' objective is to collect data based on the application of the latest generation of AI in new product development and to analyze and interpret it, the inductive approach is the best suited for this research. It will allow the authors to stay exact, clear, and accurate while offering flexibility which will grant to the authors the ability to understand the different outcomes more precisely. The authors will be able to adapt throughout their research as they underline different patterns of AI usage.

Moreover, an inductive approach will allow the authors to define an idea of the current use of AI without having to generate and collect primary data.

3.2.4 Research strategy/method/s

As stated by Mohr and Ventresca (2001) “archival methods are those that involve the study of historical documents; that is, documents created at some point in the relatively distant past, providing us access that we might not otherwise have to the organizations, individuals, and events of that earlier time” (Mohr & Ventresca, 2001).

This study will be mainly based on existing documents that have been created in the past 18 years and that will provide the authors with knowledge about how organizations, individuals, and events are evolving toward the use of AI in new product development processes. The authors chose a time horizon at 18 years because in 2005, Henry Markram and a team of 35 computer scientists, mathematicians, biologists and physicists created the first virtual brain: Blue Brain. This meant that machines could now think like a human. As this paper refers to the latest generation of AI, the authors valued this key innovation as the perfect point in time to start researching from.

However, the authors will also be using data recovered from social media, video, websites, and so on as Ventresca and Mohr also acknowledge the fact that “archival methods can also be applied to the analysis of digital texts” (Mohr & Ventresca, 2001).

3.2.5 Methodological choice

This research applies to a mono-methodological approach based on qualitative data. It involves the use of a single data collection and corresponding analysis technique. (Saunders et al., 2009, p. 595).

This will allow the authors to dive into a more in-depth analysis of the research question as the authors will be focusing their attention on analyzing and understanding the information present in their secondary data.

3.2.6 Time horizon

“Longitudinal studies [...] are generally observational in nature, with quantitative and/or qualitative data being collected on any combination of exposures and outcomes, without any external influence being applied.” (Caruana et al., 2015).

Based on this definition of longitudinal studies, the authors can state that the research horizon will be longitudinal. Our objective is to study the applications of the latest generation of AI over the past 18 years. Therefore, the qualitative data that they have gathered will be used to describe and examine this subject and its evolution over this defined time horizon.

3.3 Data collection

As Saunders et al. (2009) stated a qualitative data analysis “is used predominantly as a synonym for any data collection technique (such as an interview) or data analysis procedure (such as categorizing data) that generates or uses non-numerical data. Qualitative therefore can refer to data other than words, such as pictures and video clips”.

This research used secondary qualitative data from relevant publications, articles, and theses as well as videos and website pages. To encounter the documents used in this paper, the authors used

Google Scholar as a key medium. Keywords such as “artificial intelligence”, “new product development”, “innovation”, “based on AI”, “process”, and “data analysis”, and each word of the 8 stages of NDP by Gürbüz were entered in in the research bar. Renown websites were also utilized by making the same type of research directly into Google. Social media such as LinkedIn or Instagram have also been looked at with the same type of keyword and methodology. Thanks to this process the authors managed to gather 195 documents.

3.4 Data analysis

The data have been analyzed with the help of NVivo software. In the table below, readers will be able to find the codebook created based on the research framework that was used to analyze and categorize data into Nvivo.

Table 1 Codebook for data analysis

Code	Definition	When to use	When not to use
AI usage in the process of idea generation (IG)	Artificial Intelligence potential usage in the process of idea generation which includes the process of generation, development, and communication of an idea as a basic visual, concrete or abstract element.	Use this code to identify and mark any passages of text that refers to examples of idea generation that include or might be applicable to the use of AI.	Do not use it for any publication that refers to anything else than idea generation stage that include or might be applicable to the use of AI.
AI usage in the process of idea evaluation (IE)	Artificial Intelligence potential usage in the process of idea evaluation which includes the verification of the feasibility, the potentiality of profits and the compatibility with the company.	Use this code to identify and mark any passages of text that refers to examples of idea evaluation that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than idea evaluation stage that include or might be applicable to the u se of AI.
AI usage in the process of concept development (CD)	Artificial Intelligence potential usage in the process of concept development which includes turning the idea into a detailed concept before introducing it to a group of selected customers.	Use this code to identify and mark any passages of text that refers to examples of concept development that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than concept development stage that include or might be applicable to the use of AI.

AI usage in the process of marketing strategy (MS)	Artificial Intelligence potential usage in the process of marketing strategy which includes the definition of the market, price and long-term sales of the product.	Use this code to identify and mark any passages of text that refers to examples of marketing strategy that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than marketing strategy stage that include or might be applicable to the use of AI.
AI usage in the process of business analysis (BA)	Artificial Intelligence potential usage in the process of business analysis which includes a projection of the sales and a projection of the costs and profits.	Use this code to identify and mark any passages of text that refers to examples of business analysis that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than business analysis stage that include or might be applicable to the use of AI.
AI usage in the process of product development (PD)	Artificial Intelligence potential usage in the process of product development which includes the creation of samples of the product in order to test its safety, attractiveness and effectiveness.	Use this code to identify and mark any passages of text that refers to examples of product development that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than product development stage that include or might be applicable to the use of AI.
AI usage in the process of test marketing (TM)	Artificial Intelligence potential usage in the process of test marketing which includes definitions of all marketing elements in order to rethink the marketing strategy.	Use this code to identify and mark any passages of text that refers to examples of test marketing that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than test marketing stage that include or might be applicable to the use of AI.
AI usage in the process of commercialization (Cm)	Artificial Intelligence potential usage in the process of commercialization which includes how, where and when the product will be introduced in the market.	Use this code to identify and mark any passages of text that refers to examples of commercialization stage that include or might be applicable to the use of AI.	Do not use it for any publications that refers to anything else than commercialization stage that include or might be applicable to the use of AI.

3.4.1 Qualitative data analysis

To assist in their qualitative data analysis, the authors used a computer software named Nvivo. This software is a powerful system that can assist with organization, extraction, and analysis from various sources in various formats (See Appendix 1). This software allowed the authors to collect relevant citations efficiently and code them appropriately using nodes. The nodes were carefully applied

based on the research framework and relevant discoveries and were divided into smaller sub-nodes (See Appendix 2). This tool proved its usefulness by allowing authors to map their ideas.

In addition, a codebook was created and used to help the authors define terms be sure to code qualitatively, and to define when to use a code or not. The common work of the codebook and Nvivo allowed the authors to analyze the document by the research question while saving a lot of time and being as efficient as possible.

3.5 Ethical considerations

This research is guided by a strong commitment to ethical standards. It makes sure that all secondary data used is obtained ethically and legally while maintaining strict measures regarding data secrets and confidentiality. Additionally, the study acknowledges and objectively analyzes potential data limitations and biases.

In the pursuit of information and knowledge, the research has put a priority on avoiding any negative implications for individuals or groups. Moreover, the authors aim to ensure fair and truthful communication of research findings. Respecting these ethical principles, this research tries to produce reliable and precise results while upholding social responsibility and research accountability.

4 Research Results

4.1 Idea generation stage

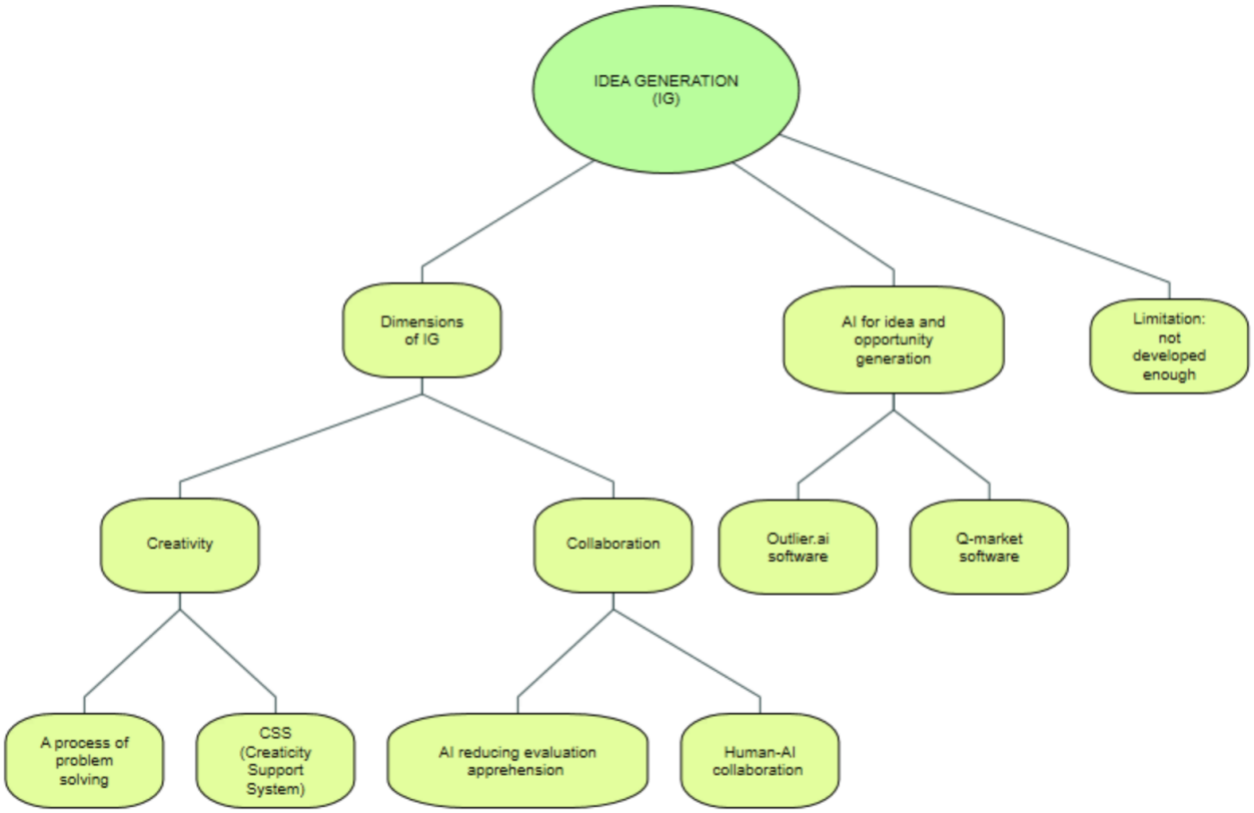


Figure 3 Mind map generated using Nvivo 12 illustrating the different areas of idea generation adapted to AI usage.

The mind map demonstrates the different important aspects to consider while entering the idea generation phase.

4.1.1 Definition & dimension of Idea generation

As explained in the literature review, “The stage of idea generation, also called "ideation", whose objective is individual or collective identification of new ideas or opportunities, is often recognized as one of the highest leverage points for an organization” (Toubia, 2006) *(Appendix 4.1).*

This study discovered evidence for 2 out of the 4 dimensions of idea generation in which AI exerts influence on the IG process.

Regarding creativity, Simon, in 1988 explained the possibility of computers having creativity. He explained that, if creativity was imported to a computer in the format of a problem-solving situation, a computer might be capable of cognitive processes. Moreover, the CSS (creativity support system), which reference system that was specifically designed to help the creative process, can be viewed as "real partners in the creative process intervening at different points in order to generate, evaluate, or refine ideas" (Lubart, 2005) (*Appendix 4.1.1.2)*. Siemons (2023) also divided the different support CSS could bring into 4 categories (*Appendix 4.1.1.2)* :

- the nanny which provides helps by setting agendas, and deadlines and monitoring the creative process
- the pen-pal provides the possibility to receive, compose, and distribute an idea.
- the coach which provides help and guidance about the system. It's capable of offering different steps to take in idea generation or recommending other methods.
- the colleague which is an AI-based system that can actively part in the creative process.

Regarding collaboration, it was found that AI can reduce human apprehension regarding the evaluation stage. Hwang & Won found that "that participants consistently contributed more ideas and ideas of higher quality when they perceived their team working partner to be a bot" (Hwang & Won, 2021) *(Appendix 4.1.2.1)*. Thanks to their research, they concluded that AI-based systems could address the fear of negative evaluation and therefore allow for more idea-sharing.

Moreover, "with recent advances in generative language models (GLMs), however, human-AI collaboration for creative tasks might be feasible" (Gero et al., 2022) *(Appendix 4.1.2.2)*. Their study aimed to test the willingness of humans to participate in brainstorming sessions with a generative AI. Thanks to the results presented in the qualitative survey that the participants took to evaluate their experience, Gero et al. argued that "signs of group effects […] known from human brainstorming sessions partially occur in such human-AI groups as well." (Gero et al., 2022) *(Appendix 4.1.2.2).*

4.1.2 Artificial intelligence can provide help for idea and opportunity generation

If we now look at the process of idea generation as a whole and not through the 4 different dimensions, we can note that AI can provide help. As AI uses machine learning algorithms with a large amount of data “they can recognize problems, opportunities, and threats above and beyond local search routines and knowledge domains, which may be helpful to discover and generate new ideas” (Haefner et al., 2021) *(Appendix 4.2)*. Haefner also showed that “AI offers promising methods for idea and opportunity generation, especially by identifying relevant consumer needs and problems” (Haefner et al., 2021) *(Appendix 4.2)*. Moreover, AI-based novelty detection models could help by evaluating large sets of data. It can then provide individuals with propositions of opportunities or ideas.

An example of an AI that can provide help is Outlier.ai. “After analyzing a firm's data, Outlier generates a set of customized ‘stories’ that summarize actionable and interesting insights for specific managers. In doing so, Outlier can highlight innovative opportunities for managers.” (Haefner et al., 2021) *(Appendix 4.2.1)*.

Q-market software could also provide help in the idea-generation process. It’s an idea generation management tool that incorporates AI features such as automated translation or similar idea recognition. For example, the users can “choose from 20+ languages with automated content translation and custom terminology” (Qmarkets, 2023) *(Appendix 4.2.2)*.

4.1.3 Artificial intelligence limitation towards idea generation

Although artificial intelligence can be of help for the first stage of the new product development none of them can develop entire solutions. We could argue that a software like ChatGPT could be seen as a “colleague”, as with a certain type of prompt ChatGPT can come up with a certain list of ideas but it will always be limited to the information that it was provided.

We can therefore state that, to be able to identify and generate ideas that humans can’t, artificial intelligence needs to be developed even more *(Appendix 4.3)*.

4.2 Idea evaluation stage

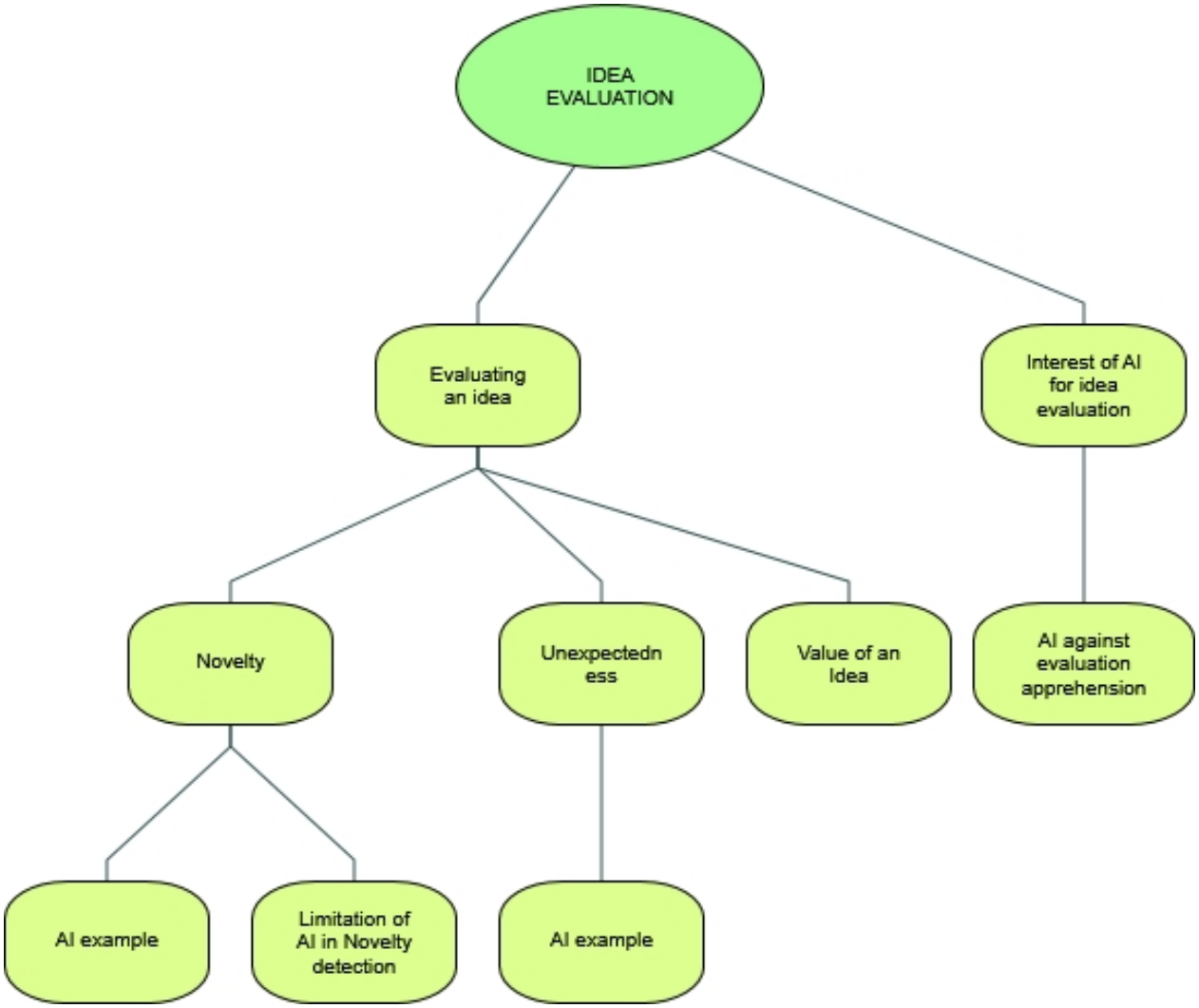


Figure 4 Mind map generated using Nvivo 12 illustrating the different areas of idea evaluation adapted to AI usage.

The mind map above illustrates the different areas of idea evaluation to see how AI usage can be implemented in different areas.

4.2.1 Evaluating an Idea

There are a lot of ways to evaluate an idea and no good answer to how to do it. However, Maher and Fisher (2012) developed an AI that was based on three criteria that seems the best to see how AI can be applied in Idea Evaluations:

- Novelty
- Unexpectedness
- Value of the idea

4.2.1.1 Novelty

Novelty references to the quality of being new and unusual. It is a really important step when you evaluate an idea because your idea mustn't be just a copy of something already existing.

For AI applications, Füller et al. (2023) found that AI novelty-based detection is more efficient “for ideas below the median word length and when comparing crowdsourced ideas to a range of existing product categories” (Just et al., 2023) *(Appendix 5.1.1)*. They therefore help us to know that, novelty detection is limited for AI usage. Current AIs cannot evaluate novelty without being given a database of existing products and are therefore limited in how they can detect novelty, as they can only compare novelty to a given data. Moreover, they also found that when using AI for novelty detection, the way the idea is explained need to be concise and efficient for an AI to work in an optimal way.

Maher and Fisher (2012) state that “there are many accounts of measuring novelty using computational approaches” (Maher & Fisher, 2012) *(Appendix 5.1.1)*. However, they decided to make their system function by virtually mapping the main sets of descriptions of attributes of an idea and measuring the distance with the closest idea. In this way, the distance between the closest ideas allows them to evaluate the novelty fact. Moreover, it can allow a comparison of the results of different ideas and check which one is the most distant to existing artifacts and therefore which one is the newest and more unusual.

4.2.1.2 Unexpectedness

Unexpectedness or surprise refers to the fact that an idea is similar to something but adds an unusual new twist that does not exist for similar patterns. Moreover, unexpectedness is kind of subjective as the principle of expectations tends to change from person to person. However, it is a necessary quality while evaluating a new product idea.

While doing research, the authors did not encounter many examples of AI applications for unexpectedness detection. However, it does not mean that it is not something feasible, but rather that there is no current way of doing so, especially as characteristics of unexpectedness are not clearly defined and Maher and Fisher (2012) chose to make their unexpectedness detection based on pattern detection. The way they explain the function of their AI is by checking if "an artifact, α, is considered surprising when we recognize a pattern in recent artifacts, and the potentially creative artifact does not follow the expected next artifact in the pattern" (Maher & Fisher, 2012) *(Appendix 5.1.2)*. This way of evaluating surprise allows AI to do its job based on its most efficient quality, pattern recognition, and prediction. This allows to measure how surprising an artifact is by checking how close to its original pattern the idea it is. The AI was more applied to evaluate the unexpectedness of a feature than a general idea, but a similar way of functioning could apply to the unexpectedness of a product in idea evaluation.

4.2.1.3 Value of an idea

Maher and Fisher (2012) state "The value of any artifact is judged by criteria that are established by the requirements and performance attributes associated with the class of artifacts." (Maher & Fisher, 2012) *(Appendix 5.1.3).* Therefore, this definition of AI allows us to see a mechanical definition applicable to AI as it can be programmed to analyze an idea and compare if it has a certain base of criteria corresponding

As well as for unexpectedness, while doing their research, the authors did not encounter a lot of examples of AIs to evaluate the value of an idea. However, it does not mean that AI cannot be applied for this.

To evaluate the value of an idea, Maher and Fisher chose to evaluate the efficiency of the product based on different aspects of it and compare it to other similar products. They stated that their overall goal was to outline ideas "based on attributes that have utility preferences associated with them." (Maher and Fisher, 2012) *(Appendix 5.1.3)*

4.2.2 Interest of AI for Idea evaluation

Overall, the AI presented by Maher and Fisher allowed us to see clear proof of the usage of AI for Idea Evaluation. It could be easy to imagine not only how this AI-based system could be used in industries but also how it could work with easily accessible generative AIs.

4.2.2.1 AI against Evaluation Apprehension

Siemon (2023) created an experience to evaluate the impact of using an AI in idea evaluation to reduce the evaluation apprehension. As stated by Zhou et al. (2020) “social aspects, such as hierarchy, are factors that influence individual evaluation apprehension and subsequently lead to untapped creative potential and possible missed innovations” (Zhou et al., 2020) *(Appendix 5.2.1)*. Therefore, we could easily understand why finding an AI-based solution to reduce evaluation apprehension could be useful. The way Siemon (2023) made his experience by asking participants to come up with an idea, and then they were introduced to their evaluators that were Whether Allan, a fake AI, or a human. Both Allan and the human introduced themself and how they were going to evaluate their idea. The texts were identical except for the beginning where Allan introduced himself as an AI. After they were introduced to their evaluators, participants were questioned about their overall fear regarding the evaluation. This experience proved to Siemon “that an AI-based system like Alan can address the fear of negative evaluation and can be used to evaluate ideas from individuals who would otherwise withhold their ideas because of their fear of being negatively evaluated” (Siemon, 2023) *(Appendix 5.2.1)*.

Even if there is currently no current example of efficient generative or modern AI that can currently be used to evaluate an idea in product development, we know from Siemon (2023) that “approaches for AI-based idea evaluation that exist rely on methods like latent semantic analysis, latent Dirichlet allocation, and term frequency-inverse document frequency. Such AI-based evaluation methods can be compared to human expert evaluation” (Siemon, 2023) *(Appendix 5.2)*. This allows us to have clear examples of how an AI system can be used but moreover how useful it could be. In general, we know from Ayele and Juell-Skielse that “idea evaluation [...] can be supported by machine learning and idea mining techniques” (Ayele & Juell-Skielse, 2020) *(Appendix 5.2)*.

Overall, we can easily imagine how the last generations of AI, with machine learning and other algorithms, could not only be applied to idea evaluation but might be an overall advantage for companies who could implement them to decrease the negative effects of evaluation apprehension.

4.3 Concept development

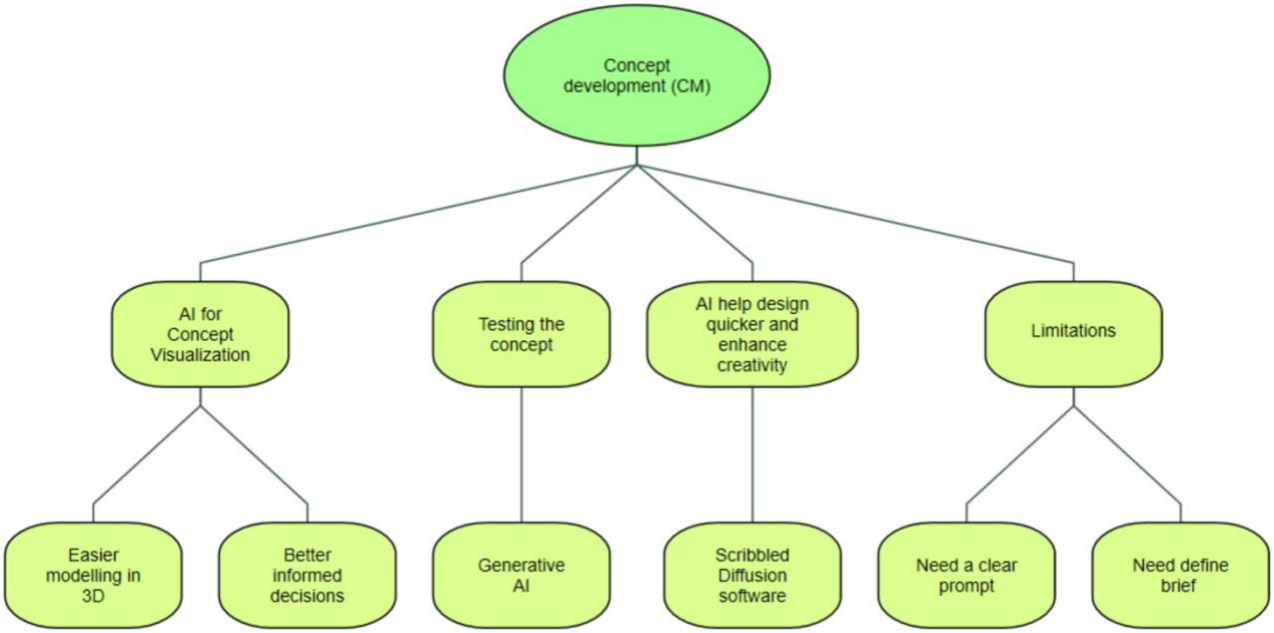


Figure 5 Mind map generated using Nvivo 12 illustrating the different areas of concept development adapted to AI usage.

In this third part of the new product development process, the authors will analyze the potential usage of artificial intelligence in the concept development stage.

Once the idea evaluation stage is done and the company is left with a few ideas, they will need to develop them to their minimum viable stage. This will give the company the possibility of "testing it with a selected group of customers and choosing the product with the best results will be developed" (Gurbuz, 2018). This stage can become very tedious and take up a large amount of time and resources for businesses. Artificial intelligence can help designers to produce their designs quicker, and it might even enhance their creativity. Fraenkel and Kamath stated that "with the human designers' guidance, AI can generate and instantly visualize new ideas, then swiftly explore

possible variations, ultimately enhancing design outcomes" (Fraenkel & Kamath, 2023) *(Appendix 5.3).* Thanks to their automated image generation, AI has become a time saver for designers who can now spend more time developing their designs and therefore offer better quality prototypes and mockups.

4.3.1 Concept visualization

Designing a product for its first test with the public is an important step that will help better define the needs and preferences of a potential customer. Creating unique, novel, and effective prototypes is a time-consuming process. To save time, AI offers different options to designers.

Designers very often create a sketch of the idea brought to them by the idea evaluation team. Based on those sketches and the approval of the managers, they move on to designing a more detailed MVP. A problem that very often arises is that a sketch can be very abstract, and the designer ends up creating a prototype that is very far from what the manager expected. Scribbled Diffusion is an AI that helps individuals create refined images from a sketch thanks to a neural network *(Appendix 5.3.1)*.

Artificial intelligence could also be used to generate "detailed visualizations from conceptual descriptions" (Young, 2023) *(Appendix 5.1)*. For this purpose, most of the AIs that will be used will be based on a NLP as this allows the AI to analyze the written description of an idea and a design and generate it in multiple images. On another hand, artificial intelligence can assist in tweaking already created designs to obtain the desired final results in a much faster manner by changing colors, styles, or even shapes. This allows a certain degree of versatility and adaptability in the process. "Generative AI algorithms can create realistic, three-dimensional renderings of new product concepts. Visualizing the design and form of a potential product makes it easier for stakeholders to understand what is required to physically build that product. Having comprehensive AI-generated renderings reduces the number of physical prototypes needed and speeds up concept exploration, review, and approval" (Bailey, 2023) *(Appendix 5.1)*.

Moreover, some AI could help designers make more informed decisions about the features of the product. By analyzing the outcome of previous designs, the AI will be able to provide recommendations on the different designs.

Modeling AI also opens a new possibility for designers to create more accurate and efficient 3D designs. AI can generate 3D models based on a certain set of inputs which frees up time for designers. This prototyping is highly beneficial for designers and future testing clients and it provides a better idea of the final product and its general features *(Appendix 5.1.1)*.

4.3.2 Testing the Prototype

Testing the developed concept is also a key aspect of this stage. It will provide the company with very important data regarding customer needs and the future product development stage. Nowadays, companies mostly rely on “focus groups to collect feedback, but focus groups aren't always accurate representations of customer sentiment, which leaves your product team vulnerable to potentially creating a product that doesn't actually serve your customers.” (Forsey, 2023) *(Appendix 5.2)*.

Artificial intelligence has the capability of making this process less time-consuming and easier for analysts. Generative AI can help summarize all the information and feedback that is retrieved from the testing and convert it into structured information. Analysts and designers can now work with data that is identified without having to spend a tremendous amount of time getting it ready, readable, and understandable. This enables designers to understand which features are appreciated or not by customers. It can also bring to light the emotions that the testing group is feeling toward the product in general. “AI provides several possibilities to learn faster and improve these experimentation cycles. Data-oriented decision-making and seamless testing have been infused into the product prototyping process with the support of AI” (Füller et al., 2022) *(Appendix 5.2.1)*.

4.3.3 AI’s limitations regarding concept development

For a generative AI to create an image or model of an idea, it will need a very defined brief and a clear prompt. If an idea is at a very basic stage, the designer must develop its features separately before asking the technology to create it. There is an option for the designer to use AI to help him figure out some features by starting with a very vague prompt and description of a product. This can help the designer come up with some new ideas. However, if a visual representation of the potential product is already very clear to the designer, he will have to work with the AI and provide it with enough information to obtain his desired outcome *(Appendox 5.4)*.

4.4 Marketing strategy

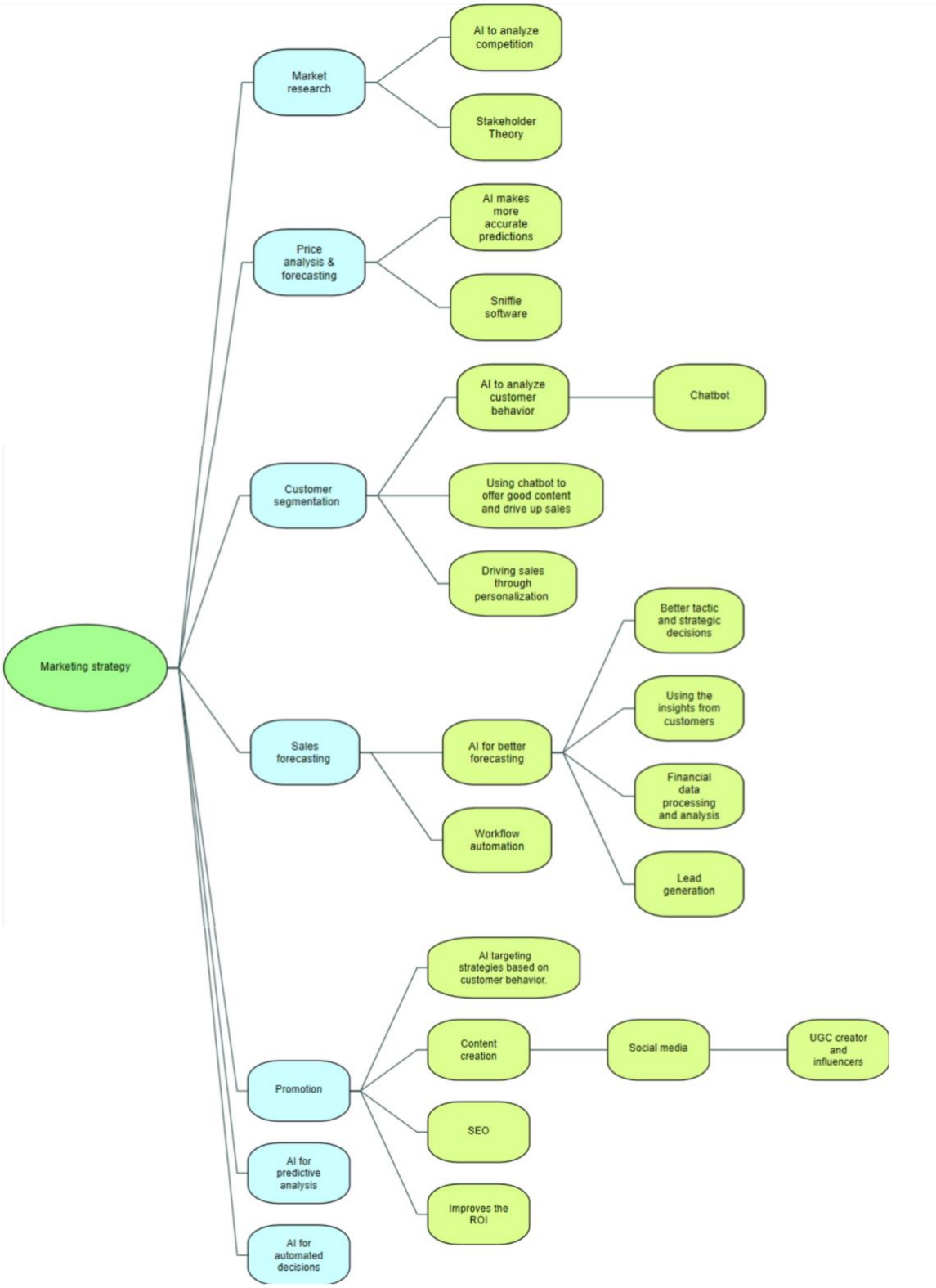


Figure 6 Mind map generated using Nvivo 12 illustrating the different areas of marketing strategy adapted to AI usage.

The mind map shows the different aspects to which AI can be applied to a marketing strategy phase.

As the authors explained above, a marketing strategy will be very different from one company to the other. Not the same resources and strategies will be used. Depending on the type of product, not every aspect of a marketing strategy will be applied in the same manner. In this part, the author wants to provide a comprehensive view of the applications of AI to the 4 stages of new product development. Flinders (2023) pointed out in an article by IBM that "AI marketing is the process of using AI capabilities like data collection, data-driven analysis, natural language processing (NLP) and machine learning (ML) to deliver customer insights and automate critical marketing decisions" (Flinders, 2023). Artificial intelligence's strongest point is to analyze data, it's a crucial tool for any market. It will help them make decisions quicker and better informed.

4.4.1 Market research

Market research and analysis play a key role in the product development process. Without this stage, a company might end up entering a product into a market that is not fitted for this product. Market research will provide an understanding of the environment, the competition, and the customer's preferences.

Fayed (2021) stated that "AI could understand markets properly. It could identify the market sectors accurately by targeting customers and identifying their characteristics, data, demographics, and purchasing capabilities. It could also identify the quantity of expected demand and revenue, each target market sector's specific needs, the preferable types of company and competitors' products." (Fayed, 2021) *(Appendix 6.1).*

This is normally a long and fastidious task for marketers to find all the relevant information and comprehensively organize it. With good market research, a company minimizes its risks of not successfully launching its product. If a company implements the use of AI in its marketing strategy, it will be able to "discover many potential prospects and new competitive advantages in the market" (Akerkar, 2019) *(Appendix 6.1)*. Artificial intelligence thanks to its analysis capabilities, could also provide key insights for the markers to define short and long-term goals.

4.4.1.1 AI to analyze the competition

A complete competition analysis can provide marketers with an excellent edge over their competitors. This should consider a company's direct and indirect competitors, their strengths, and weaknesses, the way clients view them, and whether they agree with all of their products/company values and their pricing strategy. “AI could identify the marketing mix strategies of competitors such as the pricing strategies used, the quotations they offer, the means of promotion they follow, their distribution channels, the range of the products provided through their websites, and any changes in their strategies.” (Fayed, 2021) *(Appendix 6.1.1)*. It has also been proven that AI could be a good tool for companies to follow their competition on a day-to-day basis. Providing them with constant insight, artificial intelligence enables a company to react to changes almost instantly:

“AI could determine changes in competitors' strategies” (Tjepkema, 2019) *(Appendix 6.1.1)*.

“AI identifies the customers' desires that competitors have not met to improve them” (Jabbar et al., 2020) *(Appendix 6.1.1)*.

4.4.1.2 Stakeholder Theory

Based on Freeman’s (1984) definition, a stakeholder represents an individual who is impacted by or can affect the achievements of a company's objective. “Stakeholder Theory (ST) proposes that value creation is a collaborative effort in relationships, ideally benefiting the focal business and all its Stakeholders” (E. Freeman, 2010) *(Appendix 6.1.2)*. Marketers need to take into account those individuals in their market strategy. The stakeholders need to be identified and classified into different categories/groups. In 2005, Lim et al. tested a methodology for stakeholder management strategies using a stakeholder management strategy support system (SMSS). In 2009, Castro-Herrera and Cleland-Huang presented a technique to automatically analyze the different contributions and interests of the stakeholders thanks to machine learning. Thanks to those studies, Ana Rita Henriques Montez (2022) concluded that “using AI to identify, classify and monitor stakeholders obtained better precisions and was more efficient than human classification” (Henriques Montez, 2022) *(Appendix 6.1.2)*.

4.4.2 Price analysis & forecasting

Olajiade et al. defined price as “the amount paid for acquiring any product or service” (Olajide et al., 2016). A price comprehends the cost of the product production and the profit margin for the company. The price of a product once offered to the customer, will define a wide range of criteria. “Cost of labor, manufacturing, and marketing all play a decisive role in pricing a product as well as how it will compete against similar products. If your product is competing in a saturated market, decide whether it will fall at the lower, medium, or high end of the market price range. Is it a luxury good? Or does it cater to the needs of the many? It’s important to decide your product’s market niche before manufacturing begins.” (Elias, 2023). A company must consider the demand and the willingness of the customer to pay for the product. The willingness of a customer will often be influenced by the value they see in the purchase of this product as well as their feeling toward the company in general. As with any other process, it can be time-consuming, and if the data isn’t sorted out properly, it could lead to a failure in the launch as the price wouldn’t be adjusted. AI can help “the organization reach the right price for the products using the flexible pricing strategy” (Shankar, 2018) *(Appendix 6.2)*. Hoffman and Novak (2018) also presented the fact that AI could detect pricing errors. Moreover, Singh et al. (2019), stated that AI could define pricing strategies that can help to increase sales. AI is being used by Honeywell to analyze the price elasticity and sensitivity to be able to reduce energy costs and negative price variance.

4.4.2.1 AI makes more accurate predictions

Pricing, as explained above, involves multiple factors. Reaching a final price is a complicated task but following the changes of the market isn’t an easy task either. “Real-time price variation based on fluctuating demand adds to the complexity of pricing task” (Verma et al., 2021). As the authors have developed earlier, AI algorithms can analyze a large amount of data and therefore identify patterns that humans may miss. Utilizing this tool can “lead to more accurate predictions of future prices, which can help businesses make better decisions about inventory and pricing strategies.” (Kotamäki, 2023) *(Appendix 6.2.1).* Machine learning-based AI will have the ability to learn the historical background of the data imported and make better predictions. These systems are also capable of adapting to market changes thanks to their learning abilities. Lastly, AI can take into account external factors that might influence the prices such as geopolitical events. They can therefore adjust their output on predictions accordingly.

4.4.2.2 Sniffie software

Sniffie is the perfect example of an AI that can provide help with price analysis and forecasting. The software uses AI to continuously analyze and learn about the data imported. It also takes into account the previous price history to make the best decisions possible. The platform offers different tools such as *(Appendix 6.2.2)*:

- Pricing tools: to maximize "e-commerce sales with automatic and quick pricing." (Sniffie, 2020)
- Price optimization tools: to "optimize e-commerce sales and margins with Sniffie's pricing tools." (Sniffie, 2020). They provide information to the user for them to understand their demand and use it in their forecasting.
- Market monitoring tool: to "track competitor pricing, campaigns, and availability." (Sniffie, 2020). They invite the users to use the data for "dynamic pricing or detailed market analysis." (Sniffie, 2020)
- Etc.

4.4.3 Customer segmentation

Customer segmentation is a strategy that can help organizations grow their business. It can help marketers find the correct targeted audience and therefore improve client retention as they are offering the product to the right customers. This division can be a complicated task as a lot of variations and situations can be considered. Devang et al. pointed out that "AI can help marketers segment targets more accurately" (Devang et al., 2019) *(Appendix 6.3)*. AI can also play a key role in figuring out what a customer might be looking for or what they are interested in. By analyzing data very efficiently, they help teams to come to those conclusions quicker. An example of an AI for customer segmentation can be ChatGPT. "ChatGPT can find the common traits, habits, and preferences of specific consumer groups by analyzing massive amounts of data." (Haleem et al., 2023) *(Appendix 6.3)*.

4.4.3.1 AI to analyze customer behavior

Customer segmentation will allow companies to engage better with their customers and therefore have a better return on sales. Verma et al. (2021) explained that, by analyzing the customer's behavior toward a product of a marketing campaign with AI, companies can improve their attraction and gain customer retention *(Appendix 6.3.1)*. Chatbots are a great way to gain those insights. “Chatbots can segment customers according to their behavior and preferences. They can then predict which content will speak to their specific pain points.” (Antosz, 2023) *(Appendix 6.3.1.1).* He also pointed out that “this also means chatbots can constantly collect data from prospects and customers, essential for effective sales performance management. You can use this data to improve the accuracy of your sales forecasts.” (Antosz, 2023) *(Appendix 6.3.1.1)*. Therefore, having the correct information to target the correct customer and potential customer can be used as a strategy to increase sales.

4.4.3.2 Using a chatbot to offer good content and drive-up sales.

A strategy that a company could also consider is to use the data collected through the chatbot to drive up sales. It has been shown that providing the correct content to the correct group can enhance the customer's intention to buy. Antosz showed that “by offering the right content at the right time, your reps will be more likely to land a sale, increasing their success rate and your company’s revenue” (Antosz, 2023) *(Appendix 6.3.2)*

4.4.3.3 Driving sales through personalization

The more a customer will feel like his need was thought of, the more loyal he will become and the more sales a company can hope to get. Bleich showed that “78% of consumers are more likely to make a repeat purchase with a brand that personalized their online shopping experience” (Bleich, 2023) *(Appendix 6.3.3)*. The arrival of AI into marketing has increased customer personalization by leveraging AI algorithms. “Businesses can offer personalized product recommendations, create tailored marketing messages, and respond to individual customer needs in real-time” (Chen et al., 2007) *(Appendix 6.3.3)*. This will improve customer satisfaction and therefore drive up “sales and business growth in the process” (Li et al., 2021) *(Appendix 6.3.3)*.

4.4.4 Sales forecasting

Sales forecasting enables the company to predict the number of sales they can expect in the near or long-term future. “When launching a new product, many businesses use forecasting to anticipate their sales outcomes and allocate production costs accordingly.” (Indeed, 2023) *(Appendix 6.4)*. Sales forecasting brings a lot of advantages to a company such as reducing risk, making a better profit, and identifying future market trends that could affect your demand. DealHub experts explain the main advantages of using sales projection in 4 point *(Appendix 6.4)*:

- “Improved decision-making – by estimating future sales, businesses can make informed decisions about product pricing, inventory levels, staffing needs, their sales process, and marketing strategy.
- Goal setting and tracking – sales projections can help businesses track their progress toward long-term goals and objectives.
- Better budgeting – knowing what will likely be sold in the future allows businesses to allocate their resources better.
- Reduced risks – businesses can identify and plan for potential risks in advance.” (DealHub Experts, 2023)

4.4.4.1 AI for better forecasting

Nowadays, sales forecasting has its challenges and most of the companies fail to provide an accurate one. “In fact, nine out of 10 sales managers report missing their forecast prediction by six percent or more.” (Antosz, 2023) *(Appendix 6.4.1)*. AI can provide great help with sales projections as it is capable of analyzing past data with real-time feedback. This will allow the company to have a better overview of the situation and make better-informed decisions.

4.4.4.1.1 Better tactics and strategic decisions

AI also helps the sales team to be more efficient and the leaders to have a more accurate plan regarding their short-term and long-term goals. Artificial intelligence and primarily Artificial neural networks (ANN) can now outperform the forecasting tools that were being used only a year ago. “AI and statistical methods jointly give more significant results in customer demand forecasting”

(Mediavilla et al., 2022) *(Appendix 6.4.1.1)*. Moreover, ANN can suggest another way of "making better intelligent decisions" (Biswas et al., 2023) *(Appendix 6.4.1.1)*.

4.4.4.1.2 Using the insights from customers

With AI's capacity to analyze vast amounts of data, the company can gain valuable insight into the changes that might occur in their purchasing habits. This information can come from chatbots, social media, or even internet research. "AI and ML collect vast datasets on customer behavior, preferences, purchases, pain points, and more" (Antosz, 2023) *(Appendix 6.4.1.2)*. Dealhub pointed out that "if a company's business is seasonal, then marketing and sales directors need to consider seasonal fluctuation when projecting future sales" (DealHub Experts, 2023) *(Appendix 6.4.1.2)*. By gathering data constantly, AI can highlight different variables such as seasonality and the sales can then make better sales forecasting. Moreover, thanks to natural language processing systems, companies can grasp the sentiment of a customer towards a product or a feature and adapt their strategy accordingly. By better meeting the customers' needs, the sales team can provide an easier prediction.

4.4.4.1.3 Financial data processing and analysis

Identifying cost-saving opportunities can also impact a company's sales forecasting. By combining AI with enterprise resource planning (ERP), teams can get direct feedback on the business and the whole product production and therefore identify opportunities to make better financial decisions. "AI forecasts can reduce financial risks too. For instance, by analyzing customer data (like credit score, income, and employment history), AI software can predict the likelihood of a customer repaying a loan" (Antosz, 2023) *(Appendix 6.4.1.3)*. Of course, tracking the market conditions can also bring a key advantage. AI software can follow market fluctuations which can be very important for organizations working in multiple countries.

4.4.4.1.4 Lead generation

"With AI, you can track each prospect's intent to buy in real-time, helping you fine-tune your forecasting models and close more deals, as well as reduce churn. Sales organizations as a whole can make better use of their time, as they won't waste time reaching out to prospects who aren't ready to buy." (Antosz, 2023) *(Appendix 6.4.1.4)*. AI can differentiate all the data that a customer

provides and use that information to identify the most important leads. This can also allow brands to find potential brand ambassadors and save money in the long term.

4.4.4.2 Workflow automation

“Workflow automation is the process of finding tasks performed by a team and automating them with technology. This type of automation is a great way to accomplish tasks and produce consistent results.” (Efti, 2020). With the use of new technologies such as AI, the workflow of teams is lowered but results are also more accurate and more precise. Workflow automation also means humans have less impact on the outcome and the output is therefore less subject to human error. “Thanks to workflow automation, AI forecasting software can analyze vast quantities of data from multiple sources, giving you highly accurate forecasts” (Antosz, 2023) *(Appendix 6.4.2)*.

4.4.5 Promotion

Promotion is viewed as the strategy that is put in place to increase awareness about the product and hopefully get potential customers to buy the product. To successfully achieve a new product launch, a company needs to have a complete advertising campaign. In 2018, Yilun and Michal found that AI contributes to improving the means of product promotion.

4.4.5.1 AI targeting strategies based on customer behavior.

Understanding customer behavior is not only key for a sales strategy. According to customer behavior, the marketing team can figure out which content will speak to which audience and therefore perfectionalize their strategies. “AI techniques allow recognizing the online customers' nature, their actions and behavior in the online environment. It contributes to identifying customers' preferences, tastes and personalities, identifying their feelings and ways of responding to the marketing mix and the places they are online, how satisfied they are with the products and their vision of these products by analyzing social media. With this, organizations could focus on content that attracts and persuades customers to buy” (Fayed, 2021) *(Appendix 6.5.1)*. Target content is a great way to reach the audience in the desired way. Depending on the customer and the product they are hesitating to buy, content in the format of a social media post or a newspaper article might have a different impact. “In digital marketing, it is possible to conduct target audience-oriented marketing by collecting data about customers, consumers, potential customers, and the

target audience with artificial intelligence technologies." (Cezim, 2023) *(Appendix 6.5.1)* Bleich went even further by explaining that "by analyzing user data, these algorithms can now create personalized campaigns that are more likely to resonate with customers and lead to higher conversion rates" (Bleich, 2023) *(Appendix 6.5.1).*

4.4.5.2 Content creation

A big part of marketing strategy is deciding how the content that will be offered to the clients will be created. After identifying where AI can be useful in this process, companies can utilize AI to create different types of content. Haleem et al. stated that "ChatGPT might be helpful for digital marketers that wish to enhance their campaigns and engage with their target consumers. It helps create material for social media updates, blog entries, and other forms of content" (Haleem et al., 2023) *(Appendix 6.5.2).* Social media has become an essential part of any promotion strategy. "Artificial intelligence technologies are very effective in monitoring social media, they are useful for understanding personalized content" (Devereux et al., 2019) *(Appendix 6.5.2.1).* In the past few years, we have seen an increase in influencers and UGC creators. Seeking partnerships and strategic collaboration can be part of the promotion strategy. It can help organizations extend their reach to potential customers who maybe don't know about them. "It is shown that UGC (User Generated Content) plays an important role in product sales. The social media report 2012, found out with a survey report that 70% of customers kept faith on UGC for making their buying decisions" (Chong & Zhou, 2014) *(Appendix 6.5.2.1.1).*

Here are a few examples of AI tools that can provide significant help in the content creation process:

- Postwise is a X tool that uses AI to create written content, schedule, and grow an individual or company's Twitter account.
- Syllaby provides prompts and suggestions according to the company's target audience.
- Adobe Podcast AI is a tool to turn the quality of any audio into a professional recording. This can be particularly useful for businesses that have a strong audience on social media, the radio, or even podcasts.
- Midjouney or DallE-2 to create images

Content creation has become very important and should be included in any marketing strategy.

4.4.5.3 SEO

With a constant shift toward the digital world, companies must ensure that customers will land on their page or their content before others. For that, search engine optimization (SEO) has become a key tool but it isn't always easy to put into practice as it takes a lot of factors into account. "Deploying an AI solution to enhance search engine optimization (SEO) helps marketers increase page rankings and develop more sound strategies" (Flinders, 2023) *(Appendix 6.5.3)*. Cezim pointed out that "Marketers have become more dependent on the use of AI to adapt to search engines' algorithms. SEO covers a myriad of requirements, both technically and semantically" (Cezim, 2023) *(Appendix 6.5.3)*. ChatGPT can be a tool used to help SEO, starting at its version 3.5, ChatGPT offers already-made prompts to help individuals figure out the best SEO for their product.

4.4.5.4 Improves the ROI

The correct promotion strategy can also have a tremendous impact on the return on investment (ROI) of a business. By measuring the impact of their marketing campaign, businesses will be able to rate their effectiveness. As Flinder explained in 2023, with this type of evaluation, businesses will be able to better allocate their funds to prioritize things that are working out and lower the investments on things that are not generating enough return. To help the marketing ROI of business, Ijaz (2023) demonstrated that generative AI-based testing with survey could help optimize messaging to have better conversion rates, engagement, and customer insights. "By gathering customer feedback and analyzing the performance of their messages in real-time, businesses can make more informed decisions about their marketing strategy and improve their overall marketing results" (Ijaz, 2023) *(Appendix 6.5.4)*.

4.4.6 AI for predictive analysis

In a more general view, the authors can conclude that AI is perfectly suited to help in predictive analysis. Zhiwei stated that "AI technologies have considerably transformed marketing strategies, offering unprecedented capabilities for predictive analytics" (Zhiwei, 2023) *(Appendix 6.6)*. Thanks to its effectiveness and accuracy in data analysis, AI technology is proving itself to be more useful for predictive analysis. In fact, Flinders (2023) explained that markets often face a complicated

process of having to analyze data to plan their campaign. AI could provide help thanks to its predictive analytics and its usage of efficient machine learning (ML) algorithms and provide clear insights on the customer.

4.4.7 AI for automated decisions

Marketing strategies rely mostly on making decisions. If an AI tool is provided with enough data, it should be more or less capable of making decisions in an automated manner. “Offering more than automation or other simple digital tools, artificial intelligence imitates the human mind to make decisions and function. As a result, it helps marketing teams create effective marketing plans and workflows.” (Cezim, 2023) *(Appendix 6.7*). By utilizing this tool, the marketing team can save time and resources and apply their knowledge to other topics to streamline the process.

4.5 Business Analysis

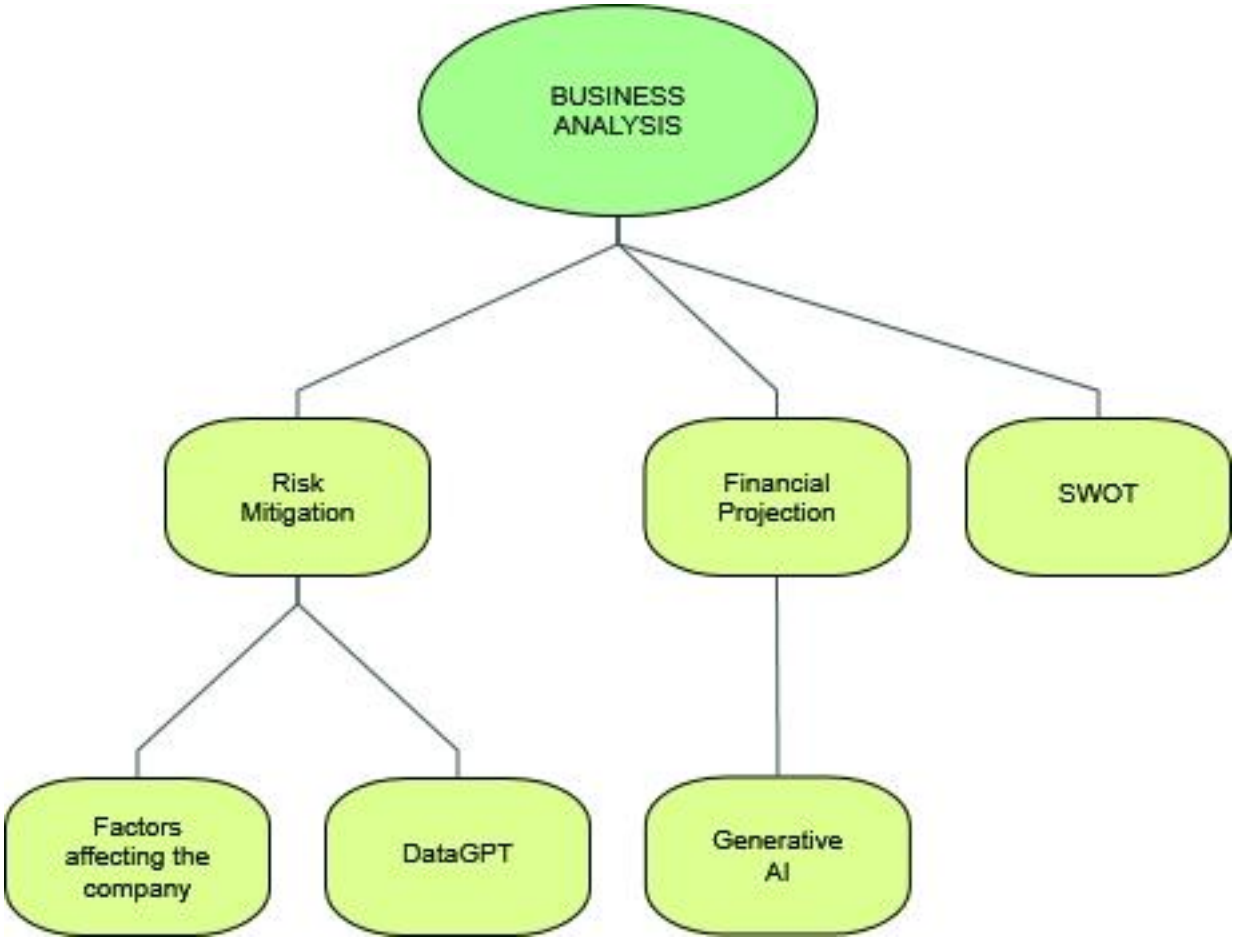


Figure 7 Mind map generated using Nvivo 12 illustrating the different areas of business analysis adapted to AI usage.

While doing their research, the authors noticed that they tend to find less information regarding Business Analysis and its usage of AI than for the other steps of product development. Overall, it does not mean that there is no possibility of implementing AI for business possibility. Knowing AI's efficiency for data analysis, it is most likely that business analysis is just an area that is less affected by AI because of ethical considerations and questions.

4.5.1 SWOT

The first area where AI could support business analysis is by supporting companies to create their SWOT analysis. An analysis that has the goal of identifying the strengths, weaknesses, opportunities, and threats that could affect the company. "AI could analyze opportunities, external threats,

strengths and weaknesses of an organization. It could collect internal and external data, analyze them accurately and determine what they offer of opportunities or external threats to the organization and the strength or weakness they provide within the organization." (Fayed, 2021) *(Appendix 8.3)*. In his explanations, Fayed allows us to ensure that not only AI can help construct a SWOT, but it can also independently collect the data before analyzing it, thus improving SWOT construction efficiency. We also know that "AI could identify the organization's opportunities as soon as they are available, it allows progressing over competitors" (Sentance, 2019) *(Appendix 8.3)*. Here we get another insight into how useful AI would prove to help in SWOT analysis. Sentance (2019) highlights the ability of AI to furnish real-time feedback to gain a huge competitive advantage by identifying opportunities at available times, which means not only gaining insights into those opportunities as soon as possible but also outside of working hours, for example during nights or weekends.

To generate a SWOT, AI needs internal data to analyze strengths and weaknesses (Syam & Sharma, 2018) and external data for threats and opportunities (Kosinski & Wang, 2018). It is therefore easy to imagine, how given the right internal and external data, it would be feasible for the latest generations of AI to create a SWOT analysis, even a generative AI combining NLP, CNN, and transformer models.

4.5.2 Risk Mitigation

One of the most important parts of the business analysis process is to "calculate risk with an estimation of minimum and maximum sales" (Gurbuz, 2018) *(Appendix 8.1)*. To do so, one of the most important steps is to identify the different factors that could affect the company. Luckily, we already know that AI allows for defining the factors affecting an organization (Kietzmann et al., 2018), including market share and product demand (Jarrahi, 2018; Vijayaraghavan, 2019). We also know from Davenport et al. (2020) that Artificial Intelligence can automate the business process, learn insights from past data, and generate consumer and market insights. Once again, we got a good idea of how AI could be usable to gain insights into the market and the consumers.

Generative AI proved itself useful for gaining insights "enabling analysis that's 15 times cheaper and queries that are 60 times faster than with traditional tools. Whenever users ask it a question, it will use generative AI to execute millions of queries instantly to surface the most relevant insights and

answers." (Wheatley, 2023) *(Appendix 8.1)*. Not only is generative AI faster and cheaper to gain insights but it is already well developed with for example DataGPT that through "uniting conversational AI with a proprietary database and the most advanced data analytics techniques, DataGPT says, its platform can proactively uncover insights for any user in any company. Nontechnical users can type natural language questions in a familiar chat window interface, in the same way as they might question a human colleague." (Wheatley, 2023) *(Appendix 8.1.2)*. Moreover, in the same text, the ease of use of DataGPT is explained through the quality of its results "It can generate both text-based responses and visualizations to help users better understand the insights it discovers" (Wheatley, 2023) *(Appendix 8.1.2)*.

4.5.3 Financial projections

Financial projections, while being one of the core of business analysis, is quite a limited area of artificial intelligence, in fact, in an article from Hoeksema for example, we can see usage for generative AI not to "build a financial model from scratch just yet" (Hoeksema, 2023) *(Appendix 8.2.1)* but step by step. This article focuses on the different step you could apply to use ChatGPT's generative AI to support financial model building by helping with:

- Finding a financial projection template
- Estimate startup expenses
- Forecast revenue based on an already existing business plan
- Project expenses as a percentage of revenue
- Estimate staffing cost

Overall, while generative AI is being usable for financial projections as an assistant, Hoeksema still adds that "while some aspects of the projections seem plausible, others deviate significantly from industry norms" (Hoeksema, 2023) *(Appendix 8.2.1)*. While AI could provide an advantage for financial projections, it still struggles to conform to industry standards.

4.6 Product development

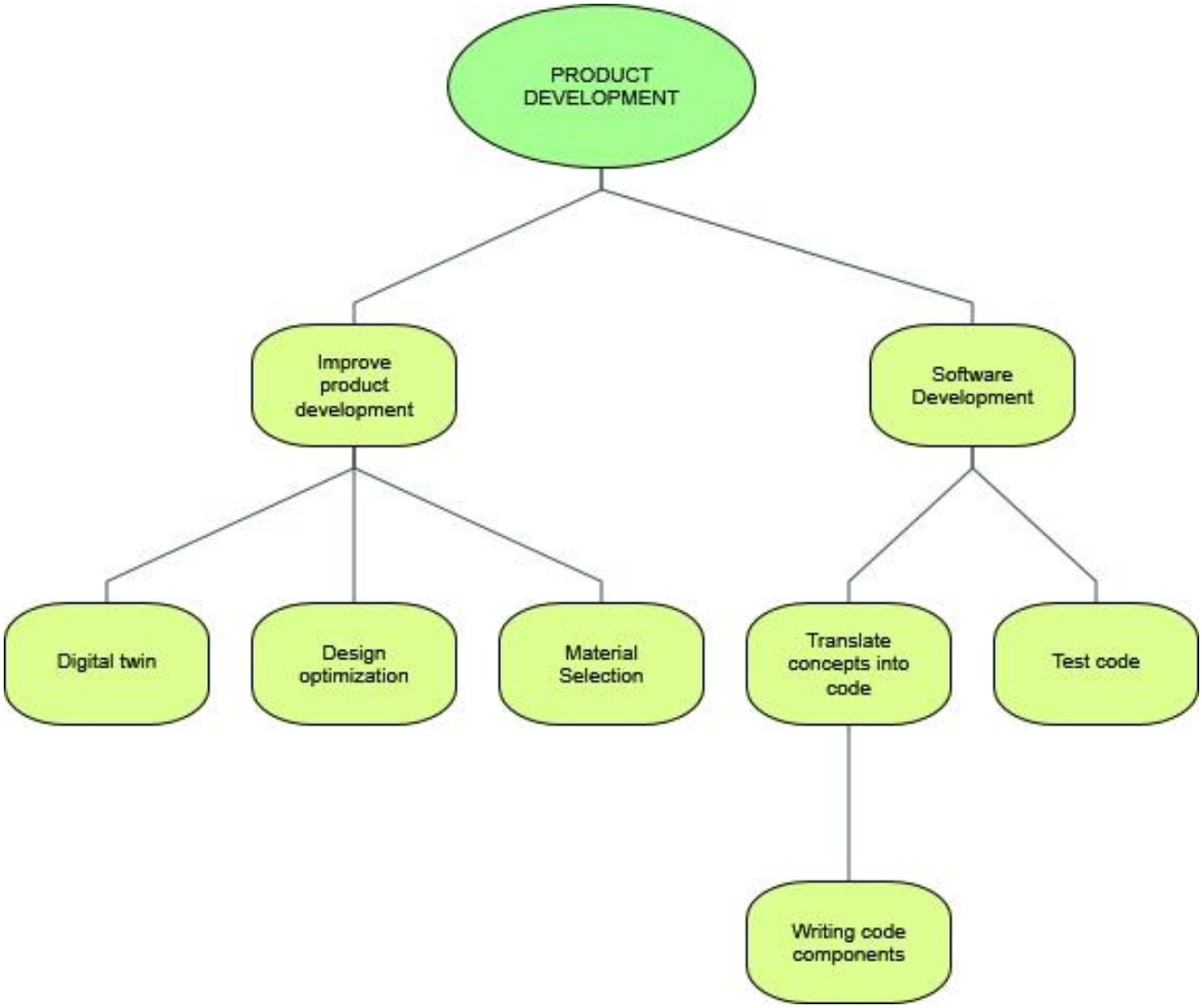


Figure 8 Mind map generated using Nvivo 12 illustrating the different areas of product development adapted to AI usage.

4.6.1 Improving Product Development

One of the main areas where AI could support product development is by optimizing the design process, therefore it could help all aspects of Gurbuz's (2018) tests of product development on safety, attractiveness and effectiveness.

A really good way to do so is by improving material selection, first of all, as stated by Oehm and Som “Algorithms can suggest materials for product innovations and predict outcomes and product failures by testing different variations” (Oehm & Som, 2023) *(Appendix 9.1)*; therefore, AI could

support safety by testing outcomes of different materials and predicting the safest one. Moreover, as stated by Bailey for the magazine Fast Company “As part of design optimization, generative AI can help choose the best materials based on cost and performance specifications. The AI algorithm can predict how different materials will perform based on their properties, assessing different materials for their strength and fatigue resistance. AI also makes it easier to predict production costs based on various material and process choices.” (Bailey, 2023) *(Appendix 9.1.3)*. Therefore, we now have proof that generative AI not only helps with safety testing with material selection but also reduces cost based on materials, and the price of using this material (transport, manufacturing,…).

In the same article, Bailey (2023) states that if given an initial design, AI algorithms could analyze its data to suggest modifications. He showed examples of questions AI could answer such as “can the product be made lighter or stronger? What impact does the design have on costs and manufacturability?” (Bailey, 2023) *(Appendix 9.1.2)*. Bailey also pointed out that thanks to generative AI, designers can create more cost-effective and better products faster. Therefore, inducing the idea that AI in general proves its cost efficiency by optimizing design, it only needs a first design to base itself upon and then make any optimization that can improve safety or attractiveness by making the product stronger and therefore more time resistant.

Another thing Bailey states is that “generative AI can render accurate digital prototypes of proposed product designs. Using digital techniques is more cost-effective for design iteration and testing compared to physical prototyping. Using digital designs reduces the number of prototype generations” (Bailey, 2023) *(Appendix 9.1.1)*. The digital designs he is referring to could easily be identified as digital twins. “Digital twins is not only a representation of physical products, but also a representation of the real world in virtual space.” (Guo et al., 2020) *(Appendix 9.1.1)*. They also support the idea that AI and digital twins are combined stating “digital twin is deeply combined with artificial intelligence technology to promote the real-time interaction of integration of information space and physical space, so as to carry out more real digital simulation in the information platform and realize more extensive application. Combining a digital twin system with a machine learning framework, a digital twin system can self-study according to multiple feedback source data, to present the real situation of physical entities in the digital world almost in real time and can speculate and preview the upcoming events. The self-learning of the digital twin system can not only rely on the feedback information of sensors but also learn from historical data or integrated

network data. In the process of continuous self-learning and iteration, the simulation accuracy and speed will be greatly improved." (Guo et al., 2020) *(Appendix 9.1.1)*. Knowing how great generative AI features with machine learning, it is therefore of no doubt how generative AI can be used for designing digital twins.

With all this information, it is clear that generative AI could be useful as it could help with both primary aspects:

- Turning business plans into concrete deliverables whether by producing a virtual or physical sample
- Being used for product testing regarding safety, attractiveness, and effectiveness

4.6.2 Software Development

A more precise area of product development that can be improved with the help of AI is software development.

4.6.2.1 Translate concept into codes

An area where generative AI could be particularly useful regarding software development is by translating concepts of human words into computer programming code. "It [AI] has the ability to translate concepts from English into the programming language" (Haleem et al., 2023) *(Appendix 9.2.1)*.

For example, Cheng stated that "ChatGPT has the capability to generate code in different languages. It could be used to supplement developers by writing small components of code, thus enhancing the productivity of developers and software quality." (Cheng, 2023) *(Appendix 9.2.1.1)*. Overall, this proves not only the possibility of using AI for software development but also how accessible it is with for example ChatGPT.

Currently, modern AI examples to write code instead of the user are well incremented with for example Framer, a product that uses AI to assist and help beginner users with website development.

4.6.2.2 Test code

Other than writing code, an important part of software development for product development is testing. The number of examples of modern AI that can support code testing is huge. Here is an example of some of the authors' findings:

- Kodezi AI: an AI-based system to correct errors inside of a codebase
- Testim.io: An AI-based system that uses machine learning to verify code and can later assist in maintenance
- TestComplete: An AI-based system that verifies the functioning of the user interface
- Aqua ALM: An AI-based system that uses NLP to perform automated test
- Mabl: An AI-based system that can perform code testing without the need for specific queries

Overall, AI and Generative AI are quite useful in Product development by enhancing both delivering concrete deliverables and performing tests, especially regarding software development.

4.7 Test Marketing

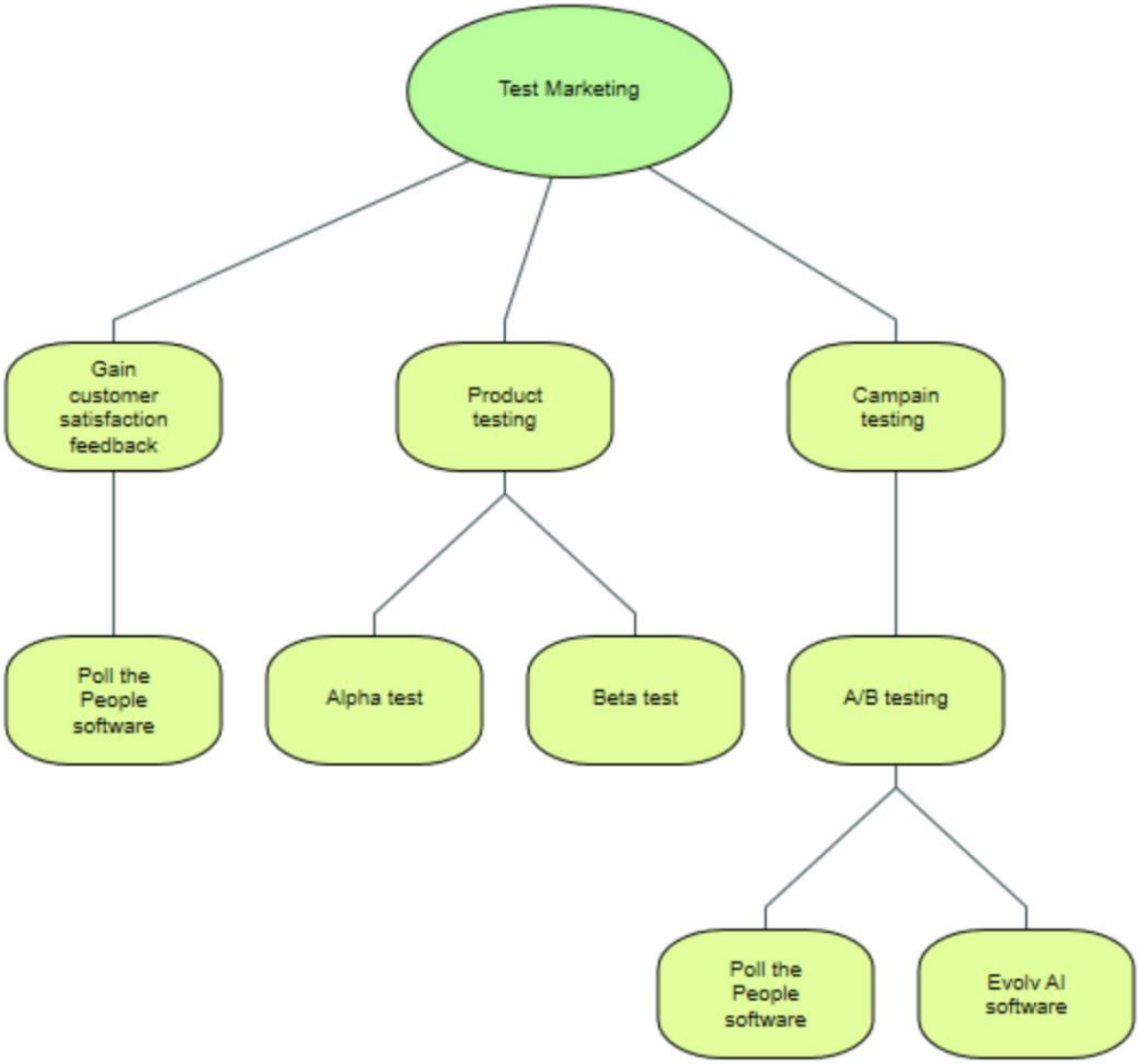


Figure 9 Mind map generated using Nvivo 12 illustrating the different areas of test marketing adapted to AI usage.

The mind map shows the different aspects to which AI can be applied to a test marketing phase of the new product development process.

Test marketing is the stage where a company will test the product in its final to a certain number of clients. This form includes all the final aspects of the product such as its features and its marketing strategy. It allows companies to see if the final product still engages customers' interest or if it needs

to be reworked. “Test marketing, also known as market testing, is a marketing technique that businesses use to evaluate the viability of their new products, services, or marketing campaigns before releasing them on a large scale.” (Bakutyte, 2020). This process can provide game-changing information for the business to have a successful product launch.

4.7.1 Gain customer satisfaction feedback

Test marketing allows a company to gain a large amount of data from the customer and gain a better idea of what functions and what doesn’t. It allows them to make changes if needed to provide the best possible product before making a significant investment in mass production and spreading the marketing campaign on a national market. Thanks to this, businesses might be able to save a huge amount of capital and reduce their risk. Artificial intelligence can provide a significant help in gathering and understanding customer satisfaction feedback. “Generative AI-based message testing with surveys can provide businesses with more accurate customer feedback. By using advanced algorithms, the AI can analyze responses to survey questions and identify patterns in customer behavior and preferences, allowing businesses to make more informed decisions about their messaging.” (Ijaz, 2023) *(Appendix 10.1)*. AI capable of analyzing feedback as well as feelings and emotions, will be able to provide valuable insights to the team to make more informed decisions. Poll the People is an AI software used for message testing. It uses AI to gather feedback from the customer and analyze the performance of a campaign in real time.

4.7.2 Product testing

We can use the test marketing part as two defined parts: product testing and campaign testing. Product testing refers to the process of proposing only the final product to customers to analyze their emotions and feedback. “Gut Check. AI can assist in identifying potential product flaws and highlight areas for improvement, to allow adjustments to be made before product launch.” (Fraenkel & Kamath, 2023) *(Appendix 10.2).* Product testing can be done in 2 ways:

Alpha testing: this testing will be done in the company. Testing will be done with the staff before getting the product tested by customers. This can provide primary insight into changes that the company might undertake before beta testing.

Beta testing, also known as user acceptance testing (UAT) or end-user testing, refers to the test being done with an external audience. The company will do an early release of the product to a limited and defined group of customers to gather their feedback. This often relies on a free sample of the product. Quantilope explained that “monitor data in real-time and watch as it’s automatically populated into your existing data charts and reports” (Quantilope, 2023) *(Appendix 10.2.2)*.

As the objective of these test is to gather the feedback on the product before launching the commercialization, AI can provide help by automating the testing process and provide results and insight by category to help easily visualize the potential problems.

Those tests will enable the company to predict the market response to a product and make changes if needed.

4.7.3 Campaign testing

The other part of test marketing is campaign testing. Understanding which format will suit the promotion of the product can be a game changer. With the correct campaign, a company might be able to reach customers that were normally out of their targeted market. One of the better ways to test a campaign is to use an A/B testing. “A/B testing is a way to compare two variations of a digital touchpoint to see which performs better.” (Severn, 2019) *(Appendix 10.3.1)*. “Marketers use A/B testing to send one advertisement to some users and a different one to others to test how well the audience responds to certain words, phrases, features and placement of items.” (Terrell Hanna, 2022) *(Appendix 10.3.1)*. Artificial intelligence can make this process more efficient and less complicated. This process produces a lot of data that can be complex and fastidious to analyze. Thanks to AI's capability to treat and analyze big data they can provide instant insight with more accuracy than humans. “A/B Testing Capabilities Poll the People enables businesses to conduct A/B testing to compare the performance of different messaging variations. The platform’s generative AI algorithms analyze the results of A/B tests to identify the most effective messaging and optimize messaging for increased conversion rates, engagement, and customer insights.” (Ijaz, 2023) *(Appendix 10.3.1.1)*. On the other hand, other AI tools can also provide better help and insights than A/B testing. AI can perform real-time experiments by continuously testing and eliminating poor-performing idea while adding new variants. Thanks to the use of AI, this can be done without having to stop and start the experiment. For example, Severn (2019) pointed out that if a combination that

is performing well is increasing orders but reducing the number of items per order, AI can automatically introduce a new variant to make it easier to increase items in the cart without having to run a separate test *(Appendix 10.3.1.)*.

Evolv AI for example can run 6 years' worth of experience in 3 months and Poll the People. *(Appendix 10.3.1.2)*.

4.8 Commercialization

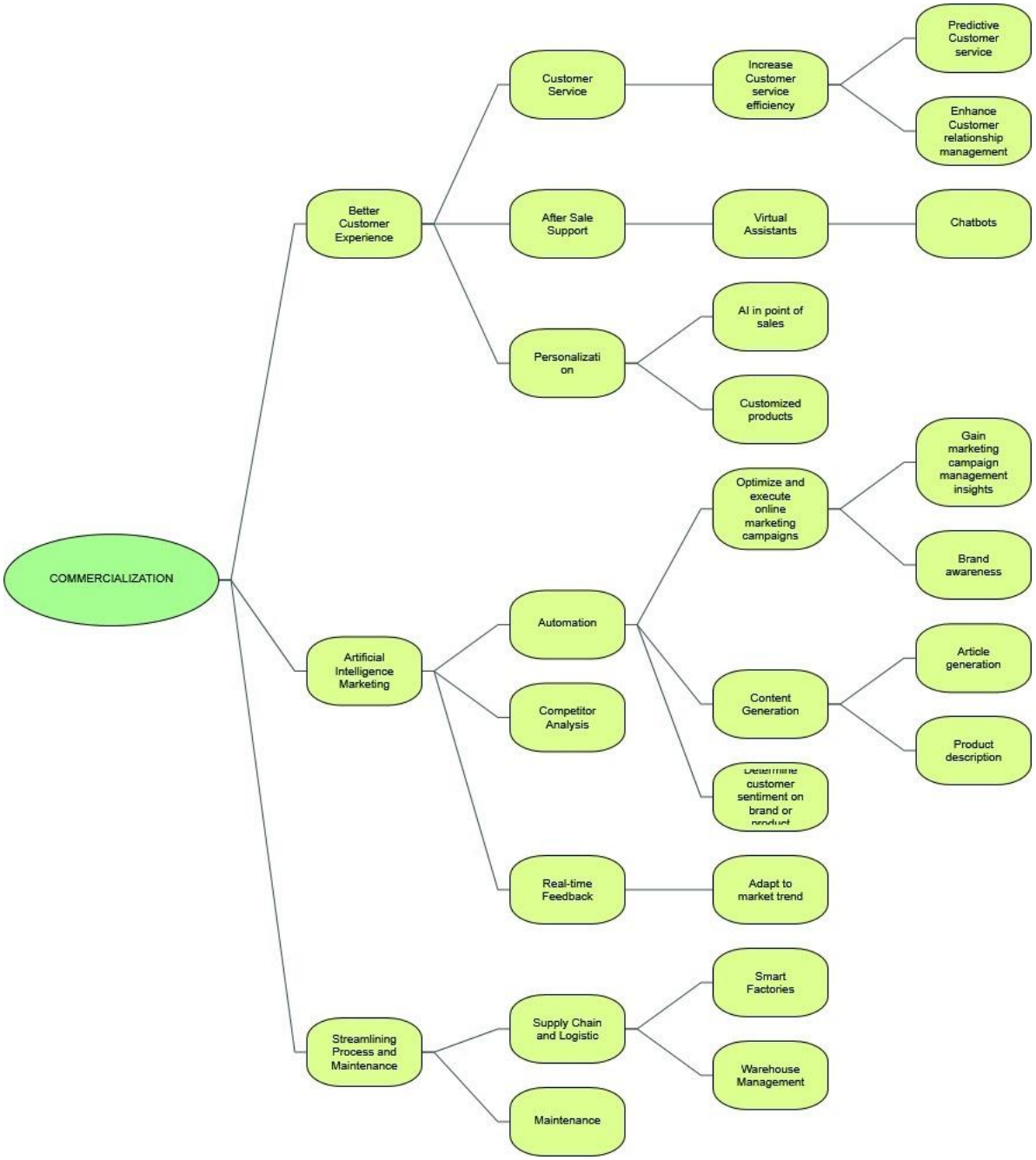


Figure 10 Mind map generated using Nvivo 12 illustrating the different areas of commercialization adapted to AI usage.

While doing their research, the authors noticed that commercialization is one of the areas of new product development with the most AI applications.

4.8.1 Improving customer experience

4.8.1.1 Improving customer service

AI could help to improve customer service by improving its efficiency. We know that AI could be used for this task by its ability to answer customer queries 24 hours a day (Oosthuizen, 2021). Another way to do so would be by implementing more predictive customer service. For example, Saffron, an AI-based application has been used by USAA to predict how customers might get in touch with them and they improved the efficiency of those predictions from 50% to 88% with the use of AI. (Devang et al., 2019). Predictive customer service proves itself valuable for a company as stated "Predictive Customer Service specifies and engages clients by reaching them with offers, coupon and suggested info after completing purchases to increase the engaging audience and avoid churning." (Theodoridis & Gkikas, 2019) *(Appendix 11.1.1.1.1)*. The importance of predictive customer service is especially valued for big companies with large audiences, for example, we know that using layer 6 AI, Netflix can save up to $1 billion with predictive analysis (Devang et al., 2019). Companies can also improve customer service efficiency by applying CRM (Customer relationship management). "CRM is a business strategy that adapts to a customer-centric approach by filtering valid information and maximizing the collection of user information. It is an excellent AI-driven strategy for gaining accurate insights." (Cezim, 2023) *(Appendix 11.1.1.1)*.

Not only is CRM efficient for gaining accurate insights, but it is also useful for reducing human errors and identifying at-risk customers, as has been stated by Flinders, "AI technologies help marketing teams improve their customer relationship management (CRM) programs by automating routine tasks like the preparation of customer data. They can also reduce the likelihood of human error, deliver more personalized customer messages, and identify at-risk customers." (Flinders, 2023) *(Appendix 11.1.1.1.1)*. Finally, AI technologies reveal themself as helpful combined with CRM by "analyzing the mood of consumers and their emotions through natural language processing (NLP) which helps managers get to know their customers better and improve the experience of their interaction with the brand" (Gerlich et al., 2023) *(Appendix 11.1)*.

4.8.1.2 Improving after-sale support

After-sale support is one of the most important parts of customer experience, sometimes a bit overlooked by companies. We not only know that AI technologies using NLP "manages to engage a

two-way conversation to provide the appropriate customer support" (Daqar & Smoudy, 2019) *(Appendix 11.1.2)* but we also know from Forrester (2016) that customer support is one of the main areas for investments and adoption of AI systems.

We for example know that virtual assistants are a useful appliance of AI for after-sale support. "Many customers enjoy talking to a virtual assistant during or after their purchasing process." (Daqar & Smoudy, 2019) *(Appendix 11.1.2.1)*. Already existing examples of virtual assistants proved themselves useful. "A virtual assistant embedded in a mobile bank app, taking advantage of NLP, handles client requests alone by responding to their inquiries. A virtual assistant presents application features, options to make a purchase of bank products by oneself and providing information about the location of bank branches and cash machines (ING Bank Śląski)" (Jarek & Mazurek, 2019) *(Appendix 11.1.2.1)*. One of the best examples of existing virtual assistants that thrive in the industry is Chatbots. Chatbots prove themselves useful by operating "24/7, letting you engage with customers consistently and resolve issues as soon as they arise" (Antosz, 2023) *(Appendix 11.1.2.2)*. This all-time availability of chatbots is useful when we know that "51% of customers believe that a business should be opened to support all the time (24/7)." (Daqar & Smoudy, 2019) *(Appendix 11.1.2.2)*. Other than being available at all times, Cezim (2023) showed that chatbots prove themselves useful by dealing with multiple customers at the same time. There is already an enormous amount of existing chatbots, most modern websites are built with chatbots nowadays. For example, Starbucks is using one in their app, and through virtual assistants such as Google Home or Amazon Alexa, these chatbots allow customers to easily order without needing to be in one of their sales points. As chatbot usage increases, companies need to implement one, this is the service that is for example proposed by Tidio.com, an AI-based chatbot that can be implemented for any company.

4.8.1.3 Personalization

Offering personalization is nowadays one of the most important aspects of customer experience and it is therefore logical that it is at least partly AI supported. We know that AI can for example be "used to personalize the shopping experience with personalized searches, personalized recommenders or personalized prices and promotions" (Weber & Schütte, 2019) *(Appendix 11.1.3)*. The customized shopping experience with AI can for example be seen in point of sales. "A major application of AI within this task set is the replacement or automation of activities at the point of

sales (POS). AI applications related to serving customers have particularly been developed for POS digitization, automation and advertising." (Weber & Schütte, 2019) *(Appendix 11.1.3.1)*. Another area of personalization that would prove its efficiency is personalized products. "Designing an artwork for each specific user according to his or her preferences would simply be impossible. But an AI factory, and in particular reinforcement learning loops, can address this design problem effectively." (Verganti et al., 2020) *(Appendix 11.1.3.2)*. This idea of AI factories that would be able to offer a slightly different product for every user based on his preferences is the current most advanced product personalization AI could offer.

4.8.2 Artificial Intelligence Marketing (AIM)

One of the main current uses of AI is in marketing, creating the new area of Artificial Intelligence Marketing (AIM). "Artificial Intelligence Marketing (AIM) is an approach of optimally utilizing technology and customer data to enhance the customer's experience." (Jain & Aggarwal, 2020) *(Appendix 11.2)*.

4.8.2.1 Marketing tasks automation

First of all, AI can prove itself useful in managing and executing marketing campaigns. For example, with the use of Albert, an AI-based system for marketing automation, Harley Davidson increased their dealership leads by 29 times in only 3 months (Devang et al., 2019). Albert AI is not only a campaign manager but also a great tool for marketers to gain insight and improve the way they work as this "AI learns the specificity of a given company, then, based on data analysis, comes up with recommendations concerning the campaign strategy" (Jarek & Mazurek, 2019) *(Appendix 11.2.1.1.1)*. Those insights can prove useful for marketers to know which area of focus they should concentrate on. "What Artificial Intelligence does is help marketers in analyzing customers' search patterns and determining the key areas to which they must focus their efforts." (Jain & Aggarwal, 2020) *(Appendix 11.2.1.1.1)*.

"Development of a marketing campaign to launch a new car model - the Toyota Mirai. Using data provided by a selected target group, computers performed an analysis of texts and videos on YouTube to teach the machines the preferred style of the said target group. Next, through multiple iterations, they developed the first creative advertising campaign, and the final texts for the adverts

were approved by the supervising team. The result was almost a thousand of advertising spots tailored to the profiles of the ad recipients on Facebook." (Jarek & Mazurek, 2019) *(Appendix 11.2.1.1)*. The Toyota Mirai campaign is a great example of how the latest generation of AI can prove itself useful and even better performing than humans for marketing as it would be otherwise unfeasible for a company to be able to propose high numbers of tailored advertising spots.

AIs also are useful for generating content, hence facilitating marketers' work. "AI used for content generation can save marketing teams time and money by creating blogs, marketing messages, copywriting materials, emails, subject lines, subtitles for videos, website copy and many other kinds of content aimed at a target audience." (Flinders, 2023) *(Appendix 11.2.1.2)*. The content generation of AI could be from article generation helping with SEO, as the example with Wordsmith, an AI-based system (Devang et al., 2019).

One last area where AI could help with marketing task automation is by allowing marketers to know customers' sentiments on the brand or one of its products. "Marketers can also employ emotional AI to perceive consumers' feelings about their brand publicly." (Jain & Aggarwal, 2020) *(Appendix 11.2.1.1.1)*. Moreover, marketers already can use generative AI for consumers' feelings and perceptions making it widely available. "ChatGPT may be used to evaluate customer reviews and determine the general sentiment of a brand, product, or service, providing essential insights into market research and relationship development" (Haleem et al., 2023) *(Appendix 11.2.1.1.1)*.

4.8.2.2 Competitor analysis

Another main area of Artificial Intelligence marketing is the assistance regarding competitor analysis. Hughes pointed out that there are multiple innovative AI-powered platforms that can automate and accelerate competitor research. He showed the example of competitor profile generation that could be realized through Large Language Models (LLMs). Therefore, it is quite easy to imagine how those technologies could be used with generative AI. "LLMs like ChatGPT can help in identifying subtle patterns and relationships within competitors' strategies, uncovering nonobvious yet valuable insights through its vast training data and analytical capabilities" (Hughes, 2023) *(Appendix 11.2.2)*.

Hughes also provided a list of current examples across industries of applications of AI for competitor analysis:

- A snack food manufacturer used AI to analyze rival's customer reviews “Capitalizing on this insight, the company developed an alternative with premium ingredients that testing showed consumers preferred.” (Hughes, 2023) *(Appendix 11.2.2)*
- A company in the automobile industry used AI tracking to identify competitors launching. “However, social media monitoring revealed concerns about safety and liability. The company postponed similar plans for its own model to re-evaluate the technology.” (Hughes, 2023) *(Appendix 11.2.2)*
- A company used AI to scan customers feedback over a competitor’s app update. “The analysis detected frustrations with difficult navigation and settings. The company chose to maintain its own app's familiar UX based on these findings.” (Hughes, 2023) *(Appendix 11.2.2)*

All those examples allow us to be sure of the interest of AI for competitor analysis.

4.8.2.3 Real-time feedback from AI

One of the main interests of AI for marketers resides in the ability of AI to give real-time feedback. This is especially seeable thanks to business intelligence (BI). The real-time feedback AI provides is particularly useful for companies to adapt to market trends. “Supporting foresight efforts and trend detection to determine unserved markets and future disruptions can help companies to act faster.” (Oehm & Som, 2023) *(Appendix 11.2.3.1)*. Other than a real-time reaction to market trends, AI feedback is also able to predict future ones. Tiwari stated that while “for the majority of businesses, understanding trends is a tremendous challenge” (Tiwari, 2023) *(Appendix 11.2.3.1)*, real-time models built with AI and machine learning can allow marketers to more accurately predict future events.

Those uses of AI are already well developed, and we can therefore see ways to use generative AI towards those objectives. “These algorithms [Generative AI] can analyze large amounts of data in real-time, allowing businesses to quickly respond to changing consumer trends and market conditions.” (Bleich, 2023) *(Appendix 11.2.3)*

4.8.3 Streamlining Process and Maintenance

“AI-powered solutions can optimize inventory management, automate the supply chain, and streamline fulfillment processes.” (Bleich, 2023) *(Appendix 11.3.1)*. This means that AI can be used by companies to help them during their streamlining process. This is a factor that can allow us to imagine a positive future relationship of AI in and streamlining process, with the possibility of a 100% AI-based streamlining process. Keller stated that AI-enhanced management solutions in the future are headed “toward systems that can carry out end-to-end procurement, supply chain and logistics processes within parameters strategically set and overseen by humans” (Keller, 2023) *(Appendix 11.3.1)*. One of the main areas of interest for AI and streamlining processes is inventory and warehouse management. Fayed showed how AI can help identify distribution channels suitable for customers. He also stated that AI usage helps make optimal distribution and storage decisions. Finally, he showed that AI can be used in “warehouse management to detect weaknesses in a supply chain and forecasts potential sales.” (Fayed, 2021) *(Appendix 11.3.1.2)*. The streamlining process could also be paired with smart factories “smart factories where machines, products, and systems communicate and cooperate with each other. This leads to more flexible and efficient manufacturing processes.” (InbuiltData, 2023) *(Appendix 11.3.1.1)*. Those smart factories could prove themselves especially useful by “Detecting faults and errors in product functioning and forecasting malfunction occurrences. The synchronization of the work performed by the technical team responsible for device (lift) monitoring and repair works (if necessary).” (Jarek & Mazurek, 2019) *(Appendix 11.3.1.1)*.

AIso, AI could prove itself useful to help with maintenance. “Generative AI can be used to automate the process of identifying and fixing bugs or to optimize the performance of a software system, significantly improve First Contact Resolution (FCR) by helping clients with basic queries.” (Cheng, 2023) *(Appendix 11.3.2)*. Not only is generative AI proving itself useful to help with maintenance, but in the same article, Cheng also states how accessible, software maintenance can be made with generative AI as ChatGPT. As he mentions, ChatGPT can ameliorate FCR by also ensuring that issue resolution time is shorter while offering to the personnel to focus its attention on more complex cases. Of course, those current applications of AI only concern software maintenance, it could be easy to imagine how AI with the help of smart factories could be used for maintenance in general.

5 Discussion

5.1 Limitations, reliability and validity

First of all, it is important to note that this paper is based on secondary data, and therefore, gathering sufficient data of good quality was the primary focus. However, gathering data about artificial intelligence, which is such a current subject, can be somewhat difficult. Moreover, with artificial intelligence applied to such a large amount of sectors and activities, gathering accurate and complete data on the application of the latest generation of AI in the new product process development can be challenging. To overcome this limitation, the authors realized methodological research and especially analyzed documents covering large numbers of different industries to find out common aspects of AI usage or comparison to NPD process. This allowed the author to get a huge classification of data about AI that not only highlighted common areas of AI usage, but also to discover different areas of data usage that are sometimes indirectly linked to NPD process.

Furthermore, as artificial intelligence is constantly evolving and developing in new ways, gaining the latest news or information about its impact can be a challenge. It is also important to know that, because of its constant evolution, grasping the full picture of artificial intelligence applications can be somewhat challenging. The results might evolve and change in a matter of days.

A limitation of this study is that, depending on the countries, regulations regarding artificial intelligence usage may differ and therefore having a global picture of the application of the latest generation of AI in new product development processes might not apply to every country.

Lastly, publications regarding artificial intelligence are found in every form but not all are relevant or accurate. Finding the correct article, webpage or even social media post was a challenge for the authors.

Despite all these limitations, this paper provides a comprehensive overview of the application of the latest generation of artificial intelligence in the new product development process. The authors provide a coherent explanation of the advantages and limits of artificial intelligence in the field of innovation and business.

To ensure the research's reliability, the authors processed 195 papers to select only the most relevant publications and prioritized the most recent information. Moreover, the authors defined a clear research methodology by clearly defining their research framework and time frame.

Regarding the research validity, the authors reviewed the sources carefully and analyzed the different methodologies used on those publications to better select publications with verified sources and accordance to our research topic. Moreover, by citing all the sources, the authors provided validity to this paper and respected the work of each individual.

5.2 Answering the research questions

Throughout this research, the following research question was asked by the authors:

RQ1: How the new generation of AI can be used to help decision-making in the different steps of new product development?

RQ1.1: How the new generation of AI can be used to help decision-making in the idea generation stage of new product development?

AI is used for both areas of Idea Generation: Creativity and collaboration. AI is found to reduce human apprehension, enhancing creativity in collaboration. Gero et al.'s study highlights the potential of human-AI collaboration in creative tasks, leveraging advancements in generative language models. Additionally, AI's role in idea generation involves utilizing machine learning algorithms to identify problems and opportunities based on customer needs. Tools like Outlier.ai and Q-market software aid in providing insights and enhancing the creative process, incorporating features like translation. While AI, including chat GPT, can generate ideas based on prompts, further development is needed for surpassing human capabilities in idea generation.

RQ1.2: How the new generation of AI can be used to help decision-making in the idea evaluation stage of new product development?

The potential of AI for idea evaluation is demonstrated across various industries, addressing evaluation apprehension. Siemon's experiment with Allan, an AI-based system, shows its ability to reduce fear of negative evaluation and encourage idea sharing. Siemon highlights methods like latent semantic analysis and machine learning as comparable to human expert evaluation. Maher and Fisher (2012) propose an AI model for idea evaluation that assesses novelty, unexpectedness, and value of ideas.

RQ1.3: How the new generation of AI can be used to help decision-making in the concept development stage of a new product development?

AI has significantly enhanced the efficiency of designers by serving as a time-saving tool. Neural networks enable the refinement of images from sketches. Natural Language Processing (NLP) facilitates the automatic generation of images based on descriptions, expediting design modifications and reducing the reliance on physical prototypes. Designers can employ AI to create 3D models for better visualization, allowing them to adapt features based on various analyses. In the context of customer feedback, Generative AI plays a crucial role in streamlining the process. It can summarize and categorize information gathered from tests, saving time and minimizing potential mistakes for analysts. This, in turn, enables better-informed decisions regarding product features. Overall, artificial intelligence proves to be a valuable tool in the design process, balancing the need for precision and creativity.

RQ1.4: How the new generation of AI can be used to help decision-making in the marketing strategy stage of new product development?

AI proves itself useful in the Marketing Strategy stage. Ai can help with market sector identification, demand forecasting, strategic planning, and competition analysis. This technology can assist in determining product prices, analyzing customer segmentation and creating sales projections. Additionally, AI can be employed for targeted marketing strategies, content generation, SEO optimization, and predictive analysis. AI is particularly useful due to its automation capabilities that allows efficient decision-making and resource savings in marketing tasks.

RQ1.5: How the new generation of AI can be used to help decision-making in the business analysis stage of new product development?

AI is useful for BA in three main areas: SWOT analysis, risk mitigation, and financial projections. AI proves its usefulness in SWOT analysis, by efficiently identifying strengths, weaknesses, opportunities, and threats through the analysis of both internal and external data. It offers real-time feedback, enabling quick identification of opportunities. In risk mitigation, AI excels in calculating and analyzing risks by learning from past data. Generative AI platforms like DataGPT enhance the speed and cost-effectiveness of gaining insights, providing natural language responses and visualizations. In financial projections, tools like ChatGPT guide users through tasks such as estimating expenses and forecasting revenue.

RQ1.6: How the new generation of AI can be used to help decision-making in the product development stage of new product development?

Generative AI is useful in advancing both product and software development. In product development, it optimizes design processes, suggesting materials and predicting outcomes, enhancing safety and cost-effectiveness. Integration with digital twins, as discussed by Guo et al. (2020), expedites design iterations through accurate prototypes and real-time simulations. In software development, generative AI tools like ChatGPT improve productivity by translating human concepts into code, while specialized systems contribute to code testing and user interface verification, collectively advancing product and software quality.

RQ1.7: How the new generation of AI can be used to help decision-making in the test marketing stage of new product development?

AI has multiple applications for test marketing, especially to gain customer feedback before product launch. Basing messages on AI proves itself valuable in analyzing consumers' responses and identifying patterns. This enables companies to make informed decision-making and eventually save capital. AI can be integrated into alpha/beta testing to automate testing, detect product flaws, and provide insights for adjustments. Some companies make use of AI for real-time monitoring and feedback analysis to facilitate product refinement. Tools such as Evolv AI can be used also in A/B

testing to analyze complex data, provide instant insights, and conduct real-time experiments for optimization. AI integration enhances market campaigns, offering better conversion rates, engagement, and customer insights. All of this, without needing to halt and restart experiments.

RQ1.8: How the new generation of AI can be used to help decision-making in the commercialization stage of new product development?

Artificial Intelligence (AI) significantly enhances customer service efficiency, addressing queries 24/7 and providing personalized responses, leading to cost savings for companies. In Customer Relationship Management (CRM), AI-driven strategies automate tasks, deliver personalized messages, and identify at-risk customers, improving overall customer experience. AI's impact extends to after-sale support through NLP-driven virtual assistants and chatbots, engaging customers in meaningful conversations and resolving issues promptly. In marketing, AI automates tasks like campaign management and competitor analysis, adapting to market trends and offering valuable insights. Additionally, AI revolutionizes inventory management, supply chains, and fulfillment processes, optimizing distribution decisions and contributing to flexible and efficient manufacturing through smart factories.

The main research question was answered using secondary data. Based on this data, the authors found that there was a high possibility of implementing new generations of AI to support each step of product development. This study reveals not only how AI can be used for decision-making but also how it could replace or enhance human work in the key areas of idea generation, idea evaluation, concept development, marketing strategy, business analysis, product development, test marketing, and commercialization. All of those areas of new product development have been detailed by the authors to understand how AI could be applied in all key areas of each step of new product development.

The study also tried to encompass how AI could be used for big companies and startups or independents, especially when a focus could be made on how accessible AI could help for the different steps of idea generation, idea evaluation, concept development, marketing strategy, business analysis, product development, test marketing and finally commercialization.

5.3 Dialogue between key results and knowledge base

The findings from this study provide insights into the uses of AI for new product development. The research in chapter 4 allowed to identify how AI technologies could be used for each step of new product development: idea generation, idea evaluation, concept development, marketing strategy, business analysis, product development, test marketing, and commercialization.

In section 2.1, AI could be used as a peer for idea generation (Memmert & Tavanapour, 2023). The results in section 4.1.1 proved that AI could support creativity by playing the role of a nanny, a pen pal, a coach, or a colleague with the help of CSS (Creativity Support System) (Lubart, 2005).

In section 2.5, AI would be valuable for stakeholder analysis (Henriques Montez, 2022). The results of section 4.5.3 proved that even with the current development of high technology like generative AI, AI is for the moment still limited, sometimes delivering results that deviate too much from the industry norm Hoeksema (2023).

In section 2.6, AI can analyze multiple areas of data to improve product design Guo et al. (2020). The results of section 4.6.1 proved not only the interest of AI for design but also how AI can emphasize material selection to increase the cost and safety of the product.

Overall, the findings from this study can be used as a sort of guideline and help add material to the new area of AI and economics, especially for the product development cycle. Moreover, it encompasses how the different aspects of AI can be used whether by startups, independents, or companies with high resources with the goal of reducing time and resource consumption.

5.4 Compliance with research ethics guidelines

This research examined the application of the latest generation of AI in the new product development process by using secondary data from relevant publications. While doing this research, the authors made sure to carefully adhere to ethical guidelines. As this study is based on secondary data that was collected by the authors, the primary focus regarding ethical consideration was the respect for the data's privacy and confidentiality.

The data used for this paper came from reliable sources such as academic and journal articles, renowned websites, company reports, and social media. Each work was properly referenced in this paper to ensure compliance with copyright regulations. Moreover, it is important to note that no intellectual property-protected information was incorporated into this paper.

Afterward, the authors paid close attention to the potential harm that could arise from the use of sensitive information, particularly to individuals' personal data. To minimize the risks associated, only worldwide available and publicly disclosed information was used. The authors took significant precautions to avoid incorporating statistics linked to individual identities or specific groups with special beliefs for a comprehensive risk reduction.

Subsequently, multiple steps were taken to keep data confidentiality by storing all information in a secure folder with restricted access. For any information that was provided by an individual, the authors ensure to not share the data without the external parties' proper authorization.

Moreover, the authors ensure to recognize any biases present in a paper used in this information. No reference was made to any information that was based on an individual's personal opinion. All the information that wasn't backed with a proper study or analysis wasn't taken into account.

Lastly, the authors acknowledge and keep conscience of the potential limitations and challenges regarding secondary data analysis. To address these concerns, the authors adopted a risk-mitigation strategy that involved cross-verifying data and approaching the analysis with a critical and impartial perspective.

6 Conclusions

6.1 Summary of Findings

Table 2 Summary of the findings for the Idea Generation phase

Key idea	Summary of finding
Dimensions of idea generations	The authors have identified the influence of Artificial Intelligence on 2 dimensions of IG (creativity and collaboration). Regarding creativity, Simon's (1988) proposed the concept of computers showing creativity thanks the CSS (Creativity Support System) which can categorized in 4 roles: nanny, pen-pal, coach, and colleague and therefore help solve problems. In the context of collaboration, the use of AI has shown to reduce human apprehension and therefore enhance their creativity. Lastly, the study of Gero et al. (2022) revealed the potential of human-AI collaboration in creative tasks thank to the recent advancement in generative language models.
Artificial intelligence can provide help for idea and opportunity generation	Artificial Intelligence plays an importance role in idea generation by utilizing machine learning algorithm to identify problems and opportunities according to the customer needs, wants and problems. Tools suchs as Outlier.ai. and Q-market software can provide insights and incorporate features such as translation to enhance the creative process.
Artificial intelligence limitation towards idea generation	Although AI, such as chat GPT, can help in this first stage by providing lists of ideas based on a prompt, AI still need further developing before generating ideas beyond human capabilities.

Table 3 Summary of the findings for the Idea Evalution phase

Key idea	Summary of finding
Evaluating an idea with AI	This part examines the integration of AI for idea evaluation. AI applications for idea evaluation are currently limited but Maher and Fisher (2012) proposed a model that do so by evaluating novelty, unexpectedness and value of an idea. The evaluation of novelty involves mapping attributes, unexpectedness could be identified through pattern detection, and value assessment could be realized by AI through comparison of product efficiency based on pre-established criteria.
Interest of AI for idea evaluation	This part discusses the interest of AI in evaluating ideas and addresses the issue of evaluation apprehension. Maher and Fisher's AI system demonstrated the potential of using AI for idea evaluation in various industries. Siemon's experiment revealed that an AI-based system like Allan could alleviate fear of negative evaluation and encourage idea sharing. Despite the absence of efficient generative AIs for idea evaluation, Siemon highlighted AI-based evaluation methods, such as latent semantic analysis and machine learning, as comparable to human expert evaluation. The latest AI generations, incorporating machine learning and algorithms, could significantly benefit companies by mitigating the negative impacts of evaluation apprehension during idea assessment.

Table 4 Summary of the findings for the Concept Development phase

Key idea	Summary of finding
Concept visualization	AI has become a time saver for designers. For example, thanks to neutral networks, AIs such as Scribbled Diffusion, can refine images from sketches. NLP can automatically generate images based on descriptions helping with faster design modification and limiting the need for multiple physical prototype. Lastly to better visualize the product, designers can utilize AI to create 3D models and therefore adapt the features according to the different analyses.
Testing the prototype	The test will provide crucial information on the customer feedback. Generative AI can streamline the process by summarizing and categorizing the information gathered. This prevents long hours and potential mistakes for the analyst and allows them to make better informed decisions regarding the products features.
AI's limitation regarding concept development	Artificial intelligence will need a very define brief and prompt to create an image or a model for the designers to use as a prototype. Designers will therefore need to provide very details prompt to the AI if they want to accomplish a certain idea. However, AI can be used to explore new ideas by utilizing vague prompts at the start.

Table 5 Summary of the findings for the Marketing Strategy phase

Key idea	Summary of finding
Market research	Market research is crucial in NDP to understand the market environment, competition, and customer preferences. Thanks to its analytical capabilities, AI can provide help to correctly identify market sectors, demand forecasting and strategic planning. AI can also reveal some potential prospects, competitive advantages and help define short and long-term goals. In competition analysis, AI can identify, pricing tactics, competitors strategies, and some of the customers unmet needs to help companies adapt to changes rapidly. Stakeholder has an important impact on the company well-being and AI can help categorize and monitor them in a more effective way.
Pricing analysis & forecasting	The determination of the correct price for a product can be a challenging process that can be helped by AI. By utilizing pricing strategy, detecting pricing and defining strategies to increase sales, Artificial intelligence has become a key player in pricing analysis and forecasting. AI can also analyze price elasticity and sensitivity and enable markets to reduce energy costs and negative price variance. For example, by learning form historical data, Sniffie Software can offer accurate predictions to help adapt to market changes.
Customer Segmentation	AI can help to improve client retention by analyzing the different customer segmentation to offer them right type of product. ChatGPT has for example been used to analyze massive data to identify habits, preferences, and common traits of specific consumer groups. Chatbots can also help client retention by better engaging with customer and predicting content that will resonate with the clients. Thanks to those chatbot, company can collect data on their clients to analyze their

	behavior and drive-up sales. Artificial intelligence can also enhance personalization thanks to its algorithms capable of offering personalized product recommendations, tailor marketing message and lowering the time of responses to individual customer needs. This helps increase customer satisfaction and in turn drive up sales and business growth (Chen et al., 2007; Li et al., 2021).
Sales Forecasting	Creating an accurate sales projection can be a very challenging process that can be help by AI. AI can analyze the past the data automatically and provide real-time feedback to help with decision-making. ANN can also outperform traditional tools and provide insights for better strategical and tactical decisions. Moreover, artificial intelligence can analyze a vast set of data which provide insight on customer behavior and market fluctuation for better analysis of the future sales. This analysis can also enable companies to find leads to save money in the long run. Finally, with this process, AI can contribute to workflow automation and accelerate the process.
Promotion	AI-powered tools are used to create targeted marketing strategies that are based on customer behavior which allows for the creation of personalized campaign and content according to each segment (Fayed, 2021; Haleem et al., 2023). Thanks to this, the conversion rate turn-out higher because the customer segmentation is more accurate and the promotion offer to them follows their values. AI tools such as Postwise, Syllaby, Adobe Podcast AI, Midjouney, and DallE-2 are used to generate content quicker and of better quality. Moreover, AI can also optimize the SEO and therefore enhance page rankings. Finally, by utilizing AI, markets can optimize their promotion strategy and ultimately improve their ROI.

AI for predictive analysis	Thanks to its analysis capabilities, AI is highly effective for predictive analysis. Machine learning is also a key player in this process to help markets navigate the complex data and results in better decision making.
AI for automated decisions	By imitating the human mind, AI can make its own decision in an automated manner which in return helps marketers save time and resources for more strategic development.

Table 6 Summary of the findings for the Business Analysis Strategy phase

Key idea	Summary of finding
AI for SWOT generation	AI can support business analysis, particularly in the creation of SWOT analysis, by identifying strengths, weaknesses, opportunities, and threats that may impact a company. According to Fayed (2021), AI can collect and analyze both internal and external data, enhancing the efficiency of SWOT construction. Moreover, Sentance (2019) emphasizes AI's ability to provide real-time feedback, offering an advantage by identifying opportunities quickly, even beyond regular working hours. For a comprehensive SWOT analysis, AI requires internal data for strengths and weaknesses and external data for threats and opportunities. With the right data, the latest AI generations can generate detailed SWOT analyses.
AI for risk mitigation	AI's interest in risk mitigation revolves in its ability to calculate and analyze risks by identifying factors affecting organizations. Artificial Intelligence can learn from past data, and generate valuable insights, providing a comprehensive approach to risk management. Additionally, generative AI, through platforms like DataGPT, proves to be a faster and more cost-effective tool for gaining insights, offering users the ability to ask natural

	language questions and receive both text-based responses and visualizations to enhance understanding of discovered insights.
AI for financial projections	Utilizing generative AI, such as ChatGPT, for financial projections involves step-by-step assistance in tasks like finding templates, estimating startup expenses, forecasting revenue, projecting expenses, and estimating staffing costs However, according to Hoeksema (2023), while AI can serve as an assistant, some projections may deviate significantly from industry norms, highlighting the challenge of aligning AI-generated results with established standards.

Table 7 Summary of the findings for the Product Development phase

Key idea	Summary of finding
AI to improve product development	Generative AI, as shown by Bailey (2023) and supported by the insights of Oehm and Som (2023), proves itself useful in advancing product development by optimizing the design process. AI technologies' ability to suggest materials, predict outcomes, and facilitate design modifications enhances safety, cost-effectiveness, and overall product performance. The integration of generative AI with digital twins, as discussed by Guo et al. (2020), further accelerates the design iteration process by providing accurate digital prototypes and allowing real-time simulations. However, results due to digital twins are highly discussed as not everybody is ready to trust AI 100%, due to technical limitations.
AI for software development	AI, especially generative AI, can significantly enhance software development by translating human concepts into programming code. For instance, ChatGPT can generate code in various languages, assist

	developers in writing code components and improve productivity. Additionally, there are AI-based systems like Kodezi AI, Testim.io, TestComplete, Aqua ALM, or Mabl that are specialized for code testing, error correction, and user interface verification, contributing to overall improvements in product development and software quality.

Table 8 Summary of the findings for the Test Marketing phase

Key idea	Summary of finding
Gain customer	Test marketing allows companies to gain insights on customer feedback before launching the production. AI-based messaging can become particularly handy as it can directly analyze the responses and identify patterns enabling companies to make informed decisions about their product and potentially save substantial capital. Poll the People for example helps the marketing teams by gathering real-time feedback and providing comprehensive insights.
Product testing	AI is becoming an increasingly important tool in product testing processes like alpha and beta testing. It can automate the testing process, identify potential flaws in the product and provide categorized insights to help companies visualize potential problems and make necessary adjustments before launching the product commercially. For instance, companies like Gut Check and Quantilope use AI to enable real-time monitoring, automatic data population, and comprehensive feedback analysis during the testing phase, which allows them to predict market responses and refine their products effectively.

Campaign testing	A/B testing is a valuable strategy in campaign testing to try-out different variations and optimize messaging for better conversion rates, engagement, and customer insights. AIs, such as Evolv AI, can enhance this process by efficiently analyzing complex data, providing instant insights, and conducting real-time experiments to continuously optimize messaging variations for better performance. This contributes to more effective marketing campaigns without the need to stop and start experiments.

Table 9 Summary of the findings for the Commercialisation phase

Key idea	Summary of finding
AI to improve customer service	AI proves itself useful for enhancing customer service efficiency. One approach of AI usage in customer service by using it to address customer queries 24/7, ensuring prompt responses (Oosthuizen, 2021). AI is also really useful for predictive customer service with companies like Netflix who saved up to a billion dollars by using it. Furthermore, the integration of Customer Relationship Management (CRM) as an AI-driven strategy enhances customer-centric approaches, provides accurate insights and reduces human errors (Cezim, 2023). Notably, AI technologies within CRM automate tasks, deliver personalized messages, and identify at-risk customers, as highlighted by Flinders (Flinders, 2023). Moreover, AI ability with NLP allows it to analyze customer emotions, thus gaining a deeper understanding of customers and improving its experience.
AI to improve after sale support	This part underscores the transformative impact of AI applications on after-sale support, highlighting their potential to enhance customer experience. With a focus on NLP-driven virtual assistants and chatbots, AI shows their capacity to engage customers in meaningful two-way

	conversations. Examples from ING Bank Śląski and Starbucks illustrate how these AI technologies contribute to not only resolves issues promptly but also elevates customer engagement, making it imperative for companies to integrate such solutions into their after-sale support strategies. Services like Tidio.com are positioned as valuable resources for businesses seeking to implement AI-based chatbots and enhance their overall customer experience.
AI to improve personalizat-ion	This part emphasizes AI-supported personalization in customer experience, citing Weber & Schütte (2019) to demonstrate how AI can personalize shopping for example through searches, recommenders, and pricing. The application of AI at the point of sales (POS), involves digitization, automation, and advertising, enhancing the overall customer experience. Furthermore, as suggested by Verganti et al. (2020), AI factories, employing reinforcement learning loops can allow the creation of personalized products based on individual user preferences.
Artificial Intelligence Marketing	This part explores the role of Artificial Intelligence (AI) in marketing, specifically within Artificial Intelligence Marketing (AIM). AI is used for automating marketing tasks, such as campaign management and content generation. Examples like Toyota Mirai's tailored advertising showcase AI's effectiveness. Another area of AIM is competitor analysis for which Large Language Models (LLMs) like ChatGPT can help identify patterns and insights within competitors' strategies. AI, through real-time feedback, can also help companies to adapt to market trends and predict future events accurately. Overall, AI plays a crucial role in enhancing efficiency and providing valuable insights across various marketing functions.

AI for streamlining process and maintenance	As outlined by Bleich (2023) and Keller (2023), AI is revolutionizing inventory management, supply chains, and fulfillment process. Fayed (2021) highlights AI's role in optimizing distribution decisions and detecting supply chain weaknesses. Smart factories, as proposed by InbuiltData (2023), contribute to flexible and efficient manufacturing, detecting faults, and forecasting malfunctions (Jarek & Mazurek, 2019). AI is really impacting software maintenance thanks to bug identification and resolution. Specifically, ChatGPT enhances First Contact Resolution (FCR), reducing issue resolution times and allowing personnel to focus on complex cases. This AI potential extends to general maintenance, aligning with smart factories. AI's integration in streamlining processes offers businesses efficiency, flexibility, and improved problem resolution, from inventory management to smart factories and maintenance.

6.2 Key Findings

This study found that artificial intelligence is starting to have significant impacts and applications on the various aspects and stages of the new product development process. This paper's results provide an overview of each aspect in which AI can be applied to innovation and the new product development process. The following key findings regarding the whole process were identified:

AI is nowadays mostly used to reduce "time to market" and therefore improve the management of resources. In each sector of the new product development process, teams use AI to save time and streamline the process. This is shown for the idea generation stage with the help of Creativity Support Systems or software such as Q-Market or Outlier.AI. For the Idea evaluation stage, this is shown by Maher and Fisher's AI. Regarding Concept development, AI usage to reduce time to market is seeable through Scribbled diffusions. AI usage in the Marketing Strategy stage is present in many ways to reduce time to market, with the example of Sniffie, ChatGPT, Postwise, or DallE-2. Regarding the Business Analysis stage, numerous examples of AI to reduce time to market are seeable such as ChatGPT or DataGPT. The product development stage is also filled with AI examples

that are used to reduce time to market such as Framer, Chat GPT, Aqua ALM, or Testim.io. Regarding the test marketing stage, AI usage regarding time to market reduction is seeable through for example Evolv AI. Finally, the commercialization stage of new product development process can reduce its time to market with AI as for example Wordsmith, Tidio.com, or generative AIs such as ChatGPT.

AI is primarily used as an assistant in the new product development process and has yet to completely take over a stage of this process.

AI, as of today, is essentially used for:

- analytical purposes
- creating content for a marketing campaign
- enhancing customer experience with more personalization

AI's usage is not widely developed in each area of the new product development process. The two main areas are marketing strategy and commercialization.

AI can produce automated decisions which can help to better manage the new product development process.

It is important to note that, due to the quick development of these technologies, the following key findings that were identified regarding the whole process are susceptible to changing in the near future.

6.3 Managerial implications

The findings from this study could help with new product development management, especially for marketing managers, with marketing being one of the main current areas of AI implementation. The following recommendations are advised based on the results obtained:

Focus on AI as an assistant and not an employee: currently, AI proves itself useful, but the findings prove that nowadays AI is more efficient for AI-human cooperation than for working on its own.

Focus usage of AI towards its main advantages: while it is important to not be overtaken by new technologies, it is important to start by focusing on AI for its main qualities, especially for startups or independents who can't access R&D resources. the authors would therefore advise managers to focus their implementation of AI for:

- analytical purposes
- marketing
- offer more personalization

Use AI for automated decisions wisely: While AI is useful for automation and automated decision-making, it is important to use it wisely. AI is really useful to save cost and resources but a bad use of it could turn into a loss of time and resources.

By implementing those recommendations, managers should be able to make the best use of AI, especially regarding the new product development process, but also for general management.

6.4 Recommendations for future research

The findings indicate an inequitable distribution of data for the implementation of AI in the new product development process. Consequently, the authors propose a set of recommendations to broaden the scope of investigation and pursue novel research avenues.

First of all, several areas seemed to contain less data while it would still be interesting to implement AI. Those areas are the following stages of the new product development process:

- Idea generation
- Idea evaluation
- Concept development

- Test marketing
- Business Analysis

The domain of commercialization and marketing strategy, in the context of artificial intelligence (AI), has been extensively explored and developed. However, it would be intriguing to explore the potential of this field for the stages that are currently less explored, in order to further advance the field of AI. Through those explorations, we may gain valuable insights into new avenues of research and development that can help to enhance the capabilities of AI and bring it to new heights.

Many of our researchers have explored the concept that AI is the driving force behind humanity's fourth NL revolution. This area of study holds great potential for future research, as it involves the broad and diverse applications of AI. Given the ongoing debate among researchers about the potential impact of AI on the world, further study to clarify this topic would be both intriguing and valuable.

References

Aattouri, I., Mouncif, H., & Rida, M. (2023). Modeling of an artificial intelligence based enterprise callbot with natural language processing and machine learning algorithms. *IAES International Journal of Artificial Intelligence (IJ-AI)*, *12*(2), 943.

Abode. (2023). *Adobe Podcast | AI audio recording and editing, all on the web*. https://podcast.adobe.com

Akerkar, R. (2019). Employing AI in Business. In *Artificial Intelligence for Business* (pp. 63–74).

Antosz, D. (2023). 5 Ways to Utilize AI for Sales Forecasting. *Close*. https://blog.close.com/sales-forecasting-ai/

Axley, K. (2023, August 10). AI Tools for UGC Content Creators. *The UGC Club*. https://www.theugcclub.com/ai-tools-for-ugc-content-creators/

Ayele, W. Y., & Juell-Skielse, G. (2020). *A Process Model for Generating and Evaluating Ideas: The Use of Machine Learning and Visual Analytics to Support Idea Mining* [Springer International Publishing]. https://doi.org/10.1007/978-3-030-58957-8_14

Bailey, K. (2023, May 31). *How generative AI is streamlining the concept phase in new product development*. Fast Company. https://www.fastcompany.com/90902288/how-generative-ai-is-streamlining-the-concept-phase-in-new-product-development

Bakutyte, J. (2020, May 7). Marketing and User Journey Testing Methods [+Infographic]. *Yieldify*. https://www.yieldify.com/blog/5-marketing-testing-methods/

Balaban, H. S., & Weiss, D. (2009). Product Effectiveness and Cost Analysis. In M. Pecht, *Product Reliability, Maintainability, and Supportability Handbook* (2nd ed., p. 462). https://books.google.cl/books?hl=fr&lr=&id=MW3QUUWLxjMC&oi=fnd&pg=PA391&dq=%22product+effectiveness%22+%22definition%22&ots=2UpBhQV-

xN&sig=c07WslmVIcvDNfA1vpvcIClwpbw&redir_esc=y#v=onepage&q=%22product%20effectiveness%22%20%22definition%22&f=false

Baqi, A., Abdeldayem, M., & Aldulaimi, S. (2022). *Embedding Artificial Intelligence and Green Ideology in Formulating Corporate and Marketing Strategies*. 1–4. https://doi.org/10.1109/ICETSIS55481.2022.9888893

Bennet, N. L. (1997). The voices of evaluation. *Journal of Continuing Education in the Health Professions*, 198–206.

Berger, T., Lettner, D., Rubin, J., Grünbacher, P., Silva, A., Becker, M., Chechik, M., & Czarnecki, K. (2015). What is a feature?: A qualitative study of features in industrial software product lines. *Proceedings of the 19th International Conference on Software Product Line*, 16–25. https://doi.org/10.1145/2791060.2791108

Bertoni, A. (2020). Data-driven design in concept development: Systematic review and missed opportunities. *Proceedings of the Design Society: DESIGN Conference*, *1*, 101–110. https://doi.org/10.1017/dsd.2020.4

Bhuiyan, N. (2011). A Framework for successful new product development. *Journal of Industrial Engineering and Management*, *4*(4), 746–770. https://doi.org/10.3926/jiem.334

Biswas, B., Sanyal, M. K., & Mukherjee, T. (2023). AI-Based Sales Forecasting Model for Digital Marketing. *International Journal of E-Business Research (IJEBR)*, *19*(1), 1–14. https://doi.org/10.4018/IJEBR.317888

Bleich, C. (2023). *Benefits of a MACH-compliant Customer Data Platform | MACH Alliance*. https://machalliance.org/insights/the-benefits-of-a-mach-compliant-customer-data-platform

Bloomreach. (2023). *What Is Generative AI? Everything You Need To Know*. Bloomreach. https://www.bloomreach.com/en/blog/2023/what-is-generative-ai

Bradač, B., & Rebernik, M. (2008). *Idea evaluation methods and techniques*. https://www.rockypeaklc.com/ideaevaluation.pdf

Brennan, K. (2009). *A Guide to the Business Analysis Body of Knowledger*. IIBA.

Buchanan, B. G. (2001). Creativity at the Metalevel. AAAI–2000 Presidential Address. *AI Magazine*, *22*(3), 13–28.

Büyüközkan, G., & Feyzioglu, O. (2006). *Evaluation of New Product Development Projects using Artificial Intelligence and Fuzzy Logic*. *11*, 183–189.

Cambridge Dictionary. (2023). *Profit | definition in the Cambridge English Dictionary*. https://dictionary.cambridge.org/us/dictionary/english/profit

Camlek, V. (2011). How to spot a real value proposition. *Information Services & Use*, *30*(3–4), 119–123. https://doi.org/10.3233/ISU-2010-0615

Caruana, E. J., Roman, M., Hernandez-Sanchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of Thoracic Disease*, *7*(11).

Cezim, B. (2023a, August 28). *How Companies Are Using AI in Digital Marketing*. Digital Agency Network. https://digitalagencynetwork.com/how-companies-are-using-ai-in-digital-marketing/

Cezim, B. (2023b, August 28). *How Companies Are Using AI in Digital Marketing*. Digital Agency Network. https://digitalagencynetwork.com/how-companies-are-using-ai-in-digital-marketing/

Chaveesuk, S., Khalid, B., & Chaiyasoonthorn, W. (2019). *Emergence of New Business Environment with Big Data and Artificial Intelligence*. 181–185. https://doi.org/10.1145/3357419.3357441

Chen, Z., Yao, S., Lin, J., Zeng, Y., & Eberlein, A. (2007). Formalisation of product requirements: From natural language descriptions to formal specifications. *International Journal of Manufacturing Research*, *2*(3), 362–387. https://doi.org/10.1504/IJMR.2007.014730

Cheng, X. (2023, October 20). Generative AI in Software Development. *MLearning.Ai*. https://medium.com/mlearning-ai/generative-ai-in-software-development-3e90e466eb91

Chong, A. Y.-L., & Zhou, L. (2014). Demand chain management: Relationships between external antecedents, web-based integration and service innovation performance. *International Journal of Production Economics*, 48–58.

Choy, J. J., & Ozkan, B. (2019). *Disruptive Innovation in Business and Finance in the Digital World* (Vol. 20).

Columbus, L. (2020). *10 Ways AI Is Improving New Product Development*. Forbes. https://www.forbes.com/sites/louiscolumbus/2020/07/09/10-ways-ai-is-improving-new-product-development/

Cooper, R. (1988). The New Product Process: A Decision Guide for Management. *Journal of Marketing Management*, *3*, 238–255. https://doi.org/10.1080/0267257X.1988.9964044

Courtney, M. (2023, October 19). *Automating Generative AI Development*. The Next Platform. https://www.nextplatform.com/2023/10/19/automating-generative-ai-development/, https://www.nextplatform.com/2023/10/19/automating-generative-ai-development/

Daqar, M. A. M. A., & Smoudy, A. K. A. (2019). The role of artificial intelligence on enhancing customer experience. *International Review of Management and Marketing*, *9*(4), 22–31. https://doi.org/10.32479/irmm.8166

Dasha. (2023, December). *How to Create Value Propositions with Generative AI | Dasha.AI*. https://dasha.ai/en-us/blog/how-to-create-value-propositions-with-generative-ai

Davenport, T., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, *48*(1), 24–42. https://doi.org/10.1007/s11747-019-00696-0

DealHub Experts. (2023). *Sales Projection*. DealHub. https://dealhub.io/glossary/sales-projection/

Devang, V., Chintan, S., Gunjan, T., & Krupa, R. (2019). Applications of Artificial Intelligence in Marketing. *Annals of "Dunarea de Jos" University of Galati Fascicle I. Economics and Applied Informatics*, *1*, 10. https://doi.org/10.35219/eai158404094

Devereux, E., Grimmer, L., & Grimmer, M. (2019). Consumer engagement on social media: Evidence from small retailers. *Journal of Consumer Behavior*, *19*(2), 151–159. https://doi.org/10.1002/cb.1800

Dole, V. (2021). *Marketing budget: Towards an effective marketing plan*. *12*, 135–138.

Efti, S. (2020). How workflow automation can make inside sales teams more productive. *Close*. https://blog.close.com/worflow-automation-productive/

El Haiba, M., Elbassiti, L., & Ajhoun, R. (2017). Idea Management: Idea Generation Stage with a Qualitative Focus. *Journal of Advanced Management Science*, *5*(4), 271–278. https://doi.org/10.18178/joams.5.4.271-278

Elias, M. (2023, October). *Guarantee quality assurance with a product evaluation checklist* [Lumiformapp]. Lumiform: Inspection, Safety & Compliance App | Try for Free. https://lumiformapp.com/resources-checklists/product-evaluation

Espenschade, A. S., & Rarick, G. L. (1973). DESCRIPTIVE RESEARCH. In *Research Methods in health, physical education, and recreation* (3rd ed., p. 943). https://files.eric.ed.gov/fulltext/ED095160.pdf

Euopean Parliament. (2020, September 4). *What is artificial intelligence and how is it used? | News | European Parliament*. https://www.europarl.europa.eu/news/en/headlines/society/20200827STO85804/what-is-artificial-intelligence-and-how-is-it-used

Farzan, S. (2023). *Ethics First: The Imperative Of Responsible AI Adoption In Marketing*. Forbes. https://www.forbes.com/sites/sunshinefarzan/2023/09/29/ethics-first-the-imperative-of-responsible-ai-adoption-in-marketing/

Fayed, A. E. (2021). Artificial Intelligence for marketing plan: The case for e-marketing companies. *Marketing and Management of Innovations*, *1*, 81–95. https://doi.org/10.21272/mmi.2021.1-07

Fifield, P. (2012). *Marketing Strategy*. Routledge.

Flinders, M. (2023). AI in marketing: How to leverage this powerful new technology for your next campaign. *IBM*. https://www.ibm.com/blog/ai-in-marketing/

Forrester. (2016). *Global State Of Artificial Intelligence Online Survey* (Q2).

Forsey, C. (2023, June). How AI Will Revolutionize Product Development, and How to Prepare [Insights from AWS' Senior Advisor to Startups]. *Hubspot*. https://blog.hubspot.com/marketing/how-ai-will-revolutionize-product-development

Fraenkel, V., & Kamath, R. (2023). *In What Ways Can AI Be Used For Product Development?* Delve. https://www.delve.com/insights/how-collaborating-with-ai-is-transforming-product-development

Freeman, E. (2010). Managing for stakeholders: Trade-offs or value creation. *Journal of Business Ethics*, 7–9.

Freeman, E. R. (1984). *Strategic Management: A stakeholder Approach*.

Füller, J., Hutter, K., Wahl, J., Bilgram, V., & Tekic, Z. (2022). How AI revolutionizes innovation management – Perceptions and implementation preferences of AI-based innovators. *Technological Forecasting and Social Change*, *178*, 22. https://doi.org/10.1016/j.techfore.2022.121598

Gabelaia, I. (2022). The Applicability of Artificial Intelligence Marketing for Creating Data-driven Marketing Strategies. *Journal of Marketing Research and Case Studies*, 1_11. https://doi.org/10.5171/2022.466404

Gad-Elrab, A. A. A. (2021). Modern Business Intelligence: Big Data Analytics and Artificial Intelligence for Creating the Data-Driven Value. In *E-Business—Higher Education and Intelligence Applications*. IntechOpen. https://doi.org/10.5772/intechopen.97374

Gemini: Google's latest and greatest AI model. (2023). https://www.youtube.com/watch?v=jV1vkHv4zq8&t=66s

Gerlich, M., Elsayed, W., & Sokolovskiy, K. (2023). Artificial intelligence as toolset for analysis of public opinion and social interaction in marketing: Identification of micro and nano influencers. *Front. Commun*.

Gero, K. I., Liu, V., & Chilton, L. (2022). *Sparks: Inspiration for Science Writing using Language Models*. 1002–1019.

Guo, T., Eckert, R., & Li, M. (2020). Application of Big Data and Artificial Intelligence Technology in Industrial Design. *International Journal of Advanced Trends in Computer Science and Engineering*, *Vol 5*, 10–14.

Gurbuz, E. (2018). Theory of New Product Development and Its Applications. In *Marketing*. IntechOpen. https://doi.org/10.5772/intechopen.74527

Haefner, N., Wincent, J., Parida, V., & Gassmann, O. (2021). Artificial intelligence and innovation management: A review, framework, and research agenda☆. *Technological Forecasting and Social Change*, *162*, 10. https://doi.org/10.1016/j.techfore.2020.120392

Haenlein, M., & Kaplan, A. (2019). A Brief History of Artificial Intelligence: On the Past, Present, and Future of Artificial Intelligence. *California Management Review*, *61*(4), 5–14.

Haleem, A., Javaid, M., & Singh, R. (2023). An era of ChatGPT as a significant futuristic support tool: A study on features, abilities, and challenges. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, *2*, 100089. https://doi.org/10.1016/j.tbench.2023.100089

Henriques Montez, A. R. (2022). *Artificial Intelligence applied to Stakeholder Theory* [ISCTE Business School]. https://repositorio.iscte-iul.pt/bitstream/10071/26764/1/master_ana_henriques_montez.pdf

Herbert Ferrara, M. (2013). *Gale Business Insights Handbook of Investment Research*.

Hilgenfeldt, N. (2023a). *7 Stages of a Successful New Product Launch*. https://www.myos.com/en-blog/stages-of-a-successful-new-product-launch-to-expand-business

Hilgenfeldt, N. (2023b). The implementation of your product launch plan and the actual release of your product into the market. *MYOS*. https://www.myos.com/en-blog/stages-of-a-successful-new-product-launch-to-expand-business

Hoeksema, A. (2023). *How to Use AI Tools like ChatGPT for Financial Projections* [ProjectionHub]. https://www.projectionhub.com/post/how-to-use-ai-for-financial-projections

Hoffman, D. L., & Novak, T. P. (2018). Consumer and Object Experience in the Internet of Things: An Assemblage Theory Approach. *Journal of Consumer Research*, *44*(6), 1178–1204. https://doi.org/10.1093/jcr/ucx105

Hollensen, S., & Opresnik, M. O. (2020). *Principles and Practice: A Management-oriented Approach*.

Homburg, C., Kuester, S., Nikolaus, B., & Ajay, M. (2005, August 1). Determinants of Customer Benefits in Business-to-Business Markets: A Cross- Cultural Comparison. *Journal of International Marketing*, 1–31.

Houck, J. P. (1984). *'Market': A Definition for Teaching*.

Hughes, C. (2023). *Harnessing AI To Take Competitor Analysis To The Next Level*. Forbes. https://www.forbes.com/sites/forbesbusinesscouncil/2023/10/19/harnessing-ai-to-take-competitor-analysis-to-the-next-level/

Husein, S., & Nuryakin. (2018). *The Effect of Product's Attribute Attractiveness on The Relationship Between Product Innovation and Customer's Purchasing Interest (A Study on Customers of Honda Matic Motorcycle in Indonesia)*. *15*.

Hwang, A. H.-C., & Won, A. S. (2021). IdeaBot: Investigating Social Facilitation in Human-Machine Team Creativity. *CHI '21: Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, *712*, 1–16. https://doi.org/10.1145/3411764.3445270

Hyscaler. (2024). *How AI Can Boost Your Brand Positioning with 5 Amazing Social Media Insights*. HyScaler. https://hyscaler.com/insights/ai-brand-positioning-5-insights/

IBM. (2023). *What is natural language processing (NLP)?* IBM. https://www.ibm.com/topics/natural-language-processing#:~:text=Natural%20language%20processing%20(NLP)%20refers,same%20way%20human%20beings%20can.

Ijaz, H. (2023). Top 4 Ways AI-Powered Message Testing Can Boost Your Marketing Results. *Poll the People*. https://pollthepeople.app/ai-message-testing/

InbuiltData. (2023). Industry 4.0: A Revolution in Manufacturing / Industry 4.0 and Digital Transformation. *LinkedIn*. https://www.linkedin.com/pulse/industry-40-revolution-manufacturing-digital-transformation

Indeed. (2023, June). *How To Forecast Sales for a New Product in 6 Steps*. Indeed. https://www.indeed.com/career-advice/career-development/forecast-product

Jabbar, A., Akhtar, P., & Dani, S. (2020). Real-time big data processing for instantaneous marketing decisions: A problematization approach. *Industrial Marketing Management*, *90*, 558–569. https://doi.org/10.1016/j.indmarman.2019.09.001

Jain, D., Mahajan, V., & Muller, E. (1995). An approach for determining optimal product sampling for the diffusion of a new product. *Journal of Product Innovation Management*, *12*(2), 124–135. https://doi.org/10.1016/0737-6782(94)00042-E

Jain, P., & Aggarwal, K. (2020). *Transforming Marketing with Artificial Intelligence*. https://doi.org/10.13140/RG.2.2.25848.67844

Jarek, K., & Mazurek, G. (2019). Marketing and Artificial Intelligence. *Central European Business Review*, *8*(2), 46–55. https://doi.org/10.18267/j.cebr.213

Jarrahi, M. H. (2018). Artificial Intelligence and the Future of Work: Human-AI Symbiosis in Organizational Decision Making. *Business Horizon*.

Just, J., Ströhle, T., Füller, J., & Hutter, K. (2023). *AI-based novelty detection in crowdsourced idea spaces*. https://www.tandfonline.com/doi/epdf/10.1080/14479338.2023.2215740?needAccess=true

Kasper, G., & Clohesy, S. (2008). *How Getting More Systematic about Innovation Could Improve Philanthropy and Increase Social Impact*. 1–78.

Keller, J. (2023). *Aided By Artificial Intelligence, Business Networks Set To Transform Core Operational Processes*. Forbes. https://www.forbes.com/sites/sap/2023/10/13/aided-by-artificial-intelligence-business-networks-set-to-transform-core-operational-processes/

Kerner, S. M. (2023, September). *What are Large Language Models? | Definition from TechTarget*. https://www.techtarget.com/whatis/definition/large-language-model-LLM

Khaleel, M., Ahmed, A. A., & Alsharif, A. (2023). Artificial Intelligence in Engineering. *Brilliance: Research of Artificial Intelligence*, *3*(1), Article 1. https://doi.org/10.47709/brilliance.v3i1.2170

Kietzmann, J., Paschen, J., & Treen, E. R. (2018). Artificial Intelligence in Advertising: How Marketers Can Leverage Artificial Intelligence Along the Consumer Journey. *Journal of Advertising Research*, 263–267.

Korinek, A., & Stiglitz, J. E. (2021). *Artificial Intelligence, Globalization, and Strategies for Economic Development* (Working Paper 28453). National Bureau of Economic Research. https://doi.org/10.3386/w28453

Kosinski, M., & Wang, Y. (2018). Deep neural networks are more accurate than humans at detecting sexual orientation from facial images. *Journal of Personality and Social Psychology*, *114*(2), 246–257.

Kotamäki, E. (2023). Maximizing Profits with AI: Forecasting and Price Simulation. *Sniffie*. https://www.sniffie.io/blog/maximizing-profits-with-ai-forecasting-and-price-simulation/#:~:text=Accurate%20predictions%3A%20AI%20algorithms%20can,about%20inventory%20and%20pricing%20strategies.

Kraemer, D. (2023, September 30). *How To Use AI To Brainstorm A Billion-Dollar Business Idea*. Crunchbase. https://web.archive.org/web/20230930205935/https://news.crunchbase.com/ai-robotics/how-to-use-ai-chatgpt-brainstorm-business-ideas

Kunerth, V. (2023, August). *Leveraging Artificial Intelligence in Business Analytics for Strategic Decision-Making*. LinkedIn. https://www.linkedin.com/pulse/leveraging-artificial-intelligence-business-analytics-volkmar-kunerth

Lawton, G. (2023). *What is Generative AI? Everything You Need to Know*. Techtarget. https://www.techtarget.com/searchenterpriseai/definition/generative-AI

Leggett, K. (2017). *How AI Will Transform Customer Service*.

Li, X., Wang, C., Huang, L., & Bai, X. (2021). The use of AI in e-commerce marketing in China: An exploratory study. *Information Systems and E-Business Management*, *19*(2), 355–379.

Lubart, T. (2005). How can computers be partners in the creative process: Classification and commentary on the Special Issue. *International Journal of Human-Computers Studies*, 365–369.

Maher, M. L., & Fisher, D. H. (2012). *Usigns AI to Evaluate creative designs*. 45–54.

Maslow, A. H. (1943). *A Theory of Human Motivation*. 370–396.

Mediavilla, M. A., Dietrich, F., & Palm, D. (2022). Review and analysis of artificial intelligence methods for demand forecasting in supply chain management. In *Procedia CIRP* (Vol. 107, pp. 1126–1131).

Meijer, B. (2023). *A Comparative Analysis of Human and A.I. Feedback on Business Idea Evaluation*. http://essay.utwente.nl/95453/1/Meijer_BA_faculty.pdf

Memmert, L., & Tavanapour, N. (2023). *Towards human-ai-collaboration in brainstorming: Empirical insights into the perception of working with a generative ai*.

Mileva, G. (2023, May 15). *10 Best AI Software Tools for More Effective Customer Segmentation*. Influencer Marketing Hub. https://influencermarketinghub.com/ai-software-customer-segmentation/

Muirhead, B. (2007). *Integrating creativity into online university classes, Educational Technology & Society*. *10*(1), 113.

Neil Patel (Director). (2023, April 27). *Revolutionizing Marketing with AI: The Future is Here*. https://www.youtube.com/watch?app=desktop&v=l_U4aQTj6Mg

Oehm, M., & Som, O. (2023). *AI in New Product Developments: How Hidden Champions Can Leverage Their Innovation Potential*. 1–21. https://www.proquest.com/docview/2840810937/abstract/66678B5CD2D44CA1PQ/5

Olajide, B., Mohdlizam, Esther, O., & Onn, H. (2016). Understanding The Conceptual Definitions of Cost, Price, Worth and Value. *IOSR Journal of Humanities Social Science (IOSR-JHSS)*, *21*, 53–57. https://doi.org/10.9790/0837-2109015357

Oosthuizen, K. (2021). Artificial intelligence in retail: The AI-enabled value chain. *Australasian Marketing Journal*, *293*(3), 264–273. https://doi.org/10.1016/j.ausmj.2020.07.007

Perttula, M. K., & Sääskilahtl, M. T. (2004). *Product concept development as a conscious resource*. 42–50. https://www.designsociety.org/publication/27301/DS+49%3A+Proceedings+of+NordDesign+2004+Conference%2C+Tampere%2C+Finland%2C+18.-20.08.2004

Prem, E. (2019). Artificial Intelligence for Innovation in Austria. *Technology Innovation Management Review*, *9*. https://doi.org/10.22215/timreview/1287

Product Innovation Academy (Director). (2023, March 8). *A.I. Product Design—THIS will change everything!* https://www.youtube.com/watch?app=desktop&v=bAQvlSbxl-U

Qmarkets. (2023). *Intelligent Idea Management Software* [Computer software]. Qmarkets. https://www.qmarkets.net/lp/idea-management-software/?utm_medium=ppc&utm_campaign=Tier+1+Countries+%7C+Bronze+KWs+-+%28Exact+%26+Phrase%29&utm_source=adwords&utm_term=idea%20generation&hsa_grp=145719592782&hsa_tgt=kwd-296288562159&hsa_ver=3&hsa_ad=656341878853&hsa_net=adwords&hsa_kw=idea%20generation&hsa_mt=p&hsa_acc=3759777188&hsa_cam=11845412154&hsa_src=g&gad_s

ource=1&gclid=CjwKCAjw15eqBhBZEiwAbDomEgd69oK3VA-_7qQYbkHwL8FTD69QvrxsHXTUzIeFGxNHSeB6Yz7AXBoCMkgQAvD_BwE

Quantilope. (2023). *9 Best AI Market Research Tools*. https://www.quantilope.com/resources/best-ai-market-research-tools

Rani, V. S., & Sundaram, N. (2022). Collaborative Social Media Marketing in Small Scale Business Using Artificial Intelligence. *ECS Transactions*, *107*(1), 5175–5182. https://doi.org/10.1149/10701.5175ecst

Ringle, C., Sarstedt, M., & Zimmermann, L. (2011). Customer Satisfaction with Commercial Airlines: The Role of Perceived Safety and Purpose of Travel. *Journal of Marketing Theory and Practice*, *19*, 459–472. https://doi.org/10.2753/MTP1069-6679190407

Robson, C. (2002). *Real World Research: A Resource for Social Scientists and Practitioner-Researchers 2nd Edition* (2nd ed., Vol. 2).

Ruiz-Real, J. L., Uribe-Toril, J., Torres, J. A., & Pablo, J. D. (2021). Artificial intelligence in business and economics research: Trends and future. *Journal of Business Economics and Management*, *22*(1), Article 1. https://doi.org/10.3846/jbem.2020.13641

Ruparelia, A. (n.d.). *Why is a profit and loss forecast important for businesses?* Agicap. Retrieved 30 October 2023, from https://agicap.com/en/article/profit-and-loss-forecast/

Salehi, H., & Burgueño, R. (2018). Emerging artificial intelligence methods in structural engineering. *Engineering Structures*, *171*, 170–189.

Salesforce. (2022). *What is the history of artificial intelligence (AI)? | Tableau*. https://www.tableau.com/data-insights/ai/history

Salesforce. (2023). *What is AI Marketing & How Can You Utilise It?* Salesforce. https://www.salesforce.com/in/resources/guides/role-of-ai-in-marketing/

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed). Prentice Hall.

Schank, R. C. (1995). *What we learn when we learn by doing*. https://www.rogerschank.com/What-We-Learn-When-We-Learn-by-Doing

Schwab, K. (2016). *The Fourth Industrial Revolution*.

Segal, T. (2022). What Is Big Data? Definition, How It Works, and Uses. *Investopedia*. https://www.investopedia.com/terms/b/big-data.asp#:~:text=Big%20data%20refers%20to%20the,v's%22%20of%20big%20data).

Sentance, R. (2019). 15 examples of artificial intelligence in marketing. *Econsultancy*. https://econsultancy.com/15-examples-of-artificial-intelligence-in-marketing/

Severn, R. (2019). *Evolv AI* [Computer software].

Shankar, V. (2018). How Artificial Intelligence (AI) is Reshaping Retailing. *Journal of Retailing*, *94*(4), 6–11. https://doi.org/10.1016/S0022-4359(18)30076-9

Siemon, D. (2023). Let the computer evaluate your idea: Evaluation apprehension in human-computer collaboration. *Behaviour & Information Technology*, *42*(5), 459–477. https://doi.org/10.1080/0144929X.2021.2023638

Singh, J., Brady, M., Arnold, T., & Brown, T. (2017). The Emergent Field of Organizational Frontlines. *Journal of Service Research*, *20*(1), 3–11. https://doi.org/10.1177/1094670516681513

Slevin, M. (2023). *Channel Strategy: Using AI to Choose the Right Channels for Your Product*. https://www.linkedin.com/pulse/channel-strategy-using-ai-choose-right-channels-your-michelle-3pele

Sniffie. (2020, February 17). *AI-based Price Optimization—Sniffie*. https://www.sniffie.io/software-solutions/ai-based-price-optimization/

Soltani-Fesaghandis, G., & Pooya, A. (2018). Design of an artificial intelligence system for predicting success of new product development and selecting proper market-product strategy in the food industry. *International Food and Agribusiness Management Review*, *21*(7), 847–864. https://doi.org/10.22434/IFAMR2017.0033

Surbhi, S. (2014). *Differences between price, cost and value.Worldthinknest and lightest business notebook*.

Syam, N., & Sharma, A. (2018). Waiting for a sales renaissance in the fourth industrial revolution: Machine learning and artificial intelligence in sales research and practice. *Industrial Marketing Management*, *69*, 135–146. https://doi.org/10.1016/j.indmarman.2017.12.019

Terrell Hanna, K. (2022). *What is Test Marketing and How Does it Work?* WhatIs. https://www.techtarget.com/whatis/definition/test-marketing

Theodoridis, P., & Gkikas, D. (2019). *How Artificial Intelligence Affects Digital Marketing*. 1319–1327. https://doi.org/10.1007/978-3-030-12453-3_151

Thomas, D. R. (2003). A General Inductive Approach for Qualitative Data Analysis. *American Journal of Evaluation*, 1–11.

Titus, P. A. (2000). Marketing and the creative problem-solving process. *Journal of Marketing Education*, *22*(3), 225–235.

Tiwari, A. (2023). *AI Driven Marketing Or Marketing Through AI !* https://www.proquest.com/docview/2823660095/abstract/EBC63FE3AD884D2FPQ/2

Tiwari, S. (2022). Artificial Intelligence Implications in Engineering and Production. *Engineering Proceedings*, *31*(1), Article 1. https://doi.org/10.3390/ASEC2022-13823

Tjepkema, L. (2019). *What Is Artificial Intelligence Marketing & Why Is It So Powerful*. 53–55.

Tongkachok, K., Elkady, G., & Haddad, S. (2022). *Effective role of artificial intelligence and chatbots in marketing strategies for decision making for online customers*. *20*(2), 1150–1165.

Toubia. (2006). *Idea generation, creativity, and incentives, Marketing Science* (Vol. 25).

Touhami, S. E. (2023). *Here are some helpful AI design Tools to become a better designer*.

Trinh, C., Meimaroglou, D., & Hoppe, S. (2021). Machine Learning in Chemical Product Engineering: The State of the Art and a Guide for Newcomers. *Processes*, *9*(8), Article 8. https://doi.org/10.3390/pr9081456

Umuemufo, L., Omonzejele, F. E., & Ogbogbo, O. G. (2023). Statistical analysis on the effect of test marketing on new product development: A case study of delta state polytechnic, otefe-oghara water factory. *Innovative Journal of Science (ISSN: 2714-3309)*, *5*(5), Article 5.

Verganti, R., Vendraminelli, L., & Iansiti, M. (2020). Innovation and Design in the Age of Artificial Intelligence. *Journal of Product Innovation Management*, *37*. https://doi.org/10.1111/jpim.12523

Verma, S., Sharma, R., Deb, S., & Maitra, D. (2021). Artificial intelligence in marketing: Systematic review and future research direction. *International Journal of Information Management Data Insights*, *1*, 8. https://doi.org/10.1016/j.jjimei.2020.100002

Vijayaraghavan, N. (2019). How Artificial Intelligence (AI) Can Power B2B Marketing. *G2*. https://learn.g2.com/ai-powered-b2b-marketing

W. Mohr, J., & Ventresca, M. (2001). Archival Research Methods. In *Companion to Organizations*. https://www.researchgate.net/publication/258628588_Archival_Research_Methods

Weber, F., & Schütte, R. (2019). State-of-the-art and adoption of artificial intelligence in retailing. *Digital Policy, Regulation and Governance*, *21*. https://doi.org/10.1108/DPRG-09-2018-0050

Wheatley, M. (2023, October 24). DataGPT uses generative AI to transform every employee into a skilled business analyst. *SiliconANGLE*. https://siliconangle.com/2023/10/24/datagpt-uses-generative-ai-transform-every-employee-skilled-business-analyst/

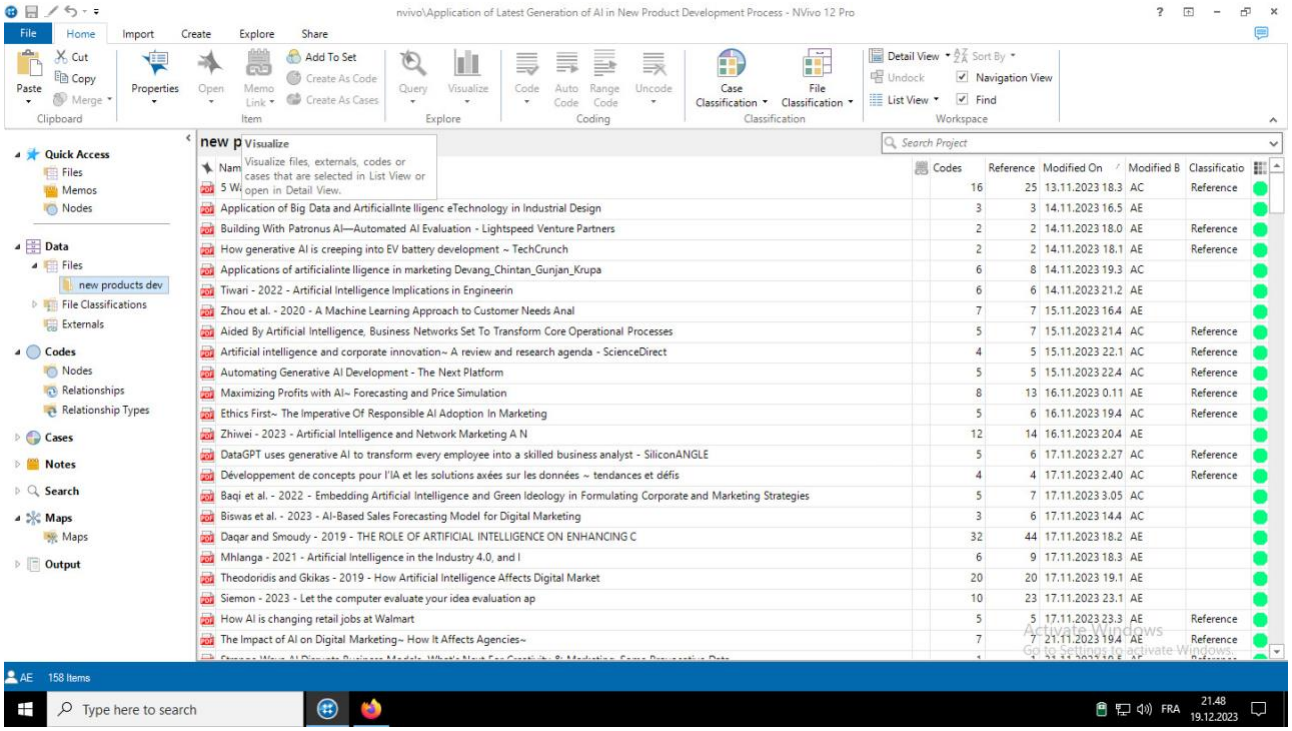
Young, M. (2023, October 2). *UNC Researchers Present VideoDirectorGPT: Using AI to Generate Multi-Scene Videos from Text*. Medium. https://ai.plainenglish.io/unc-researchers-present-videodirectorgpt-using-ai-to-generate-multi-scene-videos-from-text-1fad9b29ee9d

Zhiwei, X. (2023). Artificial Intelligence and Network Marketing: A New Era for Chinese E-Commerce. *Journal of Digitainability, Realism & Mastery (DREAM)*, *2*(04), Article 04. https://doi.org/10.56982/dream.v2i04.100

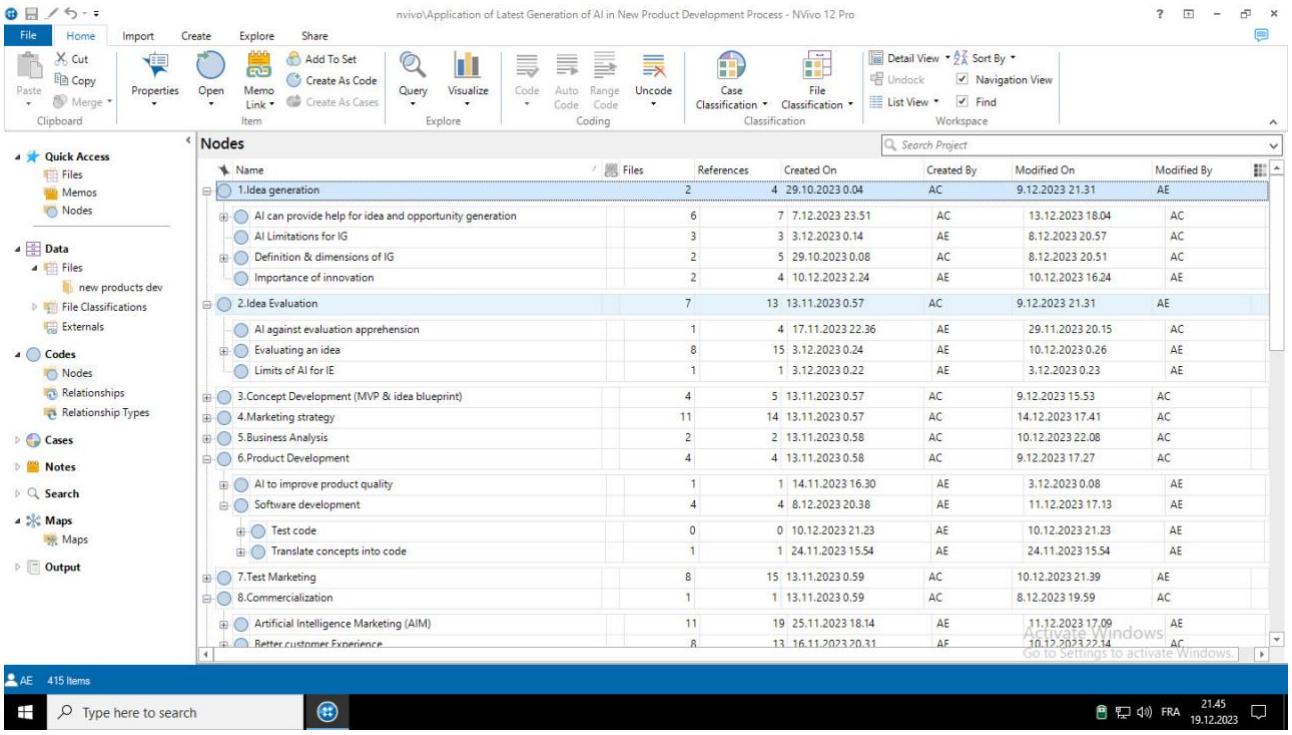
Zhou, F., Ayoub, J., Xu, Q., & Jessie Yang, X. (2020). A Machine Learning Approach to Customer Needs Analysis for Product Ecosystems. *Journal of Mechanical Design*, *142*(1), 13. https://doi.org/10.1115/1.4044435

Appendices

Appendix 1. A screenshot showing the publications uploaded as secondary data on the NVivo12 program.



Appendix 2. A screenshot showing the nodes created during data analysis phase (from the NVivo 12 program).



Appendix 3. Definitions

1- **Big Data**: Artificial intelligence functions thanks to data, mostly big data. “Big data refers to the large, diverse sets of information that grow at ever-increasing rates. It encompasses the volume of information, the velocity or speed at which it is created and collected, and the variety or scope of the data points being covered (known as the "three v's" of big data). Big data often comes from data mining and arrives in multiple formats.” (Segal, 2022). AI can process large amounts of data quickly and efficiently and is therefore able to produce optimized highly accurate results which is very important for companies.

2- **Market**: Houck (1984) has defined a market as: “a collection of actual or potential buyers and sellers of a specific good or service. This collection has two characteristics: (1) none of the buyers has the option to purchase the item from sellers outside this collection and (2) none of the sellers has the option to sell the item to buyers outside this collection. The interaction of these buyers and sellers generates a set of interrelated prices and conditions of sale or use. The principles or facts determining which buyers and sellers are in this collection identify the market spatially, temporally, and politically.” (Houck, 1984)

3- **Profit**: According to the Cambridge dictionary, profit is “money that is earned in trade or business after paying the costs of producing and selling goods and services” (Cambridge Dictionary, 2023).

4- **Value proposition**: Worth is based on the usefulness or importance that an individual will see in an object or service. It is therefore very important that a business can identify and demonstrate the value that their product is adding to the consumers' lives. "Essentially, a value proposition will state the measurable value or tangible customer benefits that a product or service will provide to its customers and will illustrate the return on the investment or other tangible positive outcomes of choosing a particular service provider over its competitors" (Camlek, 2011).

5- **Market share**: "Market share describes the relationship between a company's success and the success of its competitors. It is the percentage of an entire industry's sales earned by a particular company during a discrete period of time" (Herbert Ferrara, 2013).

6- **Price**: It is important to note that price is represented in numerical terms. Surbhi (2014) defines price as the "amount of money expended by the buyer to the seller in exchange for any product and service, that is, the amount charged by the willing seller for a commodity is referred to as its price, which includes cost and the profit margin" (Surbhi, 2014). To simplify, Olajide et al. have defined price as "what you pay for goods or services you receive"(Olajide et al., 2016).

7- **Marketing budget**: "A marketing budget documents how much the business plans to spend on marketing over a particular period, similar to a year, quarter, or month." (Dole, 2021).

8- **Marketing mix strategy**: "The marketing mix refers to the tactics (or marketing activities) that we have to satisfy customer needs and position our offering clearly in the mind of the customer" (Hollensen & Opresnik, 2020). McCarthy proposed the idea of a "marketing mix" as a conceptual framework for translating marketing planning into practice (Bennet, 1997). It includes the 7P mix: product, price, place, promotion, physical environment, process people.

Appendix 4. Quotes from relevant publications to highlight the evidence of figure 3

Idea Generation stage	
Idea	Citations

Appendix 4.1 - Dimension of IG	"The innovation process – which is at the core of innovation management's attention – is commonly understood to comprise a series of stages including (1) the recognition, discovery, creation, and generation of innovative ideas, opportunities, and solutions; (2) the development or exploitation of various ideas, opportunities, and solutions; and finally (3) the evaluation and selection of one or several of the most promising ideas, opportunities, and solutions (e.g., Kijkuit and van den Ende, 2007)." (Haefner et al., 2021) "The stage of idea generation, also called "ideation", whose objective is individual or collective identification of new ideas or opportunities, is often recognized as one of the highest leverage point for an organization" (Toubia, 2006) "This is the creative stage where new ideas are generated and/or new opportunities identified." (El Haiba et al., 2017) "According to Titus, idea generation, or the act of generating novel, applicable ideas, is the activity most frequently associated with creative problem solving (CPS) [8]" (El Haiba et al., 2017) "Idea generation is the process in which creative thinking based on knowledge and learning from prior experience is used to individually or collectively

	produce novel ideas adapted to the context wherein they are spawned" (El Haiba et al., 2017)
Appendix 4.1.1 - Creativity	"Each innovation necessarily starts with the generation of creative ideas. According to Muirhead, a basic definition of creativity is the ability to produce novel (original/unexpected) work that is high in quality and is appropriate (useful) [11]" (El Haiba et al., 2017) "Also Titus has defined creativity as "the birth of imaginative new ideas"" (El Haiba et al., 2017) "AI can support ideation by scanning external information for customer needs (Christensen et al., 2016; Haefner et al., 2021; Yams et al., 2020; Zhan et al., 2016)" (Oehm & Som, 2023)
Appendix 4.1.1.1 - A process of problem solving	"Simon, in exploring the potential of a computer program called "BACON" that he and his colleagues had developed at Carnegie Mellon University, was supporting a rational perspective of cognitive processes (Simon, 1988), where creativity could be interpreted as a process of problem solving (and therefore, partly embedded into computers)." (Verganti et al., 2020) Csikszentmihalyi instead proposed "problem finding as the hallmark of creativity." (Verganti et al., 2020)
Appendix 4.1.1.2 - CSS (Creativity Support System)	"But the new generative machine models take this process a step further: They can still apply patterns to unseen data, but they can also get a deeper

	understanding of the thinking behind the creative process.” (Forsey, 2023) “real partners in the creative process intervening at different points in order to generate, evaluate, or refine ideas” (Lubart, 2005) “Systems that have been designed for tasks in which creativity is necessary, including science studies, literary work, musical work, musical depiction, design, mathematics, and art (Gabriel et al., 2016) are called creativity support systems (CSS).” (Siemon, 2023) “The nanny supports by monitoring the creative process, setting agendas and deadlines.” (Siemon, 2023) “The pen-pal helps by providing the possibility to receive, compose and distribute an idea” (Siemon, 2023) “the coach represents a support system that helps with a specific method or with the system itself, e.g. by recommending other methods or steps within idea generation” (Siemon, 2023) “the computer as a colleague depicts an AI-based system that actively takes part in a creative process” (Siemon, 2023) “With said creative systems, individuals could use programs for creative tasks where the computer

	extends the human's cognition and acts as a creative collaborator e.g. by evaluating, commenting and providing further feedback to an idea" (Siemon, 2023)
Appendix 4.1.2 Collaboration	"Innovation is fundamentally a collaborative effort. Great ideas are rarely created by a solitary genius. More often, innovation comes from the right network of people and teams bringing disparate ideas together [10]" (El Haiba et al., 2017) "Great ideas are rarely created by a solitary genius." (Kasper & Clohesy, 2008) "Collaboration nurtures emergence, which can often lead to unexpected opportunities." (Kasper & Clohesy, 2008)
Appendix 4.1.2.1AI reducing evaluation apprehension	"That participants consistently contributed more ideas and ideas of higher quality when they perceived their teamworking partner to be a bot" (Hwang & Won, 2021) "The results indicate that an AI-based system like Alan can address the fear of negative evaluation and can be used to evaluate ideas from individuals who would otherwise withhold their ideas because of their fear of being negatively evaluated" Siemon, 2023)
Appendix 4.1.2.2 Human-AI collaboration	"With recent advances in generative language models (GLMs), however, human-AI collaboration for creative tasks might be feasible" (Gero et al., 2022)

	"In our exploratory, mixed-method study (qualitative emphasis), participants individually brainstorm with a generative AI and reflect on their experience afterward via a qualitative survey. We show that signs of group effects (e.g., cognitive stimulation and free riding, Pinsonneault et al., 1999) known from human brainstorming sessions partially occur in such human-AI groups as well." (Memmert & Tavanapour, 2023)
Appendix 4.2 AI for idea and opportunity generation	"When evaluating large sets of ideas in crowdsourcing contests, AI-based novelty detection presents fast and straightforward access to particularly distinctive contributions." (Füller et al., 2022) "AI systems use machine learning algorithms that demand and process vast amounts of data (Brynjolfsson and McAfee, 2017). They can recognize problems, opportunities, and threats above and beyond local search routines and knowledge domains, which may be helpful to discover and generate new ideas (Haefner et al., 2021)." (Füller et al., 2022) "Idea generation is one of the most important stages of product design. However, due to psychological inertia, it is not always possible to generate creative and innovative ideas (design fixation). During the conceptual design process, human designers can easily become stuck on some design ideas, impeding their ability to think about developing novel ones. This is a significant impediment to achieving the ideal/perfect design. The process of inspiration is complex, requiring thorough market investigation as well as domain

	expertise, intuition, a sharp mind, and creative abilities. Prolonging this process may result in higher costs of production and a loss of market share. AI has been used to overcome this barrier through verbal, written, and visual inspiration." (Khaleel et al., 2023) "Product ideation is the best place to start. When you only have vague initial ideas, generative AI can really help to crystalize them." (Kraemer, 2023)
Appendix 4.2.1 Outlier.ai Software	"These AI applications are able to process much more information to generate new ideas and opportunities that would likely be overlooked by humans operating on their own. A typical example is an application developed by Outlier.ai. The company uses a suite of machine learning methods to process raw metrics data into insights that are humanly readable (Unemyr, 2018). After analyzing a firm's data, Outlier generates a set of customized 'stories' that summarize actionable and interesting insights for specific managers. In doing so, Outlier can highlight innovative opportunities for managers." (Haefner et al., 2021) "Outlier's ability to find anomalies and significant patterns in business data is one way in which AI can assist firms in generating or recognizing innovative ideas and opportunities." (Haefner et al., 2021)
Appendix 4.2.2 Q-market Software	"Customize the idea submission form to ensure your users are focused on what matters. Feel free to use

	your own idea generation methodology or framework" (Qmarkets, 2023) "Easily tap into the collective wisdom of the HeroX global community of problem solvers and experts, to gather highly relevant ideas and solutions for your initiative. This allows you to benefit from the power of crowdsourcing without having to generate your own audience." (Qmarkets, 2023) "choose from 20+ languages with automated content translation and custom terminology" (Qmarkets, 2023)
Appendix 4.3 Limitation: not developed enough	"These AI methods may not be able to independently develop entire solutions, but they can point human managers towards the most promising avenues for innovation." (Haefner et al., 2021) "Siemon et al. (2015) developed a prototype to aid humans in brainstorming by showing related social media content. They transformed user's ideas into search queries for web and social media platforms and showed the queried content generated by others to offer inspiration. While these approaches affect performance processes, they cannot generate (new) ideas in a comparable manner to a human team member." (Memmert & Tavanapour, 2023) "to generate new ideas that a human cannot identify AI needs to be further developed (A, 2022)." (Oehm & Som, 2023)

Appendix 5. Quotes from relevant publications to highlight the evidence of figure 4

Idea Evaluation stage	
Idea	Citations
Appendix 5.1 Evaluating an idea	"AI has the potential to substantially support idea selection by providing more and nonbiased information and insights." (Füller et al., 2022) "One of the most time-consuming aspects of product development is combining a new invention's form, style, functionality, and ergonomics. Generative AI makes performing "what if" scenarios simpler and enhances the process of comparing and assessing different product concepts. Comparing design concepts helps designers and engineers make informed decisions about which concepts to pursue. It also clarifies which product designs won't work, reducing the risk of investing time and resources in an idea that isn't feasible." (Bailey, 2023) "However, user demands often contain uncertainties that need to be clarified. Furthermore, this conventional evaluation process becomes extremely difficult and time-consuming, especially for a large number of design options which is usually the case [28,29]. With AI methods, an objective and rapid evaluation can be made, and thus significant time and cost savings can be achieved." (Khaleel et al., 2023)

Appendix 5.1.1 Novelty	"The evaluation of the novelty [...] from a generated pool is done using the Bayesian Surprise method" (Siemon, 2023) "for ideas below the median word length and when comparing crowdsourced ideas to a range of existing product categories" (Just et al., 2023) "there are many accounts of measuring novelty using computational approaches" (Maher & Fisher, 2012)
Appendix 5.1.1.1 AI example	"Maher and Fisher (2012) developed an AI-based system that evaluates the novelty, the degree of surprise, the unexpectedness and the value of an idea" (Siemon, 2023) "With the help of AI-based clustering methods, the distances of the key figures to other products are evaluated for the criterion novelty" (Siemon, 2023)
Appendix 5.1.1.2 Limitation of AI in novelty detection	"Our analysis reveals that AI-based novelty detection works better for ideas below the median word length and when comparing crowdsourced ideas to a range of existing product categories" (Just et al., 2023)
Appendix 5.1.2 Unexpectedness	"The degree of unexpectedness is evaluated by comparing the development patterns" (Siemon, 2023) "an artifact, α, is considered surprising when we recognize a pattern in recent artifacts, and the potentially creative artifact does not follow the

	expected next artifact in the pattern" (Maher & Fisher, 2012)
Appendix 5.1.2.1 AI Example	"Maher and Fisher (2012) developed an AI-based system that evaluates the novelty, the degree of surprise, the unexpectedness and the value of an idea" (Siemon, 2023)
Appendix 5.1.3 Value of an idea	"For the value of the idea, an adaptive function with a genetic algorithm is used" (Siemon, 2023) "The value of any artifact is judged by criteria that are established by the requirements and performance attributes associated with the class of artifacts." (Maher & Fisher, 2012) "based on attributes that have utility preferences associated with them." (Maher and Fisher, 2012)
Appendix 5.2 Interest of AI for Idea Evaluation	"Using an AI-based system for idea evaluation, therefore, causes less feeling of concern or unease about an upcoming evaluation, whereas the evaluation by a human causes higher evaluation apprehension." (Siemon, 2023) "Machine learning and visual analytics tools could be used to support idea generation and evaluation, referred to as idea mining" (Ayele & Juell-Skielse, 2020) "approaches for AI-based idea evaluation that exist rely on methods like latent semantic analysis, latent

	Dirichlet allocation, and term frequency-inverse document frequency. Such AI-based evaluation methods can be compared to human expert evaluation" (Siemon, 2023) "idea evaluation [...] can be supported by machine learning and idea mining techniques" (Ayele & Juell-Skielse, 2020)
Appendix 5.2.1 AI against evaluation apprehension	"Social aspects, such as hierarchy, are factors that influence individual evaluation apprehension and subsequently lead to untapped creative potential and possible missed innovations" (Zhou et al., 2020) "that an AI-based system like Alan can address the fear of negative evaluation and can be used to evaluate ideas from individuals who would otherwise withhold their ideas because of their fear of being negatively evaluated" (Siemon, 2023).

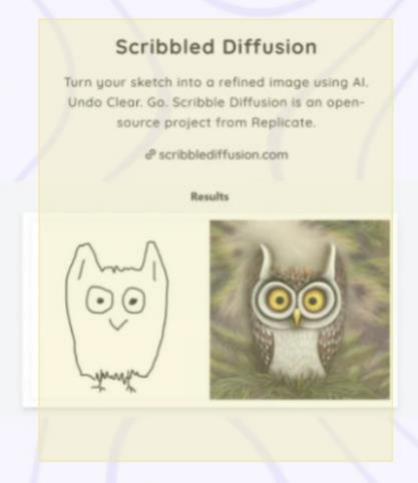
Appendix 6 Quotes from relevant publications to highlight the evidence of figure 5

Concept Development stage

Idea	Citations
Appendix 5.1 AI for concept visualization	"1. Concept Visualization - Generative AI algorithms can create realistic, three-dimensional renderings of new product concepts. Visualizing the design and form of a potential product makes it easier for stakeholders to understand what is required to physically build that product. Having comprehensive AI-generated renderings reduces the number of physical prototypes needed and speeds up concept exploration, review, and approval." (Bailey, 2023) "Virtual prototyping. New technologies are opening up unprecedented levels of detail and complexity for idea development and refinement in the prototyping process." (Kasper, 2008) "Virtual prototyping can be applied to many projects and can be further refined for ideas that are less tangible, such as service programs." (Kasper, 2008) "Some of the key AI applications in design include inspiration and concept generation: AI tools can be used to generate and suggest new design ideas based on a set of input parameters, such as style, color, and shape" (Khaleel et al., 2023) "AI can assist designers in making informed decisions about design choices by analyzing data and providing insights into the design process. AI algorithms can analyze design data and provide recommendations

	based on previous design outcomes." (Khaleel et al., 2023) "Being able to automatically create videos spanning diverse events and multiple scenes from text would open up many exciting applications. For instance, generating detailed visualizations from conceptual descriptions" (Young, 2023)
Appendix 5.1.1 Easier modelling in 3D	"Modelling: AI can automate the 3D modelling process, allowing designers to create more accurate and efficient 3D models of their designs. AI algorithms can generate 3D models based on input parameters and data, reducing the time and effort required by designers." (Khaleel et al., 2023) "Modelling is highly beneficial for both designers and product stakeholders as it provides a general idea of the product's structure. Traditionally, designers can create a limited number of 3D models that can take weeks or months after the conceptual design phase [35,36]. AI algorithms and methods can aid designers in automating the modelling process in MATLAB environments. The development of 2D and 3D model repositories has made 3D model generation via AI more accessible." (Khaleel et al., 2023)
Appendix 5.1.2 Better informed decisions	"AI can assist designers in making informed decisions about design choices by analyzing data and providing insights into the design process. AI algorithms can analyze design data and provide recommendations

	based on previous design outcomes." (Khaleel et al., 2023)
Appendix 5.2 Testing the concept	"Once you have a prototype, or even a minimum viable product, you can't stop iterating there. You'll need to test it with prospective or current customers to learn how to improve or iterate upon it next." (Forsey, 2023) "For now, many product teams rely on focus groups to collect feedback, but focus groups aren't always accurate representations of customer sentiment, which leaves your product team vulnerable to potentially creating a product that doesn't actually serve your customers." (Forsey, 2023)
Appendix 5.2.1 Generative AI	"Fortunately, "Generative AI can help convert customer feedback into data for your business," Mishra explains. "Let's say you get a lot of social media feedback or product usage comments or chatter on customer forums. Now, you can convert that information into charts and trend lines and analyze it in the same way you've always analyzed structured data." (Forsey, 2023) "Build-measure-learn loops are commonly applied for developing, testing, and obtaining feedback when introducing new products (Ries, 2011). While feedback gathering and analyzing methods remain immensely important in the concept and solution development phase, AI provides several possibilities to learn faster and improve these experimentation cycles. Data-

	oriented decision-making and seamless testing have been infused into the product prototyping process with the support of AI. For example, generative design applications (Krish, 2011) based on machine learning algorithms offer benefits by providing a more comprehensive range of design options and optimizing for materials, costs and manufacturing methods." (Füller et al., 2022)
Appendix 5.3 AI help design quicker and enhance creativity	"With the human designers' guidance, AI can generate and instantly visualize new ideas, then swiftly explore possible variations, ultimately enhancing design outcomes." (Fraenkel, & Kamath, 2023)
Appendix 5.3.1 Scribbled Diffusion Software	 (Touhami, 2023)
Appendix 5.4. Limitations – Need a clear prompt – Need define brief	"See that's one of the limitations. You have to give it a very specific defined criteria" (Product Innovation Academy, 2023)

Appendix 7 Quotes from relevant publications to highlight the evidence of figure 6

Marketing strategy stage	
Idea	Citations
Appendix 6.1 Market Research	"Market research and analysis play a critical role in understanding the market landscape, customer preferences, and competitive dynamics. It involves gathering information from the target market through various research and analysis." (Hilgenfeldt, 2023) "AI could understand markets properly. It could identify the market sectors accurately by targeting customers and identifying their characteristics, data, demographics and purchasing capabilities. It could also identify the quantity of expected demand and revenue, each target market sector's specific needs, the preferable types of company and competitors products." (Fayed, 2021) "A market is a collection of actual or potential buyers and sellers of a specific good or service. This collection has two characteristics: (1) none of the buyers has the option to purchase the item from sellers out-side this collection and (2) none of the sellers has the option to sell the item to buyers outside this collection. The interaction of these buyers and sellers generates a set of interrelated prices and conditions of sale or use. The principles or facts determining which buyers and sellers are in this collection identify the market spatially, temporally, and politically." (Houck, 1984)

	"Fortunately, AI can help solve for this. AI-fueled data analysis can help startups collect a more accurate, well-rounded view of the quantitative and qualitative data they'll need to determine whether their product actually meets their customers' needs — or whether they've even selected the right audience in the first place." (Forsey, 2023) "Launching new products involves some risk, but you can minimize potential challenges by conducting a market research study. Work with the sales and marketing departments to gather research and assess market trends of competing businesses. You can also perform primary market research by speaking directly with customers. Send surveys to current customers or organize product focus groups to help you estimate the demand for the new product." (Indeed, 2023) "discover many potential prospects and new competitive advantages in the market" (Akerkar, 2019)
Appendix 6.1.1 AI to analyze competition	"AI could determine changes in competitors' strategies (Tjepkema, 2019). For example, it could determine changes in the prices of their products (Davis, 2018), carefully analyze these strategies (Pedersen, et al., 2018), and identify the level of competitors' websites (Bakhsh, 2019)." (Fayed, 2021) "AI is used to accurately identify and analyze all competitors' strategies. Then, their future moves are identified; the actions necessary are taken to outdo

	them, to be prepared for any actions that competitors may take." (Fayed, 2021) "AI could identify the marketing mix strategies of competitors such as the pricing strategies used, the quotations they offer, the means of promotion they follow, their distribution channels, the range of the products provided through their websites, and any changes in their strategies." (Fayed, 2021) "Competitive Analysis – Analyze your direct and indirect competitors regarding their strengths, weaknesses, pricing strategies, and how customers view them." (Hilgenfeldt, 2023) "the customers' desires that competitors have not met to improve them" (Jabbar et al., 2020)
Appendix 6.1.2 Stakeholder Theory	"Stakeholder Theory (ST) proposes that value creation is a collaborative effort in relationships, ideally benefiting the focal business and all its Stakeholders (Freeman et al., 2010). Therefore, not considering a specific group as an interested party can represent a risk for the company. This group can contribute positively to market opportunities and prevent environmental, social, and economic problems (Gil-Lafuente & Paula, 2013)."(Henriques Montez, 2022) "Stakeholder Theory has its origins in the field of strategy when Freeman (1984, p. 25) proposed for the first time the Stakeholder approach as strategic management, classifying it as "any group or individual

	who can affect or is affected by the achievement of the firm's objectives".”(Henriques Montez, 2022) “Castro-Herrera and Cleland-Huang (2009) developed a new technique to automatically analyze through ML the contributions and interests of various stakeholders to identify experts in the subject for a topic.” (Henriques Montez, 2022) “three steps: intelligence gathering, tagging and feature selection, and automatic classification. The structure's input and output are web and BI data discovered after applying the steps. Each step allows human knowledge to guide the application of techniques.” (Henriques Montez, 2022)
Appendix 6.2 Price analysis & forecasting	“Honeywell is using AI to reduce energy costs and negative price variance by tracking and analyzing price elasticity and price sensitivity as well” (Columbus, 2020) “Demand and Pricing Analysis – Consider the demand, price sensitivity, and customer willingness to pay to arrive at a reasonable pricing strategy.” (Hilgenfeldt, 2023) “Singh et al. (2019) found that AI could define pricing strategies to increase sales. It helps the organization reach the right price for the products using the flexible pricing strategy (Shankar, 2018). In the study (Hoffman and Novak, 2018), the author concluded that AI could

	also detect pricing errors and fraud. Liu (2020) mentioned AI could adjust quotations." (Fayed, 2021) "businesses can use AI to forecast and simulate prices" (Kotamäki, 2023)
Appendix 6.2.1 AI makes more accurate predictions	"algorithms can take into account external factors such as economic indicators, weather patterns, and geopolitical events to make even more accurate predictions" (Kotamäki, 2023) "One of the AI techniques used in price forecasting is machine learning. Machine learning algorithms can learn from historical data and use that knowledge to make predictions. The algorithms can also adapt to changes in the market and adjust their predictions accordingly" (Kotamäki, 2023) "Real-time price variation based on fluctuating demand adds to the complexity of pricing task" (Verma et al., 2021). "AI algorithms can analyze large amounts of data and identify patterns that humans may miss. Utilizing this methodology can lead to more accurate predictions of future prices, which can help businesses make better decisions about inventory and pricing strategies." (Kotamäki, 2023)

Appendix 6.2.2 Sniffie Software	"Maximize your ecommerce sales with automatic and quick pricing. Make your pricing dynamic with our pricing tools" (Sniffie, 2020) "M Price optimization tools Optimize ecommerce sales and margins with Sniffie' s pricing tools. Undestand your demand and use it in forecasting." (Sniffie, 2020) "Track competitor pricing, campaigns and availability. Use the data for dynamic pricing or detailed market analysis." (Sniffie, 2020) "Software like Sniffie uses AI to continuously learn and understand from your previous price history to make accurate predictions and suggestions which will give you the most optimal prices" (Kotamäki, 2023)
Appendix 6.3. Customer Segmentation	"AI can help marketers segment targets more accurately" (Devang et al., 2019) "By analyzing customer interactions and datasets generated by each individual interaction, generative AI can pick up on small cues that indicate what a customer is interested in or what they may be looking for." (Lawton, 2023) "AI has been instrumental in refining this model, providing sophisticated tools for customer segmentation, predictive modeling" (Zhiwei, 2023)

	"ChatGPT can find the common traits, habits, and preferences of specific consumer groups by analyzing massive amounts of data." (Haleem et al., 2023).
Appendix 6.3.1 AI to analyze customer behavior	"Green marketers can adopt (AI) technological approaches to navigate ecofriendly consumers behaviors or activities in a sustainable framework. (AI) or big-data enables marketers to facilitate richer discussions and form the lifestyle and consumer preferences that are smarter and far more sustainable. It could also stand as an emerging opportunity to attract niche shoppers and create targeted experience-sharing for those who are looking forward to contributing to green campaigns." (Baqi et al., 2022) "AI offers consumer insight on consumer behavior essential for customer attraction and customer retention." (Verma et al., 2021) "AI can also help businesses optimize their advertising spend by identifying which channels and messages generate the best returns. By leveraging machine learning algorithms, businesses can analyze data from various sources to identify which ad campaigns are driving sales and which ones are not. This enables them to reallocate resources and optimize their advertising strategies for maximum impact" (Bloomreach, 2023)
Appendix 6.3.1.1 Chatbot	"This also means chatbots can constantly collect data from prospects and customers, essential for effective sales performance management. You can use this data

	to improve the accuracy of your sales forecasts." (Antosz, 2023) "In addition, chatbots can segment customers according to their behavior and preferences. They can then predict which content will speak to their specific pain points." (Antosz, 2023) "As an A.I. chatbot can give feedback instantaneously and is less likely to make mistakes when given the right instructions" (Meijer, 2023)
Appendix 6.3.2 Using chatbot to offer good content and drive-up sales	"They can also give customers personalized product suggestions and promote up-selling and cross-selling." (Antosz, 2023) "By offering the right content at the right time, your reps will be more likely to land a sale, increasing their success rate and your company's revenue." (Antosz, 2023) "The application of generative AI technology includes improving search capabilities on e-commerce platforms, using voice assistants, and creating chatbots that can mimic natural language." (Bloomreach, 2023)
Appendix 6.3.3 Driving sales through personalization	"By tailoring experiences that meet customers' specific needs and preferences, companies can drive sales and build brand loyalty to keep up in today's extremely competitive market." (Bloomreach, 2023)

	"Personalization 78% of consumers are more likely to make a repeat purchase with a brand that personalized their online shopping experience" (Bleich, 2023) "Firstly, the integration of AI into network marketing has the potential to significantly enhance custome personalization (Huang & Rust, 2018). By leveraging AI algorithms, businesses can offer personalized product recommendations, create tailored marketing messages, and respond to individual customer needs in real-time (Chen et al., 2019). Such heightened personalization can significantly improve customer satisfaction and loyalty, driving up sales and business growth in the process (Li et al., 2021)." (Zhiwei, 2023)
Appendix 6.4 Sales Forecasting	"Sales forecasting estimates the future demand for your product or service, making it easier to plan your inventory, assign resources, and guide your sales" (Antosz, 2023) "Sales forecasts help you identify future market trends and economic factors that could affect demand. You can then take steps to safeguard your cash flow" (Antosz, 2023) "Forecasting product sales is a tool businesses use to predict the number of sales they expect to achieve in the future. When launching a new product, many businesses use forecasting to anticipate their sales

	outcomes and allocate production costs accordingly." (Indeed, 2023) "Sales projections are not without their challenges, however. Businesses need to have accurate data about past sales to create reliable projections." (DealHub Experts, 2023)
Appendix 6.4.1 AI for better forecasting	"predicting future sales is notoriously difficult, and traditional sales forecasting methods are often inaccurate. In fact, nine out of 10 sales managers report missing their forecast prediction by six percent or more" (Antosz, 2023) "The use of AI in sales improves the accuracy of sales forecasts by combining detailed sales data with real-time customer insights. This provides a more complete picture of your business, so you can make smarter decisions." (Antosz, 2023) "The challenge is that, till date, recent literatures cannot ensure any definite prescribed predictive model with guaranteed success rate. Even very few literatures can ensure a reasonable level of error margin during modeling anticipated sales." (Biswas et al., 2023) "In many situations, the conventional human expert system is not capable of taking a unanimous decision and is often inconsistent in judgment." (Biswas et al., 2023)

Appendix 6.4.1.1 Better tactic and strategic decision	"AI and machine learning models analyze vast quantities of data in real-time. This means they can identify relationships between variables that humans may otherwise miss. So, AI sales forecasts help business leaders plan more effectively in both the short and long term." (Antosz, 2023) "AI and statistical method jointly give more significant result in customer demand forecasting (Mediavilla, Dietrich & Palm, 2022, p.1126). ANN suggests a way for making better intelligent decision." (Biswas et al., 2023) "To solve such kind of predictive problems, Artificial Intelligence (AI) mainly ANN outperformed year-old forecasting tools." (Biswas et al., 2023) "Organizations can take better tactical and strategic decisions on sales volume, if the forecasting is done by an intelligent process, may be the game changer for an organization" (Biswas et al., 2023)
Appendix 6.4.1.2 Using the insights from customers	"AI forecasting that uses customer sentiment analysis can provide actionable insights your reps can use to increase engagement and close more deals." (Antosz, 2023) "AI and ML tools can also use natural language processing (NLP) to capture verbal and nonverbal cues and analyze customer sentiment." (Antosz, 2023)

	"AI and ML collect vast datasets on customer behavior, preferences, purchases, pain points, and more. You can use these insights to generate accurate sales forecasts that consider a range of variables, like seasonality." (Antosz, 2023) "If a company's business is seasonal, then marketing and sales directors need to consider seasonal fluctuation when projecting future sales." (DealHub Experts, 2023)
Appendix 6.4.1.3 Financial data processing and analysis	"AI tools can detect fraud and predict cybersecurity risks, improving security for you and your customers." (Antosz, 2023) "AI forecasts can reduce financial risks too. For instance, by analyzing customer data (like credit score, income, and employment history), AI software can predict the likelihood of a customer repaying a loan." (Antosz, 2023)
Appendix 6.4.1.4 Lead generation	"AI sorts through vast quantities of data on your current and historical monthly sales and uses this information to identify the most lucrative leads and produce more accurate sales forecasts" (Antosz, 2023) "AI can provide insights into the individuals who are most likely to become brand ambassadors. It can also identify which prospects have the most influence in a company, which is particularly helpful for B2B sales." (Antosz, 2023)

	"With AI, you can track each prospect's intent to buy in real-time, helping you fine-tune your forecasting models and close more deals, as well as reduce churn. Sales organizations as a whole can make better use of their time, as they won't waste time reaching out to prospects who aren't ready to buy." (Antosz, 2023)
Appendix 6.3.2 Workflow automation	"Thanks to workflow automation, AI forecasting software can analyze vast quantities of data from multiple sources, giving you highly accurate forecasts." (Antosz, 2023) "AI bots can automate parts of the sales process, augmenting the capabilities of existing sales teams. There may be backlash if customers know (upfront) that they are chatting with an AI bot (even if the AI bot is otherwise capable)" (Davenport et al., 2020) "Workflow automation is the process of finding tasks performed by a team and automating them with technology. This type of automation is a great way to accomplish tasks and produce consistent results." (Efti, 2020) "Workflow automation as a sales opportunity has been talked about since 1989. Back then, most sales were done over the phone, and while that's still a prominent avenue—email has soared to the top as a channel for sales as well." (Efti, 2020) "Developers are exploring ways that generative AI can improve existing workflows, with an eye to adapting

	workflows entirely to take advantage of the technology." (Lawton, 2023)
Appendix 6.5 Promotion	"In the study (Yilun and Michal, 2018), the authors found that AI contributes to improving the means of product promotion. It offers programmed ads and videos targeting customers according to their personality (Davenport et al., 2020)." (Fayed, 2021) "AI has revolutionized the world of e-commerce marketing by providing companies with the tools needed to create more effective campaigns. By analyzing user data, AI algorithms can uncover insights into customer behaviors, preferences, and purchasing habits" (Bloomreach, 2023) "Content analytics can optimize value and message effectiveness. Customer likings and disliking can be tracked in real time with emotive AI algorithms. Netnography on social media content offers new avenues for marketers to align their marketing strategies as per the customer likings (Tripathi & Verma, 2018 ; Verma, 2014 ; Verma & Yadav, 2020)." (Verma et al., 2021)
Appendix 6.5.1 AI targeting strategies based on customer behaviors	"Audience segmentation: AI helps businesses intelligently and efficiently divide up their customers by various traits, interests and behaviors, leading to enhanced targeting and more effective marketing campaigns that result in stronger customer engagement and improved ROI." (Flinders, 2023)

	"AI techniques allow recognizing the online customers' nature, their actions and behaviour in the online environment. It contributes to identifying customers' preferences, tastes and personalities, identifying their feelings and ways of responding to the marketing mix and the places they are online, how satisfied they are with the products and their vision of these products by analyzing social media. With this, organizations could focus on content that attracts and persuades customers to buy." (Fayed, 2021) "When artificial intelligence has extracted and processed user data, targeted advertising is activated, working with vast amounts of data and classifying users according to their expectations, emotions, and moods. As a result, an advertisement is generated that considers all the information about the buyers." 0/0/0000 0:00:00 AM
Appendix 6.5.2 Content creation	"Content generation: The recent launch of OpenAI's generative AI platform ChatGPT in November of 2022 has prompted a flood of new use cases for AI. AI used for content generation can save marketing teams time and money by creating blogs, marketing messages, copywriting materials, emails, subject lines, subtitles for videos, website copy and many other kinds of content aimed at a target audience." (Flinders, 2023) "ChatGPT might be helpful for digital marketers that wish to enhance their campaigns and engage with their target consumers. • It helps create material for

	social media updates, blog entries, and other forms of content" (Haleem et al., 2023) "Once you've identified the areas where you can benefit from it, you can use AI to create various types of content, including blog posts, social media content, video scripts, and ad copies." (Cezim, 2023)
Appendix 6.5.2.1 Social media	"The analysis shows a predominance of the use of text mining techniques on social media and online reviews to identify customers' needs," (Bertoni, 2020) "Social media was becoming an essential resource for small scale businesses looking to increase brand awareness, drive sales, and reach new customers." (Rani & Sundaram, 2022) "Artificial intelligence technologies are very effective in monitoring social media, they are useful for understanding how personalized content and the images they share enable savvy business marketers to identify the logos of brands or companies active in social media content (Devereux et al 2019)." (Rani & Sundaram, 2022)
Appendix 6.5.2.1.1 UGC creator and influencers	"Postwise is a Twitter tool that uses AI to write, schedule, and grow your Twitter account. If you're trying to build a personal brand on the platform, this can be a good option. If you're lacking inspiration or ideas for your next Twitter post, you can easily write content that has been engineered for engagement. Postwise is optimized for sales, allowing you to easily

	plug in links, retweet winning content, and automatically send DMs." (Axley, 2023) "AI Pitch Generator is created specifically for UGC creators reaching out to brands for UGC deals. You'll save your details and profile, outlining your unique skills as a creator, and then just enter the name of the brand you want to pitch, and watch the AI tool craft a perfectly customized email." (Axley, 2023) "Syllaby is a platform that simplifies the process of content creation, providing you with prompts and suggestions powered by AI. Now this is especially useful if you're trying to build a personal brand as a UGC creator. Syllaby can analyze the target audience and industry to generate questions being asked within that sphere." (Axley, 2023) "user-generated social media data is also growing at an unprecedented volume and speed making it hardly possible to analyze the data manually to meet companies' demands [11]." (Ayele & Juell-Skielse, 2020)" (Biswas et al., 2023) "It is shown that UGC (User Generated Content) plays an important role on product sales. The social Media report 2012, found out with a survey report that 70% of customers kept faith on UGC for making their buying decisions (Chong, and Zhou, 2014, p.48)" (Biswas et al., 2023)

Appendix 6.5.3 SEO	"Search engine optimization (SEO): Deploying an AI solution to enhance search engine optimization (SEO) helps marketers increase page rankings and develop more sound strategies. AI can help marketers create and optimize content to meet the new standards." (Flinders, 2023) "Marketers have become more dependent on the use of AI to adapt to search engines' algorithms. SEO covers a myriad of requirements, both technically and semantically. The use of artificial intelligence in SEO improves the ranking of your web page and allows for more adaptive strategies and better content development for your business." (Cezim, 2023) "With the recent hype that artificial intelligence created, many companies focused on leveraging their SEO practices with the help of AI." (Cezim, 2023)
Appendix 6.5.4 Improve the ROI	"Improved return on investment (ROI) on marketing initiatives: AI marketing tools can help marketers identify actionable insights from data generated by a campaign in near real-time. Additionally, the same tools can help identify the right channels for a media buy and even the optimal placement of an ad based on customer behavior. Modern AI marketing solutions help stakeholders ensure that they are getting the most out of their investment in a campaign." (Flinders, 2023) "Measuring the ROI: To judge the effectiveness of the marketing budget, measuring the ROI – return on

	investment is important. With this evaluation, the business can allocate more funds to things which are working out and lower spend on things which are not generating enough returns" (Dole, 2021) "It analyzes user information, such as age, gender, areas of interest, and location, and shows its ads to people or audiences to whom the business is relevant. This results in a higher return on investment (ROI) from advertising." (Cezim, 2023) "Improved Marketing ROI Generative AI-based message testing with surveys can help businesses improve their marketing ROI by optimizing messaging for increased conversion rates, engagement, and customer insights. By gathering customer feedback and analyzing the performance of their messages in real-time, businesses can make more informed decisions about their marketing strategy and improve their overall marketing results" (Ijaz, 2023)
Appendix 6.6 AI for predictive analysis	"AI marketing is the process of using AI capabilities like data collection, data-driven analysis, natural language processing (NLP) and machine learning (ML) to deliver customer insights and automate critical marketing decisions" (Flinders, 2023) "More meaningful insights from customer data: Today, many marketers struggle with the sheer amount of data available to them when they're planning a campaign. AI can help by performing predictive analytics on customer data, analyzing huge amounts in

	seconds using fast, ef~cient machine learning (ML) algorithms. It uses the data to generate insights about future customer behavior, suggest more personalized content and spot patterns in large data sets for marketers to act on" (Flinders, 2023) "Predictive ability Because AI can help firms predict what customers will buy, using AI should lead to substantial improvements in predictive ability." (Davenport et al., 2020) "Because of its effectiveness and accuracy in data analysis, as well as its ability to support a wide range of smart device features, AI technology is gaining popularity. [...]it will be nearly hard to establish accurate projections on which to build marketing plans." (Tiwari, 2023) "Predictive AI, in distinction to generative AI, uses patterns in historical data to forecast outcomes, classify events and actionable insights. Organizations use predictive AI to sharpen decision-making and develop data driven strategies." (Lawton, 2023) "AI technologies have considerably transformed marketing strategies, offering unprecedented capabilities for predictive analytics" (Zhiwei, 2023) "AI has been instrumental in refining this model, providing sophisticated tools for customer segmentation, predictive modeling" (Zhiwei, 2023)

Appendix 6.7 AI for automated decisions	"AI marketing is the process of using AI capabilities like data collection, data-driven analysis, natural language processing (NLP) and machine learning (ML) to deliver customer insights and automate critical marketing decisions" (Flinders, 2023) "Marketing intelligence today utilizes (AI) applications and big data to produce automated decisions built on data collection, predictive analysis, detailed interpretations of audience or economic trends that may impact organization's marketing strategies." (Baqi et al., 2022) "Offering more than automation or other simple digital tools, artificial intelligence imitates the human mind to make decisions and function. As a result, it helps marketing teams create effective marketing plans and workflows." (Cezim, 2023) "Artificial intelligence (AI) plays a crucial role in business analytics by enabling managers to delegate management decisions effectively to AI systems." (Kunerth, 2023)

Appendix 8 Quotes from relevant publications to highlight the evidence of figure 7

Business Analysis stage	
Idea	Citations
Appendix 8.1 Risk mitigation	"Price simulation can help businesses identify potential risks and make informed decisions to mitigate them. A successful but poorly planned strategy runs the risk of being halted due to insufficient inventory. To avoid customer disappointment, simulate the amount of stock needed to properly measure any pricing campaign" (Kotamäki, 2023) "Supporting the innovation process with AI could generate real value for firms by reducing both the riskiness and the costliness of innovation processes" (Haefner et al., 2021) "calculate risk with an estimation of minimum and maximum sales" (Gurbuz, 2018) "enabling analysis that's 15 times cheaper and queries that are 60 times faster than with traditional tools. Whenever users ask it a question, it will use generative AI to execute millions of queries instantly to surface the most relevant insights and answers." (Wheatley, 2023)

Appendix 8.1.1 Factors affecting the company	"AI allows defining the factors affecting an organization (Kietzmann et al., 2018), including the market share and product demand (Jarrahi, 2018; Vijayaraghavan, 2019)." (Fayed, 2021) "Artificial Intelligence can automate the business process, learn insights from past data, and generate consumer and market insights" (Verma et al., 2021)
Appendix 8.1.2 Data GPT	"By uniting conversational AI with a proprietary database and the most advanced data analytics techniques, DataGPT says, its platform can proactively uncover insights for any user in any company. Nontechnical users can type natural language questions in a familiar chat window interface, in the same way as they might question a human colleague. Questions such as "Why is our revenue down this week?" will be answered in seconds, and users can then dig deeper through additional prompts, such as "Tell me more about the drop from influencer partnerships" to understand the real reasons why it's happening." (Wheatley, 2023) "It can generate both text-based responses and visualizations to help users better understand the insights it discovers" (Wheatley, 2023)
Appendix 8.2 Financial Projections	"Because AI tools can't build a financial model from scratch just yet, the best place to start is going to be a financial projection template." (Hoeksema, 2023)

	"Financial planning and forecasting play a crucial role in ensuring the success and sustainability of a company. Without a clear understanding of future revenues and expenses, companies may struggle to make informed decisions, allocate resources effectively, and ensure sustainable growth. A powerful tool to tackle these challenges is the profit and loss forecast." (Ruparelia, 2023)
Appendix 8.2.1 Generative AI	"In summary, while some aspects of the projections [from a generative AI] seem plausible, others deviate significantly from industry norms." (Hoeksema, 2023) "[Ai cannot] build a financial model from scratch just yet" (Hoeksema, 2023)
Appendix 8.3 SWOT	"AI could analyze the organization's opportunities, external threats, strengths, and weaknesses (Sentence, 2019; Goldberg, 2018; Nasser, 2018). That is possible by collecting data, whether from inside or outside the organization, and then analyzing it to identify the organization's weaknesses, strengths, opportunities, and threats (Goldberg, 2018). In turn, if the AI could identify the organization's opportunities as soon as they are available, it allows progressing over competitors (Sentence,2019)" (Fayed, 2021) "AI could analyze opportunities, external threats, strengths and weaknesses of an organization. It could collect internal and external data, analyze them accurately and determine what they offer of opportunities or external threats to the organization

	and the strength or weakness they provide within the organization. AI could thus identify marketing opportunities as they happen." (Fayed, 2021) "SWOT Analysis – Effective strategies result from careful analysis of the organization's SWOT (strengths, weaknesses, opportunities, and threats)." (Hilgenfeldt, 2023)

Appendix 9 Quotes from relevant publications to highlight the evidence of figure 8

Product Development stage	
Idea	Citations
Appendix 9.1 Improve product development	"Using AI in the innovation process can reduce metrics like time to market, cost of modification, and uncertainty in product developments" (Oehm and Som, 2023)

	"AI can also assist with production tasks [...]. Algorithms can suggest materials for product innovations and predict outcomes and product failures by testing different variations " (Oehm and Som, 2023)
Appendix 9.1.1 Digital twin	"In addition to building physical prototypes, generative AI can render accurate digital prototypes of proposed product designs. Using digital techniques is more cost-effective for design iteration and testing compared to physical prototyping. Using digital designs reduces the number of prototype generations." (Bailey, 2023) "digital twin is deeply combined with artificial intelligence technology to promote the real-time interaction of integration of information space and physical space, so as to carry out more real digital simulation in the information platform and realize more extensive application. Combining digital twin system with machine learning framework, digital twin system can self-study according to multiple feedback source data, so as to present the real situation of physical entities in the digital world almost in real time, and can speculate and preview the upcoming events. The self-learning of digital twin system can not only rely on the feedback information of sensors, but also learn from historical data or integrated network data. In the process of continuous self-learning and iteration, the simulation accuracy and speed will be greatly improved" (Guo et al., 2020)

	"Digital twins is not only a representation of physical products, but also a representation of the real world in virtual space." (Guo et al., 2020)
Appendix 9.1.2 Design optimization	"Once the product development team has an initial design, AI algorithms can analyze the design data and suggest modifications. For example, can the product be made lighter or stronger? What impact does the design have on costs and manufacturability? With the help of generative AI, designers can create better and more cost-effective products faster." (Bailey, 2023)
Appendix 9.1.3 Material Selection	"As part of design optimization, generative AI can help choose the best materials based on cost and performance specifications. The AI algorithm can predict how different materials will perform based on their properties, assessing different materials for their strength and fatigue resistance. AI also makes it easier to predict production costs based on various material and process choices." (Bailey, 2023)
Appendix 9.2 Software development	"Generative AI can be used to generate high-level architecture diagrams based on a set of inputs or specifications, recommends the appropriate technologies to use in a software system based on a set of requirements or constraints, e.g. performance, scalability, security, best practices, trade-off analysis." (Cheng, 2023)

	"a "technology-push" from current AI development tools, which are now widely available, often at rather low costs, or even for free online." (Prem, 2019)
Appendix 9.2.1 Translate concepts into code	"It [generative AI] has the ability to translate concepts from English into the programming language and verify human programmers' language for flaws" (Haleem et al., 2023)
Appendix 9.2.1.1 Writing code components	"ChatGPT has the capability to generate code in different languages. It could be used to supplement developers by writing small components of code, thus enhancing the productivity of developers and software quality" (Cheng, 2023)
Appendix 9.2.2 Test code	"AccelQ automates different test designs, and plans, and executes them. It is one of the AI testing tools with self-healing capabilities. Besides, it is useful for UI, mobile, API, and PC software tests. Furthermore, it displays a complete view of the entire QA lifecycle. Also, it features predictive and path analysis for multiple test scenarios. In addition, it is a cloud-based tool that offers non-stop API and functional automated tests. Moreover, it leverages natural language processing to offer continuous testing at every phase." (Mileva, 2023) "Applitools is one of the with multiple uses. It is used for software testing, monitoring, and app visual management. In addition, it can be used for manual QA and automated tests for desktop, mobile, and web-based apps. The tool is a good choice for

	engineers and digital transformation teams. Furthermore, it is a highly adaptive tool that leverages AI and ML to perform tests. Equally, the tool is known for its speed and accuracy in meeting performance needs." (Mileva, 2023) "Aqua ALM leverages its natural language processing capabilities to perform tests. It is one of the AI driven test automation tools with multi-lingual testing capabilities. Additionally, this web-based platform offers high flexibility, full visibility, and easy-to-use tools. With this platform, developers can speed up their test time and do more tests. Furthermore, it is designed as a test management system for busy companies. Specifically, the tool is a perfect choice for large technology companies." (Mileva, 2023) "Functionize is one of the top that leverage both AI and ML. The tool is best for testing complex applications for small and large organizations. Apart from this, the tool eliminates the need for creating repetitive test scripts. Moreover, it is an intelligent platform that combines both ML and insights from humans. It allows any developer to create end-to-end tests in no time. Additionally, it allows collaboration between production, quality engineers, and development teams." (Mileva, 2023) "Mabl features a powerful intuitive GUI interface. It is one of the AI testing tools that offer low code testing capabilities. In addition, it does not need the writing of scripts. Also, the tool allows high-velocity testing for

	busy teams. It performs end-to-end tests from the time the first code is created to the last. Equally, the tool enhances collaboration with clients and managers across every phase." (Mileva, 2023) "Sauce Labs is an AI-based tool that offers full-scale testing capabilities. It can be launched at the starting phase of software development to offer continuous testing. Moreover, it works on any device, browser, or OS. Again, it allows the automation of functional testing on a wide range of browsers and systems. Due to this, a developer gets a deeper view of how the system or website will function. Furthermore, it allows combined parallel testing to redeem the time." (Mileva, 2023) "TestComplete is an intuitive tool with dynamic UI testing elements. Additionally, it contains a feature known as checkpoints which test images, tables, and app properties. It is a scriptless tool that allows users to trigger tests using keywords or the record-and-play feature. Furthermore, the tool features data-driven testing for web, PC, and mobile UI tests. Above that, it performs test report analysis and generates a report." (Mileva, 2023) "Testim.io uses AI and machine learning algorithms to execute automated testing. It is one of the AI testing tools that work well with a variety of platforms and browsers. Moreover, it is a perfect tool for software maintenance needs. Many developers use it for executing AI-powered UI and functional end-to-end

	tests. Also, agile teams and it useful for scaling processes." (Mileva, 2023)

Appendix 10 Quotes from relevant publications to highlight the evidence of figure 9

Test Marketing stage	
Idea	Citations
Appendix 10.1 Gain customer satisfaction and feedback	"More Accurate Customer Feedback Generative AI-based message testing with surveys can provide businesses with more accurate customer feedback. By using advanced algorithms, the AI can analyze responses to survey questions and identify patterns in customer behavior and preferences, allowing businesses to make more informed decisions about their messaging." (Cezim, 2023) "First, it allows businesses to get customer satisfaction feedback on a product or campaign from real-world consumers directly before making a significant investment in mass production or widespread distribution to a national market. This can help to avoid potential costly mistakes if the product's performance leaves more to be desired or is not well received." (Terrell Hanna, 2022) "feeling AI for customer understanding" (Gabelaia, 2022)

	"Generative AI-based message testing with surveys can provide businesses with more accurate customer feedback. By using advanced algorithms, the AI can analyze responses to survey questions and identify patterns in customer behavior and preferences, allowing businesses to make more informed decisions about their messaging." (Ijaz, 2023).
Appendix 10.1.1 Poll the People Software	"AI-powered message testing is a technological and effective method of optimizing marketing ads and maximizing their impact. With AI, businesses, and organizations can access valuable insights into how their target audience perceives their messaging and utilize the data to improve their marketing strategies. Poll the People is a lead AI-powered message testing provider that helps business owners achieve their marketing goals. The platform uses advanced machine learning algorithms and natural language processing techniques to analyze customer feedback and provide actionable insights to improve messaging." (Ijaz, 2023) "Conduct Message Testing With Poll The People Poll the People is a survey platform that leverages generative AI to gather customer feedback and analyze the performance of messaging in real-time." (Ijaz, 2023)
Appendix 10.2 Product testing	"AI can assist in identifying potential product flaws and highlight areas for improvement, to allow adjustments to be made before product launch." (Fraenkel & Kamath, 2023)

	"Test marketing can engage stakeholders in an informal experiments in a field laboratory of real-life situations, learning conversation or can be formal often without people knowing they are participating." (Kasper & Clohesy, 2008) "A (2022) and D (2022) state that AI has potential during testing and validating the new product" (Oehm & Som, 2023)
Appendix 10.2.1 Alpha testing	"ChatGPT has a major role in the testing phase. It can be used to generate various test cases and to test the application just by giving prompts in natural language. It can be leveraged to fix any vulnerabilities that could be identified through processes such as Dynamic Code Analysis (DCA) and perform chaos testing to simulate worst-case scenarios to test the integrity of the application in a faster and cost-effective way." (Hilgenfeldt, 2023a) "Conversely, alpha testing is testing that is done by internal staff prior to beta testing. It's important to note that not all software companies use both beta and alpha testing; some may use one or the other, or neither." (Terrell Hanna, 2022)0/0/0000 0:00:00 AM
Appendix 10.2.2 Beta testing	"In software development, a common example of test marketing is a beta test run. Beta testing, also known as user acceptance testing (UAT) or end-user testing, involves providing an early release product to a limited

	sample of the intended audience." (Terrell Hanna, 2022) "Beta testers are invited to provide feedback on the product that will help improve it for the full product launch. If testers are enthusiastic about the product, they also generate buzz for it and increase the likelihood of its success." (Terrell Hanna, 2022) "Collecting feedback from users through various channels, such as surveys, interviews, and beta testing." (Hilgenfeldt, 2023) "monitor data in real-time and watch as it's automatically populated into your existing data charts and reports" (Quantilope, 2023)
Appendix 10.3 Campaign testing	"Better Understanding of Customer Needs Generative AI-based message testing with surveys can help businesses gain a better understanding of their customers' needs and preferences. By asking specific questions about customer preferences, businesses can use the data collected to tailor their messaging to better meet the needs of their target audience." (Ijaz, 2023)
Appendix 10.3.1 A/B testing	"By removing the complexity of building, deploying, optimizing, and analyzing A/B tests, AI empowers organizations to meet their goals with more velocity" (Severn, 2019)

	"Concerning customer experience, A/B testing is a way to compare two variations of a digital touchpoint to see which performs better." (Severn, 2019) "Improved A/B Testing: AI algorithms enable faster and more comprehensive A/B testing. From web copy to design elements, AI can run campaigns through algorithms, learning and improving with each iteration. This enhances the efficiency of testing and provides marketers with more insightful results to optimise their marketing strategies." (Salesforce, 2023) "Unlike A/B testing, AI iterates on running experiments in real-time: removing poor-performing ideas and adding or removing new variants without starting and stopping an experiment. For example, suppose your top-performing combination increases orders but decreases units or items per order. In that case, AI can automatically add a variant that makes it easier to increase cart items without running a separate test." (Severn, 2019) "Marketers use A/B testing to send one advertisement to some users and a different one to others to test how well the audience responds to certain words, phrases, features and placement of items." (Terrell Hanna, 2022)
Appendix 10.3.1.1 Poll the People Software	"A/B Testing Capabilities Poll the People enables businesses to conduct A/B testing to compare the performance of different messaging variations. The

	platform's generative AI algorithms analyze the results of A/B tests to identify the most effective messaging and optimize messaging for increased conversion rates, engagement, and customer insights." (Ijaz, 2023)
Appendix 10.3.1.2 Evolv AI software	"According to one of our partners, "Evolv AI enabled us to run 6 years worth of experimentation in 3 months."" (Severn, 2019) "You can also let Evolv AI's recommendation engine provide suggestions for experiments that are likely to convert" (Severn, 2019)

Appendix 11 Quotes from relevant publications to highlight the evidence of figure 9

Commercialization	
Idea	Citations
Appendix 11.1 Better customer experience	"AI opened tremendous doors in the fields of business, especially in the marketing field. The firm can enjoy enhanced customer experience through highly personalized customer service and on-demand customer support while keeping timely and costly processes reduced" (Daqar and Smoudy, 2019) "Several organizations now increasingly use AI to enhance the personalized customer experience." (Daqar and Smoudy, 2019)

	"There is a positive relationship between AI and customer experience" (Daqar and Smoudy, 2019) "[AI implementations turns in] Reduced friction: Better support for successful customer service journeys" (Leggett, 2017) "The ease of use and convenience of a chat-based user experience could drive users towards AI-based solutions over traditional search." (Neil Patel, 2023) "analyzing the mood of consumers and their emotions through natural language processing (NLP) which helps managers get to know their customers better and improve the experience of their interaction with the brand" (Gerlich et al., 2023)
Appendix 11.1.1 Customer servive	"Ai is at the core of the digital transformation that is improving the economics and capabilities of all aspects of business, including customer service. Ai can help agents complete repetitive, predictable tasks — or take over those tasks completely — and interact with customers autonomously to add value." (Leggett, 2017) "Ai finds patterns in large data sets that reveal new insights that companies can use to create and monetize completely new services for customers." (Leggett, 2017) "Second, managing customer interaction across retail channels can be complex, and AI can improve

	customer service by answering customer queries 24 hours a day" (Oosthuizen et al., 2021) "Major retailers (i.e., Walmart, Home Depot and Amazon) that have invested in AI are generating economic wins with AI by reinventing [...] customer service" (Oosthuizen et al., 2021)
Appendix 11.1.1.1 Increase customer service efficiency	"[AI implementation turns in] Increased efficiency: Improved core operational metrics for customer service productivity" (Leggett, 2017) "Artificial intelligence technologies and branches like Natural Language Processing (NLP) and Machine Learning (ML) play an active role in digital marketing on personalized content suggestions, email marketing, improved customer service, real-time customer support, and social media marketing." (Cezim, 2023) "Second, managing customer interaction across retail channels can be complex, and AI can improve customer service by answering customer queries 24 hours a day" (Oosthuizen et al., 2021) "CRM is a business strategy that adapts to a customer-centric approach by filtering valid information and maximizing the collection of user information. It is an excellent AI-driven strategy for gaining accurate insights." (Cezim, 2023)

Appendix 11.1.1.1.1 Predictive customer service	"AI technologies help marketing teams improve their customer relationship management (CRM) programs by automating routine tasks like the preparation of customer data. They can also reduce the likelihood of human error, deliver more personalized customer messages, and identify at-risk customers." (Flinders, 2023). "Predictive Customer Service specifies and engages clients by reaching them with offers, coupon and suggested info after completing purchases to increase the engaging audience and avoid churning." (Theodoridis & Gkikas, 2019).
Appendix 11.1.1.1.2 Enhance customer service	"Integrating AI into various market facing experiences that customers can connect and interact with" also yields a higher customer experience." (Daqar and Smoudy, 2019) "Ai finds patterns in large data sets that reveal new insights that companies can use to create and monetize completely new services for customers" (Leggett, 2017) "AI opened tremendous doors in the fields of business, especially in the marketing field. The firm can enjoy enhanced customer experience through highly personalized customer service and on-demand customer support while keeping timely and costly processes reduced" (Daqar and Smoudy, 2019)

Appendix 11.1.2 After sale support	"AI manages to engage a two-way conversation to provide the appropriate customer support." (Daqar and Smoudy, 2019) "customer support is actually one of the leading areas in the investment and adoption of AI systems" (Daqar and Smoudy, 2019) "it's highly recommended to employ AI in call centers and the other after-sales support services to shortening the customers waiting time" (Daqar and Smoudy, 2019)
Appendix 11.1.2.1 Virtual assistants	"many customers enjoy talking to a virtual assistant during or after their purchasing process" (Daqar and Smoudy, 2019) "A virtual assistant embedded in a mobile bank app, taking advantage of NLP, handles client requests alone by responding to their inquiries. A virtual assistant is presenting application features, options to make a purchase of bank products by oneself, and providing information about the location of bank branches and cash machines" (Jarek and Mazurek, 2019)
Appendix 11.1.2.2 Chatbots	"Chatbots can operate 24/7, letting you engage with customers consistently and resolve issues as soon as they arise." (Antosz, 2023) "Customer service chatbots: Increasingly, marketers are exploring the possibilities of enabling AI chatbots to enhance certain aspects of customer service. Once

	trained, these bots can interact with customers no matter where they are on their customer journey, help resolve tickets quickly and effectively and increase customer satisfaction." (Flinders, 2023) "Using chatbots or other automation technologies to free customer-waiting time, as well as reduce the pressure on the employees" (Daqar and Smoudy, 2019) "With chatbots, data and machine learning join forces to extend an always-open arm of your customer service team and use data to tailor the experience," state the authors. They state that 51% of customers believe that a business should be opened to support all the time (24/7). And by using intelligent chatbots, businesses have the opportunity to offer customer human-like support 24 h a day, 7 days a week. Such technological strategies will deliver smarter experiences to customers." (Daqar and Smoudy, 2019) "chatbot applications have started to provide many advantages to improving customer experience and customer services. For example, while customer representatives deal with a single person, chatbots can deal with many customers at the same time." (Cezim, 2023) "Intelligent chatbots are providing majestic customer support in different sectors like fashion, healthcare, insurance etc. Chatbots can even create personalized content for humans by accessing huge amounts of

	customer-cantered data. They can comprehend position or environment specific requests to understand patterns, identify problems and guide users for what's causing that certain issue. Chatbots are not limited to customer service only." (Jain & Aggarwal, 2020) "According to the graph above, 34.5 percent of respondents said "it takes a long time to help," which is one issue with chatbots. Then 28% of people said that "it doesn't understand my wordings" is an issue. "It couldn't interpret my query," 23% of respondents remarked. A major concern with chatbots, according to nearly 9.6 percent of respondents, is that "it was solve my issue and I needed to speak to a person." Other respondents stated that they are dealing with other issues such as technical, psychological, and so on." (Tongkachok et al., 2022)
Appendix 11.1.3 Personalization	"ChatGPT may be taught to respond to frequently asked queries, provide customer service, and suggest product" (Haleem et al., 2023) "Within omnichannel retailing, AI is also used to personalize the shopping experience with personalized searches, personalized recommenders or personalized prices and promotions" (Weber and Schütte, 2019) "Furthermore, AI-powered marketing automation can improve the customer experience by providing personalized content and recommendations. With the help of AI algorithms, businesses can analyze customer

	data and provide tailored product recommendations, content, and messaging. This creates a more personalized experience for the customer, which can result in higher engagement and better customer satisfaction." (Lawton, 2023)
Appendix 11.1.3.1 AI in point of sales	"A major application of AI within this task set is the replacement or automation of activities at the point of sales (POS). AI applications related to serving customers have particularly been developed for POS digitization, automation and advertising." (Weber & Schütte, 2019)
Appendix 11.1.3.2 Customized products	"Designing an artwork for each specific user according to his or her preferences would simply be impossible. But an AI factory, and in particular reinforcement learning loops, can address this design problem effectively." (Verganti et al., 2020)
Appendix 11.2 Artificial Intelligence Marketing	"Artificial intelligence marketing demonstrates a practical and comprehensive way to harness the power of data-driven marketing strategies and achieve the utmost success for the companies." (Gabelaia, 2022) "marketing professionals today must integrate AI into their marketing strategies if they expect to keep up with, much less bear, the competition" (Gabelaia, 2022) "Artificial Intelligence Marketing (AIM) is an approach of optimally utilizing technology and customer data to

	enhance the customer's experience." (Jain & Aggarwal, 2020) "AI today is enabling businesses to build and execute more human-like, innovative marketing tactics that may delight customers and win them over as staunch brand champions." (Tiwari, 2023)
Appendix 11.2.1 Automation	"AI can also increase the efficiency and the effectiveness of the workflow. This gives marketers more time for strategy, creativity, and working smarter for better results." (Daqar and Smoudy, 2019) "Marketing Automation classifies customers and use optimized content according to what time should contact them, what phrases would trigger them and what offers should they make the business wants to reach them. 1:1 Dynamic Emailing makes sophisticated promotion of products and services relevant to the recipients" (Theodoridis & Gkikas, 2019) "One of the most significant benefits of AI-powered automation is its ability to improve efficiency and reduce manual labor. For example, using AI algorithms, businesses can automate repetitive tasks like data entry or customer support, freeing up valuable time for staff to focus on more important tasks" (Lawton, 2023)
Appendix 11.2.1.1 Optimize and execute online marketing campaign	"Harley Davidson made use of Albert to centralize and automate their online marketing campaigns right from optimization to execution [...] Dealership leads

	increased by 29 times within three months" (Devang et al., 2019) "Development of a marketing campaign to launch a new car model - the Toyota Mirai. Using data provided by a selected target group, computers performed an analysis of texts and videos on YouTube in order to teach the machines the preferred style of the said target group. Next, through multiple iterations, they developed the first creative advertising campaign, and the final texts for the adverts were approved by the supervising team. The result was almost a thousand of advertising spots tailored to the profiles of the ad recipients on Facebook" (Jarek and Mazurek, 2019)
Appendix 11.2.1.1.1 Gain marketing campaign management insights	"Marketers analyze consumers' needs through this data and adopt artificial intelligence to increase sales" (Cezim, 2023) "What Artificial Intelligence does is help marketers in analyzing customers' search patterns and determining the key areas to which they must focus their efforts." (Jain & Aggarwal, 2020) "In the first weeks, AI learns the specificity of a given company, then, based on data analysis, comes up with recommendations concerning the campaign strategy" (Jarek & Mazurek, 2019)

	"Marketers can also employ emotional AI to perceive consumers' feelings about their brand publicly." (Jain & Aggarwal, 2020) "ChatGPT may be used to evaluate customer reviews and determine the general sentiment of a brand, product, or service, providing essential insights into market research and relationship development" (Haleem et al., 2023)
Appendix 11.2.1.1.2 Brand awareness	"Sampling, in fact, offers a firm an effective vehicle to create brand awareness, promote brand identity, jmprove brand loyalty, and expand product category." (Jain et al., 1995)
Appendix 11.2.1.2 Content generation	"The recent launch of OpenAI's generative AI platform ChatGPT in November of 2022 has prompted a flood of new use cases for AI. AI used for content generation can save marketing teams time and money by creating blogs, marketing messages, copywriting materials, emails, subject lines, subtitles for videos, website copy and many other kinds of content aimed at a target audience." (Flinders, 2023) "The role of AI in visual content creation is becoming increasingly evident. As marketing visuals are crucial for audience engagement, AI is proving instrumental in enhancing this domain. Tools like Midjourney and Leonardo.ai are utilizing AI to refine designs and anticipate upcoming trends, all in real time." (Cezim, 2023)

	"Some of the potential benefits of implementing generative AI include the following: Automating the manual process of writing content. Reducing the effort of responding to emails. Improving the response to specific technical queries. Creating realistic representations of people. Summarizing complex information into a coherent narrative. Simplifying the process of creating content in a particular style." (Lawton, 2023) "A noteworthy example of the use of AI for marketing visuals is Heinz's partnership with the agency Rethink. Together, they introduced a unique ad campaign featuring visuals entirely crafted by AI, aptly named "A.I. Ketchup." They prompted the AI with inventive concepts like "ketchup in space," and the generated images unmistakably echoed the Heinz brand identity, even without specific branding. Intriguingly, the online community soon joined the initiative, offering their own prompts, reinforcing the deep connection between the Heinz brand and ketchup."(Cezim, 2023)
Appendix 11.2.1.2.1 Article generation	"Yahoo uses Wordsmith which is a NLG platform to help convert their data from fantasy football into detailed match previews, recaps and reports [...] Yahoo has added over 100 years equivalent of incremental audience engagement by working with Wordsmith" (Devang et al., 2019)
Appendix 11.2.1.2.2 Product description	"company with which Deci is working that is skillfully using AI to generate content. "They have thousands of different products and SKUs. They use generative AI to

	write product descriptions [...] Now these product descriptions aren't just a two-liner. They include the product descriptions, technical specifications, and feature information. They're using generative AI to write 90 percent of those product descriptions." (Courtney, 2023)
Appendix 11.2.2 Competitor analysis	"In addition, LLMs like ChatGPT can help in identifying subtle patterns and relationships within competitors' strategies, uncovering nonobvious yet valuable insights through its vast training data and analytical capabilities." (Hughes, 2023) "When applied effectively, AI and competitor analysis and research tools unlock game-changing benefits, including: • Rapidly analyzing competitors' product portfolios to identify benchmarking opportunities and areas of differentiation. • Gathering expansive market data on pricing, features, reviews and customer feedback across competitors via automated web scraping and surveys. • Tracking new competitor activities, partnerships and strategic shifts in real-time through automated news and social media monitoring.

	• Evaluating the positioning and segmentation of rivals' target customers compared to one's own via data synthesis and pattern recognition. • Identifying potential new market entry points and opportunities to meet unmet customer needs before competitors capitalize on them." (Hughes, 2023) "AI could then help conduct due-diligence: competitive analysis, market forecasting, labor market statistics and financial modeling" (Kraemer, 2023) "A snack foods manufacturer used AI to analyze customer reviews of a rival's new product line. The tool surfaced that while many loved the item, a commonly cited downside was a low-quality ingredient. Capitalizing on this insight, the company developed an alternative with premium ingredients that testing showed consumers preferred." (Hughes, 2023) "An automotive company utilized AI tracking to identify a competitor launching a new model with self-driving capabilities. However, social media monitoring revealed concerns about safety and liability. The company postponed similar plans for its own model to re-evaluate the technology." (Hughes, 2023) "A software firm employed AI to scan customer feedback on a competitor's new app interface update. The analysis detected frustrations with difficult navigation and settings. The company chose to

	maintain its own app's familiar UX based on these findings.” (Hughes, 2023)
Appendix 11.2.3 Real time feedback	“Through AI and the implementation of a unique tonality analysis function, it has become possible to perform a highspeed and practical analysis of public opinion and better understand the mood of customers, their expectations, the degree of satisfaction with the product and the recommendations they leave in the open Internet space.” (Gerlich et al., 2023) “Today, the competitive pressure of businesses has increased the requirement for almost real-time BI, which called operational BI. The operational BI goal is reducing latency between data analysis time and data acquisition time. Reducing response time enables the system to take suitable action when an event exists. With operational BI realization, companies can discover patterns or time trends across flow of operational data.” (Gad-Elrab, 2021) “AI has been instrumental in refining this model, providing sophisticated tools for customer segmentation, predictive modeling, and real-time feedback” (Zhiwei, 2023) “These algorithms [Generative AI] can analyze large amounts of data in real-time, allowing businesses to quickly respond to changing consumer trends and market conditions.” (Bleich, 2023)

Appendix 11.2.3.1 Adapt to market trend	"Supporting foresight efforts and trend detection to determine unserved markets and future disruptions can help companies to act faster" (Oehm and Som, 2023) "For the majority of businesses, understanding trends is a tremendous challenge. Marketers can more accurately predict future events by employing real-time models built with AI and machine learning." (Tiwari, 2023) "Another important factor to consider is the speed and scalability of generative AI algorithms. These algorithms can analyze large amounts of data in real time, allowing businesses to quickly respond to changing consumer trends and market conditions. This is particularly important in the e-commerce industry, where companies need to be able to react quickly to customer demands and changes in the market." (Lawton, 2023)
Appendix 11.3 Streamlining process and maintenance	"For example, by automating inventory management or shipping and fulfillment, businesses can reduce manual errors and improve efficiency. This not only improves the customer experience, but also helps businesses reduce costs and increase profitability." (Lawton, 2023)
Appendix 11.3.1 Supply chain and logistics	"Where are AI-enhanced spend management solutions headed in years to come? Toward systems that can carry out end-to-end procurement, supply chain and

	logistics processes within parameters strategically set and overseen by humans" (Keller, 2023) "In addition to the ability to create highly personalized experiences (as mentioned earlier), another important impact of AI on online shopping is the ability to improve operational efficiencies. AI-powered solutions can optimize inventory management, automate the supply chain, and streamline fulfillment processes." (Lawton, 2023)
Appendix 11.3.1.1 Smart Factories	"Smart Factories: Industry 4.0 is associated with the development of smart factories where machines, products, and systems communicate and cooperate with each other. This leads to more flexible and efficient manufacturing processes." (InbuiltData, 2023) "Detecting faults and errors in product functioning and forecasting malfunction occurrences. The synchronisation of the work performed by the technical team responsible for device (lift) monitoring and repair works (if necessary)" (Jarek & Mazurek, 2019)
Appendix 11.3.1.2 Warehouse management	"Through AI, distribution channels suitable for customers are identified [...], and optimal distribution and storage decisions are made [...]. It is also used in warehouse management to detect weaknesses in a supply chain and forecasts potential sales" (Fayed, 2021)

Appendix 11.3.2 Maintenance	"Maintenance: ChatGPT can significantly improve First Contact Resolution (FCR) by helping clients with basic queries. In the process, it ensures that issue resolution times are significantly reduced while also freeing up service personnel to focus their attention selectively on more complex cases." (Cheng, 2023) "Generative AI can be used to automate the process of identifying and fixing bugs or to optimize the performance of a software system, significantly improve First Contact Resolution (FCR) by helping clients with basic queries. In the process, it ensures that issue resolution times are significantly reduced while also freeing up service personnel to focus their attention selectively on more complex cases." (Cheng, 2023)