



**UNIVERSITY
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Improving Project Success by Integrating Artificial Intelligence (AI) in Product Development

The Effect of AI Integration on Project Success

Department of Mechanical and Materials Engineering

Bachelor's thesis

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8.5.2024

Turku

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Bachelor's thesis

Subject: Mechanical Engineering

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Title: Improving Project Success by Integrating Artificial Intelligence (AI) in Product Development

Supervisor(s): Professor Jussi Kantola

Number of pages: 25 pages

Date: 8.5.2024

AI usage has increased significantly in the past few years. Some companies have started to adopt it into their business and some not so much. With this kind of rapidly developing technology there is much potential for new kinds of opportunities and challenges. This thesis looks at the integration of AI to the product development process. The goals were to find what are the pros and cons of integrating AI to product development and what are the results from this.

The findings were derived from existing studies on the success factors for product development projects and a study where AI was already deployed within companies. Based on success factors for successful projects AI was found to have many applications that can increase success rates. From the study where AI was already deployed it had had large increases of success due to the integration.

From these studies it was found that integrating AI gave businesses potential for higher success rates and lower failure rates. AI can make processes like idea generation, customer inclusion and concept creation more streamlined and efficient. Less mistakes are made when AI is used thus decreasing costs and increasing quality and speed. However, challenges occur concerning building the infrastructure and training staff to use the new tools. Fear of change and the loss of jobs are also challenges to consider.

Key words: Artificial intelligence, product development, new product development, AI applications, project success

List of used abbreviations:

AI	Artificial Intelligence
ANI	Artificial Narrow Intelligence
AGI	Artificial General Intelligence
ASI	Artificial Super Intelligence
B2C	Business-to-consumer
B2B	Business-to-business
NPD	New Product Development
PD	Product Development
VoC	Voice-of-the-customer

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1 Introduction

1.1 Thesis objectives and execution

Artificial intelligence (AI) is in its own revolution like the industrial revolution in the 1800s or the technological revolution in the 1900s [1]. AI has been around since the 1950s and has grown rapidly since. As product development is a crucial part of any business, I was keen on finding out how the rapid growth of AI has and will impact this part of businesses.

The main goal for this thesis is to find out how the integration of AI into the product development process affects the success rates of projects based on previous research. The goal culminates through these research questions:

1. What are the pros of integrating AI to the product development process?
2. What are the cons of integrating AI to the product development process?
3. What are the results of AI integration to the product development process?

In this thesis different applications of AI, which can be added to the different stages of product development, will be evaluated. Focus is on what drives success in product development and how AI can be helpful in the different stages of product development.

The massive expansion and availability of this new technology is a very fascinating theme for the possibilities it creates. Therefore, this is a big part of the motivation for this thesis on this subject. Through the integration of AI to product development, the development of new technologies can be accelerated thus enhancing the world we live in today. This paper will give valuable insights that can help businesses harness the full potential of AI and reduce the risks.

1.2 Methodology and data research

This thesis is a literature review based on previous studies on this subject making most of this paper qualitative. There are two case studies that are quantitative but none of the personal reflecting or research. This makes the thesis mixed-method research. There was very little research done on companies that had AI already in their product development processes.

In this paper UTU Volter and Google Scholar were used as the main source for articles and research. OpenAI's ChatGPT 3.5 and 4 were used to help find articles. They were also used and found helpful when deriving conclusions, especially with different aspects when deriving

the advantages and disadvantages of AI integration. The different perspectives were based on the preliminary thesis.

1.3 Thesis structure

The thesis starts with the introduction, where the objectives, methods used, and the structure of the thesis are described. Section 2 is the literature review section, and this is started by defining the main subjects of the thesis: Artificial intelligence and product development. This will give a better understanding of what each subject is and how they affect each other. The literature review will also give possible artificial intelligence applications to each stage of the product development process. Section 3 is the case study section which goes through studies about product development success factors and a study on AI integration and how it has affected the success rates of new products. Section 4 gathers all information and pieces together practical solutions and gives answers to the objectives set. This elaborates on the opportunities and challenges of integrating artificial intelligence to the product development process. Section 5 briefly summarises and concludes this thesis.

2 Literature review

The two main subjects of this thesis are artificial intelligence and product development. In this chapter, I will give explanations of these concepts and different aspects regarding them. I will also describe various applications of artificial intelligence into the product development stages.

2.1 What is artificial intelligence?

Artificial intelligence has become widely known from movies and television shows. Now it has become a part of our everyday lives although many may not even notice AI and its affects. Haenlein and Kaplan describe AI as “a system’s ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.” [2]

2.1.1 History of Artificial Intelligence

To understand AI, it is vital to start from the beginning. During the Second World War an English mathematician named Alan Turing was developing the Bombe, a code breaking machine against the German’s Enigma Code. He was successful with his project and came to the realization that the machines could be intelligent. Years later in 1950 he published an article named “Computing Machinery and Intelligence”. In the article he discussed how to make intelligent machines and came up with a method of testing its intelligence. 1956 was the year the word Artificial intelligence was officially coined, when Marvin Minsky and John McCarthy hosted a summer research project on Artificial intelligence, which took place in Dartmouth. A long period of significant success followed after the project within the field of AI. [2]

After a few decades of progress some criticism came from the U.S. Congress about the amount of funding AI research was getting. A statement from a British mathematician James Lighthill that AI wouldn’t reach further than the level “AI” in tasks like chess and reasoning, ended funding in the United Kingdom. It didn’t take long for the U.S. Government to follow Britain’s example. [2]

The development of AI continued after a decade of silence. In the late 90’s IBM’s innovative Deep Blue program emerged. It was a revolutionary advancement when a program was able to beat the chess world champion Gary Kasparov. Later in 2015 google developed AlphaGo which is a program that is designed to play the boardgame Go. Once again, the program was able to

win against the world champion of the chosen game. Go is much more complex a game than chess. [2]

Today in 2024, AI has had a rapid boost in its growth with OpenAI's various projects during the recent years. These projects include DALL-E 3 and Sora that are able to create very high definition and realistic hard to distinguish from real life images and videos from written human input [3]. Many companies have started to integrate AI to many sectors of their businesses trying to gain a competitive advantage. [4]

2.1.2 Types of AI

Next, we need to dive into the types of artificial intelligence there are. AI is typically divided into 4 categories consisting of reactive, limited memory, theory of mind and self-aware. There is also an alternative categorization comprised of artificial narrow intelligence (ANI), artificial general intelligence (AGI) and artificial superintelligence (ASI). [5]

Reactive AI is the most basic form, it is unable to gather information and use it to better itself. It works by coming to certain conclusions using algorithms and patterns with data inputted [5]. An example of this would be social media platforms like Instagram or Tiktok that give you recommendations based on your previously watched content. You as the user give these platforms data and your behavioural patterns are then put into an algorithm to feed you relevant content.

Limited memory AI has the ability to learn from previous inputs. It stores large amounts of data to use for future problems [5]. This type is as far as humans have been able to develop AI. This type is being used in driving cars, virtual assistants and chatbot like ChatGPT. Reactive and limited memory AI's fall under the alternative categorization of artificial narrow intelligence (ANI), since they cannot exceed a certain level of intelligence predefined by their programming.

The last two types fall under the alternative categorization of Artificial General Intelligence (AGI). Theory-of-mind AI is still under development, and it is not known when this stage could be reached. The difference between theory-of-mind and the previous types is that the system would be able to understand and identify what is important and what are the intents for certain behaviours [5]. It would understand for example why humans get scared when a car flashes right by you almost killing you in the process. Theory-of-mind AI could identify the motives behind actions and learn from these situations giving the user a better and more personalized experience.

The last type is self-aware AI. This type of AI would have human-level intelligence that could feel and understand emotions like humans. These systems could outperform humans in almost all tasks. They would be able to have human-like desires, urges and even beliefs [5]. Self-aware AI is on the border of ASI. Although this type is often seen in movies, we are very far away from it.

Artificial superintelligence (ASI) is even farther away in the future than self-aware AI. It is the next level from AGI but with all knowledge and unheard-of processing power. It would surpass humans in all aspects of life [5]. For a machine to have such quantities of data or computing power to be qualified as superintelligent is unrealistic. Our resources to produce chips that can process such quantities of data will run out before anything will take us over. [6]

2.2 What is product development?

Product development (PD) is the process of creating something new or to further develop an already existing product. Ulrich and Eppinger describe the product development process as “a sequence of steps or activities that an enterprise employs to conceive, design, and commercialize a product” [7]. The process varies in length and number of stages it contains. Some models of product development have 3 stages and some may go up to 13 [8]. The process also varies between companies and types of products that are developed. A general PD model is a 6-stage model where the stages are as follows: idea generation, idea screening, business analysis, development, testing & validation, and commercialization launch [9]. The first few of the PD process stages can also be referred to as front end stages. These are the stages that ideas are generated and are in a very early phase. Back-end stages are the last few. Commercialization, launch and post launch activities can be considered as back-end [10]. The PD process model generally is a stage-gate model. This means that the process is divided into milestones and the project may continue only if it passes the given milestone [11]. Figure 1 is a modified representation of Coopers stage-gate model, comprising of previously mentioned stages and gates to pass the stage [9].

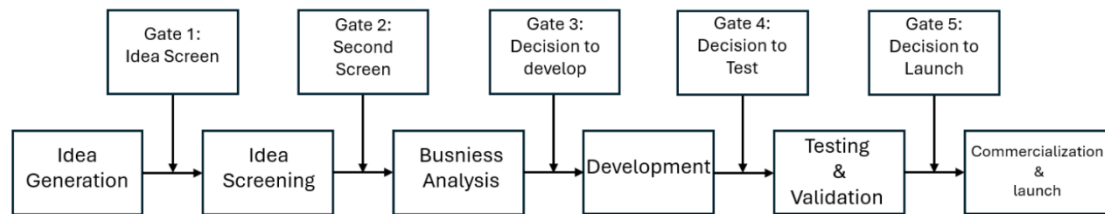


Figure 1: Stage-Gate process (Modified from [9])

It is said that about 40% of new products fail at release [12]. The success of PD can certainly be improved. Important factors for successful PD processes are a clear process, the organization of PD (project teams, leaders, etc.), PD strategy (portfolio management), organization culture and involvement of senior management [10]. Most successful products are nearly always the ones that have had a considerable amount of input from the customers or end users [12]. It is also common for engineers to over engineer products making them too advance or different to what customers are used to.

The product development process commonly starts with brainstorming ideas or someone having a great idea to begin with. This is called the idea generation stage. It is said that the best ideas come from customers, since the product should give value for their needs [12]. At this stage, possibilities are limitless, and the primary focus is to initiate the process and explore various potential directions. It is very important to answer questions such as: Who will be the customer? What value does the product bring to the customer [13]?

This is followed by idea screening which is part of the front-end phase. In this stage the ideas are filtered to the best ones. The definition of the future product is sharpened and specified [11]. Initial research must be done to go further with the process. Introductory assessment of the market, technical requirements, business and financials are done in this stage [9].

This brings us to the next stage of PD – the business analysis stage. After brainstorming and screening the ideas, the next step involves narrowing them down and specifying a singular concept. From there, the product undergoes further definition based on the chosen idea. [9] In the business case stage, the research is taken much further with market analysis, sales potential predictions and analysing competitor activities. Concrete actions, such as hosting an event

promoting the new idea, creating a webpage for the product and surveying potential customers for more insight for their needs [13]. These activities can give a good estimate of the demand for the product. It also helps to develop the product directly to the customer's needs.

Stage 4 is development. In this stage the PD team should have a clear understanding of what they are developing, and market research must have been finished. Designing of prototypes is started and refined during this process. Customer feedback is gathered to improve the designs. Internal testing of the product is conducted and the planning of manufacturing processes, packaging, distribution and marketing launch are started. [13,9]

Some iterative testing and validation happen during the development stage. Field trials, beta tests and in-home consumer tests are done during the testing and validation stage. [1] During this stage the launch and operations plans are finalized [9]. The main goal of this stage is to see if the product is functional and how the consumer perceives it.

Commercialization & launch is the final stage. In this stage the product is fully developed and launched into the market for consumers to purchase. Full production and operations have begun, and everything is monitored. [9]

2.3 AI applications for the product development process

In the idea generation stage AI can be utilized to generate new-product ideas. Machine learning algorithms analyse data from different sources like customer feedback and social media. So called AI scanners scan the internet going through sites like social media, forums, comment sections and news. The scanner then reveals what customers like or dislike. These tools can be used to generate new ideas directed straight to the customer and their needs. [1]

During the idea screening stage AI has a vital role. Concepts are created in this stage and AI can help evaluate these concepts. As some natural language models have the ability to generate visuals from written language, the concepts can also be generated during this stage. This gives stakeholders the chance to see the product helping them to understand what is needed to succeed. Fast technical, financial, risk and legal assessments can be assisted by AI. [1]

Like in the idea screening stage the business case stage has a lot of assessment. AI can be used to estimate the size of the competition, market, and target segment for the product. Things like future sales, pricing and costs can be predicted using AI. [1] It can examine data to discover product features and their feasibility [14]. By analysing financial data, it can predict potential

revenue and profitability of the new product. Risk assessment is a very developed area of AI and can present actions to reduce these risks. [1]

In the development stage AI can be used in various ways. AI automates many designing tasks like creating and generating models and technical drawings [1]. This can manually take very long. Prototyping takes place in this stage. This task can be made much quicker with the power of AI. [15] Prototypes can be evaluated against performance specifications, give improvement options for cost reduction, quality, and alternative designs. Some companies have used AI to predict possible customer reactions and simulate how the product is used. [14] These actions reduce the amount of iterations needed to progress to the next stage, thus making the whole process quicker. [1]

Although the testing and validation stage has the least amount of AI usage it has some uses here too [14]. Manual testing has its disadvantages caused by human error. These can be minimized through automated testing which ensures better identification of defects and vulnerabilities. This improves the reliability of the product and speeds up testing. [15] Other aspects like monitoring testing trials and analysing feedback from these trials can facilitate AI.

AI helps companies market their new product more effectively in the final stage of the PD process commercialization, and launch. Aspects like creating advertisements, targeting ads, suggesting actions for sales teams, and setting the right price for the product are where AI can be used. [1]

3 Case studies

This section looks at what studies show on the best practices in product development, what are the drivers of success in new-product development projects and a study that looked at how integrating AI has impacted the success rate of new product development projects.

3.1 Best practices for NPD?

According to PDMA's 2021 global survey on the best practices in new product development and innovation the success rate of new products was 59.6 % meaning that about 40 % of products fail. The research surveyed 651 NPD and innovation managers from 37 countries around the world and from these 62 % were from Europe or the UK but only 6 % were from North America. In the study, firms were categorised into the Best or the Rest. Differentiating factors were program success, competitive success, and market/financial success. Program success measured the average from two items: did the new product meet the performance objectives set and the new product program success. While competitive success measured the surveyed subjective assessment of their business unit's product success compared to their primary competitors over the past 5 years. The last factor market/financial success measured the average of percentage of total sales, total profits, success of new products based on the firm's definition of success and successfulness of new products in terms of profitability. [16]

The study used the Uncertainty Matrix shown in figure 3 to showcase firms' innovation strategies [16]. This is a 2x2 matrix that shows the innovativeness of projects. In this matrix, the axes represent levels of technological and market uncertainty. In the lower left-hand corner are incremental innovations. These have low technological and market uncertainty. These usually include modifications to existing products or have small redesigns made to reduce costs. If both technological and market uncertainty is high the project can be considered as radical. Radical innovations are new to the world products. The matrix also showcases more innovative projects when either market or technological uncertainty is high. [10] The study found that the Best focused more on innovative/radical projects while the Rest had their focus more on less innovative/incremental projects. This suggested that innovation strategy had a major role in differentiating the two. [16]

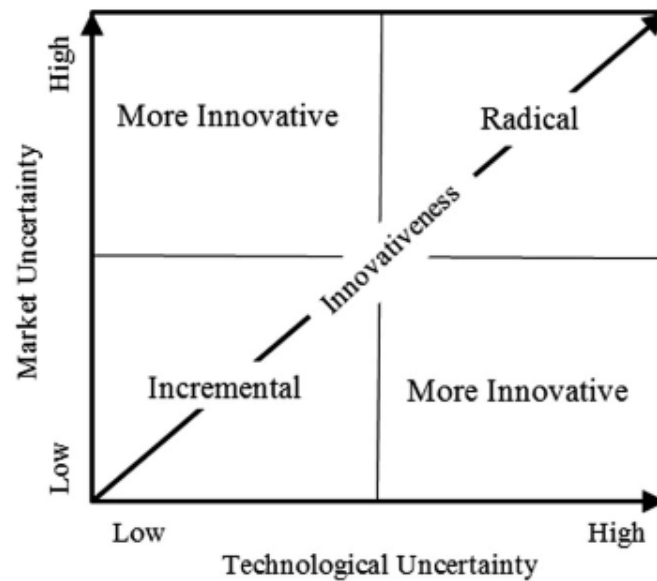


Figure 2 Uncertainty Matrix [8]

Innovation strategy can also be categorized into four strategies: Prospectors, analysers, defenders, and reactors. Prospector companies want to be the first ones delivering their product to the market. Analysers are rarely first ones delivering their product but are fast at following and bringing a slightly different, perhaps more cost-efficient, or innovative product to the market. Defenders try to play it safe by finding a secure and stable segment in the market. This is done by offering higher quality, better service and at lower prices. Reactors on the other hand are not aggressive and respond with new products when forced. With these strategies in mind the study found that prospectors were the most likely to be among the Best firms. 48% of prospectors were found to be among the Best while 88.5 % of reactors were found to be in the Rest category. [16]

Next, the study looked at what the project managers would choose when having to choose between speed versus cost, cost versus quality or quality versus speed. They found that the Best favour reducing cost over quality and speed. They also found that they would rather have good product quality over speed of making it. [16]

3.2 Drivers of success in new product development

There are certain factors that indicate success for a new NPD project. In Robert G. Cooper's research paper, "The drivers of success in new-product development" he identifies success factors from numerous studies on NPD. The results were gathered from studies on B2B and

B2C firms. He stated that there is no hard evidence that the success factors would differ between the two. He found 20 drivers for success. The factors were divided into three categories: Success drivers of individual new-product projects, Drivers of success for businesses – organizational & strategic factors and the right systems, processes and methodologies. [12]

3.2.1 Success drivers of individual new-product projects

The study found that for individual new-product projects factors like products that have unique benefits and meet users' needs had five times the success than of products that didn't or were copies of already existing products. Even if the product is new and innovative it is very important that the product delivers valuable benefits to the customer because otherwise customers won't have any use for it. [12]

Voice-of-the-customer (VoC) is a term used to describe the customers' feedback, experiences and expectations for a product [17]. Coopers study found that involving the customer is essential for success. The customer should be a part of almost all stages of the PD process. Idea generation from customers, VoC research and showing models/prototypes to customers present only a few ways to involve them into the process. [12]

The third success factor is pre-development work or so called the homework. This means that money and time should be spent on front-end activities (mentioned in chapter 2). Market and technical assessments, market studies and business & financial analysis are to be done in detail before deciding to start full development. Doing these activities in detail speed up the rest of the PD process. [12]

To have a successful project its scope and specs must remain sharp and defined. Scope creep is a huge time waster for projects. Scope creep is especially challenging for technical people since they try to chase targets that change constantly. Sharp product definitions during the previously mentioned homework phase is a solution for this. [12]

The fifth success factor is to fail often, fail fast and fail cheap. This does not mean to fail completely and kill the project. Markets change fast and so do the wants and needs of the customers. To combat this, one must take the hits and fail to build oneself up again. One can also create revisions of the project and showcase these to the customer to see what they think of it and from their answers continue with the one with most potential. A business that is too rigid and has too linear processes have a harder time to adapt to changes. [12]

Global products have a greater chance of success. These products are much harder to develop because they need huge amounts of resources. For global products VoC research, concept testing, and product testing must be done in multiple countries. This also means that project teams must be spread into multiple different countries. On various performance gauges it was found that the difference between global and domestic products was 2 or 3:1. [12]

The last individual new-product projects factor is planning and resourcing the launch of the product. Even if the product was the first and best in the world it doesn't sell itself. It must have marketing supporting the launch. Well planned and resourced launch is a must for the product's success. [12]

3.2.2 Drivers of success for businesses – organizational & strategic factors

Next the drivers of success for businesses. A product innovation and technology strategy has been linked to impact the product's performance positively. Defined innovation goals and objectives, the role of product innovation in achieving business goals and areas to strategically focus on to create new opportunities and growth for the business are parts to be considered when defining the strategy. [12]

Cooper states that most companies have too many projects and often many are bad ones that don't get time and resources dedicated to them. Bad project must be killed, which results in better focus on the ones that have more potential. Also, better success rates and shorter time to market is the result from killing bad projects. [12]

The third factor is leveraging competencies and having a synergy between the need of the project and resources, competencies, and experience. Stepping into a new area for a business is hard and expensive. Therefore using already existing experiences and resources is a safer and more successful way to act. [12]

Selecting and targeting an attractive market is crucial for the success of the new product. There are two types of market attractiveness: market potential and competitive situation. Market potential consists of large and growing markets for long term potential. Competitive situation on the other hand is not the place to grow. It has low margins and a lot of competitiveness in pricing. [12]

The research found that many projects suffer from commitment. Once again, the number of projects in progress within a company is a factor for failure. Best-practice businesses have

dedicated workers working in a single project and not multitasking on many and have enough resources for the project. [12]

For success there must be a set project team that has a leader, members from different departments of the company and these members working from start to finish. Although the members are from different departments of the company, they shouldn't be representatives of their departments. Rather they should be true members of the team and work together towards set goals in a cross-functional manner. [12]

A positive climate and culture as well as support from top management are the last drivers of success from the business point of view. Passionate management, rewarding for smaller successes and transparency are a few things that bring a more positive climate to the company. This has a big impact on the moral of the personnel working in the company, which has been proven to improve the success rate of projects. Also, top management has a big role. Long term commitment to product innovation from top management has been found in the best-performing companies. [12]

3.2.3 The right systems, processes, and methodologies

It has been proven that a systematic process like the Stage-Gate model (mentioned in chapter 2) has potential to improve success rates in businesses. They improve teamwork, reduces rework, and helps in detecting failures earlier. These make the whole process smoother and more streamlined by having to check if the development has reached its goal between every stage in the process. [12]

Being first to the market gives a competitive advantage against competitors. This means that speed is an important factor in having a successful product. Although speed is important it cannot be at the expense of quality of execution. Avoiding big mistakes and not having to go back to fix them is one of the best ways to save time. Things like overlapping stages are also way to save time and speed up the process. [12]

Good ideation is key to create a successful product. The most popular way of ideation is by using internal employees to come up with ideas. This has been proven to not be the most effective. VoC methods have been proven contrary. Some way to integrating VoC into the early stages of the PD process are for example customer visit teams, ethnography – meaning spending time with the customers to observe their behaviours and to understand their needs – and focus

groups with groups of customers. Another effective ideation method is open innovation. This is when the innovation process is not just in-house but open for other parties to participate. [12]

The last driver for success for NPD projects is the quality of execution. The importance of quality in executing all aspects of the process cannot be understated. A study found that 73 % of failed projects had poorly done market research and 54 % had weak product launches. [12]

3.3 Deploying AI for New Product Development Success

Next, we will take a look at a case study conducted by Haili Zhang, Xiaotang Zhang and Michael Song on integrating AI to the different stages of PD. [14] They investigated how AI usage affected the success rate of PD projects and proposed three hypotheses:

1. Successful NPD projects will have higher levels of AI usage in the seven NPD stages compared to projects that fail.
2. Organizational commitment to AI will improve AI usage in the NPD process.
3. AI capability will increase AI usage in the NPD process.

They conducted the case study with 18 different new product development teams from various industries and companies. They used two surveys and collected success data from 558 NPD projects. They also conducted interviews and focus groups. Based on the interviews they identified the six most adopted AI technologies. These were analytic AI (demand forecasting and risk assessment), functional AI (internet of things solutions and robots), interactive AI (personal assistants and chatbots), text AI (text recognition and translation), visual AI (computer vision and augmented reality) and robotic AI (process automation).[14]

They found that successful projects have higher levels of AI usage in all stages of PD but also the amount in certain stages vary. The biggest differences in AI usage between successful and failure project occurred in the idea generation, development, business analysis and operations management stages. AI usage in the operations management stage increased the success rate 46.6 percent while in the business analysis stage the increase was 45.2 percent and in the development stage the increase was 43 percent. Operations management stage is not a stage in the stage-gate model although a very important stage none the less. The study also found that there was no significant difference in AI usage between successful and failure project in the testing and validation stage. This stage increased the success rate by only 9.3 percent. [14]

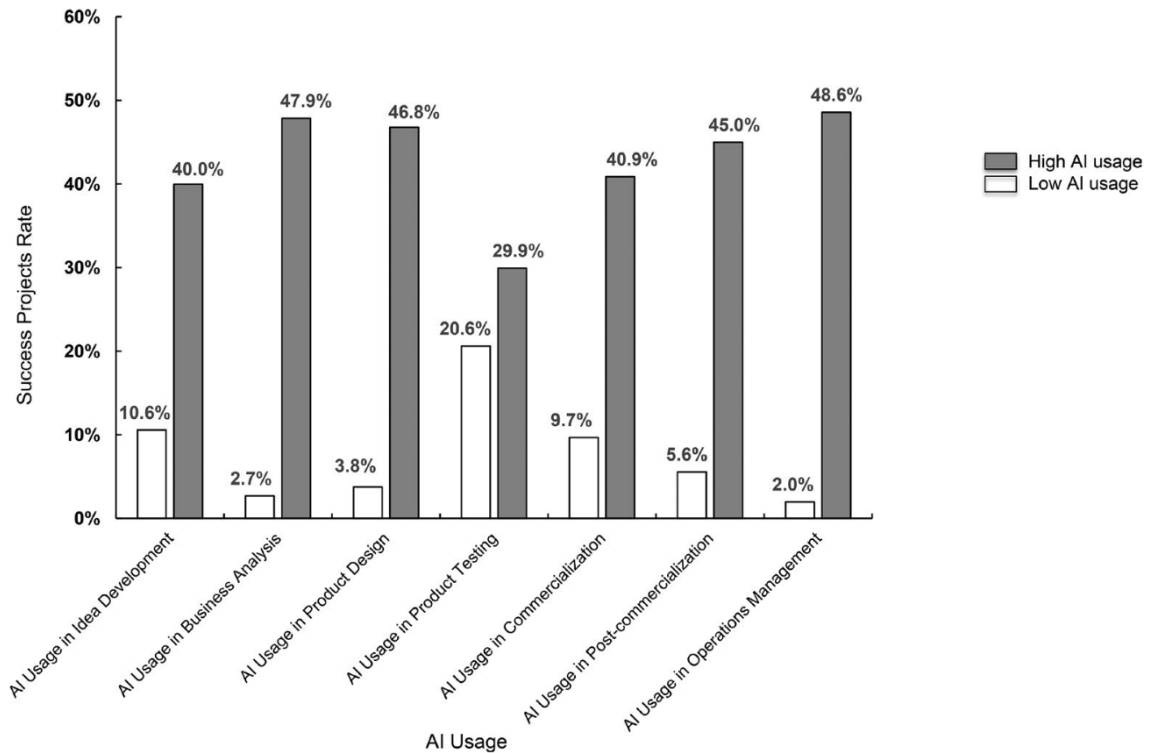


Figure 3 Effect of AI on project success rate [14]

The study found that increasing organizational commitment to AI had a big impact on the usage of AI in the PD process. Organizations that had high commitment to AI had the highest usage in the operations management stage and the lowest in the testing stage. Organizations with low commitment had the highest usage in the post-commercialization stage and the lowest in the commercialization stage. [14]

According to the study the capability of the six earlier mentioned AI technologies has a significant impact on the success rate of the project with the biggest increase in success from robotic AI (48.4 percent). The second biggest impact was from the increase of interactive AI (45.5 percent). The lowest impact was from text AI with the success rate increase of 40.5 percent. [14]

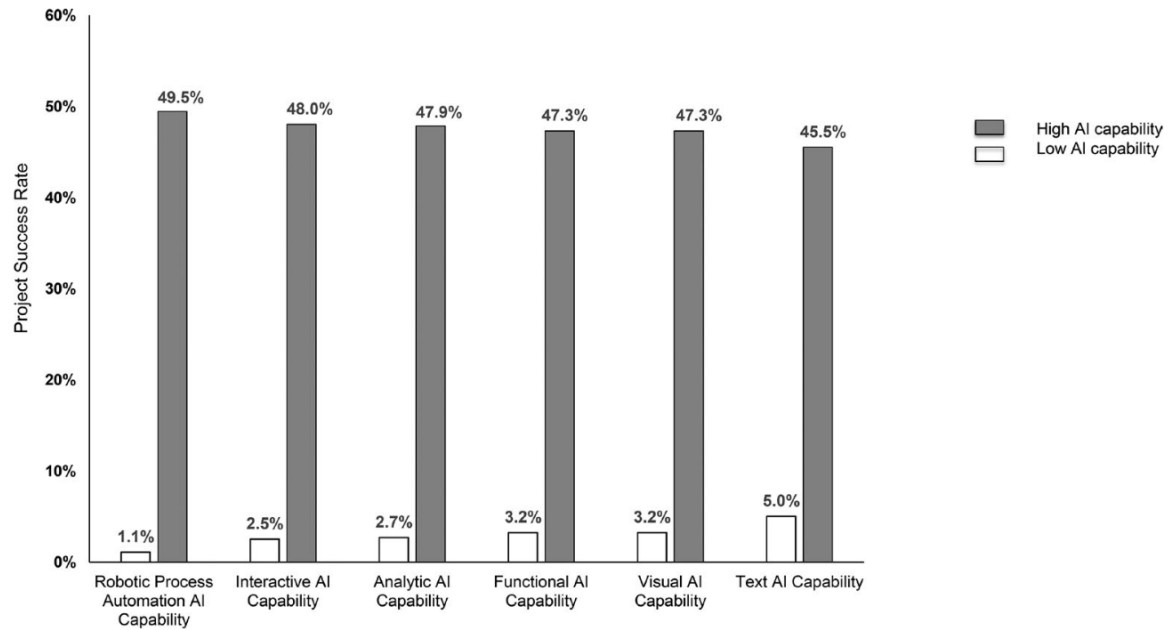


Figure 4 Effect of capability of AI technologies on project success rate [14]

The companies that participated used the most AI in three stages: operations management, business analysis and product design. The uses in operations management were decision making, flexibility of offerings, reducing costs of delivery and executing higher quality management. In business analysis the successful projects used AI in cases like predicting market potential, customer preferences and product adaption which means that the companies used AI to discover innovative features and products. In the product design stage successful companies used different tools of AI to make engineering assessments, develop product prototypes and evaluate these against specifications. [14]

In conclusion the study showed that the increase in AI had a significant impact on the success rate of the project while it also reduced the rate of failure. The usage of AI in companies' PD process is still low but the study showed that it is very beneficial to invest in AI capabilities thus it increased the success rate remarkably. [14]

4 AIs effect on product development

Reflecting on the insights from the previous chapter it is important to understand the best practices in PD and how AI can change the success rates of new products. Recently AI development has increased significantly. AI can facilitate many roles in the PD process. New technological developments come with new advantages but it most likely also means that there are some kind of drawbacks. This chapter will finally discuss the advantages and disadvantages of integrating AI to the PD process reflecting on the information gathered from previous studies and findings made in the previous chapters.

4.1 Advantages

As mentioned in the AI applications chapter AI can scan the internet and huge amounts of data to see what customers like or dislike helping the business in the idea generation stage by using the data gathered from market trends and consumer behaviours. This makes idea generation easier and more directed to customer needs. One of the drivers of success in PD is to have a great idea. AI can make this stage more efficient and speed up the process.

Making innovative/radical inventions always starts from the idea generation stage. Unique products having great benefits for the customer and with innovative/radical solutions seem to be the way to have the greatest potential for success.

Integrating visual AI into the idea generating and screening stages assist in making concepts and prototypes. This allows the stakeholders to see and evaluate how the project is going. This accelerates decision making which can lead to faster revisions and refinements. With these applications AI can reduce the amount of scope creep which is a big problem within projects.

Risk assessment has a vital role in the success of PD projects. By using AI algorithms to analyse dataset potential risks and uncertainties are identified faster. These then can be addressed earlier in the process to minimize delays and thus improving the project's success rate. Being first to the market is one of the best practices for PD projects because it gives a competitive advantage against competitors.

Designing/development has a lot of potential for the integration of AI while testing was found to have the least. Designing can facilitate many aspects of AI making the process more streamlined. Tasks like model generation and technical drawings are manually time consuming. AI can accelerate the development and reduce missed design flaws which results in higher

quality products. One of the drivers of success is to have quality products and process. Increasing the quality of the process also makes it more efficient.

One can conclude from the PDMA's study and from the applications of AI that AI is very beneficial for projects since it can reduce critical design mistakes which increases quality, reduces costs and also speeds up the timeline which are the factors the project managers prefer to pursue.

Giving AI data gathered from different segments of business helps it predict various things thus offering businesses a competitive edge. It can estimate the size of the market and competitors within the market. Even predicting customers' reactions of the product can be assisted by AI. With predictive analytics the business can make better decisions regarding pricing strategies and market positioning thus increasing their competitive advantage.

One of the drivers of success is to have a marketing strategy that supports the launch of the new product. This process has high potential for AI applications. Targeting ads to customers and creating ads that appeal to bigger market segments by analysing consumer behaviour and preferences can be assisted by AI. AI tools to determine optimal pricing strategies are making the launch activities more efficient and increase the depth of the company's presence and influence within the market.

A major advantage of AI in the PD process is that it increases project efficiency and scalability. Repetitive tasks can be automated and team members' workflows can be made more streamlined. Although it was, in the previous studies, seen as the opposite of a driving success factor these can enable businesses to handle more projects at once.

Automated process with robotics and task management tools enhances the quality of the PD process by minimizing errors, reducing the amount of rework needed from human error and ensuring that the products meet required industry standards. This leads businesses to deliver higher quality products that may even exceed customer expectations.

Combining all these aspects of AI into the PD process increases quality, speed and reduces costs. It also makes employees' workflows more streamlined and gives a competitive advantage when the product is launched into the market. As stated in the case study "Deploying AI for New Product Development Success" these aspects increase the success rates of projects while reducing failure rates.

4.2 Disadvantages

With such technology as AI some disadvantages appear as well even though these did not come evident in the previous studies.

The biggest fear is the loss of jobs due to the increase of AI. The media is also very interested in spreading news about the effects of AI in human work force. As an example, Klarna, a Swedish online financial services company dismissed 10 % of their employees which is equivalent to about 700 employees. These were mostly customer service workers and now the same job is facilitated by AI chatbots. Klarna has stated that the dismissal of the employees was not because of AI. However, they have also mentioned that the chatbots now handle the workload equivalent to that of 700 employees. [18] Also according to another study conducted by PricewaterhouseCoopers the department of business, energy, and industrial strategy in the UK may face up to 30% of automation over the next 20 years [19].

There is also the possibility that when there is too much AI within a company, people start to rely on it too much. This may lead to the decrease of creativity and lack of self-initiative. There must be a balance between the use of AI and human input.

Large amounts of data are processed by AI, and this brings up concerns about data privacy and security. To combat this, businesses need to place cybersecurity and encryption measures to protect their data from any breaches or misconduct of information. This of course takes time and needs financials to be executed. Not knowing when you are interacting with an AI can be very difficult and thus may bring fear into some. For example, as one mean against this the EU passed an AI act that forces companies to be transparent with their AI's. This means that the user needs to be notified when interacting with an AI. [20]

Another challenge concerns the large amounts of data needed to use AI tools. Therefore, the question is: What data is relevant for the certain tool? The data that is used has a big impact on the performance. [21] Giving irrelevant data can change the outcomes of the tool thus resulting in wrong kind of results.

The implementation process is also much more complicated than what it seems. Big investments must be made to build the infrastructure for AI tools and applications. Training staff members how to use these new tools also takes a lot of time and requires significant investments. When the infrastructure is in place and the staff is trained to use these tools

maintaining the system is the next expense. Regular maintenance and updates are needed to keep optimal performance for these tools.

There is always resistance to make changes to the way things are based on human nature. To overcome such resistance, it is key to have a detailed plan, management strategies and to start quite slowly. Starting slow can mean for example explaining why certain changes are being made and adding tools one at a time so that people are not overwhelmed and thus helping them understand the meaning of changes more deeply and better.

4.3 Results from previous research

The results from the case study conducted by Haili Zhang, Xiaotang Zhang and Michael Song show that there are substantial benefits from integrating AI into the PD process. They found significant increases in success rates when AI was used. They found that only 49 percent of the participating companies already had AI in use.

These results show that companies should invest more, as it was found that the most successful companies had already invested in AI, therefore being on top. It would be wise to start investing to build foundations for the future, i.e. which will involve an increasing amount of AI.

To stay up to date with constantly developing technology trends, companies need to hop on and adapt their businesses and start building the infrastructure for AI technologies as early as possible. Many companies have already started and therefore starting now is very important to stay competitive and relevant within the company's business segment. Adopting AI technologies early on will not only streamline PD processes but also drive innovation, increase efficiency, and possibly increase business success.

5 Conclusion

In conclusion the case studies presented give valuable insights to how product development projects can have higher success rates, as well as how AI can impact the success. These practices can revolutionize traditional product development. From these studies the advantages and disadvantages of integrating AI to the product development process were derived.

AI has many applications that give an advantage for a business. Thanks to aspects like AI making idea generation easier, including the customers preferences and concept & prototype creation have the potential to improve success rates of projects. Efficiency of quality, speed and costs have a major impact on the success rate of projects. AI accelerates many aspects of projects such as business assessments, marketing and product designing since these tasks can be automated or assisted.

Difficulties and fears arise with developing technologies. Infrastructures and relevant data are needed to facilitate AI tools and applications. These take time, need money, and require sufficient training for employees to use them. With extensive use of this technology human creativity may decrease.

The use of AI within businesses was found to be low. Increasing the usage was found to result in substantial benefits and the increase of success rates. Research on why AI is so low within businesses would be beneficial especially as current studies show more advantages than disadvantages. A study about how to manage the disadvantages would increase understanding of how to best implement AI in businesses. Furthermore, research about implementation and integration would be very beneficial, mostly for businesses to have the courage to start investing in AI technologies. This would make these businesses more competitive and develop internal process. Research about understanding the benefits and challenges of AI-driven product development would also encourage businesses to implement more AI. Further research on more concrete applications like the tools, their scope, usage and how to apply them in different business stages would be valuable, especially in case of product development.

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