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Artificial Intelligence in Internal Business Processes

Mixed-Method Approach to Identify Use-Cases and Evaluate its Value Addition

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ABSTRACT (MAX. 200 WORDS):

Artificial Intelligence (AI) has over the past two decades evolved from something theoretical into something more practical and applicable. The technological advancements of the modern era have enabled us to utilize more advanced systems to facilitate various tasks. AI more specifically, has been integrated into many of the systems we use in both everyday lives, as well as in business systems. This thesis set out to analyse the possibilities of AI enabled process improvement systems, to assist businesses in optimising their internal processes by creating and adopting suggestions and improvements. After a thorough literature review of the existing AI systems, the authors conducted a survey, to analyse where different corporations implement AI. Further, based on the empirical data of the survey, interviews with participants from the survey that recognised the usage of AI in internal business process optimisation were conducted. The result of the study indicates that implementing AI in process optimisation is a more difficult task than anticipated. Some of the obstacles that have yet to be overcome, are: hardware maturity and limitation, ethical considerations, lack in expertise, and economical resources. Conclusions show that AI for process improvement has yet to reach its full potential.

Abbreviations

A-System	Association System
AI	Artificial Intelligence
BPM	Business Process Management
BPR	Business Process Reengineering
DL	Deep Learning
DM	Data Mining
ES	Expert System
IBP	Internal Business Process
IE	Inference Engine
IS	Information System
IT	Information Technology
KB	Knowledge Base
KBES	Knowledge-Based Expert System
KPI	Key Performance Indicator
ML	Machine Learning
NLP	Natural Language Processing
NN	Neural Networks
PM	Process Mining
R-System	Response System
R&D	Research and Development
RF	Reference Framework
RL	Reinforcement Learning
RPA	Robotic Process Automation
RV	Recreational Vehicle
S-System	Sensory System
WM	Working Memory

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1 Introduction

This chapter explores the topic background and the motivation to research this specific topic. The motivation leads up to the research gap which is the basis of the research question. Sequentially, the research question is defined and shortly explained. The last part of this chapter recognises the delimitations of this research.

1.1 Background

As a general-purpose technology, Artificial Intelligence (AI) promises to disrupt the world of business. In a way this revolution has already begun. Companies produce data at an unprecedented rate, utilizing these large volumes of data to improve business processes and decision-making is crucial in order to stay competitive (McAfee & Brynjolfsson, 2012). At the current time, AI is a hype, a buzzword, where its capabilities seem endless, and its performance seems to be increasing by the day. This is also reflected by the vast amount of resources that managers invest into AI adoption. According to Kappelman et al. (2020) the topic of analytics is and has been the top Information Technology (IT) investment priority of managers for the last 10 years; however, only a few of the projects initiated end up successfully delivering business value. In a survey conducted by Capgemini in 2014, it was found that only 13% of the respondents have accomplished full-scale production for their big data projects (Colas et al., 2015). Similarly, Gartner found in 2018 that 85% of the initiated projects to implement AI fail to deliver business value (Kidd, 2018).

AI is a technology mostly used within the automation of business tasks (Davenport & Ronanki, 2018). Nonetheless, AI brings more benefits for an organisation. According to a study by Davenport and Ronanki (2018), 51% of the surveyed executives mentioned that this technology is beneficial for the enhancement of features, functions, and performance of their company's products. Further, decision making processes, product innovation and the optimisation of business operations, especially internal processes were listed with 36% (Davenport & Ronanki, 2018). The optimisation of internal business processes sparked interest. Specifically, because of the reason that in today's businesses the processes are often less explicitly defined and more in the nature of tacit knowledge (Havliza, 2018; Heisig, 2003; Starke, 1994; Trkman, 2010).

There are various reasons that affect AI projects in general. Figaliet al. (2020) identified five interconnected factors that form a vicious circle (discussed in 2.2.3) with the result that many projects do not go beyond the prototypical stage. Similar to AI projects, the optimisation of business processes is likely to fail. According to Ibrahim et al. (2019) and Garcia et al. (2019), process optimisation projects have a likelihood of 60-70% of being stopped or fail in general. The main reasons why projects within the process improvement area fail are a lack of management and employee commitment as well as communication gaps (Antony & Gupta, 2019; Kasim, Haracic & Haracic, 2018; Kruger, 2017).

In order to better understand the phenomena that AI is and what value it can bring to businesses, this research aims at contributing to the existing body of knowledge about AI application in the business world. There are plenty of research articles that focus on the utilisation of AI for a specific use-case or a certain technology (e.g., Hosny et al., 2018; Panesar et al., 2019; Qi et al., 2018); however, there exists a research gap when it comes to analysing a specific process

and the value that AI can bring to this process. Additionally, AI is often used in two main areas, that is either *outward facing processes*, e.g., marketing (Sterne, 2017) or customer service (Adam, Wessel & Benlian, 2020), or the *manufacturing process*, e.g., car manufacturing (Tubaro & Casilli, 2019). Therefore, in order to achieve a contribution that is an addition and not a replication of the existing knowledge, this research focuses on the Internal Business Processes (IBP) instead. IBPs are business processes where the process customer is within the company and the overall profit goal of a business is achieved indirectly (Laguna & Marklund, 2013). Consequentially, IBPs define the way a company can keep up its business, they are the internal gears that provide the company with the ability to carry out their main business (Laguna & Marklund, 2013). As such, improving these processes can have great implications on companies and their way of conducting business which further motivates this study.

1.2 Problem Area

As previously mentioned in the background section, AI is a wide field with various use-cases and techniques which means that this work needs to address a more specific point of view to achieve a meaningful and valuable knowledge contribution. However, simply focusing on AI in IBPs is still too broad since there are various processes that are defined and executed differently across companies and industries. Therefore, the authors decided to focus on one specific IBP to sufficiently narrow down the scope.

In order to decide which process will be chosen, knowledge from two input sources was collected. First, a survey was conducted that had the main purpose of finding which internal processes have a high utilisation of AI in businesses. This was done in order to identify which processes have low AI utilisation and are therefore less valuable to research in this regard. Secondly, a literature review was conducted with the goal of quantifying the extent of available literature for specific IBPs. This enables the researchers to focus on a process that is less researched, therefore enabling a more useful contribution to the overall body of knowledge. Overall, these methods serve the purpose of identifying which IBP has high utilisation of AI, and is little researched. The resulting process is then further investigated, which was done later in the research process through an additional more concentrated literature review and qualitative expert interviews.

In the above-mentioned survey, 18 participants quantified the extent of AI usage in eight IBPs. Further information about the survey methodology can be found in chapter 3.2. The processes are listed below in Table 1 and were chosen based on an initial literature research, as mentioned in chapter 3.2.3. The survey results depicted below show the AI utilisation within different processes, ranked by the participants in regards to their company. It was possible to answer on a scale from 1 to 5, with 1 meaning “no AI utilisation”, and 5 “full dependency”. In order to rank the results, the results for each IBP were summed up. Additionally, the participants had the option of checking the “unsure” option, which was counted and also displayed in the table. It can be seen that the processes Project Management, Legal (Compliance), and Human Resources are at the bottom of the ranking and can therefore be neglected in the remainder of this research. This is due to the fact that a low sum means that the AI utilisation in these processes is comparable low and therefore the impact of this study would be limited. According to the survey results, the highest ranked process is Research and Development (R&D) with a total number of 54 and the lowest number of “unsure” votes. However, after further discussion with some of the survey participants, it became clear that AI is not most used in the R&D process

(e.g., drug discovery or similar processes) but instead the usage of AI is still in the R&D phase and not actively utilised in the actual business processes.

Further research in the literature came to the same conclusion. AI is researched and developed, but AI is not used within the R&D process. Much literature focuses on how AI is still in the process of being researched and further examined to use in other processes (Gomez-Fernandez et al., 2020; Leech & Scott, 2008; Wang & Preininger, 2019; Zhang & Alijla, 2019). However, little research has been done on using AI for R&D. And in the research that has been done it refers to using data for improving R&D (Fox-Skelly, 2018; Tang et al., 2020). Following this result, R&D was eliminated from the list of possible IBPs. The second highest ranked process is Process Improvement, closely followed by Manufacturing.

Table 1: Ranking of IBPs

Rank	Process	Sum	Unsure
1	Research & Development	54	2
2	Process Improvement	46	4
3	Manufacturing	42	6
4	Finance & Accounting	40	6
5	Strategy Management	37	5
6	Project Management	30	5
7	Human Resources	27	6
8	Legal (Compliance)	27	7

Additional to the survey, a literature review was conducted with the goal of quantifying the existing AI research in the specific processes. The literature review focused on the highest ranked processes and showed that there is a high number of research papers that focus on AI in the manufacturing process (e.g., Ansari et al., 2018; Chien et al., 2020; Demlehner, Schoemer & Laumer, 2021; Kraus, 2020; Kusiak, 2019; Moreno et al., 2019; Riva & Riva, 2020), but little research that explores AI as a tool or technique for process improvement. Combining the survey and the literature review results, it was decided that this paper focuses on AI within process improvement. In this context, process improvement refers to any AI system, approach or technique that has the goal of improving a business process. This can be done in two ways, either directly by using an AI-enabled system for a certain process, e.g., an AI enabled accounting software, or indirectly through AI-enabled process analysis and improvement, e.g., process mining.

1.3 Research Question

Whereas the motivation explained the reasoning behind choosing this specific topic, the problem area chapter narrowed down the scope to one specific IBP, process improvement. According to the findings from the survey and the literature review, this thesis attempts to answer the following research question:

- (1) *To what extent can AI be used for process improvement to generate business value at the current time in European companies?*

This question implies a two-fold research approach which results in the following two sub-questions:

- (1.1) *To what extent can AI be used for process improvement?*
- (1.2) *How can that specific AI solution generate business value?*

This means in order to answer the main research question (1), it first has to be identified to what extent AI systems, approaches, or technologies can be used for process improvement (1.1) in today's European companies. After identifying what AI-enabled solutions are being used in businesses, they have to be further analysed to find out if and how they can generate business value (1.2). Overall, it can be seen that the questions are complementary, meaning that (1.2) is highly dependent on the results of (1.1) since only the value of those AI-solutions can be analysed that are previously identified.

1.4 Delimitations

In accordance with general research, this work has its delimitations. The results are highly depended on the communication with the participants both in the survey and the interviews. This means that the same approach could yield different results if other participants would have participated in the survey and or the interviews. This is a factor further impacted by the fact that the participants were mostly geographically homogenic, i.e., all interviewed participants lived and worked in Europe, mostly Sweden or Germany. Therefore, the findings are limited to the mentioned geographic areas and can therefore not be considered true on a global scale without further research. Additionally, due to the delimitation to one specific process, the application and value generation of AI cannot be generally described but just for that specific process since it can strongly vary depending on the chosen process. One general constraint of the current time is the Covid-19 pandemic, which makes it impossible to conduct face-to-face interviews and also can be a factor that restricts the number of available participants for both the interviews and the survey.

2 Literature Review

This part of the thesis aims at capturing the concepts that are being used throughout the thesis. By reviewing the existing literature, the key concepts can be defined and put into relation to each other as well as to the findings of this study.

2.1 Literature Overview

As stated in the introduction and implied by the research question and its sub-questions, the theme of this thesis revolves around the key concepts of AI, process improvement, and business value. In order to utilise the body of knowledge that already exists, within this chapter these concepts and their subfields are explored to deepen the understanding for further analysis.

AI is a broad and varying field due to the numerous reference disciplines contributing to it (Russell & Norvig, 2020). Within chapter 2.2, AI will be explored by first introducing its history briefly. Following, an overview of the AI subfields and concepts will be given. The focus herein lies with the concepts that appear later in this study.

The second key concept of this report is business processes and their improvement. Relevant literature will be presented in chapter 2.3. The chapter starts with a definition of the terms process and process improvement, and continues with ways and methods of increasing the business value that can be gained from it.

In order to further facilitate the understanding of the above-mentioned business value, chapter 2.4 dives deeper into its definition. Here the focus is on Information Systems (IS) or IT-related business value. Lastly, six different approaches to measure business value will be given, to gain different perspectives and connect them later in the discussion with the business world.

The literature was found in a variety of online literature databases like Google Scholar, LUB Search, EBSCOhost, etc. The named databases complement each other in the matter that Google Scholar has a wide reach, LUB Search gives the authors institutional access to certain contents, and EBSCOhost enables the researchers to filter for peer-reviewed literature and sort after the number of citations. The key words that were used to find relevant literature were all directly related to the topic and or combinations of those, and are therefore not further stated here.

2.2 Artificial Intelligence

AI is a topic that over the past century has developed from something hypothetical, to something possible, to something usable. The definition of AI however, changes depending on the context of the application as well as the Reference Framework (RF) of the user. With RF, it's implied the knowledge and experience about the topic in general and in regard to this work. In some perspectives, AI is commonly defined 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 task through flexible adaptation”* (Haenlein & Kaplan, 2019, p.5). Whilst others envision the true purpose

of AI to be that of seamlessly integrating itself into the human body, enabling superhuman abilities and prolonging life (Samuelson, 2020). Further studying the definitions and applications of AI, understanding the concepts, foundations, and vision of AI is essential. When studying AI, due to the difference in definition and applications of AI, finding literature that is commonly used and known is a challenge.

2.2.1 The History of Artificial Intelligence

The formal term *Artificial Intelligence* can be traced back to the mid 1950's, to the scientific journal collection made into the book *Automata Studies No. 34*. Included in this collection, the American (born Russian) scientist John McCarthy discussed the theories and science of intelligent machines and their possibilities to conduct complex tasks and create solutions that are too complex for human beings to understand (Shannon & McCarthy, 1956). McCarthy (2007), today considered as the *Father of AI*, defined AI as the following:

“It is the science and engineering of making intelligence, machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable” (p.2)

This definition is observable in many of the AI enabled systems we use today. The perception and idea of thinking machines, however, can be traced even further back to the classical sci-fi short-story (book) named *Runaround*, written by Isaac Asimov in 1942. In the book, Asimov (1942) introduced the three laws of robotics to tackle the evolution of self-aware robots and make sure to prohibit intelligent, sentient machines to act harmfully towards human beings:

- (1) “A robot may not injure a human being, or, through inaction, allow a human being to come to harm.” (n.p.)
- (2) “A robot must obey the orders given it by human beings except where such order would conflict with the First Law.” (n.p.)
- (3) “A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.” (n.p.)

Following the evolution of AI and the vision of General Artificial Intelligence (also referred to as self-awareness), it is clear to see that Asimov's laws created groundwork for further ideas to spring in the same scientific scope. A couple of years later, in 1950, Alan Turing published his research (Turing, 1950) which quickly came to be known as the *Turing Test*. The research paper giving birth to the test, *Computing machinery and Intelligence* (Turing, 1950) would complement the vision of AI created by Asimov and further question the possibilities of thinking machines. Turing sought out to analyse the question: *Can machines think?*, a question which is difficult to interpret according to **himself** without understanding what is meant by *think* and *machine*.

“The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words ‘machine’ and ‘think’ are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, ‘Can machines think?’ is to be sought in a statistical survey such as a Gallup poll. But this is absurd. Instead of attempting such a definition I shall replace the

question by another, which is closely related to it and is expressed in relatively unambiguous words.” - (Turing, 1950, p.433)

Understanding AI and enabling research from multiple perspectives and authors requires a common conception of what defines the research scope. Just as Turing previously reasoned, researching a topic that results in solutions that might be incomprehensible to human beings, sharing a common RF is key. Turing proceeded to formalise the research question into something replicable and sharable by applying the research question to a game popular during the 50's: *the imitation game*. The imitation game is a simple game of three people: One interrogator, one man and one woman. The interrogator's task is by asking question to player A or B, determine which one is the man and which one is the woman (Turing, 1950). Turing proceeded to ask:

“What will happen when a machine takes the part of A in this game? Will the interrogator decide wrongly as often when the game is played like this as he does when the game is played between a man and a woman? This question replace our original, ‘Can machines think?’” - (Turing, 1950, p.434)

Together, Asimov, Turing and McCarthy stand out as the three founding ancestors of the spectrum of AI we speak of today, half a century later. Where the formal term AI birthed by McCarthy, or the *Laws of Robotics* by Asimov can be found referenced in everything from widely known literature such as *Robot Ethics*, by Patrick Lin, Keith Abney and George A. Bekey (2012), or science fiction movies such as *I, Robot*. Marking the official birth of the AI-era; however, is said to be the 1956 *Dartmouth Summer Research Project on Artificial Intelligence*. An eight week long workshop where the *Rockefeller Foundation* gathered some of the most successful and innovative researchers working within the scope of AI, in an attempt to enable for new research to build machines capable of simulating the human intelligence (McCarthy, Minsky & Shannon, 1955). Unfortunately however, the technology at the time limited the capabilities of their research, which lead to no significant progress made within *Dartmouth Summer Research Project on Artificial Intelligence*, resulting in an AI winter that would last around two decades (Haenlein & Kaplan, 2019). Though minor steps were taken when the interest in AI awoke during the 70's, no real progress could be identified due to hardware limitations, until 1997 (Haenlein & Kaplan, 2019). It was during this year that IBM's chess expert system Deep Blue managed to beat the current world champion Gary Kasparov by being able to predict the game 20 moves ahead. In order for Deep Blue to be able to do this, it had to process around 200 million possible moves with a speed of around 2.5 million positions per second (Campbell, Hoane & Hsu, 2002). By beating the world champion, Deep Blue and IBM were awarded the *Fredkin price*, a \$100.000 price that was to be awarded to the creators of the first computer program that could become the world champion in the human league (Loviglio, 1997; Mittman, 1980). By showing that a computer could reach such potential, to even beat the world champion of chess, IBM and their Deep Blue team, sparked anew the interest in AI and its possibilities for the 21st century.

2.2.2 Artificial Intelligence and its Subfields

The umbrella term Artificial Intelligence can be divided into numerous different approaches, methods, and technologies. Each technology is both theoretically relevant in order to get a comprehensible image of the research scope, as well as empirically relevant due to their connections to the interview participants and their responses. In order to generate this proper understanding of each technology and its relation to each other, the following section will briefly describe

each relevant technology and put them into context. Furthermore, the chapter dives deeper into some of the technical aspects in order to prevent the understanding of the AI field in this research having the mentioned buzzword character. Understanding the most basic traits of each aspect is relevant in order to differentiate and debunk the previously emphasised *AI is a magical all-purpose tool* perception.

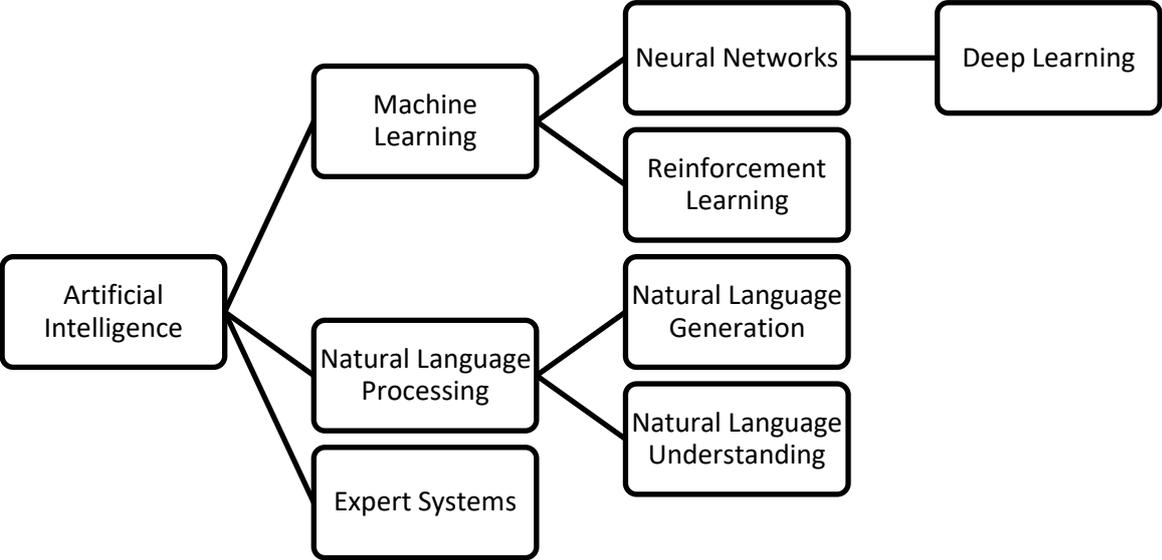


Figure 1: Artificial Intelligence Subfields

Figure 1 is a visualisation of the different fields of AI created by the authors, based on the literature of the following chapters.

AI → Machine Learning

Machine Learning (ML) and its origin can be traced back to 1949 in Donald Hebb’s book *The Organisation of Behaviour* (Hebb, 1949), in which **he** discussed the possibilities to replicate the human brain nerve-system using electronic systems. His idea and theory (Hebb’s Theory) came to be known as “*Hebbian Learning*” in ML research (Hebb, 1949). It was by using this groundwork that the American psychologist Frank Rosenblatt, a decade later, in his studies of ML and brain replication, created the *Perceptron* (Rosenblatt, 1957). In the first publication of the work on the *Perceptron*, Rosenblatt (1957) wrote:

“Since the advent of electronic computers and modern servo systems, an increasing amount of attention has been focused on the feasibility of constructing a device possessing such human-like functions as perception, recognition, concept formation, and the ability to generalize from experience. In particular, interest has centred on the idea of a machine which would be capable of conceptualizing inputs impinging directly from the physical environment of light, sound, temperature, etc. – the ‘phenomenal world’ with which we are all familiar – rather than requiring the intervention of a human agent to digest and code the necessary information.” (p.1)

Rosenblatt's vision of learning machines came to be developed into several different subfields over the following decades up until present. One of the most common use-cases of modern times that is fairly well known and widely discussed, is the technology of self-driving cars (Stilgoe, 2018). In the use-case, ML is used to continuously process visual data gathered from different image-sensors all around the vehicle in order to improve the recognition capabilities of the self-driving system (Stilgoe, 2018).

ML → Neural Networks

Neural Networks (NN), or clustered artificial neurons, have its most basic form in Rosenblatt's (1957) *Perceptron* research based on the fundamentals of *Hebbian Learning* (Hebb, 1949). Due to the nature of NN, where a system teaches itself by positive reinforcement, it falls under the same vision as mentioned by the early works of Rosenblatt (1957), and will hence be categorised as a subfield of ML. Since NN itself can be defined in different ways, this thesis will refer NN by the fundamental principle, the *Perceptron* (or the artificial neuron). The following section, will therefore be literary grounded in the original work by Rosenblatt (1957).

A NN builds upon the principle of using several *Perceptrons* to recognise complex patterns with similar informational value or traits. A *Perceptron* consists of three main components:

- (1) *The Sensory System (S-System)* corresponds to the data collecting function of the NN. The S-System collects data, i.e., photographic data in a TV raster. Each S-System is connected to one or several A-Systems. The data from the S-System is sent in either a positive or negative connection to the A-System. The positive connection sends data to be interpreted by the A-System, and the negative connection fetches feedback from the A-system to self-improve the data recognition and collecting function (Rosenblatt, 1957).
- (2) *The Association System (A-System)* performs fast switching between outputs and inputs. Each A-System unit receives input from an S-System and transmits an output to one or several R-Systems. Each A-System unit has an internal threshold parameter Q , that when has been triggered or surpassed by the algebraic sum of the inputs from the S-System, triggers an output to the R-System (Rosenblatt, 1957).
- (3) *The Response System (R-System)* is typically consisting of a fewer number of units compared to the A-System. The R-System acts as a final gateway between the NN's internal structure and the interpretable data that the NN is to generate. Each R-System, similarly to the A-System, has a threshold parameter Q_r that when exceeded, terminates all similar operations on all the other R-System to avoid any other node from generating the same output. At the same time as the R-System outputs a response going outside the NN, it sends a positive reinforcement to all the A-Systems to recognise the output as a correct one and hence improve until the next operation (Rosenblatt, 1957).

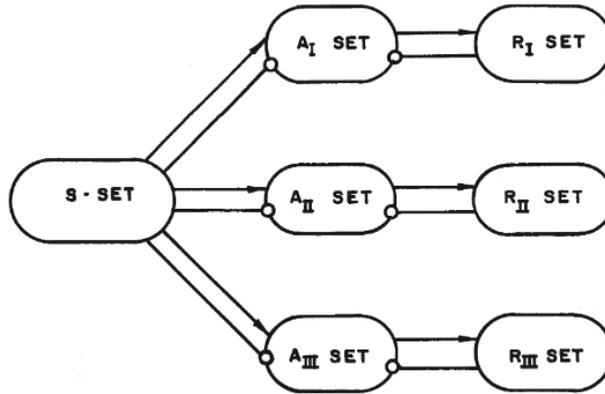


Figure 2: Perceptron with Three Independent Output-Sets (Rosenblatt, 1957, p.6)

By using the three different systems, the NN can recognise patterns and provide predictions by thresholding enough similarities in the S-Systems inputs together with the A-System algorithms. Once enough A-System units (nowadays, more commonly referred to as *nodes*) have triggered from enough positive input from the S-System, the R-System triggers a response in the form of a complete *Perceptron* output, as well as positively reinforcing the A-System with a reward for making a correct association, hence improving the A-System's associations (Rosenblatt, 1957). Simple applications of a NN can be tasks such as distinguishing whether a sound (calculated on the amplitude and frequencies) is a fabricated explosion or thunder after a lightning. More complex applications which will be revised below in the Deep Learning (DL) section, can be that of distinguishing a cat from a dog based on visual traits.

NN → Deep Learning

The concept of a single layer *Perceptron* with very few S-System units, A-System units and R-System units can often handle simple to somewhat complex mathematical tasks. Should the problem rather be more complex, like identifying a dog in an image, or distinguishing whether it is a cat or a dog in an image, DL is a more complex NN that is capable of handling more complex problems. DL uses a large quantity of *Perceptrons* with multiple layers of A-System units and R-System units within each *Perceptron* (Bengio, Goodfellow & Courville, 2015). For a computer or AI to understand how a cat looks by only seeing a set of pixels however, is impossible due to variations possibly caused by shadows, angles, obstructing views and more. DL tackles this problem by diving a complex task into simpler task and assigning each task to a separate *Perceptron* layer. This ability to separate the stages of a complex task into simpler ones is what differentiates DL from NN (Bengio, Goodfellow & Courville, 2015).

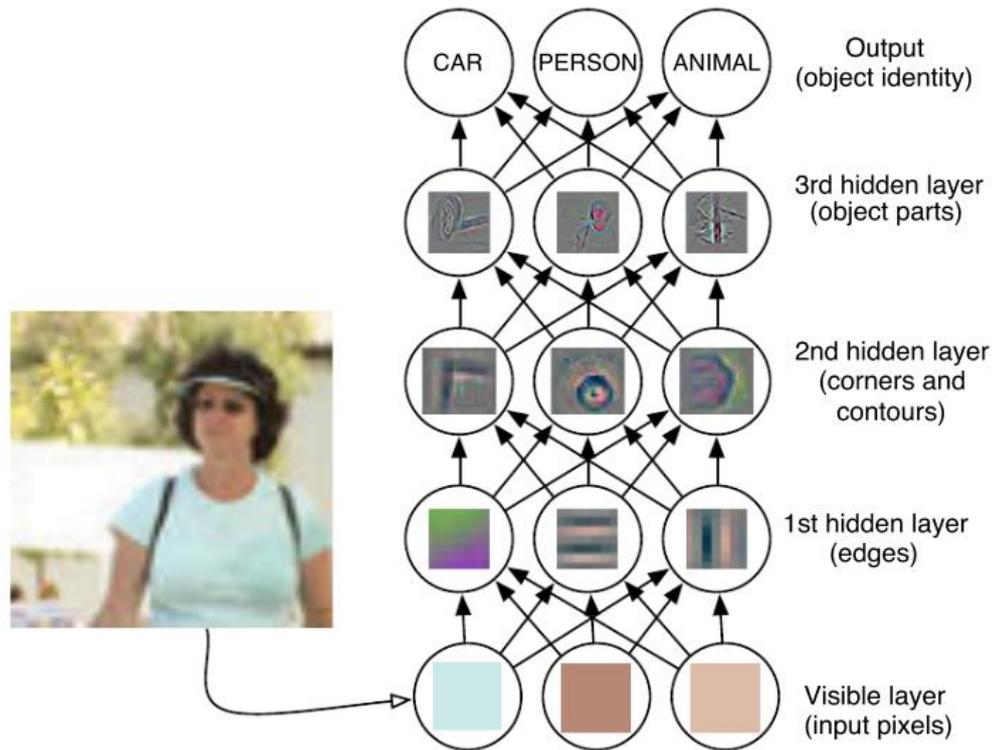


Figure 3: DL Perceptron Network (Bengio, Goodfellow & Courville, 2015, p.6)

The figure above visualises an example of how a DL network has separated the task of classifying the image to the left into three different stages (layers). The 1st to 3rd layers are so called *hidden layers*, due to the fact that they do not process interpretable data, but rather process the algorithms previous associations and layers. In the figure, the primary *visible layer* separates the image into the most common pixel colours. The 1st layer then creates hard edges existing in the image by comparing the brightness of the neighbouring pixels. The 2nd layer then creates corners and contours by the collections and areas populated by most edges. The 3rd layer lastly identifies and creates details and objects by classifying the specific collections of corners and contours. Finally the DL algorithm presents an output that can be used to determine what objects are contained in the input image (Bengio, Goodfellow & Courville, 2015).

Another use-case of DL in modern times, are smart home speakers, i.e., Google Assistant. Smart assistant uses DL to learn the users voice pattern in order to be able to distinguish it from other voices, as well as learn the users voice in order to be able to recognise it even with a noisy surrounding (Kim et al., 2017).

ML → Reinforcement Learning

Reinforcement Learning (RL) is the ML subfield considered the *trial-and-error* approach (Kormushev, Calinon & Caldwell, 2013a). RL takes the approach of an algorithm programmed to perform a certain task, i.e., moving a robotic arm from the right side of the table to the left side. However, this task is a task the user or programmer does not wish to program manually, but rather leave for the robot to manage itself (Sutton & Barto, 2018a). This can be done by adding a positive reinforcement factor, such as a value X and adding it to the algorithm (Kormushev, Calinon & Caldwell, 2013b). The algorithm is then programmed to strive for the highest value possible. Further, the algorithm is rewarded when it figures out, by the *trial-and-error* approach, to move the robotic arm to the left (Sutton & Barto, 2018b). I.e., rotating the

arm one degree to the left, increases the X value with 1 and so on. For each iteration, the machine becomes better and better by slowly testing the most optimal way to complete its goal and remembering what worked best in the previous iteration (Sutton & Barto, 2018b). Another use-case that is more common in the modern society, is the environment recognition used by smart vacuum cleaners using RL to determine the most efficient way (measured in time) to clean a house or an apartment (Romero-Martí et al., 2016a). This is done by the algorithm memorising where obstacles such as furniture or walls are throughout the mapped environment (Romero-Martí et al., 2016b).

AI → Natural Language Processing

The development of Natural Language Processing (NLP) is a natural step towards achieving a human-like AI, capable of verbal communication and understanding both written and verbal information. According to Nadkarni, Ohno-Machado and Chapman (2011) in their paper about NLP in the *Journal of the American Medical Informatics Association*, NLP's first most purpose: "*NLP must ultimately extract meaning ('semantics') from text*" - (p. 544). Although NLP as a usable functioning system was not possible up until 20 years ago, the concept and dependency of NLP was already discussed during the 50's in context with Alan Turing's test (Turing, 1950). Even a bit earlier than this, according to Liddy (2001), NLP was used for code translation during World War II.

NLP, originally known as Natural Language Understanding, deals not only with the understanding of human language (Liddy, 2001). NLP focuses on two parts, the processing itself and the generation, known as Natural Language Generation (Liddy, 2001). Liddy (2001) states that NLP has different levels, similar to the levels of language itself. Since the "*levels of human language processing follow one another in a strictly sequential manner*" (p.5), it is possible to assemble the intention by connecting all levels. **She** names seven levels which convey the different types of meaning: *Phonology, Morphology, Lexical, Syntactic, Semantic, Discourse and Pragmatic*. Further, **she** explains the approaches to process language, which are *Symbolic, Statistical* (today's standard) and *Connectionist* approach. With the capabilities that NLP brings, it is no surprise that this technology found its way into several applications where it increases the convenience of the users (Liddy, 2001). Nameworthy are systems for information retrieval (e.g., search engines such as Google), information extraction, question-answering, summarisation, machine translation and dialogue systems, such as chatbots and or devices such as smartphones and smartwatches as part of our everyday life (Goldberg, 2019).

AI → Expert Systems

Whilst other AI systems adopt self-learning capabilities, some systems included in the AI category, do not necessarily do. Expert Systems (ES) are systems capable of performing simple tasks on an equal level of a human expert, by applying an existing knowledge base to an inference engine that applies rules to draw conclusions (Leondes, 2002). The earliest versions of ES originated from somewhere in the 60's, after the AI winter had begun. Scientist were still interested in the topic of AI but had to resort to less complex solutions due to the limitations in hardware and knowledge. It was during this time more research and development went into creating the earliest version of ES, that utilised a manually created knowledge base, and applied rules to tackle problems using the knowledge base (Leondes, 2002).

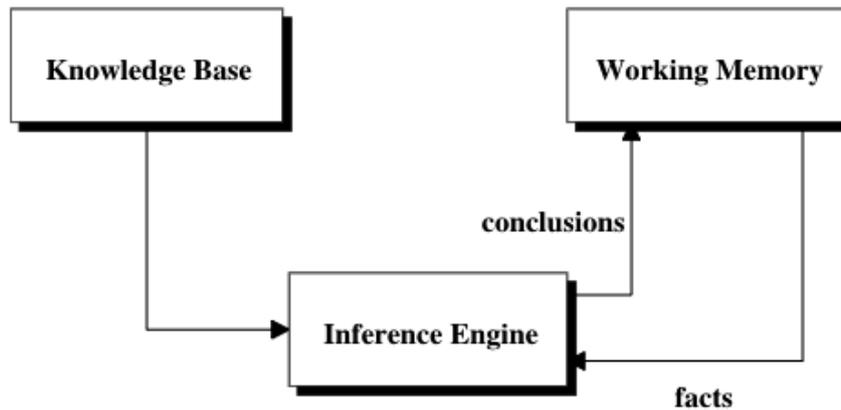


Figure 4: Expert Systems (Leondes, 2002, p.25)

The Knowledge-Based Expert System (KBES), which is the most common type of ES, has three main components: The *Knowledge Base* (Database), the *Inference Engine* (Rule engine), and the *Working Memory* (Cache) (Krishnamoorthy & Rajeev, 1996; Leondes, 2002).

(1) *The Knowledge Base (KB)* contains a predefined set of data that the system is familiar with and can use to draw conclusions (Leondes, 2002).

i.e., blood taken directly from a veena is sterile (Buchanan & Shortliffe, 1984).

(2) *The Working Memory (WM)* contains the facts available for the current problem in process of solving. When the process of solving is ongoing, the WM, similar to a cache, stores the currently known facts, and is continuously fed new facts regarding the current problem from the IE (Leondes, 2002).

i.e., the current patients' blood is taken from a veena (Buchanan & Shortliffe, 1984).

(3) *The Inference Engine (IE)* has a set of rules that is also predefined by the creators of the ES. The IE's rules use the facts available from the WM, selects the appropriate knowledge from the KB and applies the knowledge to the facts in order to generate conclusion and generate additional facts that is sent back and stored in the WM (Leondes, 2002).

i.e.,

-> (WM, Fact) the current patients' blood is taken from a veena.

-> (KB, Knowledge) blood taken directly from a veena is sterile.

=> (IE, Conclusion) the patients' blood is sterile.

(Buchanan & Shortliffe, 1984)

For further information on the functioning of ES, a more technical example of the classic MYCIN system, presented by Buchanan and Shortliffe (1984) can be found in Appendix C.

2.2.3 Challenges of AI Adoption

In several of the use-cases, AI implementation tend to fail among companies and their attempts at system implementation due to various reasons (Colas et al., 2015; Kidd, 2018). In the recent case study presented by Figalist et al. in 2020, **they** interviewed several technical managers, product owners and software architects to understand their point of view and experience when implementing AI driven systems. The study results show that even if both the stakeholders, as well as the technical staff in charge of the implementation, can see a value and usage for the

AI-driven systems, there are more challenges outweighing the positive outcome (Figalist et al., 2020). **The authors** came to the conclusion that the following factors are the most common ones hindering the implementation from leaving the prototypical stage:

- (1) Low priority due to pressure of developing new features
 - (2) Challenge of combining multiple sources into one data model
 - (3) Challenge to convince others to realise the value of the system
 - (4) Difficult to convince management to provide resources
 - (5) Difficulty to prove value due to limited resources
- (Figalist et al., 2020)

In another recent similar study conducted in the Netherlands by Strohm et al. (2020), **their** study concluded similarly, with the same factors hindering proper implementation of an AI driven system. Using the different factors, Figalist et al. (2020) created a model called the *Vicious Circle*, to represent the cause of failure for implementation of AI systems.

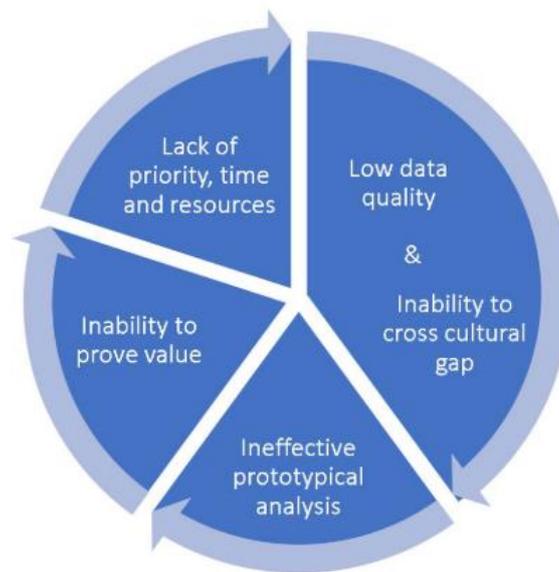


Figure 5: The Vicious Circle (Figalist et al., 2020, p. 11)

“A lack of priority, time and resources results in a low quality of data and the inability to cross the cultural gap between data scientists and other stakeholders. This leads to an inefficient prototypical analysis and the inability to prove its value, which again prevents an increase of the priority and consequently also time and resources. As a result, these key drivers form a vicious circle that is difficult to break.” - (Figalist et al., 2020, p.12)

As a result of the lack of trust for a new system, as shown by Strohm et al. (2020), as well as the complexity of understanding a completely new way of working and system usage, it is easy to end up inside the vicious circle (Figalist et al., 2020) of mistrust. However, following the reasoning of both Figalist et al. (2020) and Strohm et al. (2020), could the stakeholders and managers be ensured to understand the value of the system from the start, the probability of a successful implementation increases. More resources equals higher data quality, which ensures further resources allocation (Figalist et al., 2020).

2.3 Process Improvement

The different business processes create the actual business of a company (Kasim, Haracic & Haracic, 2018). In order to be profitable the company then has to exploit scarce resources in a cost-efficient manner (Kruger, 2017). Further, companies are trying to reduce time in any activity, reduce costs, increase their productivity, improve quality of the outcomes, reduce risks, and in general maximise the success (Garcia et al., 2019). To gain all this, the processes of companies are constantly reviewed and improved. Additional to the named improvements, companies optimise their processes to maximise their investments, generally improve the businesses efficiency and effectiveness, enlarge profits, improve business operations, optimisation of the usage of resources, increase customer satisfaction and since a few years, reduce the negative impact on the environment as well (Kasim, Haracic & Haracic, 2018).

Good process improvement requires a drastic re-design of the involved processes (Kruger, 2017). According to Geyer-Klingeberg et al. (2018) process improvement can guarantee accurate and consistent processes which result in significant cost reductions. The development of the business, quality improvements and changes in the management are elementary for successful process improvement (Bendell, 2005). Many improvements are simple and easy to implement, they consist of general process understanding and analysis (Bendell, 2005). A general understanding of the process itself leads to the recognition necessary to re-design the process (Bendell, 2005). Kasim, Haracic and Haracic (2018) focus on process improvement through *Business Process Management* (BPM), *Business Process Improvement* and *Business Process Reengineering* (BPR). Further, **they** state that BPM will be more and more important in the future. However, in this thesis BPM is used as an umbrella term which includes every methodology in terms of business processes from visualising, analysing, re-designing, and monitoring. Especially, the analysing and re-designing will result in an improvement to make the business more efficient and productive (Ibrahim et al., 2019).

Process improvement is a crucial part of today's businesses. There are a lot of different methodologies and tools to improve business processes. However, according to Ibrahim et al. (2019) 60-70% of process improvement projects fail or are not completed. A list of reasons why they might fail is given in the following chapters. First and foremost, chapter 2.3.1 describes in general the term of a business process and creates a suitable definition for this thesis. Further, chapter 2.3.2 describes the regular steps on how processes are optimised, and the mentioned methodologies and tools are illustrated in chapter 2.3.3. The last chapter 2.3.4 dives deeper into the challenges that are encountered along the way when process improvement measures are taken.

2.3.1 Business Process

In order to define what a business process is, it might be helpful to first look at the definition of a business. According to the Internal Revenue Service of the United States (IRS, 2021) a business is any organisation with the goal of making profits with an emphasises on regular activities and transactions that lead to the production of income. In this definitions actually making profits is not a necessity but there has to be a profit motivation (IRS, 2021). Another definition by Wöhe, Döring and Brösel (2002, own translation) states that “A *business is a planned and organised economic unit in which production factors are combined in order to manufacture and sell goods and services*” (p.29). The differences in these definitions can be explained by their purpose, whereas the IRS (2021) definition is a formal legal definition, the one from Wöhe, Döring and Brösel (2002) is from a traditional economics textbook. Both points of view can be

combined in order to get a more extensive perspective of what defines a business. This means that a business is not merely combining production factors or provides services to customers but is also a planned establishment with regular transactions and income that ultimately has a profit motivation.

As stated in the definition, a business is a planned and organised endeavour. As such, the different parts or processes of the business are vital to its success. In the literature there are various definitions of the term *business process* which vary in focus and extent (Lindsay, Downs & Lunn, 2003). Lindsay, Downs and Lunn (2003, p.1015) cite the following three authors and their definitions:

- (1) Ould (1995) describes the characteristics of a business process in his book as the following, “*it contains purposeful activity, it is carried out collaboratively by a group, it often crosses functional boundaries, it is invariably driven by outside agents or customers*”
- (2) “*The set of internal activities to serve a customer*” (Jacobson, 1995)
- (3) “*Set of partially ordered activities intended to reach a goal*” (Hammer & Champy, 1993)

Another definition approach was taken by Date (2000), who distinguished business processes from business rules through the type of question that is being asked. According to Date (Date, 2000) the relevant question when it comes to analysing business processes is *how* instead of *what* which is more relevant when it comes to business rules. Holmberg and Steen (2011) agree and state that the question can be formulated as following: “*how must the flow of work be carried out to attain the desired state of affairs*” (p.2) (4). The fifth definition of the term here is more detailed and given by Becker and Schütte (2004, own translation) “*A process is the content-complete, temporal and factually-logical sequence of activities that are necessary for processing an economically relevant object*” (p.107) (5).

All the above-mentioned definitions have certain elements in common, especially all of them state that a set of activities are being utilised. However, they strongly differ when it comes to the anticipated outcome. Whereas the definitions (1) and (2) aim at delivering to the customer, the other definitions aim at reaching a goal (3), the desired state of affairs (4), or processing an economically relevant object (5). This means that the latter definitions are vaguer in the goal definition, and therefore include more content in the semantic box that is constrained by the term definition. Further differences exist in the type of activities that are being conducted. Whereas (4) does not further elaborate on the kind of workflow that needs to be conducted, (2) only requires them to be internal and (3) requires them to be ordered. In contrast to that, (1) requires them to be purposeful and be carried out by a group and (5) requires them not only to be content-complete, temporal, and factually logical but also necessary.

In order to have one definition that is used throughout the remainder of this thesis, the authors combined the definitions from the literature into the following:

A Business Process is a set of activities that is necessary to fulfil a business goal.

This definition includes the set of activities that was consistent in all the definitions. Additionally, the necessity of the activities was included to facilitate that only the required activities should be conducted to reach a certain goal in order to improve efficiency. The customer focus was left out in this definition since the focus of this work is on internal processes which by

definition only have an indirect impact on the customer which will be detailed in the next chapter. Furthermore, the goal should be business related since the object of definition is a business process.

Internal/External Processes

As explained in the introduction, this work focuses on IBPs. This means that a clear distinction has to be drawn between internal and external business processes. The difference lies in the direction in which the value proposition of the process is aimed at, either internal or external process customers (Laguna & Marklund, 2013). Whereas the external process customers are located outside of the company, e.g., regular consumers or other businesses, the internal process customers are employees of the company. One important point to mention when drawing this distinction is that the internal process customer's requirements are in-line with the overall business goal of satisfying the company's customers in order to achieve profit maximisation (Laguna & Marklund, 2013). This means that the direct goal might be directed towards internal process customers, but the overall indirect goal still agrees with the definition of a business as an entity with a profit-oriented goal. Further this means that while analysing an IBP it can be helpful to look at the connecting processes, that lead toward the customer to gain a comprehensive overview (Laguna & Marklund, 2013). It has to be noted that this kind of distinction is not always possible for a complete department, e.g., the human resources department conducts multiple processes with some of them being external (e.g., recruiting) and others being internal (e.g., payroll, vacation, shift-planning).

2.3.2 Process Optimisation

First step of any optimisation is always the recognition of an opportunity for improvement. Processes can only be optimised after carefully analysing them. After the analysis, processes can be optimised to be more efficient, effective, and productive (Ibrahim et al., 2019). Methodologies and general process modelling has been studied in the past two decades (Kruger, 2017). Their implementation requires extensive planning, training and monitoring by the management (Sokovic, Pavletic & Pipan, 2010). Teamwork, cross-functional communication, and acknowledgement by employees plays a big role in the optimisation process (Kruger, 2017).

Research has shown that it is always advantageous for the company to optimise their business processes (Kruger, 2017). Seen in absolute terms, process optimisation achieves meaningful cost savings (Geyer-klingsberg et al., 2018). Factors, on management and on customer level will be improved due to the optimisation of processes (Kruger, 2017). Moreover, process optimisation in general can be applied to otherwise becoming chaotic or already chaotic activities (Kruger, 2017). Internal aspects, such as reduced costs, maximised productivity, lowered risks and a better working environment as well as external aspects, such as customer satisfaction, product quality and sustainability are results of process optimisation (Garcia et al., 2019).

As well as Ibrahim et al. (2019), Garcia et al. (2019) found out that process improvement projects have a high failure rate from 60-70%. Even earlier, Holland (2005) found out that half of the projects in process improvement had no impact at all and a quarter actually turned out to be harmful to the company. That means process improvement does not necessarily result in actual improvement (Satyal et al., 2019). Therefore, the implementation of improvement projects need to measure the performance to produce advantages (Ibrahim et al., 2019). Before industrialisation, minor technical changes were considered to have a greater effect on cost reduction than major technical implementations (Hollander, 1965). However, through technological

advancements, today's process mining supports the selection of suitable strategies to improve processes successfully (Geyer-klingeberg et al., 2018). Moreover, as mentioned the list of methodologies and tools is long, and according to Kruger (2017) it is important how they are implemented collectively and how they interact with each other.

2.3.3 Methodologies and Tools

Radnor (2010) uses process improvement as a term to catch all relevant methodologies and tools in one. However, the improvement part is only one phase in the whole optimisation process. As stated by several authors, process improvement starts with recognising the possibility of improvement which is done by analysing a process first (Bendell, 2005; Ibrahim et al., 2019; Sokovic, Pavletic & Pipan, 2010). To analyse processes, they need to be known first, which includes the modelling or at least the knowledge of the steps within this process (Ibrahim et al., 2019; Jurisch et al., 2014). Therefore, in this thesis the phases of recognising, analysing, actual improving and monitoring are all part of process improvement. Therefore, BPM is used as an umbrella term instead of process improvement. Consistent results, options for improvement and continuous monitoring of work, even across organisations, is referred to as the science of BPM (Ibrahim et al., 2019). BPM describes the activity of constant analysis of business processes and improving them by using several sub-methodologies, such as Business Process Improvement or BPR (Kasim, Haracic & Haracic, 2018). Many other sub methodologies are named by Garcia et al. (2019), for example, "[...] *Value Stream Mapping (VSM), Six Sigma, Lean Thinking, Value-Based Management (VBM), and Economic Value Added (EVA) [...]*" (p.261). More sub-methodologies are "[...] *Business Process Improvement (BPI), Continuous Process Improvement (CPI), Corporate Performance Management (CPM), [and] Total Quality Management (TQM) [...]*" (Garcia et al., 2019, p.261). Only a few companies apply the Lean strategy (Bendell, 2005). Nonetheless, Lean is also mentioned by Antony and Gupta (2019), where **they** additionally mention a combination of *Lean* and *Six Sigma*, *Lean Six Sigma*. Sokovic, Pavletic and Pipan (2010) further mention *Operational Excellence* and *Business Excellence*. **They** state that it is important to proper select and combine the above methodologies in order to gain full advantage of all different approaches. In the following the main improvement methodologies are explained in detail.

Business Process Reengineering

Business Process Reengineering is considered to be revolutionary, according to Kruger (2017). **He** states that BPR is applied when a company or organisation wants or needs to be more effective and efficient. The existing business processes are analysed to improve them to be more productive (Ibrahim et al., 2019). BPR usually brings a radical re-design of processes and the general organisational structure (Kruger, 2017). Kruger (2017) further elaborates the importance of BPR and the role it has in building a good customer relationship and the general survival of the company. Nonetheless, **he** claims a successful improvement cannot be done in one day, it takes up to five years. **He**, however, also says that the time invested to add a value to the process to improve is less than 5%. Moreover, **he** describes the advantages a company will have when implementing BPR together with other methodologies, such as Total Quality Management and others.

Sig Sigma

The *Six Sigma* strategy is an approach rolled out company-wide, and has been proven to be highly effective due to huge cost savings and an improved customer satisfaction (Bendell, 2005). *Six Sigma's* goal is to find variations within processes to develop strategies to reduce those (Antony, 2006). As said, this will reduce the company's expenses as well as increase the satisfaction of customers (Bendell, 2005). According to Bendell (2005), the measurement of performance within *Six Sigma* is typically done via costs. **He** highlights the statistical tools, provided by *Six Sigma* to measure the performance within all DMAIC phases. These phases, according to Sokovic, Pavletic and Pipan (2010) are the following:

- (1) *Define* by identifying the right process to improve,
- (2) *Measure* process attributes and the overall performance,
- (3) *Analyse* determinants and key causes of inefficiency of processes,
- (4) *Improve* by implementing improvements and thereby optimise performance,
- (5) *Control* by monitoring the performance for continuous improvements.

Lean (Thinking)

As mentioned, several times already, it is highly important to know the process steps. *Lean* is a methodology applied on the detailed business operation actions within the processes and their understanding (Bendell, 2005). It will prove beneficial to the company by identifying value streams and making these streams flawless without any interruptions (Jones & Womack, 1996). Simply said, *Lean* will remove all unnecessary steps in a business process, as Bendell (2005) formulates it, *Lean* pursues a perfect value stream "*through the elimination of waste in all aspects*" (p.972). **He** mentions five key principles of the *Lean* methodology: "*(1) the elimination of waste (or muda), (2) the identification of the Value Stream, (3) the achievement of Flow through the process, (4) pacing by a pull (or kanban) signal, and (5) the continuous pursuit of perfection*" (p.972). As well as with other methods, *Lean* unfolds its full advantage within a combination with other techniques (Bendell, 2005).

Data and Process Mining

The process of Data Mining (DM) refers to large amounts of data being searched to discover recurring patterns (Garcia et al., 2019). This technique can also be used to search for patterns within processes. In this case it is supposed to create a bridge between DM and BPM, which is commonly known as Process Mining (PM) (Garcia et al., 2019). It is an extension to the other methodologies named before and can be used as a tool, not as a replacement (Garcia et al., 2019). PM is a data-driven technique to analyse processes and visualise the business process flow by extracting data from log files (Van Der Aalst, 2016; Van Der Aalst et al., 2012). It is thereby used to discover unused, unnecessary or ineffective activities in processes (Garcia et al., 2019). Therefore, it is an enabler of process improvement among other methodologies (Garcia et al., 2019). Within these other methodologies PM will assist to create strategies for the transformation of processes and or a shift of technology (Geyer-klingeberg et al., 2018). The main challenge is to extract and analyse the correct data from large event log files within a dynamic environment to develop a more effective and efficient process model (Garcia et al., 2019).

Robotic Process Management and Automation

Due to the existence of PM, several tools had to be created, capable of analysing log files of systems to identify processes (Leno et al., 2020). In the context of PM those tools are accumulated under a special class of tools for PM, namely Robotic Process Management tools (Leno et al., 2020). The automation of those tasks results in relevant cost benefits (Geyer-klingeberg et al., 2018). According to Hollander (1965), the overall benefit of minor automation reduces costs even more than major technological shifts. Much repetitive work within an organisation can be automated (Leno et al., 2020). Leno et al. (2020) names software solutions, such as *UiPath Enterprise RPA Platform* and the Enterprise RPA solution by *Automation Anywhere*, which are Robotic Process Automation (RPA) tools. Tools like this will guarantee consistency and accuracy for certain activities (Geyer-klingeberg et al., 2018).

2.3.4 Challenges of Process Improvement

Once a process has been improved successfully, the process is not over. Continuous improvements of the process will then be applied to maintain this optimisation also through external changes (Kruger, 2017). Despite all positive effects of process improvement, it tends to fail in companies and organisations where it is applied in different stages and not altogether (Kruger, 2017). Other reasons which increase the likelihood of a failed improvement process, is the lack of commitment from management and employees (Kruger, 2017). According to Kruger (2017) the communication between employees and management, and the trust between each other is essential for the improvements' success. He illustrates that there cannot be a success if there is a constant disagreement. As well as commitment, the understanding of the process itself and the recognition for the need of improvement is fundamental (Goksoy, Ozsoy & Vayvay, 2012; He, 2005; Jurisch et al., 2014). To improve processes correctly and successfully, the whole process needs to be carefully analysed, optimised and tested (Kruger, 2017). In many cases BPR fails because of the lack of adequate measurement tools, according to Kasim, Haracic & Haracic (2018) companies do not have suitable Key Performance Indicators (KPIs). Antony and Gupta (2019) report that many improvement projects tend to be cancelled or fail. They investigate literature and list the top ten reasons for this phenomenon:

- (1) *“Lack of commitment and support from top management”* (p.368)
- (2) *“Poor communication practices”* (p.368)
- (3) *“Incompetent team”* (p.369)
- (4) *“Inadequate training and learning”* (p.369)
- (5) *“Faulty selection of process improvement methodology and its associated tools/techniques”* (p.370)
- (6) *“Inappropriate rewards and recognition system/culture”* (p.370)
- (7) *“Scope creepiness”* (p.371)
- (8) *“Sub-optimal team size and composition”* (p.371)
- (9) *“Inconsistent monitoring and control (lack of expert supervision)”* (p.372)
- (10) *“Resistance to change (partial cooperation by employees)”* (p.372)

In spite of the reasons to fail, BPR implemented correctly will achieve a business value by an improved business process in a short time with measurable results (Kruger, 2017). Appropriate planning and continuous training is necessary for the success (Sokovic, Pavletic & Pipan, 2010). Moreover, the process needs to be monitored by management already during implementation (Kasim, Haracic & Haracic, 2018). A low productivity might be an indicator for wasteful and ineffective processes (Kruger, 2017). Those processes need to be compared to the once which

work best within their industry (Kruger, 2017). As measurement it is not advisable to use quality as the only factor of competitive advantage (Bhaskar & Singh, 2014; Borgianni, Cascini & Rotini, 2015; Huang et al., 2015; Jurisch et al., 2014; Valverde, Saade & Talla, 2014). Productivity measurement indicators for employees need to be considered as well (Kruger, 2017). In the end the planned business value can be achieved by correctly applying BPR (Kasim, Haracic & Haracic, 2018).

2.4 Business Value

One of the studies that were referenced in chapter 1.1 as part of the motivation for this study and the research gap was by Gartner and stated that 85% of the initiated projects to implement AI did not end up delivering business value. In order to further analyse this phenomenon, it has to be defined, what can be understood as business value and which approaches are being used to measure it.

According to the *Gartner Business Value Model* report, for the last decades business value has been measured by the traditional accounting measurements, i.e., net profit, earnings per share, and return on invested capital (Proctor & Smith, 2017). One measurement approach that is often cited in the literature is by Ohlson (1995) and goes in the same direction. Within, the value of a business is determined by combining reported earnings and forecasted earnings which also capture other information (Ohlson, 1995). Since the reported earnings are direct results of financial transactions, they are more reliable than the analyst's forecasts, which may include any information that is considered relevant to the value (Schaberl, 2016). These accounting measurements are all directly driven by the profit-oriented motivation that defines a business. The success of accounting metrics as a measurement for business value is mainly driven by the fact that these numbers are the common denominator that enables stakeholders to compare business performances (Proctor & Smith, 2017). However, the literature agrees that the information gain from accounting measurements has declined over the last decades (e.g., Brown, Lo & Lys, 1999; Core, Guay & Buskirk, 2003; Lev & Zarowin, 1999; Ryan & Zarowin, 2003). Attewell (1994) even calls it a *Productivity Paradox* which refers to the high number of papers that state that IT has not improved productivity even though its widespread adoption would indicate the contrary.

The report from Gartner states that the accounting measures are not accurately describing the business value anymore due to the rise of IT in companies and with it, the growing impact of intangible assets (e.g., knowledge, branding, intellectual property) which lead to a measurement gap (Proctor & Smith, 2017). Additionally, Tallon, Kraemer and Gurbaxani state that capturing and representing intangible benefits of IT is an important challenge for IS researchers (2000). In order to close this measurement gap, the accounting metrics have to be extended to include the value that is generated by IT. Consequently, the report states that companies which attempt to measure business value beyond the above-mentioned accounting metrics and act accordingly perform better in terms of return on assets and return on equity (Proctor & Smith, 2017).

2.4.1 IT-related Business Value

Before looking into the different approaches on how to measure IT related business value, this chapter focuses on the areas that promise to have the highest potential to improve business value through IT. The *Organisation for Economic Co-operation and Development* stated in their report from 2013 that the main value additions are being generated in the following areas through innovation or productivity growth (OECD, 2013):

- “*Enhancing Research and Development*” (p.4)
- “*Developing new products (goods and services) by using data either as a product (data products) or as a major component of a product (data-intensive products)*” (p.4)
- “*Optimising production or delivery processes (data-driven processes)*” (p.4)
- “*Improving marketing by providing targeted advertisements and personalised recommendations (data-driven marketing)*” (p.4)
- “*Developing new organisational and management approaches or significantly improving existing practices (data-driven organisation)*” (p.4)

Similarly, Bhattacharya (2016) researched categories of business value addition through the use of enterprise systems. Besides the most-common stated business value source of *operational efficiency improvements*, three more categories were identified, i.e., *mergers and acquisitions*, *product and process innovation*, and *strategic decision making* (Bhattacharya, 2016). More topic specific, Wamba-Taguimdje et al. (2020) studied the impact of AI on business value and found that the main driver of business value addition is the optimisation of existing processes through automation, information, and transformation effects. Further, it was found that key elements of its success are the ability to detect, predict, and interact with humans (Wamba-Taguimdje et al., 2020). Another way of looking into areas that promise high business value returns is by looking into the largest IT investments. Kappelman et al. (2020) conduct a yearly survey on the topic of IT in management and therefore also on the IT investments. In the most recent report, the list was topped by analytics, cloud computing, and security (Kappelman et al., 2020).

2.4.2 Approaches to Measure IT-related Business Value

As seen above, the application of IT is often an indirect action driven by the overall profit motivation. Since IT application is a wide field, there is a variety of approaches in the literature to its value addition and the measurement of it. Wamba-Taguimdje et al. (2020) conducted an extensive literature review and found six theoretical approaches to measure the impact of IT on business value. These six approaches will be explained more in detail below. However delivering accurate, useful, and undisputable results remains one of the major challenges for research (Wamba-Taguimdje et al., 2020).

Economic Theory-Based Approach

The economic theory-based approach is based on the idea of finding an economic function that describes the relationship between IT and the performance of the business (Wamba-Taguimdje et al., 2020). Lehr and Lichtenberg (1999a) view the IT value-addition measurement problem as a more general issue, i.e., the assessment of service sector productivity. This puts IT in the same category as e.g., payrolls or purchasing which are considered service functions and are therefore difficult to measure in regards to output and productivity measurements (Lehr & Lichtenberg, 1999b). In an earlier paper, Lichtenberg (Lichtenberg, 1995) examined the costs

for IS, i.e., labour and tangible assets like computers, and contrasted them to non-IS capital. This was done by analysing longitudinal firm-level data and incorporating IS into a production function where IT investments were contrasted to the nominal gross output (Lichtenberg, 1995). By doing this analysis across firms, industries, and years, it was found that investments into IT provide excess returns, meaning that the rate of return on investment is higher in IS than those earned by other factors (Lichtenberg, 1995). These results are in line with a more detailed analysis later on by Lehr and Lichtenberg (Lehr & Lichtenberg, 1999b), other research using a similar firm-level approach by Brynjolfsson and Hitt (1993) and an industry-level approach by Griliches and Siegel (2008).

Social Psychology Approach

The second approach concentrates on the effects that IT has on its users instead of its direct value addition since user adoption is believed to be a major hurdle in the value addition of IT (Davis, 1989; DeLone & McLean, 1992; Zmud, 1979). Zmud (1979) identified in his paper three categories that are important to IS success, i.e., *user performance*, *IS usage*, and *user satisfaction*. In his often cited paper Davis (1989) took a similar approach and researched user acceptance of technology and found two main determinants, i.e., *perceived usefulness* and *perceived ease of use*. The perceived usefulness relates to the fact that people decide to use or not use a technology based on their perception of how useful the technology is to improve their work performance (Davis, 1989). Secondly, even if the technology is perceived as useful in assisting their work, the difficulty of its usability will be put into relation to its value addition, which in turn makes ease of use an important factor in technology adoption (Davis, 1989). It should be noted that both of these factors are rather subjective than objective and can therefore vary for each user (Davis, 1989). DeLone and McLean (1992) built upon the previous research and established a more comprehensive IS success model, which considers six categories to be important for IS success: *system quality*, *information quality*, *information use*, *user satisfaction*, *individual impact*, and *organisational impact*. This model was further refined ten years later in a follow-up paper due to its popularity (DeLone & McLean, 2003). The updated model consists of three quality determinants, i.e., *information quality*, *system quality*, and the new *service quality* (DeLone & McLean, 2003). These quality determinants are closely related to the two major success hurdles: *intention to use* and *user satisfaction* (DeLone & McLean, 2003). Only if those two factors are considered positive, a *net benefit* can be generated (DeLone & McLean, 2003).

Competitive Analysis Approach

This approach views IT as a way to outperform competitors in terms of productivity, profitability, and quality. In a study conducted by McAfee and Brynjolfsson (2012) this was empirically underlined. It was found that companies that use data-driven decision making perform better in terms of productivity and profitability than their competitors (McAfee & Brynjolfsson, 2012). Similarly, in a study conducted by Deva and Kohli (2003) in the hospital industry, it was found that the greater the actual usage of IT in a hospital, the greater was the financial and quality performance of the hospital. This was done by analysing financial and non-financial measurements of performance in hospitals and putting this data in relation to the extent of IT usage over a period of three years (Devaraj & Kohli, 2003). In a more general study Farhangi, Abbaspour and Ghassemi (2013) examined the relationship between IT, organisational structure, and firm performance. The study supports **their** hypotheses with empirical data that the firms' performance is related to the organisational structure. Furthermore, it showed that IT is not only a driver of flexibility and openness for best practices, but can also lead to higher levels of customer satisfaction (Farhangi, Abbaspour & Ghassemi, 2013). Ultimately, IT was found

to influence profitability and efficiency positively which helps companies to have stable sales growth and gain market shares (Farhanghi, Abbaspour & Ghassemi, 2013).

Strategic Alignment Approach

The strategic alignment of IT and business are considered vital to its long-term success (Henderson & Venkatraman, 1999; Tallon, Kraemer & Gurbaxani, 2000; Turulja & Bajgoric, 2018). Henderson and Venkatraman (1999) approach business value based on two assumptions. Firstly, economic performance is directly related to the *Strategic Fit* between the market positioning and the availability of a support structure to act upon that positioning. Secondly, that the *Strategic Fit* is dynamic, meaning the choices of one company in the market require re-alignment actions by the other market-participants over time (Henderson & Venkatraman, 1999). Based on these assumptions **they** proposed the *Strategic Alignment Model* which consists of internal and external integration between IT and business. On the one hand side is the external strategic integration that links the business and the IT strategy (Henderson & Venkatraman, 1999). On the other hand is the internal operational integration, that connects the organisational infrastructure and processes and the IS infrastructure and processes (Henderson & Venkatraman, 1999). Lastly, **they** note that in order to be effective, all four named domains need to be balanced.

The *Strategic Alignment Model* is in that matter similar to the *IS Strategy Triangle* which connects the three strategies that are pursued by an organisation, i.e., IS strategy, organisational strategy, and business strategy (Pearlson & Saunders, 2013). The IS strategy defines the way an organisation is providing information services and therefore enables the business strategy (Pearlson & Saunders, 2013). **They** define the business strategy as a function of competition, i.e., how the company wants to position itself in the market. The organisational strategy refers to the definition and execution of its work processes and as such it has to be aligned with the business strategy (Pearlson & Saunders, 2013). Similarly to the *Strategic Alignment Model*, all three of these strategies are strongly related and therefore have to be kept in balance in order to be successful (Pearlson & Saunders, 2013). Furthermore, that means when taking a decision that influences one of the strategies, the others also have to be re-evaluated in order to sustain the balance (Pearlson & Saunders, 2013).

Evaluation Approach

The evaluation approach analyses business value by putting emphasis on the processes and on IT as a value-adding process (Wamba-Taguimdje et al., 2020). This is in-line with Attewell (1994) who stated that in order to understand the business value addition of IT, first the dynamics of IT and productivity inside organisations have to be understood and therefore proposed a more process oriented approach to study IT business value. According to Mooney, Gurbaxani and Kraemer (1996) the focus on firm level output measures (e.g. in the economic-theory approach) does not completely describe how IT adds value to a business. Instead, **they** developed a conceptual framework that focuses on IT business value, and IT supported organisation and process design. The main reason for this is the fact that IT cannot be held accountable for the success of the business strategy but instead if it is applied successfully, it can provide support for processes and with that the organisational strategy (Mooney, Gurbaxani & Kraemer, 1996). **They** state that IT can have three types of effects on processes and due to these effects, it creates business value. The first one is the *automational effect*, which can lead to benefits like productivity improvements, labour savings, and cost reduction (Mooney, Gurbaxani & Kraemer, 1996). The second effect is the *informational effect*, which creates value through improved decision-quality, employee empowerment, decreased resource usage, and product quality

improvements (Mooney, Gurbaxani & Kraemer, 1996). Lastly, *transformational effects* leverage IT as a way to enable process innovation and transformation which can improve factors such as cycle times, responsiveness, labour count, and quality in service and product (Mooney, Gurbaxani & Kraemer, 1996). These effects are separate but complementary, meaning that the application of a specific IT system can lead to multiple beneficial effects (Mooney, Gurbaxani & Kraemer, 1996).

Resource-based Evaluation Approach

One theoretical approach to examine IT related strategic business value that is commonly used in the literature considers IT as a resource (e.g., Grant, 1991; Grover et al., 2018; Melville, Kraemer & Gurbaxani, 2004; Vitari & Raguseo, 2020). The traditional way of assessing the value of a resource is by applying the *VRIO framework* from Barney and Hesterly (2018). The framework states that a resources value is determined by the factors *valuable, rare, costly to imitate*, and *organisationally embedded* (Barney & Hesterly, 2018).

The first point *valuable* asks whether the insights of a data driven solution actually translate into business value. In most cases however, answering this questions proves difficult prior to actually implementing the data-driven solutions (Grover et al., 2018). This becomes increasingly complex if one considers that data-driven solutions have applications in a variety of fields. Grover et al. (2018) names the following areas: “*business process improvement, product and service innovation, customer experience and market enhancement, organisation performance improvement, and the creation of symbolic value such as business image and reputation*” (p.392). It can be seen that several of these factors are difficult to measure and that there could be correlations, meaning one data-driven solution could for example enhance a process that leads to an innovation in the service, which directly influences the customer experience and with it the image of the whole company. One additional noteworthy factor for the value of any data-driven solution is the data quality, which can be seen as a precondition for using and guaranteeing data value (Cai & Zhu, 2015). This means that the business value that is generated through data-driven solutions directly correlates with the data quality. There are several objective factors that can be used to determine the data quality, e.g., *completeness, consistency, accuracy, and timeliness*; however, the data quality also has a subjective dimension (Pipino, Lee & Wang, 2002). The subjective dimension depends on every stakeholder involved in the data process, i.e., collectors, custodians, and consumers of the data (Pipino, Lee & Wang, 2002).

Implementing data-driven solutions is nowadays not as scarce as it was a couple of years ago; however, as stated in the introduction, implementing it successfully is rare. The amount of public data that is freely available online increased drastically (Chen, Mao & Liu, 2014), but the data that a company creates about its customers or users internally is the scarce resource in question. These kinds of data are *rare* in the sense that they are difficult to obtain by the competition (Grover et al., 2018) and therefore they can be used to generate a competitive advantage (McAfee & Brynjolfsson, 2012). Similarly, the tools needed for such tasks are available for most firms, but implementing it and fitting it into the organisational IT landscape is the part that poses difficulties, therefore transforming factors like human talent, expertise, and experience into a resource that is potentially rare (Grover et al., 2018).

The third factor, *costly to imitate*, can easily be translated to data-driven solutions. Adopting data-driven solutions to fit into the organisational context requires time to develop and continuous support and refinement (Grover et al., 2018). Even when off-the-shelf software is being used, the software has to be configured, and expertise has to be gradually build up or acquired (Grover et al., 2018).

The last factor, *organisationally embedded*, refers to the alignment of IT and business. Data-driven solutions are part of the IT; however, in order to use insights to improve decision making the data has to be converted into information that is useful to the decision makers (Ploder, Bernsteiner & Dilger, 2020).

3 Research Methodology

The following chapter contains the reasoning and analytics behind the decisions and selected methods of this study. Initially the study approach will be explored with the more specific study design following. The remainder of the chapter focuses on the ethical considerations that have to be adhered to.

3.1 Study Approach

This study uses a mixed-method approach. However, within this thesis the quantitative research and the qualitative research have different purposes. First, the quantitative research is conducted with the help of a survey. The purpose of this survey is to collect knowledge about where AI is used and in which IBPs it is used the most. Based on the knowledge extracted from the survey results and the previously conducted literature review, the research gap was found and furthermore the final research question could be formulated. Second, the qualitative research, in this thesis in the form of interviews, was conducted afterwards to gain insights of how AI is used in the selected IBP. By transcribing the interviews, coding the transcriptions, comparing the information against the other interviews as well as existing literature, the main research question is answered.

To successfully answer the research question, the study scope needed to be narrowed down, therefore, the survey was conducted. The main part of this survey focused on where companies use AI nowadays. Literature about internal processes which help the employees of an organisation to make their work easier hardly exists. Moreover, there is little research that displays a big picture on which types of AI are suitable for which purpose. Additionally, AI is a fast-growing technology and use-cases rapidly change within short time periods. This is the reason why a survey was selected, to get knowledge about the current stand of AI and in which IBPs companies use it now. The survey in this case gives an overview of the usage extend of AI in different IBPs and gives a wide range of information since many different companies from different industries can participate. The survey is thereby free of limitations in terms of industry or sector range. Especially surveys are most suited for this kind of knowledge collection since they are fast and easy to complete by the participants (Passmore et al., 2002). As well as simple handling, Passmore et al. (2002) state that results of surveys are accurate and consistent.

The survey is the first step of this thesis and is preceding a qualitative study. Gable (1994) states that the combination of a quantitative and qualitative study results in immense growth of the contribution to the body of knowledge. Further, **he** states that the robustness of the outcome is increased by combining those two methods. Attewell and Rule (1991) call this a multi-method approach. **They** claim that this is more effective than using a single method and thereby **they** highlight the complementary nature of quantitative and qualitative methods. On top of the survey results were this study gets its information about where AI is used the most, the interviews provide thick descriptions and detailed insights on the knowledge how today's businesses use modern AI implementations to gain business value.

3.2 Survey Design

The field of AI is wide and varying which means that in order to gain valuable insights, the scope has to be sufficiently narrowed down. Sequentially, it became apparent that focusing on a specific IBP would be necessary to comply with the goal of answering the research question. By focusing on one process, but comparing companies from different industries and sectors, their different approaches and techniques can be analysed to understand similarities and differences and their implications.

Since arbitrarily choosing a process could hinder the research due to a lack of AI utilisation in the chosen process, it was decided that the choice would be based on a quantitative survey. The goal of the survey was three-fold. Firstly, the already mentioned goal of narrowing down the scope. By asking companies which areas are more/less dependent on AI the focus of this study could be shifted to a process where companies rely upon AI-supported systems. Only if a company is utilising AI, it can be beneficial for this analysis. Secondly, it would be advantageous for the remainder of the research to understand what AI means for businesses. As stated above, there are several definitions of AI, that differ in scope and specificity. By understanding, what the term AI means for the company, later on, their degree of investment and their success in implementing it could be correlated to their understanding of it. Lastly, the survey aims at understanding what priority data has to the companies. In a study by McAfee and Brynjolfsson (2012) it was found that there are measurable performance advances when a company identifies itself as data-driven. Therefore, this question aims at understanding the investment of the company in data to later correlate this information with their success of utilising AI for their benefits.

In addition to narrowing the scope and understanding to what extent companies are invested in AI, the survey aims at identifying suitable candidates for interviews. A suitable candidate is someone who either works directly with AI or delegates processes involving AI. This is due to the fact that this research aims at understanding the role that AI plays in businesses and therefore, it is necessary that the interview participants have either direct or indirect contact with it.

3.2.1 *Implications of Conducting a Survey*

A survey includes a questionnaire which is a collection of several questions. The results of a survey are statistical data from many different organisations. The data can be gathered in an easy, simple, and fast way. Surveys are the most common method used in research (Passmore et al., 2002). This data is then analysed by using mathematical and statistical techniques (Gable, 1994). In this study the survey is used to identify the extend of usage of AI in IBPs. The anticipated result of the survey is a ranking of which IBPs have the most AI implementations. Surveys are the best method to do so, because it is a good method for identifying and ranking (Skulmoski, Hartman & Krahn, 2007).

The survey in this thesis is conducted in addition to a literature review to narrow down the research scope and formulate the research question. Since this is the first step of the thesis, this process must not be very time consuming, and results are needed in a short time. Surveys are known to gather a lot of data in a short period of time (Passmore et al., 2002). Especially, electronically sent surveys can be send to many different organisations without much effort. Nonetheless, surveys deliver reliable data (Passmore et al., 2002) and the results are analysed, to identify the research gap.

AI and IT in general are a fast growing and changing area. Statements from last year might be out of date already and published and peer-reviewed literature is thereby not the only source of information about nowadays usage of AI. To get a more current stand of AI technology used in today's organisations the survey was conducted. The survey does answer the questions on where companies use AI right now and which use-cases AI is implemented in.

Surveys have several advantages over other methods. Especially self-administered ones, as it was used in this thesis, conducted in an electronical way are less expensive in terms of time and resources (Passmore et al., 2002). A huge amount of data can be collected from various organisations and different areas (Gable, 1994). Moreover, the electronical survey can be distributed over any channel and does not rely on external factors, for example post offices. They are a fast, simple, and easy method to collect data and more importantly, easier to fill out and to analyse in the process later (Passmore et al., 2002).

Although, surveys do have disadvantages, they are a good method to collect large amounts of data. However, the quantity depends on the response rate. If the response rate is low, the more likely it is that the gathered results vary from the actual common image of the nonrespondents (Passmore et al., 2002). The result only provide a current snapshot of the participants view (Gable, 1994). Not only does the reliability of the survey depend on the response rate. Passmore et al. (2002) states that the quality of surveys relates to the understanding of the participants. **They** give three attributes which can be misunderstood. First, the reading level of the participant. Complicated questions are more likely to misunderstood or ignored, than easy and simple worded ones. Therefore, the questions in our survey were very straightforward and not technical. Second, the cultural perspective plays a role in understanding a question correctly. Third attribute of misunderstanding are the language skills. The survey in this thesis is conducted in English and is send out to mostly Swedish and German speaking participants. Furthermore, the researchers as well are not native English speakers. Besides the misunderstanding of the survey questions in general the results rely on the honesty and memory of the participants (Passmore et al., 2002). The impact of measurement errors in the data can be significant (Scherpenzeel & Saris, 1997). Moreover, the results of the survey can develop into an unexpected output and thereby completely change the direction of the research.

Nonetheless, the disadvantages can be overcome by knowing and considering them. The quality and validity of the survey will be optimised by adjusting some attributes (Scherpenzeel & Saris, 1997). The three attributes of reading level, cultural perspective and language skills will be overcome by only considering participants who are working directly or indirectly in the field of AI. Further, cultural differences will be considered as less important since respondents of the survey will be European citizens. This will mean the response rate can also be lower, since only experts in the field are questioned. With a homogeneous group, already ten to fifteen participants result in sufficient data (Skulmoski, Hartman & Krahn, 2007). In addition, the questions of the survey are well-chosen and follow a structured way of conducting valuable research. The types of questions are described in detail in the following section 0. Most disadvantages of quantitative research are thereby already obliterated. Further, most problems within surveys occur due to less careful and inappropriate application, rather than the methodology itself (Pinsonneault, Kraemer & Org, 1993).

3.2.2 Structure and Execution

The main goal of the survey, find use-cases of IBPs where AI has the most usage, was considered as the most important factor while creating it. Additionally, the structure of the survey followed some basic rules. First, it should be as simple as possible to be understood and answerable by every person. Second, the survey starts with easy questions to ease into the main questions later on, as well as easy questions at the end as a cool-off phase. The questions were kept easy in terms of technical difficulty, language slang and also less abbreviations (Stehr-Green et al., 2020). Easy questions in the beginning are also recommended by Rattray and Jones (2007) so that emotional and controversial questions are not placed first. To reduce confusion, questions are stated without double negatives (Song, Son & Oh, 2015). Obviously, the survey does not only consist of a questionnaire. The survey in general describes the whole process of planning, executing, and analysis. This whole process follows an 8-step plan. Those steps are derived from the steps listed by Passmore et al. (2002) and Stehr-Green et al. (2020). The original steps by Passmore et al. (2002) are (1) State the problem, (2) Plan the project, (3) State the research question, (4) Review the literature, (5) Develop/adapt survey items, (6) Construct the survey, (7) Pilot test the draft survey, and (8) Administer the survey. Stehr-Green et al. (2020) states the following steps: (1) Identify the leading hypotheses about the source of the problem, (2) Identify the information needed to test the hypotheses, (3) Identify the information needed for the logistics of the study and to examine confounding factors, (4) Write the questions to collect this information, (5) Organise the questions into a questionnaire format, (6) Test the questionnaire, (7) Revise the questions, and (8) Train interviewers to administer the questionnaire. Based on these steps the researchers created own steps, more suitable for the topic of information technology, especially AI.

- (1) Identifying the problem
- (2) Gathering information about the topic
- (3) Formulating the first part of the research question
- (4) Identifying participants in the field of the researched topic
- (5) Constructing the questionnaire
- (6) Testing and revise the questions
- (7) Administering survey
- (8) Analysing results

The first step in this plan is important to keep the questions in one special direction, to answer the main question. To give a good overview of the topic and also to formulate the first part of the research question, a literature review was conducted. This resulted in a better view on IBPs and AI in general. Good research questions are simple, clear, relevant, appealing, and most importantly answerable (Passmore et al., 2002). The literature review was also conducted to find possible studies who answered the question already; however, none were found. After that, the questionnaire was constructed based on the gathered knowledge and the principles of good survey questions named above. A more detailed description on which question types were selected and why can be found later in this chapter. Lastly in the construction process the questions were shown to other researchers and revised based on their feedback. The final survey questions were then sent out, administered during the execution phase, and analysed after the number of participants reached more than 15.

Conducted was the survey with Google Forms. Forms is a feature of the Google Docs package and is a freely available, easy to use and widely known tool to create questionnaires (Travis, 2010). According to Travis (2010) Google Forms is absolutely adequate for small surveys which do not need a lot of customisation. **She** compares it to several other survey tools like

KwikSurveys, SurveyMethods, Alchemer (formerly SurveyGizmo), SurveyMonkey, Zoomerang, eSurveysPro, FreeOnlineSurveys.com, QuestionPro and SurveyPirate. She concludes her research with the statement that Google Forms meets most of the needs of survey creators. Although, main reasons why the researchers of this thesis choose Google Forms over the alternatives are that it is a free tool, it has no restrictions in terms of the number of participants and since Google is widely known, most participants will be familiar with the interface. Moreover, the researchers were able to collaborate on the creation, data privacy settings were available (e.g., do not collect emails or IP addresses), and the results were easy to export. Within the export, Google automatically creates suitable charts out of the data (Travis, 2010).

The final survey was sent out to private contacts as well as it was published on LinkedIn. With the publication in carefully selected LinkedIn groups, the researchers were able to achieve a large number and great variety of professional participants (Unkelos-Shpigel, Sherman & Hadar, 2015). According to Unkelos-Shpigel, Sherman & Hadar (2015) LinkedIn has several advantages. First, one can reach people who elsewhere could not be reached. Second, the research visibility will be increased and thereby the study gains impact. Third, due to tagging, sharing and re-postings the survey will receive constant and continuous feedback. Fourth, due to the carefully selected groups and range of audience of only professionals in this study area, the responses can be trusted to represent the actual current point of view from the industry. Lastly, professionals are more likely to give friendly feedback and take into account their own personal experience. Surveys of this kind, electronically distributed, are called self-administered surveys (Leung, 2001). They are easy to create and forward, not costly and they have a huge confidentiality in terms of protecting the participants identity (Song, Son & Oh, 2015).

3.2.3 Question Selection and Types

Questions in the survey were selected thoughtfully. Leading questions should not be included and the questions should encourage honest responses (Passmore et al., 2002). Further, Passmore et al. (2002) states that the formulation should not include any judgements and must not be offensive in any cultural environment. Additionally, Rattray and Jones (2007) suggest an equal allocation of positive and negative formulated questions to minimise the risk of responds in the same way. Generally, questions were ordered from general to particular, easy to difficult and factual to abstract (Leung, 2001). Those rules for question formulation will lead to the most accurate results (Hyman & Sierra, 2015). Furthermore, Hyman and Sierra (2015) recommend unambiguous, appealing, and important questions with a connection to the main research problem. Indicators show, that surveys mostly result in wrong results due to careless and inappropriate application (Pinsonneault, Kraemer & Org, 1993).

It has been specified that the survey's main goal is to find out where AI has the most extend of usage in IBPs. Nonetheless, the survey consists of more than this single question. The questions can be grouped in four different categories. First and foremost, the mentioned main question with a rating scale to identify the usage of AI in IBPs. Even if this is not the first question in the survey, the categories are named based on their priority and their importance in the survey. Secondly, an industry category with questions about the company, their industry, and the job position of the participants. Thirdly, validation questions to verify if the participant has a sufficient background knowledge and does pay attention while filling out the survey. Moreover, one specific validation question is stated in the opposite way of a previous question to verify the readers opinion. In addition to that, open questions to give a definition of AI were inserted, not only to get a more detailed perspective on what AI means to the participants but also to verify if the topic is understood well enough and to filter out black-box thinking. Lastly, the fourth

category the ending questions. In this category the participants were asked if they would be open to participate in a follow-up interview. If yes, they are asked for contact details so that the researchers can reach out and get in contact. Especially, the last category of questions pursues a second important goal of the survey: finding interview partners. Besides the main goal of finding the highest AI implementation in IBPs the survey was used to already select suitable participants for follow-up interviews. The given answers of the possible interview participants can be compared to the selected IBP to filter out which are suitable, and which might be less applicable.

Before adding the main question of the survey with content, the existing internal processes in a company needed to be analysed and categorised in internal and external ones. Processes in general are “*Marketing, Sales, Service delivery, Customer support, Research & Development, Sales & Marketing Support, HR [Human Resources], Finance, Legal, Administration, IT, Purchasing, Business Strategy [and] General Management*“ (Improving Your Internal Processes, 2021, n.p.). Other processes to be named are *Product Development, Sales, Procurement, Client Onboarding, Customer Support, Employee Onboarding, Content Promotion, Financial Planning, Accounting Management, and Process Improvement* (Gallia, 2019). After thoroughly discussing the mentioned processes, eight main internal processes were selected to be included in the survey. For example, marketing, sales, customer support, purchasing and or procurement were considered as external since the majority of stakeholders in these departments are not within the company itself. Client onboarding and employee onboarding were considered to be processes in the human resources department, whereas client onboarding would be considered as external anyway. The final eight processes are the following:

- (1) Finance & Accounting
- (2) Human Resources
- (3) Legal (Compliance)
- (4) Manufacturing
- (5) Process Improvement
- (6) Project Management
- (7) Research & Development
- (8) Strategy Management

As mentioned, every question of every of the four categories has its purpose in the survey. This is, according to Hyman and Sierra (2015) the first rule of creating questions. **They** state that only questions which address the research problem should be included. Therefore, the specific questions can only be created after the research questions have been partially formulated. Questions not related to this problem should, according to the authors, be removed. Further, **they** define more rules for the creation of questions. As already mentioned before, questions should be clear and precise. Hyman and Sierra (2015) give a good example for an unclear selection of answers for a question on how often someone is eating a candy bar. They explain that the interpretation of frequency differs between people. Some might say twice a day is often, others on the other hand might think that every other day is often. Moreover, they explain the fact, that the questions should be written in natural and familiar language, with a good example, because a survey does not intend to be a vocabulary test. Additionally, **they** state several other rules, such as aiming for mutual exclusive responses as well as only asking one questions at a time. So called double-barrelled questions must be avoided (Bowling, 2014). Considering those rules will lead to more consistent and truthful results. It needs to be assured that the survey does bring the output that it intends to bring (Song, Son & Oh, 2015). Reliability, the concern that the output in a different study under the same conditions results in similar output (Carmines & Zeller, 1979; Hasson, Keeney & McKenna, 2000), plays a vital role here.

To serve the purpose of the question in an optimal way, the questions can have different types. The type needs to be considered carefully as well as the wording, the context and the technique of collection itself (Scherpenzeel & Saris, 1997). The used tool Google Forms comes with a variety of types for questions build in (Travis, 2010). Types used in this survey are multiple choice, single choice, open responses, and scales. Google Forms also gave the option to add different sections and skip them based on previous answers (Travis, 2010). Since free-text inputs as open response questions require much more effort to fill in they are used rarely in this survey (Passmore et al., 2002). Passmore et al. (2002) further elaborates that not only the time spend by the participant will increase, the time to analyse the given answer is raised as well. He also discusses the scale questions and says they usually come as a statement where the respondent needs to range his answer from strongly agree to strongly disagree. In addition, he states that an even number of possible rating options demands a commitment whereas an odd number allows a neutral opinion. In the case of this study the rating offers the option from “no usage” to “full dependency”. Supplementary to the given rating the researchers added an extra option of “unsure” to give the participant the option to ignore the specific IBP asked for.

Table 2: Survey Sections with Questions and their Types

Section	Question	Type	Comment
Introduction	Electronic Consent	Single Choice	Agree to continue and disagree returns in an immediate submission of the form
About the company	Company name / industry	Free text	It is stated that if the participant does not feel comfortable naming the company, the industry can be given
	Job title	Free text	-
	Do you consider your company as "data-driven"?	Single choice with three options: Yes, No, Not sure	-
	How would you define AI?	Free text	Short description or keywords of how the participant would define AI
	Do you think AI usage will grow over the upcoming years?	Single choice with two options: Yes, No	Validation question which is stated later on again in the opposite way
	How does your company handle AI?	Single choice with four options: Dedicated department,	-

		differs across units, not working with AI, Others	
AI in IBPs	How do you consider the extent of AI usage in the following processes?	Range for each IBP from 1 to 5 and the additional option of unsure	-
	Other processes	Free text	Gives the participant the option to add missing IBPs
	Would you say AI in general has reached its peak of usage?	Single choice with two options: Yes, No	Second validation question
Interview	Would you be interested in participating in a follow-up interview?	Single choice with two options: Yes, No	If participant answers no, the next section of contact information will not be shown
Contact Information	How can we reach you?	Free text	Only shown if previous question was answered with “yes”
End	-	Static text	Thanking the participant and reminding him to submit it

3.2.4 Anticipated Results

The survey data is analysed through automatically created charts by Google Forms (Travis, 2010). The outcomes in general are a mixture of the answer for the main goal, the usage of AI in IBPs, a list of possible interview partners, and a more detailed description on how AI is seen in today’s businesses. The extra questions on AI definition or if the participants consider their company as data-driven can be used to sort the respondents by relevance. Data-driven companies and an insightful AI definition will support the selection of helpful responses because they are considered more relevant for this research. Furthermore, the information about the company’s industry and the participants job title will give insight about how valid the response might be. AI developers or technology directors have a better overview about the AI implementation as well as the IBPs in their companies in general. Moreover, the information whether the company has its own IT department, or they outsourced it, helps the researchers find the most suitable respondents and thereby interview partners.

3.3 Interview Design

Following the initial data collection from the quantitative survey, the results were used to narrow down and create the scope for the qualitative data collection using interviews. By using the results of the survey, a scope could be created specifying what IBPs should be examined more thoroughly with the interviews. The following chapter will discuss the creation and thoughts behind the qualitative data collection, the interviews.

3.3.1 *Creating an Interview*

Gathering responses from the quantitative data collection provided an overview of the main topic regarding business processes. To further proceed in the analytics of the thesis, details and a more thorough way of data collection had to be conducted. There are several ways to conduct interviews, as explained by Oates (2005): Structured interviews, based on the goal to maintain the same questions and form for each participant in the study. During a structured interview, the social contact is maintained, however, it would be exaggerated to view the interview as a conversation (Maiden & Rugg, 1996; Oates, 2005). During Semi-structured interviews, which this thesis aims to work with, the interview rather adapts the form of a conversation, allowing the order of the main questions, as well as forming of sub-questions to be changed and formed throughout the duration of the interview (Oates, 2005). Although there is a risk that the interview drift off topic, having the freedom to form sub-question and follow up more thoroughly on the respondent's answers outweighs the eventual risk. By allowing the respondent to more freely reply to the questions asked, the likelihood of discovering answers and key data points that the authors did not anticipate increases (Oates, 2005). Unstructured interviews relieve the researchers of the driving force of the interview. The researcher rather introduces the topic at hand and allows the participant to freely share any thoughts and questions regarding the topic (Oates, 2005). This form is the most similar to a normal conversation but can prove difficult to extract useful data for scientific theses, should the topic drift too much from the anticipated responses (Oates, 2005).

Judging by the research question, the most suited form was decided to be a semi-structured approach to the qualitative data collection since the participants experience and understanding of the topic is unknown beforehand. As a result, the time and resources needed to prepare for the interview was slightly reduced. By taking the focus of the interview away from strictly formed questions, and rather allowing a more fluid conversation and discussion to occur, the quality of the data originates from the possible sub-questions and follow-up answers from the interview where the participants own RF and experiences in the topic is analysed.

3.3.2 *Creating the Interview-Guide*

When conducting a study including a qualitative data-collection method, it is important to structure the interview considerably according to the anticipated answers in the interviews. In this study, the authors have chosen the semi-structured approach when conducting the interviews. There are numerous reasons to why a semi-structured approach is more desirable than a formal in the sense of the topic. By adopting this method, there are no limits to what follow-up questions can be asked or brought up during the interviews, just as Recker (2013) mentions in his book, this leading to the variation and depth in the responses being much broader and detailed.

With the baseline taken from the literature review together with the research question, several interview questions were created to complement the quantitative data collection. Using the results from the survey, as well as the criteria of the survey and its questions, to formulate and structure questions (see chapter 3.2), the authors created the following interview questions. The questions were chosen to further analyse the topic, now facing more towards the possible applications of AI towards internal business process improvement and optimisation. Aiming for a fluent discussion between the participants and the interviewers, easing into the main topic should be done gradually. Starting off the interview with a brief introduction of the thesis at hand, as well as a walkthrough of the privacy contract (see Appendix B). Once the presentation and the initial formalities have been passed, creating a better picture of the participant and their role and position in their company is hoped to equally create useable data as well as acting as an initial peak of interest towards the participant. By showing interest in the participant as an individual with eventual follow-up questions, the interview took shape into more of a two-sided conversation. Using the logic and reasoning grounded in the literature review as well as the reasoning above, the following questions are set as guidelines for this step of the interview:

- *What does your company do?*
- *What is your role in the company?*
- *How do you experience digitalisation in your company?*

In order to understand answers given by the participant regarding the research and their application of AI within their company, it was essential to understand the participants RF. In order to properly understand the answers given by the participant during the interview, understanding the RF is essential. The fundamentals of the RF in the scope of this thesis, can be understood by filling it with knowledge about the participant, their company and their experience working with the digital development of the company.

After having passed the initial questions regarding the participant and their company, the main topic can be lifted to discuss. Following up on the survey, and the choice to further analyse the process improvement scope, we started by creating an understanding of how the company works with process improvement for the time being:

- *How does your company approach processes and their optimisation?*

Using the main question as a guideline, depending on the direction of the interview, a direct answer may or may not be possible. Hence the question might be adapted to fit better into the flow of the interview and topic at hand. After getting an understanding of how the current situation is, preferable following up with the question:

- *What types of AI are being used by your company? And if so, any in process improvement?*

By asking a broader question like the one above, the reply is not limited to only the scope of process improvement, which should in theory ensure relevant data no matter the reply. By then asking a follow-up question regarding the direct usage of AI within process improvement, creates a proper understanding of the companies use of AI, and follows-up with the special application as well.

Seeing as how the main purpose of this thesis is to analyse the possibilities of value generation and usage of AI to improve internal processes and optimise them, providing a main question like the one above may not answer the research question directly, yet sprout follow-up questions

that provide answers. Finally, to conclude the interview and discuss the outcomes, the interview will follow the two last questions:

- *Has AI generated (business) value for your company?*
- *Did AI help optimise the processes in your company?*

Regardless of whether the company and the participant have any first-hand experience or usage of AI in process improvement, understanding how the overall situation regarding the use of AI in the company, is important. By knowing how AI is used currently, even if in other sectors, discussion and analytics can conclude and analyse the possibilities of expanding the use of AI in the future.

Tying up the interview is done best by going through that what has been discussed throughout the interview in order to both allow for the possible add of missed information, as well as feedback on how the participants information has been received and interpreted (Ferrari, Spoletini & Gnesi, 2016; Hadar, Soffer & Kenzi, 2014). By telling the interviewers interpretation, the participant is also allowed to correct any possible misunderstandings.

3.3.3 Participants and Interview Platform

As mentioned in the previous chapter of survey design, some interview participants were selected during the survey analysis. As well as the survey the interviews were addressed to several companies in different industry sectors. The reason is to gain a broad overview of AI implementations not only in one specific area. The participants who were chosen from the survey were selected based on a number of criteria, i.e., the company is considered data driven, the participants definition of AI is appropriate, and a high usage of AI in process optimisation was specified. As five respondents of the survey were interested in an interview and four of them matched the named criteria above, they were asked to participate. As one was not reachable within the time frame given by this study, only three participants were able to be selected from the survey results. Further, two more participants were found by contacting companies working with AI directly. Another attempt of LinkedIn recruiting was started as well, to find suitable participants in several groups connected to AI research and or development. In this case LinkedIn resulted in no further participants. The Covid-19 pandemic and the given time frame of the thesis had a significant impact on the sent-out invitations. 35 companies, including IBM, Microsoft, Salesforce, Alibaba, Oracle, Celonis as well as DoorDash were contacted without any results and sometimes even without any replies. Furthermore, AI specialists were contacted on LinkedIn; however, were not available considering the short time frame of this study. Another reason for not finding many more interview participants is the fact that AI implementations in many companies are in an experimental stage and their development is kept behind closed doors. Which influence this has on the results is discussed in chapter 5.2.

Nonetheless, five interviews were conducted. These five participants worked in different companies and in different industries as well as in different roles. As mentioned before, the Covid-19 situation had an influence on the interviews and thereby the interviews had to be conducted in an online environment. The Lund University provided the authors with the possibility to do so via Zoom, Microsoft Teams or Google Hangouts. The experience of the authors in Zoom and Microsoft Teams lead to the conclusion that those two were offered to the participants. Zoom had one decisive advantage, more than one participant in the call was able to record the meeting on the local device. This decreased the possibility of errors in the recording due to technical issues, such as internet connection problems or disconnection. However, the choice

of the tool was given to the participant, mainly because security and data privacy issues are highly ranked in companies nowadays. The final list of the interview participants can be seen below in Table 3.

Table 3: Interview Participants

Role	Industry	Tool	Participant-Code	Transcript Appendix	Number of Employees
Senior Business & Functional Specialist	Banking	Microsoft Teams	P1	Appendix A, Interview 1	20.000+
Sales & Marketing Manager	Hardware for AI	Zoom	P2	Appendix A, Interview 2	10-50
Director of Technology	Smart Home Development	Zoom	P3	Appendix A, Interview 3	10-50
CEO & Developer	Finance	Zoom	P4	Appendix A, Interview 4	1-10
Market Expansion Manager & Business Developer	Online Retail	Zoom	P5	Appendix A, Interview 5	100-200

3.3.4 Execution and Transcription

When conducting the interviews, selecting the optimal language to fit each interviewee, was thought to be the best way. Since the authors origin being geographically different, just as the participants, resorting to English initially seemed like the most optimal approach. After further research, it was found in a study performed by the PhD Bradford Kirkman-Liff (1991), there exist a high probability of potential information-loss in interviews when using other languages than the participants native language. In accordance with the results of Kirman-Liff's research, the group decided to enable interviews in the authors all three available native and bi-lingual languages, i.e., English, Swedish and German, with the aim of reducing the risk of information loss as mentioned by Kirkman-Liff (1991).

Besides the language, other attributes had to be considered. Especially, since the interviews were conducted online, many technical issues had to be solved first. To grasp every word and every little detail, such as gesture, emphasis and thereby feelings, the interviews were recorded with video and audio. This results in a richer description according to the Information Richness Theory (Daft & Lengel, 1983) and supports a more truthful answer to the research question. Since online recordings can be interrupted due to connection losses, the interviews were preferably held via Zoom where more than one participant was able to record on their local device. To further ensure proper data collection and safety, two or more interviewers were active in

each interview. This further allowed for one of the interviewers to take notes, and the other to drive the interview. Note taking and two recordings were considered as strong enough to avoid mistakes and not to have to hold the interview twice. Two main criteria of secureness of interview data were named. First, using the native language of interview participants. Second, have more than one interviewer attended the interview. In two interviews it was not possible to meet both criteria. Based on the language abilities of the researchers, the interviewees whose native language is Swedish, were not able to be conducted with multiple interviewers. The researchers did in this case decide that the language criteria is more important, based on the argumentation of Kirkman-Liff (1991). Therefore, two interviews, conducted in Swedish language, were only done by one researcher.

After all interviews had been conducted, the audio recording needed to be converted into text. The online version of Microsoft Word gave a good possibility for transcribing, due to the authors' institutional access. Voices are detected automatically and thereby the statements in the created transcript were labelled with the speaker. Breaks and interruptions were detected automatically and formatted with line breaks and spaces. Moreover, the final transcript can be exported with several options, e.g., with added timestamps. The transcribing process in Microsoft Word's online version also had the possibility to select the input language. It was therefore no problem to transcribe the different languages, i.e., English, Swedish and German. The automatically created transcripts only needed to be checked and minor refinements were done. This helped to reduce the regular analysis part of interviews. The usually named time of transcriptions for such interviews is five to ten times the interview duration (Pfeiffer, 2020, own translation), with the help of the automatic transcription, this time was reduced by about 50%. However, transcriptions were now available in the three mentioned languages. Since the language of the thesis is English, the transcripts also needed to be translated. Another reason for this was that not every researcher was able to read in all the three languages. Before the transcripts were able to be translated, they had to be checked, refined, blackened and checked by the participants itself who requested to do so. Afterwards, the transcripts in Swedish and German language were translated with the tool DeepL. DeepL is a translation tool based on AI, ML and DL which gained huge publicity within the last few years and added more and more languages during the last months (Cambedda, 2021). First tool that probably comes to mind for translations will be Google's translator; however, grammatical issues and sentence structures are more accurate in DeepL (Macketanz et al., 2018).

3.3.5 Coding and Analysing

Following the production of the written transcript, coding the content to allow for easier overview and analysis was required. Using the previous reasoning and logics of the literature reviews and the methodology, sixteen categories were developed and listed in the coding-schema below. Each of the categories and corresponding codes indicates content within the transcript that corresponds to key data that is to be used for discussion and results within the analysis. Time efficiency in regard to the data analysis allows for more time and resources to be spent on understanding and analysing the contents of the interviews, by coding the transcripts, the authors could easily trace back where key parts of the information was located within the transcripts.

Table 4: Coding Schema for Data Analysis

Context	Code	Description
Relevant Background Information	BG	Information about the participant or the company
AI Definition	AI-D	Definition of AI by participant
Unspecified AI	AI-T-N	Data regarding AI but no specific type given
Machine Learning	AI-T-ML	Data regarding ML
Natural Language Processing	AI-T-NLP	Data regarding NLP
Deep Learning	AI-T-DL	Data regarding DL
Reinforcement Learning	AI-T-RL	Data regarding RL
Neuronal Networks	AI-T-NN	Data regarding NN
Current Way of Process Improvement	PI-C	How does the participant's company approach process improvement right now
Previous Way of Process Improvement	PI-P	How did the participant's company approach process improvement in the past
Future Way of Process Improvement	PI-F	How does the participant's company want to approach process improvement in the future
Improvement with AI	PI-w-AI	Which process improvements were enabled and or discovered with the support of AI tools
Improvement through AI	PI-t-AI	Where was a process improved through the implementation as a replacement of AI
Other AI Implementations	O-I-AI	Mentioned implementations of AI other than in process improvement
Ethical Perspective	EP	Ethical attributes and considerations for AI implementations
Removed by Participant	Blackened in the text	Names, numbers, and information selected by the participant to be removed or blackened

For time constraint reasons, the first cycle of coding for the interview transcripts was mainly done by only one author and checked and agreed on by the other authors. However, to assure a more general view, the coding author should not be the one who conducted the interview and further, the other authors checked the coding. The usual and by the academic world, considered best way, would be to code each interview individually, take the matching codes and discuss differences between the coders (O'Connor & Joffe, 2020). Nonetheless, the taken approach of coding it once and check it, discuss, and redefine it later, will not result in less valuable knowledge since major differences are discussed within the checking process. Since all the researchers are familiar with the topic at hand as well, the intercoder reliability, as discussed by O'Connor and Joffe (2020) will be maintained. This qualitative part of the study uses interpretivism as a research philosophy. Interpretivism focusses on words rather than numbers (Recker, 2013). Since the main research question aims to understand the underlying factors leading to have an impact on business value, the authors argue that interpretivism is the most suitable paradigm to analyse the qualitative interview data. Especially, the prediction possibilities, discussed by Thanh, Thi and Thanh (2015) are considered relevant around AI and business processes.

3.4 Ethical considerations and privacy

Threading forward in the recent developments of increasingly more frequent cyber-attacks on both small and large corporations, maintaining proper data integrity and safety is key. Vulnerabilities that lead to data breaches is based on average by 23% of human error, 25% of system glitches and 52% from malicious attacks (IBM Security, 2020). During the past year, several of these incidents were noticed world-wide, by news companies reaching from BBC to Forbes, involving game development companies such as Capcom (Tidy, 2020) and CD PROJEKT RED (Criddle, 2021) to Swedish medical companies such as Läkarleasing (Pettersson et al., 2020).

Since the past 40 years have offered great advancements in technology and globalised information systems, having more knowledge and data, means having more power. By digitalising more of our lives and turning what is valuable into digital information, having said digital data compromised equals having a share of ourselves taken away by someone else.

Taking into consideration that many of the interviewed companies work with sensitive data, proper precautions had to be taken to maintain privacy and proper data ethics. Participating in an interview regarding topics such as presented by this study, or the usage of internal system and other potentially vulnerable or classified information systems, having an interview following the guidelines discussed by Recker (2013) is favourable.

3.4.1 *Voluntary participation*

In order to minimise the feeling of vulnerability, the privacy consent form (thoroughly explained below) will contain information about the rights of the interviewee and their right to withdrawal without further notice any time before, during or after the interview. By ensuring the participants that the participation is voluntary and nothing negative will come out of withdrawal, the anticipated likeliness of the interviewee answering more honestly is expected to increase.

3.4.2 Anonymity

Whilst striving towards maintaining the ability to provide total anonymity to the interviewees, there is always a slim risk that minor misses in the collected data can pass through the filtering process. Hence it is of importance to thoroughly analyse and review the collected data for personal information and data that might possibly lead to the identification of the interviewee. Filtering data must be done with caution, in order to not tamper with the key data. By primarily censoring names and details that can be used to identify the company where the interviewee works, the filtering process should result in adequate anonymity. However, due the authors possibly not having full knowledge about the industry, company and vulnerable elements raised and discussed in the interview, letting the interviewee review and possibly censor the transcript produced by the interview, is a preferable step in the filtering process.

3.4.3 Data Ethics

Proceeding to the handling and storage of the data, due to the recent times many cyber-attacks, as mentioned previously, towards both companies and private actor's data storages, the authors have decided to store the collected data in an end-to-end encrypted privately hosted cloud storage. By removing any third parties from the data management processes, proper data security can be achieved where neither the third-party hosting company, nor any external actors can access or steal the data. As reported by IBM Security (2020), many of the data breaches are caused by human factors, which indirectly leads to the conclusion that even larger corporations such as Google or Microsoft, who are commonly used for storage in their cloud platforms, can fall victims of human error. By storing the data within a closed eco-system only accessible to the authors of this report, the human factor is minimised and limited to only three people.

3.4.4 Privacy Contract

To ensure that the interview follows the guidelines discussed above, a privacy-contract (see Appendix B) was created. The purpose of the contract was to inform the participants of the contents of this thesis, as well as their rights and what is expected to be discussed throughout the interview. The contract itself was built upon the five directives and guidelines discussed by Oates (2005) in his literature on research within information systems: *The right to not participate, right to withdraw, right to give informed consent, right to anonymity, and the right to confidentiality*. It is upon these guidelines; the privacy contract and the ethical considerations were built upon.

To ensure that the privacy contract was read, it was included in the invite to the interviews for each participant. Furthermore, at the start of each interview, verbal confirmation that the privacy contract had been read, as well as verbal consent to its contents was asked for and ensured.

4 Results

This chapter summarises the findings of this research. It is divided into the two methods that were used for the data collection, i.e., the survey and the interviews. Each part will be structured along the questions that were given to the participants. The results will then be connected to the literature to put them into perspective.

4.1 Survey

The data collection process started with the survey, as described in chapter 3.1. The survey was conducted by using Google Forms and had in total 18 participants over a timeframe of four weeks. The survey starts by asking the participants about their current employment; however, in order to comply with the previously stated privacy codes, the participants also had the option of naming their industry only. The following Figure 6 displays the distribution of industries among the participants. It can be seen that the majority of the participants are working in the software industry closely followed by the finance sector and IT consultancies. The remainder of the participants worked in retail and the chemical industry.

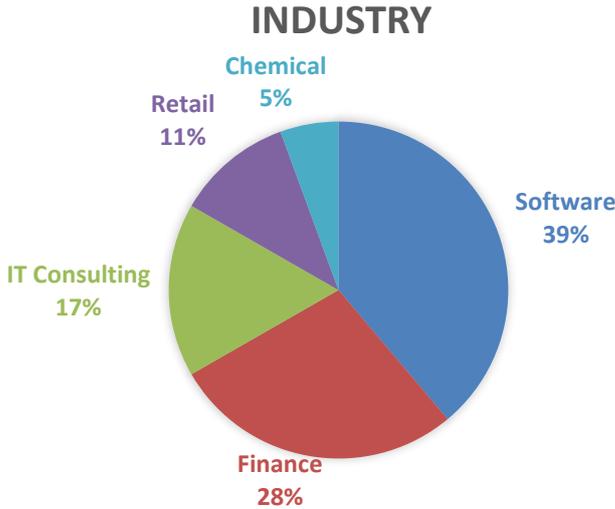


Figure 6: Survey Industries

These results are quite in line with the expectations. Technology is a universal tool in today’s business world and almost every sector utilises it to a certain extent. At this point it has to be noted that the survey was mostly aimed at people with a technical background or people in the upper management level, that have an overview of the technical solutions that are in place in their companies. Below in Figure 7 the roles of the survey participants are similarly clustered into these roles, i.e., management, technical, and others. It is visible that more than half of the participants work in a management position; whereas the remainder is mostly technical people with few participants not matching either of these categories and therefore are part of the “others” category. These results indicate that the survey reached the correct target group.

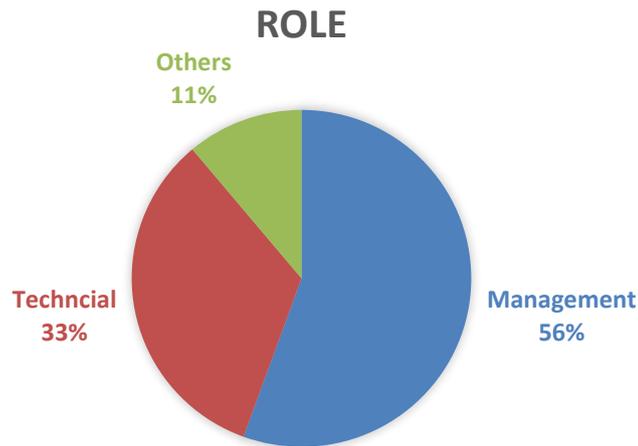


Figure 7: Survey Roles

The next question aimed at understanding how the surveyed companies prioritise data, i.e., it was asked whether the participant consider their company as data-driven. The results of this are shown below in Figure 8. 76% of the participant said that they consider their company as data-driven, whereas only 24% said they did not. Only one participant, excluded from the diagram, was unsure about the state of its company in this regard. Therefore, it can be said that data is an important asset for today's companies.

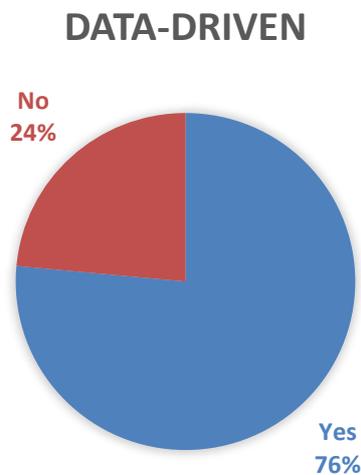


Figure 8: Survey Data-Driven

The next part of the survey aimed at understanding how AI is being defined in business. As it was anticipated, the business understanding of AI varies greatly from the definitions that can be found in the literature. The definitions given by the participants can be seen in Table 5 below.

Table 5: Survey AI Definitions (see Appendix D)

AI Definitions
Extrapolation of information from data
Automation
Automated processes, data-driven detection of sales opportunities
Automated decision making based on huge amounts of data
Efficient data management via self-learning algorithms
Future
Assistance to personal work
Future
Self-learning data system that makes decision based on self-learned insights
Automated intelligent decision making
Solve problems and take decisions automatically based on collected data
Currently AI is an alias for machine learning. And that's an elaborate way to have a big amount of IFs and ELSEs
AI helps companies speed up processes
Any artificial pattern to imitate (aspects of) natural intelligence
Recreation of the human intelligence in often an even higher level of intelligence.
Machine learning way of coding by experience & data
Intelligence by machine learning
Systems or systems of systems, that can calculate and compute the most effective, yet safest, action and execute it.

It can be seen that the definitions vary greatly among the participants. Several participants define AI simply as “future”, whereas other participants are closer to the literature definition. Several participants also use the terms AI and ML interchangeably and not, as stated in the literature, ML as a subcategory of AI. To gain a more comprehensive overview, below the participants’ definitions are visualised in a word cloud. The bigger a word within a word cloud is, the higher is its relevance. Automation is the key word that people used the most to describe AI. In addition to that, key words like data, future, and ML appeared often in the definitions as already mentioned above.

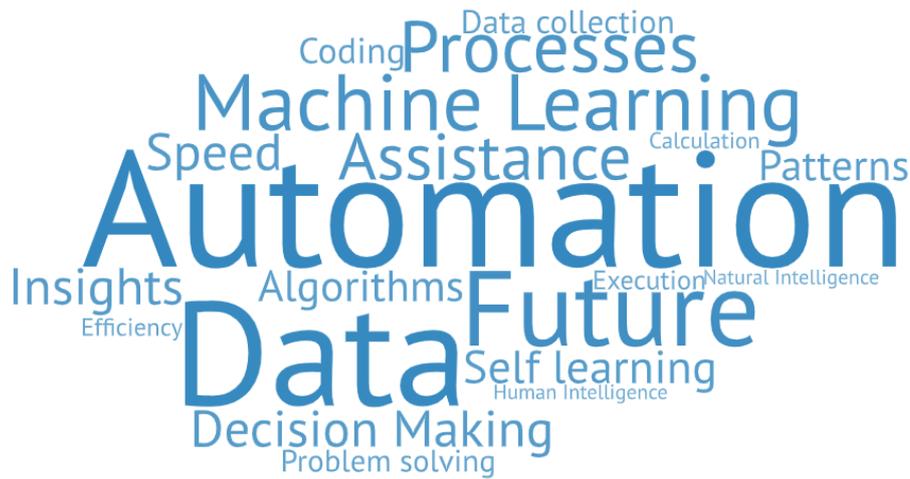


Figure 9: AI Definition Word Cloud

Besides the definitions of AI, the next question asked the participant if they think that the AI usage will continue to grow over the upcoming years. Without any exceptions, all participants agreed, that AI has not reached its full potential at this point in time. As described in chapter 3.2.3 the question was first asked as stated above and then again inversed later on, i.e., “do you think AI in general has reached its peak of usage?”. This was done to ensure the validity of the responses, as described in the previously named chapter. For the second question all participants disagreed, rendering all their responses as valid and further emphasising their expectations in the future of AI.

The next question of this section asked the participant whether their company has their own IT/AI department with 50% of the participants answering that question affirmative. The rest of the participants is almost equally divided into the other categories, “*Differs across business unit*”, “*My company does not work with AI*” and “*Others*”. This question again, aims at understanding the companies’ priorities and capabilities in the area of IT and especially AI.

As the main part of the survey, the participants were asked about the extent of AI usage in a selection of internal processes. The participant could specify the usage with a number from 1 (no usage) to 5 (full dependency) or check the “*unknown*” box. The numbers for each process were then simply summed up in order to create a comparable indicator. The results were already preliminary mentioned in the introduction in Table 1. Below the aggregated usage levels are displayed in Figure 10. The purpose of this question was mainly to narrow down the research scope, which led to the focus on process improvement. Additionally, to ranking the given processes, the participant was given the option of naming other processes. This was used by 2 participants which named “*Business Intelligence, Performance Marketing, Advertisement*”, and “*Sales B2B, B2C*”.

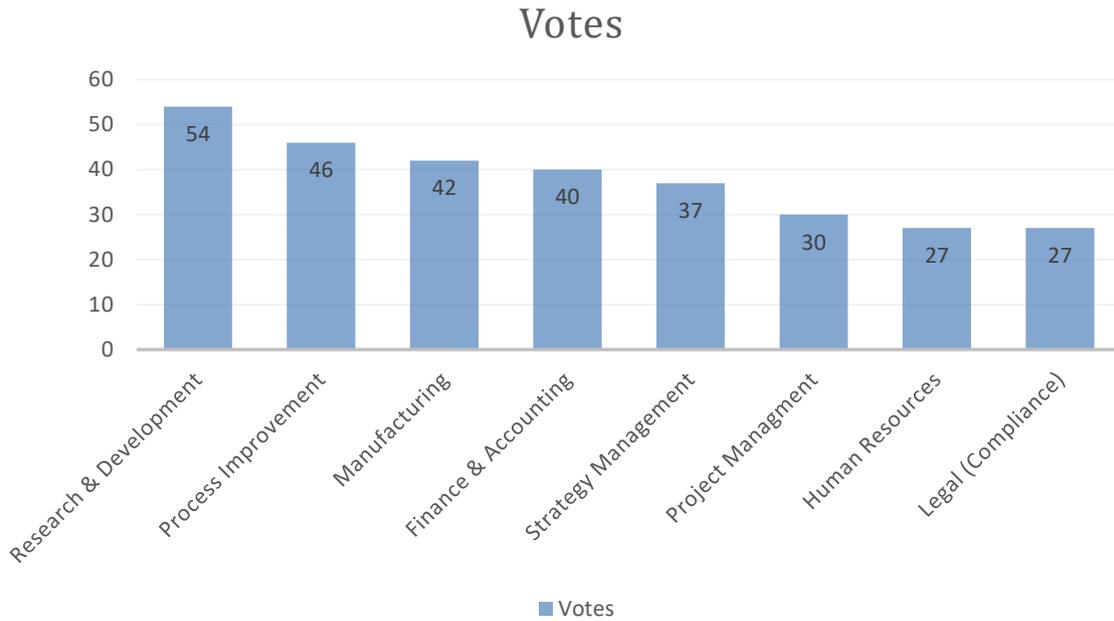


Figure 10: Extent of AI Usage

4.2 Interviews

The second part of the data collection was the conduction of the interviews as described in chapter 3.3. In total five interviews were conducted with either managers or technical experts to gain the most useful perspectives. The interviews were semi-structured and followed the interview guide that can be seen in Appendix B. As described in chapter 3.3.4 and 3.3.5 the recordings were then transcribed, if necessary translated, and coded to identify the most important sections and statements.

4.2.1 Background

The first part of the interviews focused on the participants company and their role within that company. This was done to get a more comprehensive overview of the tasks and responsibilities that this person is encountering frequently. The results are summarised below in Table 6. The industries vary greatly among the participants, e.g., from hardware to software and from retail to finance. Similarly, the roles differ as well, whereas every participant talked from a management perspective, P1, P3 and P4 additionally also had a technical background which was reflected in their statements, definitions, and approaches.

Table 6: Participant Information

Participant	Industry	Role	Tasks/Responsibilities
P1	Banking	Senior Business & Functional Specialist	<p>Anti-money-laundering division.</p> <p>Develop internal software to detect and prevent money laundering, tax evasion, and terror financing.</p> <p><i>Experience: 3+ years</i></p>
P2	Hardware for AI	Sales & Marketing Manager	<p>Sells IT infrastructure with focus on storage, networking, and security.</p> <p>Revolutionised AI infrastructure, especially for usage of GPUs within DL.</p> <p><i>Experience: 10+ years</i></p>
P3	Smart Home Development	Director of Technology	<p>Coordinating, consulting, enterprise architecture, management of external service providers.</p> <p>Development of software as a service and cloud solutions.</p> <p>Market-leader in the premium RV area.</p> <p><i>Experience: 5+ years</i></p>
P4	Finance	CEO & Developer	<p>Founder and lead developer of an algorithmic trading company.</p> <p>Specialised on ML, DL, RL, and QL.</p> <p>Developed two semi-automated trading bots with own UI-Framework.</p> <p><i>Experience: 5+ years</i></p>
P5	Online Retail	Market Expansion Manager & Business Developer	<p>Marketing performance management, global market research, stakeholder management, business expansion and development.</p> <p>Online retail for payment and gift cards.</p> <p><i>Experience: 1+ years</i></p>

4.2.2 Digitalisation

Even though the participants were not directly asked about how their companies approach digitalisation, their answers gave strong indications on that matter. Besides P1, all other interviewees' companies have been founded with a technological value proposition and thereby, are strongly invested in modern IT. It was found that the companies all use modern communication, analysis, and collaboration technologies. Furthermore, all of the participants have had touch points with AI which made it easy for them to understand the topic of this report. Nonetheless, their opinions regarding digitalisation strongly differed which will be further found in the results regarding future outlooks of IT and especially AI.

P2 stated that their company approaches digitalisation through their own value proposition by enabling their customers to build, maintain, and use modern technological infrastructure (Appendix A; Interview 2; Line 9). By selling and installing hardware specialised on high parallelisation with a focus on AI training they are working at the pulse of modern technology. Whereas the application of technology for P2 has a more outward facing focus, P1's company sees the advantages more internally. P1 stated that they are using technology to replace human labour through automation of tasks (Appendix A; Interview 1; Line 19). This application enables them to improve efficiency and quality through error prevention (Appendix A; Interview 1; Line 21). Similarly, P5 utilises technology for automation of several steps within their processes (Appendix A; Interview 5; Line 137). Additionally, they use external tools by different companies such as Google to support daily activities, e.g., testing different ad campaign strategies (Appendix A; Interview 5; Line 48,68) or detecting fraud (Appendix A; Interview 5; Line 90) which goes in the same direction as P1's error prevention. Apart from their main business, they utilise technology in several other ways to support their workflow, i.e., Asana as a project management tool (Appendix A; Interview 5; Line 140), Tableau as an analysis tool (Appendix A; Interview 5; Line 48), and Slack as a communication tool (Appendix A; Interview 5; Line 174). Whereas P5 used Google Ads for marketing, P4 relies completely on social media for online marketing (Appendix A; Interview 4; Line 87). Further, P4's approach to digitalisation is defined by understanding existing technologies and utilising them in the most efficient and effective way (Appendix A; Interview 4; Line 79).

On the topic of AI, P4 stated that everything which is artificial, has an intelligence, and is not human is supposedly AI (Appendix A; Interview 4; Line 15); however, the modern understanding of AI distinguishes it from typical sequential software through the existence of a mathematical model for pattern recognition instead of IF and ELSE statements (Appendix A; Interview 4; Line 15). On the other hand, P3 has a different view. He was more reluctant to consider something as AI. In his view it has a buzzword character, which means that people think that everything can be done with AI (Appendix A; Interview 3; Line 6). He stated that instead of enabling customers to utilise AI they are slowing them down due to the opinion that AI is not the universal tool to solve all problems (Appendix A; Interview 3; Line 6). This is grounded in his philosophy of "[...] *the most powerful skill of a programmer or an architect is to figure out what NOT to do.*" (Appendix B; Interview 3; Line 78). Further, he stated that most modern technologies require a solid baseline that you can compare its advance to (Appendix A; Interview 3; Line 12,14). This means that in order to see if AI can actually be implemented successfully, a manual solution first needs to be in place in order to see if the results can actually be improved.

4.2.3 Process Improvement

This part captures the participants statements regarding process improvement. The statements are organised by subtopics, i.e., process understanding, -modelling, -improvement management, triggers of optimisation, value of process improvement, and AI in process improvement.

Process Understanding

Since a big part of the interviews revolved around processes, the participants were asked how they understand that term to compare the participants perception with the literature. However, due to the unstructured nature of the interviews, the question was not directly asked but more a product of discussion and examples.

Since P1's company was quite large, his division was focused on a narrower scope. This led to them having a clearer idea of the processes that were involved in accomplishing their function. P1 named processes like detection and prevention of fraud, prevention of terror funding, internal software development, and transaction reviews (Appendix A; Interview 1; Line 11, 18, 21). Further he stated that they have a process to incorporate customer feedback to continuously improve their solutions (Appendix A; Interview 1; Line 28).

For P2 examples of processes were the creation of AI infrastructure and sales, but also the development of said infrastructure (Appendix A; Interview 2; Line 5, 9). Like P1 he mentioned the software development process (Appendix A; Interview 2; Line 22). Another process that was discussed was the sales process. P2's company does not only sell the infrastructure but also enables companies to rent hardware to test and run proof-of-concept projects on (Appendix A; Interview 1; Line 16,17)

P3 mentioned that their company assists mainly in processes like building apps, software as a service solutions and cloud solutions, as well as how to use social media or in general online marketing (Appendix A; Interview 3; Line 6). Another explicit process that was mentioned was data mining which was further elaborated through examples (Appendix A; Interview 3; Line 12). More concretely, P3 walked the researchers through the process of error tracking, which starts by collecting data. That data is then cross-referenced with online data and manually analysed in order to identify the error of a certain piece of hardware (Appendix A; Interview 3; Line 33). Another process that was described was the process of adopting software that was developed by third-party software providers. In order to reach the same understanding and quality metrics that are used for internal projects, the externally developed software will run through a process of quality checks before it can be integrated into the firm's software landscape (Appendix A; Interview 3; Line 35, 37, 69).

P4 stated that they are not using any processes due to the small size of the company which the researchers found unlikely considering the literature definition (Appendix A; Interview 4; Line 53). However, later in other parts of the interview, it became clear that P4 meant that they do not model processes with designated modelling languages like BPMN but still have them. It was mentioned that they work in an iterative agile software development process (Appendix A; Interview 4; Line 41). Further, it was mentioned that they use methods like pair programming and that they have a clear coding and testing process (Appendix A; Interview 4; Line 41). Their software development process for python scripts was shortly described as extract data, train the (AI) model, test the model, get signals from the model, and then decide whether it should be deployed to the client's application (Appendix A; Interview 4; Line 47).

The understanding P5 had of processes was close to the literature definition. He talked about processes like buying products, receiving and paying invoices, launching a product and the out-of-stock process (Appendix A; Interview 5; Line 40, 42, 144). However, he stated that they do not use classic process definitions but more a “phased approach”. By this P5 referred to a list of activities that need to be conducted to reach a certain goal (Appendix A; Interview 5; Line 24). Further it was talked about performance indicators in different processes and how they affect the outcome (Appendix A; Interview 5; Line 76). One process that he walked us through more in detail was the process of an external risk detection and the connected internal fraud detection process (Appendix A; Interview 5; Line 82-94).

Process Modelling

After the researchers found out what the participants understand under the term process, the next question aimed to find if those processes are modelled in a way that they are written down and or visualised to be accessible by all employees of the company. The literature review has shown that a process can only be improved if all team members are on the same level of knowledge about the process and its steps in general. In conclusion one can say that the answer to this question gives valuable information about how valid the improvement steps of the company are.

In general, the consensus of the participants was that the modelling is not done as recommended by the academic literature. P2 and P4 do not have any processes written down, they only have recurring meetings where internal processes are discussed within small project teams. P2 stated that he did not even know that the modelling is necessary to improve processes (Appendix A; Interview 2; Line 59). P4 explains the missing visualisation with the reason that it is unnecessary in a team of three (Appendix A; Interview 4; Line 53).

Nonetheless, process modelling was done at least to some extent in the companies of P3 and P5. Where written down step by step models of processes existed for small tasks like code analysis, larger business process models for enterprise solutions were not existent (Appendix A; Interview 3; Line 26). Processes, such as agile development in Scrum, are modelled by their definition itself (Appendix A; Interview 3; Line 26). Within the company of P5 processes of buying products, receiving, and paying invoices and launching a new product or a new market are modelled in the way of a checklist and tracked through the project management software Asana (Appendix A; Interview 5; Line 42, 140). Other processes were not modelled, similarly to the other interview participants. P5 described processes in general as something that comes and goes automatically (Appendix A; Interview 5; Line 38).

Process Improvement Management

As well as process modelling, it might also be important to mention the responsibilities of processes and its management. Even if this was not a defined question in the interview guide, the participants mentioned their process improvement handling along with the previous information about process modelling. Further, knowledge about who is in charge and can start a process optimisation project can be helpful to discuss to gain deeper information about how successful the company's business implements improvements.

P1, P3 and P4 mentioned they are working in an agile way. P1 stated that they are working in small teams of 15 people and each team is responsible for its own domain (Appendix A; Interview 1; Line 25). Further, he stated that each team has a tribe leader (Appendix A; Interview 1; Line 26). However, general process improvement is his own job, and he is the “[...] engine that

[...] decides how things can be improved, and then [he solves] things with machines" (Appendix A; Interview 1; Line 36). Besides agile methods, P4 uses pair programming, which reduces the workload of code review and strives to a more direct communication between all developers (Appendix A; Interview 4; Line 41). In general, a direct communication between the employees was implemented to share the responsibilities with each other (Appendix A; Interview 4; Line 53). P5's company has more employees and bigger teams than P4, therefore it was described that processes got messy and needed refinements and a clear definition of responsibilities (Appendix A; Interview 5; Line 122). The division into teams and a responsible leader simplified the process of launching new products in a market (Appendix A; Interview 5; Line 124, 126). However, the process of checking if a product is or will be out of stock has still a lot of responsible people and thereby will need to be improved soon (Appendix A; Interview 5; Line 174). P2 elaborates that his company in terms of process improvement is mainly divided in the technical and the sales department (Appendix A; Interview 2; Line 4). He suggests that an R&D department could take the lead in managing process improvement (Appendix A; Interview 2; Line 35). Because right now each department is responsible itself which creates silos where the departments have less communication with each other and thereby cannot benefit from the others knowledge (Appendix A; Interview 2; Line 53). This kind of thinking, according to P2, works well now for their business with the customer; however, not for B2B connections (Appendix A; Interview 2; Line 55). Far back, seems to be company of P3. P3 stated that they are one step before data mining, they are in the data science phase right now where it gets decided on which data is collected, who will be responsible for what and what can be done with that information later on (Appendix A; Interview 3; Line 29).

Current Triggers of Optimisation

When talking about process improvement, one of the first questions that comes to mind is *How do you know which processes you have to improve?* These triggers of optimisation greatly varied among the participants. However, for most of them process improvement in general needed a trigger and was less a continues process as some methodologies from the literature would recommend as stated in chapter 2.3.3.

One of the most stated reasons to improve a certain process was the customer. P1 mentioned that *"[...] we take feedback from our end users and ask 'ok, what do they want? How can we support them the best [...]"* (Appendix A; Interview 1; Line 28). Similarly, P3 mentioned that his company conducted ideation workshops to better understand what aspects are important to the customer in order to deliver more customer centric solutions. P5 stated that during the process of expanding their service to new countries, indicators regarding the popularity of their service for potential customers are among the most important criteria for choosing which country to prioritise (Appendix A; Interview 5; Line 26). On the other hand, he mentioned that the conversion rate, which describes the fraction of the customers that actually buy a product from the number of customers looking into a product, is a measurement that they use to adapt their effort regarding that product (Appendix A; Interview 5; Line 78). Another way that customer input can lead to process change is either directly through customer complaints (Appendix A; Interview 5; Line 170), or indirect through bad customer experience (Appendix A; Interview 5; Line 104) since that can lead to repelled customers and therefore to missed earnings (Appendix A; Interview 5; Line 178).

Another trigger that was often mentioned by P5, were organisational benefits. He stated that they changed a process due to the fact that it was in general unorganised which made it slow (Appendix A; Interview 5; Line 129). Another factor that triggered the optimisation of that process was the unpredictability of the launch date of products on the one hand (Appendix A;

Interview 5; Line 132), and on the other hand employee workload (Appendix A; Interview 5; Line 126). P5 further mentioned that the company needs to see the long-term value of a new solution to actually engage in process improvement (Appendix A; Interview 5; Line 262). On the other hand, organisational benefits can occur through knowledge. P3 and P4 mentioned that experimental projects can be a reason for a process change, since more knowledge about certain technologies can lead to new use-cases. For P3 it was experimenting with new frameworks that led to new ideas and consequentially to process improvement (Appendix A; Interview 3; Line 12). For P4 it was the trial of new AI models that showed performance gains and are in the process of being implemented into the main software (Appendix A; Interview 4; Line 75).

Whereas these triggers were internal, P3 and P4 mentioned external triggers that lead to process improvement. P3 mentioned the factor of competition. The environment in which his trading algorithms work is dependent on the other market participants. He explained that there is a shift that already today, the volume that is being traded by bots exceeds the value that is traded by humans, which means his bots do not only need to be better than human traders but also better than other algorithmic solutions (Appendix A; Interview 4; Line 127). Another external trigger for process changes that he mentioned were regulatory changes which he needs to comply with (Appendix A; Interview 4; Line 121). P3 mentioned that third-party tools can be a trigger for a process improvement since these tools are often better in a special purpose than self-developed solutions (Appendix A; Interview 3; Line 25).

The last trigger that was mentioned by participants P2, P3, and P4 are problems as part of a bigger goal. This means that in order to accomplish a certain goal, technological challenges have to be faced and overcome. Overcoming these challenges often has other beneficial effects that lead to an overall process improvement or the discovering of new use-cases or opportunities. For example, P2 stated that a lack of existing solutions led to them implementing their own software solution that exactly fulfilled its needs (Appendix A; Interview 2; Line 29-33). P3 mentioned the data collection and analysis process, where the main problem at this point in time is getting the data from the Recreational Vehicle (RV) to the cloud in order to analyse it there. In order to improve the process, the problem of a stable connection has to be solved (Appendix A; Interview 2; Line 29-33). Similarly, he mentioned that currently RVs do not have the needed processing power to execute certain technological features like voice controls which led to them using more edge computing within their hardware (Appendix A; Interview 3; Line 53). In a different way, P4 said that in order to have a long-term success with algorithmic trading, their algorithm needs to be constantly adjusted to avoid overfitting (Appendix A; Interview 4; Line 71). This constant adjusting; however, also leads to frequent improvements to the overall product and its performance (Appendix A; Interview 4; Line 75).

Value of Process Improvement

In the end, every action taken, despite what triggered it, must have a value for the business. As stated in the literature review (2.3.2), improvement of processes has a direct influence on the workload of employees, their satisfaction and overall, the company's profit. First value that one might think of is money. The more money a company earns and the less money they spend, the more profitable it is. However, an increase of revenue, is indirectly associated with other business values. Not only the literature shows that this is the case, but the statements of the interviewed persons also come to the same conclusion.

First and often mentioned business value is time. Improving processes frees up time of employees through removing and fasten unimportant or unnecessary processes (Appendix A; Interview 1; Line 31). Further it is stated that automated activities within processes save a lot of time as

well (Appendix A; Interview 1; Line 32). P3 agrees and calls it a "*reduction in workload*" (Appendix A; Interview 3; Line 78). However, he later elaborates that it is important to know the process, know the limitations and the actual benefit to have the advantage of saved labour (Appendix A; Interview 3; Line 78). P5 mentioned the process of launching a new product, which was improved by assigning specific roles and tasks to groups with a leader which saved a lot of time within this process (Appendix A; Interview 5; Line 216). P3 highlights the process of code analysis, for internally created program code as well as externally integrated software, to draw the attention of the developers to specific elements within the code which needs to be refactored instead of manually checking every line (Appendix A; Interview 3; Line 39). "*With the company it's really only about money and time.*", said P3 (Appendix A; Interview 3; Line 70).

In case of money, it is important to distinguish between increasing incoming money and decreasing outgoing money. This will result in an economical gain, according to P1 (Appendix A; Interview 1; Line 76). P2 is improving their analysis to utilise the hardware to work more efficient to generate more revenue for their customers and thereby for their own company (Appendix A; Interview 2; Line 52). The algorithmic trading bot of P4's company increases the performance of a regular fund manager from 35% to almost 50% (Appendix A; Interview 4; Line 21). Within the company of P5 money has been saved by improving the process of checking if a product is or will be out of stock. By eliminating the problem of products not available in stock, they did not need to pay back their customers and therefore saved huge amounts of money (Appendix A; Interview 5; Line 216).

The process improvements of P5 also resulted in more satisfied employees (Appendix A; Interview 5; Line 216). Thereby, they were able to work more and create more outcome in less time. However, not only direct influences create business values. The user convenience plays a huge role in today's companies. Improving business activities to simplify the customers processes have been widely implemented in P3's company, for example, the recognition of products by taking a picture for products which have no serial number or other tags (Appendix A; Interview 3; Line 45, 47). Further, the suggestion of service intervals of vehicles by sound recognition and other data ensures only necessary check-ups and thereby creates a value on customer side as well as on manufacturers side (Appendix A; Interview 3; Line 51). As mentioned, the out-of-stock process in P5's company, also created a better customer satisfaction (Appendix A; Interview 5; Line 218). Additionally, the checkout process was improved in terms of the maximum payment amount which restored the customer relationship in many regions where it had been demolished before (Appendix A; Interview 5; Line 216).

Additionally, process improvement brought many other values to the companies of the interview participants. P3 stated that new market segments were recognised which created a competitive advantage (Appendix A; Interview 3; Line 72). Moreover, the improved activities of P2's company were able to increase efficiency and thereby save resources which has a huge sustainability advantage (Appendix A; Interview 2; Line 52). Not to forget the increased security through process improvement. The named code analysis of P3 resulted in a more secure enterprise system (Appendix A; Interview 3; Line 68). P4 mentioned the market analysis to avoid drawdowns and a less risky trading through bots to be more certain that there will be no loss of 20% over night (Appendix A; Interview 4; Line 83, 85). A better risk analysis was also introduced in P5's company to check the credit-worthiness of customers before sending out payment cards (Appendix A; Interview 5; Line 90).

AI in Process Improvement

The process improvements named by the interview participants were either enabled and or discovered with the support of an AI tool, or the process was improved through the implementation of an AI tool, as a replacement of the current workflow. The answer to this question was essential for the researchers to be able to give an answer to the research question at hand. Through the knowledge of where AI is used during the process optimisation process, it can be seen in which state of the process improvement the AI is in place.

First, the results of AI as a tool, for a replacement of a current manual activity, is listed. P3 understands the AI implementation as a toolbox (Appendix A; Interview 3; Line 26). Similarly, P4 called it a supporting tool, not only in his area of trading, but he also noted that AI as a supporting tool will aid humans in every area of work and private life (Appendix A; Interview 4; Line 125). P4's company uses third-party AI systems within their automatic and semi-automatic trading robots to predict the upcoming share prices, based on historical data which is the price to a certain point of time (Appendix A; Interview 4; Line 21, 23). Within the retail company of P5, they are using Tableau and their AI tools for data visualisation and analysis (Appendix A; Interview 5; Line 48). Further, they integrated an external risk-assessment tool for preceding credit card checks (Appendix A; Interview 5; Line 90). P3's company, working with Smart-RVs (Smart recreational vehicles), like smart home solutions, uses AI in several projects (Appendix A; Interview 3; Line 33). They have a project with image recognition via ML for the customer to identify the exact model of a refrigerator or other built-in equipment, also they are working with NLP for voice recognition for error detection (Appendix A; Interview 3; Line 31, 33). All together those AI systems will help to improve the quality assurance, the preventive maintenance and more importantly, enable the predictive maintenance (Appendix A; Interview 3; Line 49). P3 mentioned TensorFlow as an "awesome package" with a lot of potential (Appendix A; Interview 3; Line 78). However, P3 also mentioned that "as soon as you understand it, most of the time it's not AI" (Appendix A; Interview 3; Line 20). Neuronal networks have very little depths today as well as 20 years ago, therefore, P3 is of the opinion that most patterns can be understood well enough to map them in an IF and ELSE construct (Appendix A; Interview 3; Line 20).

Secondly, AI can be an enabler of process improvement. Since this is how the researchers understood the part of the thesis to understand where AI is used in this area and how AI brings a value here, the results of this part are of great importance. P1's company is currently improving their processes by customer feedback. This feedback is gathered by sending out a tremendous number of letters to their customers (Appendix A; Interview 1; Line 28). Their plan is first to replace manual letters with automatic emails. Further, the analysis of the customer feedback within the returning emails, should be done by an AI (Appendix A; Interview 1; Line 29, 74). Thereby, AI promises to make the process of customer feedback easier and improve other processes as well with the given feedback of those customers (Appendix A; Interview 1; Line 74). Unfortunately, P2's company does not work with process improvement as a stand-alone process, due to the company's size; however, P2 mentioned that this is a splendid idea and can result in great advantages (Appendix A; Interview 2; Line 36, 37, 50). Similarly, P3 mentioned that such an integration of AI in their enterprise solutions and the communication in numerous sub-systems would be a huge advance (Appendix A; Interview 3; Line 18). He named data mining and process mining as buzz words in this area (Appendix A; Interview 3; Line 28). Though, their company is one step before data mining. They are implementing a base line first to determine the fundamentals of what data needs to be stored, how to store it and how to measure it (Appendix A; Interview 3; Line 29). Nonetheless, some data, such as website traffic, is already analysed with Google Analytics and thereby gave meaningful insights to improve

several processes (Appendix A; Interview 3; Line 29). P4 referenced an example of a friend of his, who is working in a bank in Switzerland. There they are using AI to predict the likelihood of employees to quit to do something about it at an early stage (Appendix A; Interview 4; Line 17, 19). P5 improved their marketing strategies with the help of AI. Keywords for search engines, such as Google, were optimised through the analysis of AI, e.g., SA360 (Appendix A; Interview 5; Line 56). Within the previous company, P5 worked for, they used ML for determining the duration of an auction (Appendix A; Interview 5; Line 64). Further, they used data to train a decision management ML model to simplify decisions on when to place ads and for which prices (Appendix A; Interview 5; Line 66).

4.2.4 Future Prospects

Similar to the survey results, all interview participants agreed that the utilisation of AI and its subfields are going to grow in the future. Their extent of confidence in AI however, varied.

P3 had the most moderate opinion of the participants about the future prospects of AI. He stated that many basic technological difficulties, such as hardware limitations, connectivity, data quality, etc., would need to be solved first before AI should be considered (Appendix A; Interview 3; Line 82). However, he also named some areas where he definitely sees AI in the future. On the one hand he mentioned preventive maintenance and on the other he suggested that “[...] *customer segmentation, will perhaps bring us to things that we might not have managed to find by hand [...]*” (Appendix A; Interview 3; Line 85). Other areas he mentioned were user convenience, e.g., person detection can be used to adjust smart features to his preferences or water in the shower could be pre-heated due to regular showering at certain times. Further, he said that AI could be used to create more sustainable solutions through the cutting of power when it is not needed (Appendix A; Interview 3; Line 85).

More in the direction of process improvement, P5 envisions an AI more as a decision-suggestion tool, “*If we take the risk measurements a little bit lower, you will probably have 100 more orders a day of which maybe two are fraud, but you can take that risk, shall I do it and I just say yes*” (Appendix A; Interview 5; Line 118). Similarly, he suggested that AI will be capable of identifying features of a product which would mean that simply adding a certain product to the online shop is enough for the AI to suggest search terms and customer profiles (Appendix A; Interview 5; Line 48). A bit further into the future, P5 imagined his business shifting to online wallets, where advertising could then be personalised to an extent where your local coffee shop displays you an ad exactly at the time when you are estimated to be in the shop (Appendix A; Interview 3; Line 228).

P1 and P2 see the future potential of AI in the automation and therefore the replacement of manual labour. When asked whether he could see implications on human labour due to AI advancements in the future, P2 replied “*Yes, but that's how it was when the spinning mills came into being at the beginning of industrialisation [...]. When the automatic spinning mills started and the steam engine was the big threat [...] that's a natural process of industrialisation. And we're into [...] the fourth industrialisation? There are lots of jobs that existed 10 years ago that don't exist today*” (Appendix A; Interview 2; Line 86). Similarly, P1 was completely sure that eventually AI will replace every kind of human labour, he stated that “[...] *I'm convinced that this will happen sometime in the future. It's just a question of when.*” (Appendix A; Interview 2; Line 36). However, one topic that P1 deemed necessary for significant advances is the topic of ethics. Once a machine takes decisions completely automatically, it has to be made sure that

the decisions are ethical, e.g., that human life cannot simply be evaluated numerically (Appendix A; Interview 2; Line 61,63,65).

In contrast to these specific use-cases, P4 sees the future of AI in the inception of the general AI, “[...] you practically train a model, and it works in two different places that have a completely different logic.” (Appendix A; Interview 4; Line 112). He goes as far as stating “We will experience a great technological singularity.” (Appendix A; Interview 4; Line 118). As an example, he mentioned Google’s AI that was capable of playing GO and chess with the same underlying model (Appendix A; Interview 4; Line 112). Further he envisioned that DL will be as common in organisations as excel is today (Appendix A; Interview 4; Line 116). Interestingly the time frame that he sets is sooner than later, “[...] we will experience a very big revolution with this technology in our lifetime”. He argues that this will be possible because the processing power will continue to grow and similarly the amount of data that is being produced in 10 years will be in the range of 10 to the power of 6 of what we have today (Appendix A; Interview 4; Line 116).

5 Discussion

This chapter discusses the results of the conducted mixed-method study. It answers the research question by putting the results into perspective and connecting the findings with the literature. Furthermore, an outlook into further study objectives will be given.

5.1 Overview

The purpose of this study was to investigate the usage and business value generation of AI in IBPs, specifically process improvement. It was stated in the introduction that AI nowadays is a hype topic with equal interest from the academic as well as the business world. Further this research was motivated by the identified research gap of AI in IBPs. The purpose of this study was to look beyond the hype and identify the potential of AI in business and further investigate the actual value addition that AI promises to deliver. The relevance of the topic is grounded in numerous studies that state that AI implementation projects have a high failure-rate or even when successfully implemented, they do not end up delivering business value. Furthermore, it was found that the literature for process improvement is coming to a similar conclusion in that regard. Process improvement shows significant potential and is supposed to be a game-changer in the business world; however, in reality high costs, lack of management or employee commitment, or communication gaps are frequent and lead to project failure in almost 3 out of 4 projects. Certainly, one study alone cannot change these devastating numbers, but it can provide an addition to the general body of knowledge with insights from practitioners on the one hand, and an extensive analysis of these insights based on the available literature on the other hand.

The first part of the study was the conduction of a survey. While the main goal of the survey was to narrow down the scope of this research by specifying the researched IBP, it also laid the groundwork for the interviews which aimed at getting more detailed qualitative data from industry practitioners. The interviews were conducted in a semi-structured form and led to many interesting insights.

The following chapter 5.2 focuses on the challenges that were encountered, both on a methodological and on a content level. Chapters 5.3 and 5.4 will go more into detail about the two main themes of this thesis, i.e., AI and business process improvement. Within, the authors will discuss the findings from both the survey and the interviews and relate it to the literature. Sequentially, in chapter 5.5 the two themes will be combined, meaning that AI in process improvement will be discussed in a similar fashion in order to answer the research question and its sub-questions.

5.2 Challenges

The often-named challenge of AI implementations in general was its buzzword character. People have high expectations and expect magic by implementing AI. Although, if one looks beyond the commonly acknowledged definition of AI, one finds that most activities done with AI need much human interaction. The technical expertise is missing and thereby AI is used as a keyword for a tool that does it all. Especially, the missing expertise and not considering AI

clearly within the conceptual phase lets AI projects fail. Experience shows that AI is often placed on top of existing projects, metaphorically speaking as the icing on the cake. Moreover, not only AI projects are failing. The investigated process improvement tends to fail as well. Reasons are a missing knowledge of the processes to improve and lack of commitment by the management and the employees. Further, lack of communication is a contributing factor that restricts improvements to only one department. This silo thinking does not support the overall value gain of a business through process improvement.

As mentioned, one major reason for failure is the modelling itself. Within this study it has been shown that the average company does not know which processes are involved in their every day's business. The interviews show that most companies, from three employees to more than 20.000, do not model their processes. Usually, they are not explicated and are known as tacit knowledge. The involved employees, only see a few steps of the process, mostly the ones they are directly involved with, and not the overall process. In one case it has been shown that a documented process, even just a brief sketch on a whiteboard, turned out to improve the process and thereby gain a significant benefit for the company in terms of revenue and employee satisfaction. The missing knowledge is only one precondition that needs to be met to implement a successful process improvement initiative. Further, this manual implemented improvement is the precondition of adding AI capabilities to it. Another precondition, already mentioned, is that AI is not the magic tool it is commonly perceived as. The usually not existing technical expertise is not available due to limited budget and time constraints. Further, these challenges are also missing if existing tools should be integrated, for example, DM. In general, DM needs expertise about what data to collect and how to utilise it. The evolving PM through DM needs the knowledge of activities within the process beforehand. And even if those conditions are met, one aspect often mentioned by the interviewees is the topic of ethics. There will never be an ethically correct decision to which everyone agrees. It is always about finding a balance between several attributes. Humanity and empathy are among the most important factors of preventing machine-based decision making. AI can only make decisions considering its given input data. Surrounding information is often not known. One example named by an interview participant was the replacement of hundreds of human employees by a machine to gain a slight revenue increase. In this case, the AI cannot yet fully understand the ethical implications of replacing human labour, in regards to the employees and society in general.

With the listed challenges above not solved, AI is just a buzzword included in projects. Many times, it is not thought through what data the AI should analyse, in what way, and for what purpose. Digital tools are just used to accelerate human manual work. Often these tools cannot be classified as AI, considering the AI definitions from the literature. Generally speaking, automation cannot always be considered as AI. Using image or voice recognition within an automated process, AI is just a small part of the overall process. It has been clearly stated by several interviewees, that AI is not the solution for everything, and the main work now consists of convincing companies of what not to do. This is mainly the reason why the authors of this study decided to include a rather technical description of AI and its subfields in the literature review (2.2), to highlight the differences of each type and their limitations.

The buzzword character of AI and the missing knowledge of what processes are, is in this study considered as the two main reasons to why the survey results might have been misleading. Misleading in a way that the extent of AI usage in process improvement from the survey results did not match the actual results from the interviews. The survey results are not wrong, the literature shows that AI tools such as *UiPath Enterprise RPA Platform* and the RPA solution by *Automation Anywhere* exist for process mining; however, it can be said that the survey results show a slightly different picture than the interview results. The interviews indicated that within

the average company the above-named tools are not used. Reasons named by the interview participants, are the not yet matched preconditions. Further, according to the definition of a business, the main purpose is to increase profit. Mostly outward facing business activities are visible and considered by the management. Internal processes are not well enough measured to raise awareness on a managerial level. This can also be seen by the results of AI definitions from the survey. Many respondents with no technical AI background replied with more philosophical answers like *future*, whilst technicians had a more grounded view, i.e., collection of IF and ELSE statements. Similar traits can be recognised in the interviews, where technical experts talked about the obstacles, such as ethical issues, infrastructure issues, missing expertise, AI as a buzzword, and sustainability issues. In contrast, the management perspective in the interviews clearly showed that the focus lies on money and time, whereas customer and employee satisfaction were hardly mentioned. Nonetheless, all participants saw a high potential of AI in the future after the challenges are overcome. Although, literature shows that AI tools for process improvement exist, the average company has not yet implemented them. This might be seen as a minor inconvenience of this study; participants did not integrate those solutions and were not working with listed methodologies of process improvement given by the literature. However, some of it is already common knowledge, e.g., that a process needs to be documented before it can be improved. Nevertheless, interviews with companies which use such tools might show what KPIs are used to convince the management to invest money in a long-term improvement with no visible short-term outcomes.

5.3 Artificial Intelligence

AI is a fast growing and important field both for academia and practitioners. Due to it being a buzzword, its use-cases seem limitless, e.g., automation, process/product innovation, decision-support, or predictions. This perception was further confirmed both in the survey and in the interviews. It was often labelled as a toolbox that eases the work of the practitioners, or extend their capabilities. Further it was named a tool that can help businesses enhance processes of any kind or even replace human labour.

In academia, AI is understood to be any kind of computing algorithm that mimics human intelligence; however, this definition is broad which is also reflected by its varying understanding in the business world. Especially, within its subfields the distinction between the view on AI from the academic and the business world vary greatly. For example, ML is in some companies used as a term for AI in general or vice versa, which became apparent when examining the survey results. Similarly, the borders between concepts like NN, ML, or NLP are vanishing in the business world. This was one of the main challenges when trying to objectively compare these technologies and their value additions. One of the factors that contributed to this, was the AI buzzword mentality. Some of the interview participants stated that their business clients have trouble identifying where the real opportunities lie, and where its capabilities are limited. This was further emphasised by one practitioner working in digitalisation. He stated that instead of motivating their clients to use modern AI technologies, his company takes more the role of explaining its limitations and dissuading them from using it for any applications where it might not be desirable. In general, it has become clear that due to AI's buzzword nature, companies see AI as a solve-it-all black-box. People with a more technical background were observed to see beyond the hype. They often stated that it is not a magical solve-it-all tool, rather just another algorithm that proves useful in certain use-cases in certain areas; however, definitely not in all. Especially, in some cases it was found that implementing or solving a task manually can be much easier than implementing an AI algorithm.

Nevertheless, the practitioners named several use-cases where AI is in place at the moment and also experimental projects to investigate future applications. One specific example was the monitoring of large amounts of transactions in the banking sector for fraud detection. This implementation of AI reduced the human labour significantly, and was also proven to be less error prone. Another example of AI implementation which reduced human labour and the error rate, was an AI based time and resource management system. Hours of work to dispatch resources and place them in the most efficient way possible, were decreased to just minutes by the AI solution. Other examples, applicable for many companies, were within the area of prediction. First of all, the prediction of employee churn. An example given by one interview participant was the prediction of how likely it is that someone will leave the company based on that employee's data. With this information, the company itself was able to work against it and try to figure out a way to keep this employee satisfied and thereby preventing him from leaving the company. Secondly, the prediction of stock prices was mentioned by the same interview participant. Within the robotic trading sector, the developed bot is able to give highly accurate forecasts of market developments in order to automatically buy or sell the available stocks to increase the user's portfolio value. Moreover, solutions to summarise large amounts of text with the help of NLP were mentioned as well as ML solutions in gaming to play GO and Chess.

Other, more practical examples, such as DM in enterprise cloud architecture solutions, and ML solutions for automatic software release processes were named. Within those solutions the AI brings a meaningful benefit in terms of optimisation and security. Another example where AI was used, mentioned the usage of a third-party risk evaluation tool. In the retail company, this risk evaluation was used to identify trustworthy customers, as well as block out customers which are not, or have a high chance of not being able to pay for the products. In this case, this was an especially important implementation, since the products sold, were codes for payment cards and thereby non-refundable. The participant mentioned several other AI implementations in the marketing area. For example, targeted advertisement and the segmentation of customers in order to save money by not showing ads to already loyal customers, and instead focus on advertising for new customers. Furthermore, they are using Google Analytics and other Google tools with a built-in AI function to analyse large volumes of data. This results in more suitable keywords for advertising, and a more specific audience that are more susceptible to the targeted ads. Data in general was highlighted as the basis of all AI solutions, just as in smart home technologies. One interview participant developed smart home applications for motorhomes and called it *Smart RV*. However, within these use-cases, the AI part was in development at the moment, since the baseline of data and possible solutions were not yet completed. These solutions were set out mostly for error detection, and predictive or preventive maintenance. On the other hand, the experimental projects mentioned, focused on two use-cases. One was the identification of a fridge through image recognition software, in order to give the user the specifications of the device, as well as help him configure the device without directly contacting the company. The other project focused on audio analysis in the area of preventive maintenance. By analysing the sound of an air conditioning unit, specific noise patterns were recognised to detect errors and suggest maintenance.

Even though the concept of modern AI existed since the mid-1950s, its widespread adoption began only recently when the computing resources became available. This was emphasised by some practitioners stating that AI is still in an experimental stage, some even stating that the modules and frameworks commonly available now, are not yet enterprise ready. Furthermore, it was stated in some interviews that in order to see the actual benefits of AI, a manual solution had to be in place first in order to compare its performance against a credible baseline. Another factor hindering its adoption that was mentioned by the practitioners, was that any task that is solvable by few manual workers is not worth automating with the help of AI due to the risk of

hardly traceable errors, or the cost of acquiring skilled expertise. The cost of labour is also one of the main factors that led to companies using only third-party AI tools for specific use-cases. Using a third-party tool enables quick solutions for specific purposes, however, it becomes less useful for many individuals and unique use-cases of companies, due its limited customisability. Another problem of third-party AI tools is that due to the black-box character that AI has, error tracing becomes difficult, and modifications are hardly possible if the company does not have personnel with that expertise.

Another point that many of the participants mentioned, was that their companies are not fit to use AI solutions yet due to several preconditions that are not met yet. In some cases, the needed data to train the models was not available or incomplete. In other cases, the computing resources needed to power complex AI solutions were unavailable. Another practitioner stated that the transmission from the data source to the analytic computing power proved difficult. Additionally, some companies had ethical considerations when it came to automated decision-making that needed to be discussed and resolved before comprehensive solutions could be implemented. In general, the topic of automated decisions poses an ethical problem that is often discussed in academia, as well as in the interviews of this study. One of the major hurdles to implementing complete AI decision solution, is the question of responsibilities. This is especially harmful to AI development since these hurdles must be solved before the system can be implemented, and its value addition can be evaluated. Another ethical perspective that was discussed in the interviews was the replacement of human labour and whether it is always beneficial to strive only for efficiency. One practitioner stated that a balance has to be kept between the societal value of human labour, and long-term efficiency gains.

However, all the practitioners stated that AI has the potential to be a great solution for certain problems once the preconditions are met. The precondition of responsibility and ethical consideration have a huge impact on today's AI implementations. For example, one practitioner mentioned completely self-driving companies or decision making within companies, such as a bar which automatically decides which DJ to hire, or which bartender to employ for a specific evening based on the anticipated crowds. Ethical issue arises when facial recognition by AI come into play, especially in public places this is a highly discussed topic in recent years. Topics where AI can bring a benefit without such barriers, are for example named in the area of supporting humans in their business and private lives. One example mentioned was a student hackathon of counting eggs of animals and other attributes of the flora and fauna to predict population and support the growth of animal and plant population. The student project was limited to the counting by image processing; however, the ideas resulting from this technology seem endless. In terms of Smart RVs, the possibilities of integrating AI will increase the satisfaction of the customer and will result in safer vehicles on the road. Preventive and predictive maintenance through analysis of multiple data sources to be able to draw more insightful conclusions were mentioned. NLP can be used to analyse sounds, and thereby classify a sound as irregular or even harmful. Further, the combination with other data from sensors as well as GPS data can be used to draw a more complete picture of the situation the vehicle is currently in. Moreover, a customer profile will help the vehicle to make predictions of the daily activities of their owners, to automatically start or stop several processes. With such a possibility the user convenience will be highly improved, the electricity consumption can be reduced and thereby sustainability can be ensured. As an example, one can name the pre-heating of water for showering, or the cut-off of unnecessary energy consumers if not used at all. Not only can user profile analysis by AI be implemented in RVs, but also has a lot of use-cases to increase the user's convenience.

Customer segmentation and user convenience were also named in other interviews. In this case it was used for targeted marketing and advertising. Here, the use-case is that already loyal customers should not see specific ads, since the ad will cost the company money, but not generate any value. Implementations like this will save a company a lot of money that they can spend on actual innovation of products and services. Further, as the example of managing time and resources, computing power can be managed automatically as well. Edge computing was given as a keyword where computing power is distributed between several smaller devices via a network. Especially in cars and mobile devices, computing power is still limited, and several AI applications, such as ML, NLP, and their subfields, cannot be run on those devices. Further, audio analysis requires a lot of computing power, therefore Amazon's Alexa only records audio and needs an active internet connection to process the audio elsewhere. The understanding and generation of language does not happen on the device itself. Alexa usually has a stable internet connection, which is mostly not the case for moving vehicles. Edge computing and a more reliable network infrastructure needs to be implemented before several AI use-cases can be explored in mobile devices.

5.4 Process Improvement

Comparable to the AI definition, the term *process* was defined in various ways in the literature review. Due to its generalisable nature, the outcome was the same as with AI; there is no clear definition among the participants both in the survey as well as in the interviews. Again, when there is no clear definition of the term at hand, analysis becomes difficult due to different understandings and perceptions. For some of the interview participants a process was simply a term used to describe a project. Other participants had very high-level definitions like the order-to-cash process. One of the participants mentioned more concrete, detailed processes like receiving and paying invoices. Another often mentioned process was the software development process with an exemplary sub-process of code analysis. Some of the participants even stated that they do not have any processes at all, which really shows that their definition of a process is not simply a set of activities that is necessary to fulfil a business goal, which the literature suggested. In some cases, the understanding was linked to the modelling of processes, meaning if processes were not defined through explicit models, it was understood that they do not exist.

The divergence of literature and business was further amplified when it came to process modelling. None of the participants had complete process models. Some of them stated that they were in the process of modelling some new processes. When asked why they did not model their processes, it was often mentioned that the time and resource constraints did not facilitate to take the time to do so. Another factor mentioned by the participants, that hindered the proper modelling of processes, was the ever-changing nature of business. It was said that their processes change regularly and therefore the effort to model and maintain that model is not worth the value that they would gain from modelling it. This was especially true for one participant who simply said, there is no structure, it comes and goes automatically, and everyone simply knows what to do in a certain situation. On the literature side, authors often state that the process modelling is an essential part of business to get an overview and stay competitive. Modelling language standards are said to be commonly used for improving overall business performance.

As the literature review states, process modelling is first necessary to be able to detect the possibility of improvement and further needed for the optimisation. The authors of this study agree to that, and see the potential of process modelling in the long run of a business. The value gain might not be visible instantly; however, a company will benefit from it gradually. Nonetheless,

to be able to recognise improvements of such projects, valid KPIs need to be implemented beforehand. As the interviews show, many companies focus on profit as a measurement index, rather than other worthwhile attributes, such as customer and employee satisfaction. As stated by only one interviewee, the employee satisfaction increased rapidly by improving just one single process. Moreover, process modelling and building a knowledge management of processes and their interactions, creates a baseline, not only for improving them, but also it creates a documentation that all employees and stakeholders have the same level of awareness. Apart from the know-how, this automatically improves the internal process of employee onboarding within the human resources department. Especially in companies with a high fluctuation of stakeholders, process modelling brings huge benefits in terms of knowledge management and productivity.

When it came to process management, the responsibilities for the processes were mostly just vaguely defined. In some cases, the business units were responsible for their own processes, in other cases no processes were formally defined meaning no responsibilities needed to be taken on a process level. Some participants stated that they worked in an agile way, which meant to them that no further process management was necessary; again, emphasising the divergence in understanding between business and academia. Certainly, agile work methods suggest certain workflows; however, they do not dictate content-based processes. Further, it was acknowledged in the interviews that making the teams responsible for their own processes led to silo thinking and less communication about process advances between departments. In the literature it was not definitely specified whether one or several process managers are needed, because this depends on the size and organisation of the company. However, it was often stated that there should be a process manager and that communication between departments is essential to properly execute high-level processes, due to the fact that these often cross departmental lines.

In summary, the vague understanding of processes led to companies not seeing the value of modelling and therefore little or no process management was the result. The company size did not affect this, small companies with only three employees stated that they are too small to formally model processes, on the other hand the biggest company had more than 20.000 employees and said that their processes are too complicated to model. This would suggest that process modelling is only necessary for medium sized companies; however, the other three companies that were supposedly in the right size did either no or only little modelling and management on a process level.

The literature suggested that process improvement is an ongoing task. This was not the case in the interviewed companies. Only one participant stated that they aim to continuously improve their processes due to customer feedback; however, this simply means that they continuously receive feedback and improve their processes on the basis of that feedback. Within the results the customer was one of the main identified triggers for process improvement initiatives. The others were: organisational benefits, external changes, and projects to accomplish a bigger goal. It was found that customer opinions or benefits were a reason for change for all of the interviewed companies. These triggers are closely related with the expected benefits of the triggered process improvement initiatives, e.g., if a project is conducted due to a customer complaint, customer satisfaction is often the main benefit of the process improvement. It was stated by one of the participants that projects in this matter were only being conducted if there is a long-term value contribution to be expected. This statement was contradictory in the sense that most of the process improvement projects, were small adjustments that are within the regular budget. Additionally, no resources were dispatched for process modelling or similar long-term planning actions that promise long-term value additions.

In general, the value that the companies gained from the process improvement was mostly measured in money or time. Both are relevant and appropriate goals since a business is after all a profit driven endeavour. These kinds of values are measurable in accordance with the Economic Theory-based approach. However, the participants did not say whether they conducted preliminary value addition estimates, based on economic indicators. Also, more indirect approaches to business value were taken by some of the interviewed companies. The organisational value which focused on employee satisfaction, did resonate with the Social Psychology approach of perceived usefulness and perceived ease of use. The main goal of the process improvement was to improve the organisation of new products, and give the employees a more predictable workload. One of the participants mentioned that they have to adapt to an ever-changing market environment in order to stay competitive, which is reflected in the literature by the Competitive Analysis approach. The last trigger for process improvement projects were challenges as part of a bigger goal as stated in the result section. Solving certain problems often enabled the companies to discover new opportunities or improve the way some processes were conducted. The motivation behind this could be overall technological advancement or the specific technical solution in order to enable more sophisticated implementations, in a broader use-case. The value gained from these types of process improvement projects are in line with the Strategic Alignment approach, meaning that gaining IT competencies related to business goals is a necessary alignment goal in order to facilitate business improvement and growth.

5.5 Artificial Intelligence in Process Improvements

Whereas the previous chapters discussed the results on the two topics AI and process improvement independently, this chapter aims at connecting the gathered results in order to answer the research question which will be done by answering the two sub-questions.

As mentioned in the literature, the task of process improvement can be broken down into the five phases of *define, measure, analyse, improve, and control*. Methods like PM go along these phases, and dependent on the extent of the system, automate the phases. The software measures timeframes and process-sequences by utilising data logs about the process flows in a company. These data will then be automatically analysed in order to identify bottle necks or unnecessary activities in the process flow, to give suggestions or pointers to areas where improvement can bring the most value or even suggest changes.

None of the interviewed companies were using any software that went into this direction. This was mainly due to the reason that the processes in the interviewed companies were not understood or modelled in the way the literature suggests it, which is a necessary precondition for these types of automated systems. Without proper process models and the necessary process data collection, these tools are not usable. The major reasons why this has not happened so far, was often the budget and the lack of quick and clearly visible value. In this regard, the research question can only be answered negatively, the companies do not use AI in the process improvement on this level. Additional to its technological feasibility, the companies were also worried about the ethical implications that would be involved by any AI that is involved in decision-making processes.

Nonetheless, the participants talked about both third-party and self-developed AI tools like the automated risk check, Google Analytics, the AI-driven time and resource management system, or the automated stock trading algorithm. These tools did, in their respected area, improve a certain process activity with the help of AI that was previously done manually. In this sense,

the companies did profit from the AI implementation and the process improvement lead to an increase in business value. Naturally, the value differed depending on the use-case, but the participants emphasised mainly time and resource savings or customer satisfaction which all indirectly lead to profit increases.

The main research question was stated with the following two sub-questions and will therefore be answered by answering its sub-questions:

(1.1) *To what extent can AI be used for process improvement?*

(1.2) *How can that specific AI solution generate business value?*

In regard to (1.1) it can be said that in the interviewed companies fully automated process improvement is not yet feasible due to the fact that the preconditions are not met. However, AI tools were used to enhance or replace human labour in certain process activities meaning that there is a limited extent in which AI can be used for process improvement in general.

Within the second question (1.2) the *specified AI solution* is therefore referring to the AI tools used to enhance process activities, and not fully automated process improvement. These solutions generated business value depending on their use-case, as was stated extensively in the two previous chapters. Most participants mentioned money and time as the goal, which are both in line with the overall profit-driven business goal. In this regard, the question does not have only one specific answer, but instead depending on the technology and use-case it generated different types of business value for the company, e.g., resource savings, time savings, customer or employee satisfaction, or an improved value proposition.

With this in mind, the main question can be answered:

(1) *To what extent can AI be used for process improvement to generate business value at the current time in European companies?*

AI can theoretically be used for fully automated process improvement at the current time, but judging from the interviewed sample, the average European company is currently not technically able to utilise these technologies, since the necessary preconditions are not met. Besides the fully automated process improvement, this report showed that there are other use-cases of AI that improve processes through improved process activities. Further, these improvements are able to successfully generate business value in regard to their use-case and goal.

6 Conclusion

This Master's thesis set out to research whether the technological advancements of today had reached a point to where companies have or could adopt intelligent AI driven systems to use for IBP optimisation. The authors research question: "*To what extent can AI be used for process improvement to generate business value at the current time in European companies?*" envisioned systems capable of suggesting and implementing decisions. Throughout the literature review, several fields of AI were accounted for, as well as literary definitions of process optimisation and business value to support the thesis with a proper theoretical background.

Furthermore, the report was built upon a mixed-methods approach, utilising both quantitative and qualitative data collection methods. Initially, a survey was conducted, to analyse the market trend and usage areas for AI in technological companies. The survey resulted in a list, ranking the different predefined processes that AI enabled systems could supplement. The results were then studied to match with an existing research gap, resulting in the primary selection of *Process Improvement*. The qualitative data collection was then built upon the research gap, to understand further to which extent AI could be used in process improvement.

The literature used in this thesis indicated that AI systems used for process improvement are viable and possible; however, it requires the company in question to fully understand all different factors required to enable such a system. When viewing the results from the qualitative data collection, it is indicated that despite the technological advancements that has led to AI enabled system, company's digitalisation has yet to reach sufficient maturity require to enable systems of this kind. Even though all the respondents had a positive attitude toward AI enabled process improvement systems, neither of the participants has had any contact with a fully automated system, nor with anyone that has managed to properly implement it. However, they are using AI tools to replace or improve certain process activities or business activities with the result of generating business value.

Comparing the literature background where frameworks such as the *Vicious Circle* discuss the main obstacles in AI system implementation, with the results of this report, it can be seen that the technology is possible. However, being possible and being viable are different things. Currently, the lack of understanding for existing processes and possible AI applications within those, as well as lacking managerial support for system implementation following the obscure resource requirements, hinder this technology of being enabled.

6.1 Knowledge Contribution

Despite the fact that this thesis has reached results that are far from those anticipated, creating a better understand to why the technology that was set out to research is not feasible just yet, is an important insight. Together with several authors from the literature review chapter, this thesis has further proven that AI enabled systems are still in their adolescence years. Further, this thesis has proven that AI driven systems can prove valuable and increase revenue for companies significantly, if they are implemented in viable use-cases. Once AI enabled systems are to be implemented in more general tasks, as the literature together with the results of this study suggest; the resources required to ensure a proper implementation go beyond the digital capabilities of today's organisations.

6.2 Further Research

To further develop the scope of this thesis, we would see it beneficial to find various companies or organisation in different sizes, that are currently using AI enabled process improvement systems, if such exist. Proceeding, interviewing these companies and their system owners can be beneficial, in order to gain an understanding of how these systems were developed, what data they use, and how they are used in business context.

Appendix A

Interview 1

Interviewer, I1: Ludvig

Participant: P1

Date: 22 April 2021

Line	Speaker	Statement	Code
1	I1	Alright, there we go. So the recording has started and let's start off with the question regarding have you read through the privacy consent form? Uh, the document I sent to you in the email?	
2	P1	I have.	
3	I1	Super, and you confirm that you are fine with the terms and understand the contents of their form.	
4	P1	I do and I confirm.	
5	I1	Super. Alright, so, uhm, starting off. We'll go through a quick introduction of about 5 minutes, uhm, and I can start off by thanking you for the participation first of all. it will turn out very beneficial for the report, all aspects of the applications of AI in business consideration is information we really need and we'll be able to use no matter what the information is.	
6	I1	Uhm starting off. What company do you work for? Or rather, what does the company you work for do?	
7	P1	Yeah, so I work at a large, uh Nordic bank. It's the second biggest largest bank in in the Nordic countries. Uhm, [REDACTED], and I work in Denmark. And of course everyone knows what a what a large bank does, so we have everything from, natural persons and business customers and large corporations and institutions as customers. And I, you ask what I do?	BG
8	I1	Yeah, and then of course, what is your role in the company?	
9	P1	Yeah, so my title is senior business and functional specialist and it's a long ass title, and probably have read Mats Alvesson on the Lund University about triumph of	BG

BG: Background • AI-D: AI Definition • AI-T-X: AI of type X •
 PI-C/P/F: Process Improvement current/past/future • PI-w/t-AI: Process Improvement with/through AI •
 O-I-AI: Other implementation of AI • EP: Ethical perspective

		emptiness and stupidity paradox, and I can actually agree with him that titles has lost its meaning, so uhm.	
10	P1	When I say that most people don't really understand what I do, but it's basically a business analyst role that I have. And I work with internal, uh, business development?	BG
11	P1	Uh, so I work in a tribe in the AML revenue Tribe. So I work with anti-money-laundering and I help develop software for our employees. To be able to detect and prevent money laundering, tax evasion, and uh, uh terror financing.	BG
12	I1	How long have you been working on this position or?	
13	P1	Uh, in this bank, and in this field I've been working for about three years, right.	BG
14	I1	Have you had any like other similar positions before you started working on this one, or is it?	BG
15	P1	No, that was when I started working, it was the first time I started working with AML and also at the bank.	BG
16	I1	Alright, when you say AML, what does that abbreviation stand for?	
17	P1	That stands for Anti-Money-Laundering	BG
18	I1	Ok, and when seeing as you develop software for the detection of AML for the internal users. How would you say, or would you say that the softwares are somewhat dependent on artificial intelligence or machine learning? Or what would you say is the connections to those topics?	
19	P1	Yes, yes, uh, they are, and uh, of course AI has not been incorporated for many years, but it started to come and it's definitely the future and it's completely going to take over in the future. For every month we, uh, we replace a machine, we replace humans with machines, basically in this tedious work of the detecting money laundering. So, uh, we use it, it's a key component in this, and even though it's a pretty new component, if you look at the bank's history, then it's definitely gonna revolutionise, quickly the way we work.	
20	I1	but when we're speaking about the, UM, the replacement of human and the use of AI, what kind of or what type of AI are we referring to? Is it machine learning that's implemented, or is it more like? Uh, it could be natural	

BG: Background • AI-D: AI Definition • AI-T-X: AI of type X •
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O-I-AI: Other implementation of AI • EP: Ethical perspective

		language processing, uh? What's the baseline of the foundation in this? In this sector?	
21	P1	Yeah, so uhm, it could be everything from instead of having, uh, employees going through all of our customers and going through all of their transactions, transaction by transaction. Maybe they sort them in an Excel file or something like that instead of doing all of that work manually. We have transaction analysis modules that have AI integrated in them. In one way, uh, machine learning is, you know, pretty new in this, so it's not like that has been around for 10 years, but that has at least started where we can detect deviations in behaviors and, detect these types of transactions much quicker. So it's, I guess it's a mix of machine learning, but then also you know digitalising processes.	AT-T-ML
22	I1	Alright, uhm, and if you would review the way you develop or kind of UM, improve these processes by implementing new types of software or new modules. How does the bank work with that currently? Is it a manual process where you review the efficiency in transaction review system? Or is it something you go through once a year perhaps? Uh, say this could be, made more efficient?	PI-C
23	P1	Can you specify a little bit?	
24	I1	I think the core question is rather how, do you improve those systems? When you say you exchange and human employees for uhm for machine code instead, or a smart modules and digitalized systems. How do you come to the conclusion that this section, let's say this employee X would be better off replaced with a computer? The, uhm, thought process behind it.	PI-C
25	P1	Yeah, so, we work in this, agile way, if you're familiar with that. So we have a tribe, for instance, I work in the AML tribe. And then in the AML tribe we have different domains, so we have one domain for automation, for instance, and we have one domain from maybe a manual case handling, and like we have one domain for, uh, data enrichment and things like that. And within those domains we have specialized squads, so maybe we have one squad that is specialized in transaction monitoring, and only works with developing that, so that's their full time job, and so it can be 15 people that consists of developers, business analysts, product owners, yeah, and their job is to constantly improve that field.	PI-C

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26	P1	And then of course we then have initiatives that are handed out from the AML tribe leader, so that the tribe leader decides what should we prioritize for the next coming year. And that initiative is broken down in epochs, and then in in in in user stories.	PI-C
27	P1	So the initiative is like a one year goal, and that is broken down into epochs that are maybe a couple of months and then we have user stories that we work on for two weeks.	PI-C
28	P1	So since we're so specialized, then everything is constantly improved and of course we take feedback from our end users as well, and look "ok, uh, what do they want? How can we support them the best if they feel like?" Well, we spend a tremendous amount of time of sending letters to our customers.	PI-C
29	P1	Could you maybe digitalise this process because It's a manual tedious task that can be done by anyone. And we have brilliant minds here that can analyze deviant, deviant behavior, but they're spending time on sending letters instead, so could you help us with that?	
30	P1	And then of course there we also have these like integrated time tracking tools. What the case handlers, like they're called, the ones that are investigating our customers.	
31	P1	They are time tracking their different process steps so we can see where they spend more time and then try to figure out. OK, could we either change the process like how they are actually working without even changing, like without even developing anything new, like just change the way that they are working, uh? Or can we build something that can replace this task that's now being done manually. Or can we do both?	PI-C
32	P1	Right and the big trend I would say is automation, that instead of reviewing every customer manually based on a time span for instance, like some customers are reviewed more often, some customers are reviewed less, but that instead of saying OK, now it was X amount of time that we, uh, reviewed this customer. Now let's do it again and go through every single transaction, every single product that the customer opened and things like that. Then, can we do it in a smart way? And, the main, uh, trend is that yes we can, and let's do it by automation. And when we do it by automation we of course need to incorporate AI.	PI-C PI-F

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33	I1	So it's more or less, uhm, feedback from both the internal professional experience and the end users feedback that triggers these events for a possible optimization internally. If I understand it correctly.	
34	I1	If you envision some AI or smart process taking over or adapting to this process, let's say a system that can automatically handle these feedbacks, or the internal, key points or key value data points and automatically present to you a solution. That says OK, here we have someone working with timestamps, for example, or reviewing the customers transactions manually. The system then presents to you a possibility that, OK, this process could be replaced with, let's say a part or module with machine learning algorithms, or, this uh obstacle could be moved to this employees work tasks instead, because it's not enough to actually have a full time employee to handle these kind of things.	
35	I1	Would you think that is a possible scenario in the future where we have those kind of systems that actually decide for us, they take in input data, let's say customer reviews analyze the review and then present it as a suggestion to the company internally, or to the development team. How likely would you see it out is something that might show up in the future?	
36	P1	Yeah, I wouldn't say that It's 99% sure, I would say that it's 100% sure, because I'm convinced that this will happen sometime in the future. It's just a question of when. And uh, humans have constantly, uh, underestimated how fast things are moving in IT, and I think that we might also underestimate how quickly this can also happen. And you can take it on an even broader level or higher level and uh I I can't see, uh, any job that can't be replaced by machine in the future. If we talk about a, you know, a couple of 100 years, uh, forward, and then of course then what you're saying here is that, well, maybe we will have machines that can, uh, give suggestions on how systems can be improved, which is basically my job, right? I'm definitely going to be replaced by a machine sooner or later, but I will not be replaced as quickly as maybe people that do manual work, because right now I am that engine that that decides how things can be improved, and then I solve those things with machines, right? Then it's just a question of when can I be replaced by a machine?	PI-F
37	P1	Uh, and that will also happen sooner or later, but I think that that is probably, not very near in the future, but	PI-F

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		definitely I think they can make suggestions and so, but in the beginning, you will question the quality.	
38	P1	Because it requires that they're coded, uh, with a great sense of logic, right? You have to be super dependent on the developers who make the code on this machine learning, because you can teach a machine to, uh, identify, uh, let's say a birds. Pictures of a bird, so you show the machine pictures of different animals and you learn the machine that this is a bird, this is not a bird. And then in the end you can show them a picture and ask them, "Is it a bird or not?". So yeah, and even sometimes when, when you teach the machine that this is a bird, they will say that a dinosaur is a bird, uh, but for a human we could, we can definitely see, well this is a Dinosaur and it's not a bird, they are extinct and we know that, but the machine can't tell.	PI-F AI-T-MI
39	P1	So that is going to happen very much in the future, that we will, it will get it right, very much of the time. And sometimes it will get it completely wrong. Where human would definitely not make that mistake. But if you look at it on the, broader terms, then you see that even though it might make some crucial mistakes sometimes, it's gonna give so much benefit anyways that it's totally worth to just go for it.	PI-F AI-T-ML
40	I1	Right. Yeah, I think you're right with the, uhm, the underlying logic that you and me as human being can determine, let's say the Dinosaur as an example. That builds a lot around the point of reference. We know that the dinosaurs are extinct, that is information that is available to us.	
41	I1	Just as you mentioned it, uh, maybe because we have it from other sources from other time perspective, we can factor in things that the machine can't handle, and that is kind of the obstacle we're trying to understand. What kind of factors would be required to actually take these, uh, well grounded decisions before making them, or not taking a decision at all, and rather just presenting the idea to change something.	
42	P1	I think, if we if we just give the machine sometime, they will also eventually learn right? Because if we're going to input things into machines and they're gonna make it right most of the time, sometimes they're going to make it tremendously wrong, then we can actually say well this was wrong due to this. Remember this now, so don't do the same mistake again. And they will never make the same	

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		mistake again. So that can happen, but uhm, it depends on how much you're willing to risk.	
43	P1	Uhm, take a self driving cars for an example. Even now, Teslas self driving cars driving much more safely than any average driver, but If a Tesla would, uh, would think that an, I don't know a cone in this in the road it's it's a child and and then, uh, drives off the road or something, and the driver is killed. Then you would stop having, like self driving cars, like maybe then Tesla would be forbidden to have these self driving cars. Just, because it makes this one mistake. Because we're not willing to risk lives, and when we're letting the control over to machines.	AI-T-N
44	P1	And then we're thinking, yeah, but OK, we lost one or two lives, even if we would have let the people drive themselves, more would have died, but that's not how the human psychology works.	AI-T-N
45	P1	We would we cannot risk people lives. So I think that's an obstacle that humans will not be able to think that rationally, in these cases where the machine fucks up. And that will be an obstacle for this, but I, but definitely, it's going to happen sooner or later. But it will, make the process a little bit slower than it could have been. And maybe it's right as well, maybe we don't want to risk lives by machines, uh?	
46	I1	No, I think you have a fair point that we see the weaknesses of the machine before the benefits. No matter how they contrast this, we gain 99%. But the 1% is dangerous. We still get stuck on the 1%. But when it comes to like these process development or process improvements, I think even though the machine can make a lot of errors. Hypothetically, we have a system that evaluates the customer, reports the feedback from the customers and the internal efficiency. If we manage to find a way to measure that.	
47	I1	Because of course building something in machine code requires you to having data in a form that the machine can interpret. So we need to measure all the internal processes or the internal machines in input and outcome. Possibly where we need to see a gain or a loss before the machine could actually take a stance to how this could possibly be improved.	
48	I1	But just as you say as the position you have now, I think the machine code or the modules that we wish to develop and replace, personnel wise, needs to have a human	EP

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		touch in the end so the machine rather than uh, analyzing the need, creating an idea, and then implementing the idea itself. We need to have humans somewhere that can, take the actual decision and say well this decision is completely bananas. This would never work even though the machine thinks this is a super idea and this could revolutionize the way we work. Just as the Dinosaur on the birds.	
49	P1	That's probably what's going to happen, like in in the beginning, right? That machines will be able to make this brilliant analysis, uhm, instead of a what I have been doing right, and they're going to suggest things, and then it will be up to a person to make a decision. OK, should we go for this or not?	PI-F PI-w-AI EP
50	P1	Just as you say, that's probably going to be the standard for many, many years. Otherwise you will have machines that run companies completely right. And the sooner later is probably going to happen. But, uh, that's almost like a philosophical question, right? But one thing that I think is a, if you think about the business development process, let's say transaction monitoring. When we screen customers transactions. Let's say that there's a scandal and, uh, a case handler, a human and human employee missed some transactions, and we let them through. Then it's somehow uncovered and we receive a big fine, and the stock goes down heavily.	PI-F PI-w-AI EP
51	P1	It's pretty easy to then put the blame on either that individual, saying that will this this individual did human error and that person is no longer working for us. Or you can say, well, the process that this human, this employee has had, has some holes, and we're working how to make it better. And the person who has been in charge for this process is now fired right?	EP
52	P1	Or the CEO that is in in the end, you know responsible completely. Uh has taken, has made cost cuts in this sector so we can get rid of that person. That's, you know, an easy way of solving that problem. But if we hand over transaction monitoring completely to a machine, right?	EP
53	P1	And we miss one transaction also, and it gets uncovered, then, uh, if we put the blame on the software. Then they're going to say, well, that means that that a software can make the same mistake again, or it will make the same mistake again, because if it let this transaction through, it will let next one also through, unless you don't have, you know, machine learning that will now relearn that	

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		machine, with that behavior. So you could criticize the whole system, and that whole system is so much bigger than, you know just one person who did a stupid mistake.	
54	P1	Uh, so then if you uncover a fault made by the system, it's a much bigger problem than if you uncover a fault that's made by one individual or one business process that needed to be changed a little bit, right? So that's also an obstacle, I think.	
55	I1	But that is also very, kind of a cruel way to act. Because the human factor is responsible for a lot of errors, both when it comes to traffic when it comes to work, and everything can happen just in the same way as you mentioned before, that the machine is just a machine,	
56	I1	It's of course it's not perfect from the start. You have to refine it. You have to polish it. Fit it in your data, feed it more data, and if we compare that to a dumb system without any machine learning or AI capabilities.	
57	I1	Of course, seeing a flaw that is created by system, puts the responsibility of those who either use or have created their system. But should we have a smart intelligence system that can see, can use its weak points to improve itself. For example, machine learning code where you see OK this transaction slip through. Uhm, wouldn't you say that it is less of a harm for the company in the end because they can take the blame and say yes this transaction was approved even though it shouldn't have been. However, the system that is handling the transaction reviewing, has been, recoded and adapted to not miss these kinds of transactions again. So then you have put the blame on the system, yet you've taken the blame and you said we are improving, we have fixed the system rather than an employee losing their job over one missed transaction.	
58	P1	Yeah definitely, but that would require that, uh, humans and the stock market and the media is completely rational. And they're not. They're emotional, because they're humans, right? So you will, you will try to find you know who is the bad guy in this. Uhm and, it's an easy way to solve the problem right? For the company, because you can just get rid of one person. We put all of the blame to that and then we can move on. But there is one key difference here and that is that if you have let's say 5000 case handlers, and it's only one of them, who is you know, who has faulty behavior? Then you could say,	EP

		well we have 4999 case handlers that are doing tremendously well. We had one that made a mistake.	
59	P1	And then if you get rid of that person, then you think that, well, the problem is solved. When you replace 5000 case handlers with one system. Then that fault, you can compare it with like saying that all the 5000 case handlers have the same issue. It's just that it was only it only happened once, but all of them. All 5000 would have made the exact same mistake, because that's what's coded into their spine, right? So that's the key difference that, the whole system would make the exact same error always, unless it would have been uncovered. Uhm, even though, the quality has risen tremendously with the system, replacing all of those manual case handlers.	EP
60	P1	People don't care about that because if something, uh breaks, they think emotionally and uh, and they can't, just like the example with the Tesla that will kill its driver because it made one mistake. Well then you criticize all Teslas right? No Tesla is safe if it killed one driver you think, even though yeah, but on average, it's much safer than a human driving the car, but that's not how we think, or most people think, and how media report it.	EP AI-T-N
61	P1	And then we have another problem and that is, uhm, coding in ethics and morale into machines. It's much easier to take the car as an example, but let's say that you have, the driver in a Tesla, and then you have a child running out in in the road. The child made the mistake right? It shouldn't be on the road and it just, uh, it just ran out. Then the Tesla needs to make a moral decision. We need to code in a moral decision; should Tesla take into account that this is a child and if I if I now, uh, if I want to save my driver, I need to run over this child and the likelihood of killing the child is 99.9%. Or should I drive off the road and I will risk my drivers life? So we need to code in these kind of things. And uh, here it gets a little bit tricky.	EP AI-T-N
62	I1	No, I get it. When it comes to those kind of decisions, where you have to put a value on a human life, I think that will step beyond the border. I don't think we as emotional beings are willing to take those decisions in the end because that has, yeah.	
63	P1	But this is a maybe an interesting side track, but it's not really in your scope, right? Because you're discussing internal business, but still maybe in in business development, maybe ethics also needs to be included sometime	EP AI-T-N

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		because, uh, maybe a machine cannot take into account that well, we should definitely go for this strategy, but that will mean that 5000 people will lose their jobs, and it will send a very bad signal to the hometown of this company where the factories are. And I will create a bad company image. I think it will be hard to code that into a machine, like what will be the negative media like the negative brand, uh, impact on things like that? Or, ok we actually can choose another option, that is maybe only like 3% less good, but it doesn't, uh hurt anyone, you know what I mean?	
64	I1	Because that was kind of where a where I was trying to take this, because the ethical considerations of the machine is impossible to calculate. The outcome is you can't really put a value on a human life, the machine can't understand that, ok, if we choose to improve the process, it will mean that 5000 people lose their job for a percentage gain in efficiency of let's say 3 or 4%. Then it would be difficult to code a machine or an improving process to understand, ok, what is more important, those 5000 jobs, or that the that 3% gain in efficiency and the outcome of a negative media image for the company.	EP AI-T-N
65	P1	And also then maybe suggest, I mean it would have been nice then, if the machine would suggest well these 5000 people will be useless, but these are their strengths. So I suggest that we should use them for this instead. I mean then it could work and in the end the machines are going to take these decisions, I'm sure. But how far in the future? But uhm, in the beginning no, Uh, and I think you have a point there, that the decision making, maybe they will not take, uhm, they will suggest different options, and then a human in the end will take the decisions for a start at least, just like transaction monitoring that the machine will scan all transactions and then they will suggest; well this seems a little bit off, look into this. And then a human will look into it, then and make the final call. And then if the machine gets so advanced in the future that maybe we don't even have to have someone look into it. We can use what the machine suggests; well, this person should not be a customer of the bank anymore. And then the customers automatically off boarded, they get a letter saying; “well, we're sorry to say but we have detected some things that that we feel does not belong in our bank, and you're no longer a customer to us. And then they could appeal or something.	EP AI-T-N

66	P1	Uh, maybe that could happen in the future, but, uh, in you know the next 10 years.	PI-F
67	I1	Yeah, no, no, I think that that is right, that the possibility for those systems to actually take decisions themselves is highly probable. Uhm, but then on the other hand, these systems needs to be quite reliable in order for us human to start trusting the systems. Yeah, and we can't get to that point without trial and error, and feeding the system what's wrong and what's right?	PI-F
68	P1	So we probably have a handheld process, even though we could have let go the control to the machine, we will have a handheld process with the machine just to double check that the machine makes correct decisions, so I think that's how it's gonna turn out.	PI-F
69	I1	Yeah, I think it comes down to ethics, no matter how or what kind of decision it comes to, because let's say your example with the machine taking a decision itself and terminating the customer as a customer, saying we've detected suspicious activity. Uh, you can appeal, but you have been withdrawn for now, uhm?	PI-F EP
70	I1	That is a heavy ethical dilemma as well, because should the machine have made a mistake that freezes, of course, now I don't exactly know how it works in the banking world, but theoretically if it freezes the persons money and account, that could lead to economical situations for the customer itself, endangering some of the real life activities of that customer. Uh, but just as you do for the moment with the transactions that the system presents to you the suspicious activity, and then a physical employee has to review the transactions.	PI-F EP
71	I1	That is, maybe something that would be used most of the time if such systems could come into place in the future. Where we have a codependent process where the machine is dependent of the human decision and the human decision is dependent on the machines suggestions, so to say.	
72	P1	And just like you give a your dog a treat when it has done something good, you will also confirm to the machine that, well spotted, this was actually true and you'll make the machine even stronger.	AI-T-N
73	I1	Exactly, so if we go to the outcome of the AI usage in your company, given the things we've spoken about where the transaction management, uh, review system is	

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		run by smart modules. How would you say the, uh, the increment of generated value has changed over the time you have been working for the company, by replacing human labor with machine modules?	
74	I1	Yeah, so it has increased in a way that I think, uh, nobody could, uh even imagine, maybe it's not the that we have replaced people, of course we have let go some people but not in connection to my tribe, or you know my area? Uhm, it's more like the bank has let go of people, more, you know, at physical branches where you go in and you know you meet your financial advisor and things like that. People don't do that anymore regardless so. So we haven't really let go of people in our area due to it, but instead we have avoided employing more people, so instead, let's say that we would spend. Uh, we would spend like an hour on a certain type of customers, and we would have to review 2,000,000 of those customers. Uh, you know that's 2,000,000 hours man hours, that we need to hire people to do. But instead we developed a system for that type of customers, and we processed those customers and in a couple of weeks instead, without, uh, much human involvement at all.	
75	P1	So you can imagine if we didn't have to pay for 2,000,000 man hours, how big of a cost saving that is.	
76	I1	So it's about both the time resources and the economical gain, in your case. It's an interesting aspect, putting the labor into man hours, it gives a quite good picture of how much a smart module can actually improve the process that is, well, a manual labor type of process.	
77	P1	And I mean also, what I work with, a business development internally in the bank, and I get a salary right. And that salary must be a positive affair for the bank, otherwise they wouldn't hire me. So it means that my salary, it's expected that what I work with will benefit the bank more than they pay for, right? Otherwise it's a loss for the bank to hire me. And if we are, you know, a couple of 100 people that work with this. Then you can, uh, imagine that we are contributing a lot to these efficiency gains, because we don't even, you know, It's not like it's a zero sum game. Ok it's a little bit plus, we give a lot of plus to the bank but still it's nothing that will increase the income for the bank, but it will decrease the costs.	
78	I1	Yeah, yeah exactly, and that if you compare it with that to let's say they pay you 100% of your salary and you generate, let's say 170% or 200% revenue for the bank	

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		compared to, the cost of having an employee and then seeing how, 100% is those 2,000,000 work hours. When the system gets that done in a week? That is a large percentage gain compared to the cost of implementing this system maybe?	
79	P1	Yeah, so in a in my yearly review we went through, you know, some of the things that I contributed to and like, we estimated that some of the things that was completely initiated by me, helped the bank save around 5-6 million DKK and that is of course much more than I have in salary. So it's, uh, it's tremendous amounts of money that we save, thanks to developing our business processes with new software? But it's also money that definitely should have been saved a long time ago. It doesn't take long if you just go into any office, and most people don't even know Excel well, right? So they can spend hours on you know, sorting things in Excel documents. When they could have done it with one click. And those efficiency gains are now happening, right? We're taking the fruit from that, and I think that is why also, the most valued stocks today are connected with a tech right, that has completely taken over the stock market and if you look at valuation, you would say that all the valuation on tech is extreme, but look what they're leading to. They're increasing efficiency everywhere, and that also leads to ethical dilemmas as we talked about before, where all of a sudden we have lots of people that are in their 50s, that still have 15 years left to work in their career, but they're not needed anymore because they have been sorting papers, they've been carrying papers from one side of the building to another, not maybe actually but you know, tasks like that, and all of a sudden they're not useful, they're very hard to train to do something else, and they're too old to maybe go to school and then re-learn, uh, so that's a dilemma.	EP O-I-AI
80	I1	Yeah, so most of it boils down to the ethical dilemmas.	EP
81	P1	Yeah, but I don't think it's gonna, maybe it's gonna prolong it a little bit, but it's still gonna happen. So it's going to be a tremendous crisis for a lot of people and it's going to start from the oldest and then go down and down and in the end. It might be that so many jobs disappear, that we'll have to consider having a uh, like citizen salary. Just because you're citizen, you get a salary without any work. And I think even Elon Musk, uh, suggested that that's probably the most likely scenario, that you will get paid for being a citizen and not for the work that we're doing.	EP

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82	I1	Yeah, I was going to jump forward to asking how you would envision the future and regarding this, but I think we've covered that quite a while, but yeah, but it's likely that, AI will, or rather it's highly probable that AI will replace a lot of both manual labor as well as intelligent labor in the future. And the kind of interesting topic is how we get there, starting from like now, changing and replacing manual laborers with intelligent algorithms. Uhm to possibly taking intelligent decisions in the future, and then in the far future, maybe even ethical decisions. But seeing how the technology is today, It's probably a long way in the future, but on the other hand, just as you mentioned, we always underestimate the speed of development when it comes to technology. So who knows, maybe it's closer in the future then we anticipate.	
83	P1	Yeah, and also the consequences of that we have, you know we have talked about it, when you think about like economical theories, then you probably have read about the Heckscher Ohlin theory, uh, which is like two Swedish economists that were awarded the Nobel Prize, uhm?	
84	P1	That you should focus on your comparative advantages and everyone should do that, and then you should have free trade. I think that the distribution of wealth will be more equal across countries, so these developing countries they will catch up because now it doesn't matter, we have seen this with Corona as well, It doesn't matter where you sit in the world, my squad it consists of a Swedes, it consists of Danes, It consists of Indians, It consists of Polish people. So it doesn't matter where you sit in the world, and the bank doesn't really care, right?	
85	P1	If a developer can do the job from India, then why not? So I think that's developing countries will have a chance to actually, uh, gain a lot from this, because their labor will be cheap, so then they can be specialized in things that has a future right now, of course, if labor is cheap, they're not going to specialize in something that has no, uh, no future, right?	
86	P1	So they're going to specialize in jobs that has a future, and then also on top of that, the labor will be cheap. So then that's a gold mine, right? If you if you compare it to someone who's born in Sweden today, compared to someone who's born in Nigeria today, maybe they will both take the same like route? They will focus on a job that has a future, but the Nigerian person will be so much less expensive and they can work from there as well, right? So why shouldn't the company choose the Nigerian instead	

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		of a Swede, who wants like five times as much in salary? So I think the distribution of wealth will catapult by this.	
87	I1	Yeah, you're probably right, this last year has showed us the possibilities of digitalization and how the geological location is more or less irrelevant, uh, proceeding into the future with smart systems and digitalization. But it will be interesting to see how that developed, both for the companies themselves, as well as the World Economic picture.	
88	I1	But yeah, I think you're heads on when it comes to how the balance of the economy will even out eventually.	
89	P1	Unless you know this creates these imbalances that are so big that countries who are rich will be greedy and they will not be able to let countries that are not so developed take part of that wealth, and it would lead to wars because, of course in in in the Western world now we have been fortunate to not have so many wars for a pretty long time, but that's no guarantee that there will not be any wars in the future. If you look historically, there has always been wars, and so who knows what will happen? Let's hope for the best, maybe we'll just leave the planet instead.	
90	I1	We have a tendency to not learn by our mistakes. I think that's why we're so harsh when judging the machines, we don't want to accept them having mistakes as well.	
91	P1	And, uhm, just a final note on that, I think that, uhm, people who will not be able to adapt to this technology, they will be the most dangerous group of people in the world, because they will lose their jobs and they have no future. So they are going to be a problem. If you don't handle that well, that could definitely become you know, lead to internal conflicts in countries and even worse. War against machines, a dystopia haha.	
92	I1	You are probably, you're right when it comes to that as well, I mean. The thing that scares us the most is not having a future, and if technology is something we don't understand and it's at the same time, what is taking our future away from us, uhm, that will become big risk. So I think we have to adapt to finding alternate solutions for other people who need to have something to do, and if it's in form of a citizen payroll or an alternative job, that depends on the situation.	

93	I1	But I think we need to present a solution aswell, we can't just take away the possibilities without having some kind of replacement, when it comes to humans at least.	
94	P1	Yeah, you're right.	
95	I1	All right, I think we've gone through all of the questions, and covered most of it. It's been a great interview.	
96	I1	Uhm, I will go ahead and stop the recording and then we can, finalize and chit-chat.	
97	P1	Sounds good.	

Interview 2

Interviewer, I1: Ludvig

Participant: P2

Date: 23 April 2021

Line	Speaker	Statement	Code
	I1	Yes no, but once again thank you very much for being part of this interview. Before the interview started, I sent out a privacy contract, about how we will process information, what we will go through during the interview, and how data will be stored and so on. And I just want to double check that it's ok, that you've read through it and that it's ok with what's written in the contract.	
1	P2	Yes, I've read through it, and I'm okay with them.	
2	I1	Super. But let's kick it off then, your name is [REDACTED], and you work for [REDACTED]. Can you tell us a little bit about what you do as a company?	
3	P2	Well, I can start with, I've been working at [REDACTED] for more than 10 years, and when I started at the company, we were a fairly traditional IT infrastructure company with a focus on computer storage and networking. To some extent also security, however main focus around the data center. And our customers ranged from small to medium business up to Enterprise size, with some emphasis towards what has been classified as Enterprise back then.	BG
4	P2	The company was started by technical consultants and engineers, and is largely run by these types of people. So we would say that we are a technology heavy company rather than perhaps a sales heavy company, if you can make the distinction, then the solutions that we sell, there is very much a focus on the technical features and how they create business value, for our customers. So all the decisions about which solutions to sell and work with are taken by the technically knowledgeable people, and then it's up to us on the commercial side to turn that into products that we can sell and market and so on. So I work as a sales, sales manager and marketing manager for [REDACTED] and for our start-up subsidiary [REDACTED], which I'll get to a bit more then.	BG
5	P2	So we work with solutions in IT infrastructure, we work with hosting and operational services that revolve around this and we work with specialist skills around this then. If we look at how we got into artificial intelligence and	BG AI-T-N

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		artificial intelligence infrastructure, artificial intelligence development and deep learning platforms and so on, we started doing that a little over 5 years ago. And how we got into it is kind of the stars aligned, you could say. We are in ██████████ and we were already working on advanced solutions for, like data storage. And the development in that has gone quite fast in recent years where you have gone from spinning disk to flash disk, which creates a lot of opportunities for faster data transfer and so.	
6	P2	And so you find yourself in ██████████ as said where. Artificial intelligence appeared on the hype map, and has been around for a long time, but lived a bit in the shadows but took a big step forward when the GPU hit the scene as something that lends itself fantastically well to deep learning back then. I guess you could call it a part of machine learning, and with the advent of GPUs, very specific infrastructure requirements started to be made. It's not just using what has traditionally been used, with CPU-based solutions for so-called high performance computing. Where you are based on CPUs which is not so parallelized, already. But works in a different way.	AI-T-N
7	P2	But now with GPUs and hyper-parallelisation, all of a sudden there are very specific requirements for everything from networking to storage. So in ██████████ about 5 years ago a company called Zenuity was started up. It's now called Zenseact and they're working on developing self-driving vehicles now for Volvo. It was an earlier company that was started by Volvo and Autoliv. They would be one of the first, I think if you look at this kind of infrastructure, so before they invested in it, there were not so many in Sweden who had invested in it at all. NVIDIA, in the same vein, NVIDIA started getting into the data center. NVIDIA then making GPUs and, um, they had previously sold gaming cards and cards for graphics and graphics applications. CAD, of course gaming and film, movie and the like.	AI-T-N
8	P2	But they kind of hadn't been that Enterprise company that had had a presence in the data center, but at the same time that this is happening then 5 years ago, that they're starting up Zenuity, NVIDIA came out with their first data center product, and sold the first one to Tesla, and then they sold the second one I think to Autoliv, in the world.	AI-T-N
9	P2	At the time anyway, we were asked to be experts in this type of specialized super-fast storage. Then it gets asked if we could be involved in looking at one and developing an infrastructure that would suit Zenuity. Because what	AI-T-N

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		they had that nobody else really had was, they had in their plan to accumulate huge amounts of data. They were going to put a self-driving car on the road and the kind of data they were collecting, and are collecting, is film based. Hard to compress, it's already compressed often, and takes up a lot of space. And the more the more data, that's how it works with AI, is the more data you can collect the better. And this data then has to be shuffled very quickly from where you store it to where it's going to be processed, and back.	
10	P2	And time is important. This is a race to whoever, it's the company that can first set a standard, so to speak, or that can get a well-functioning self-driving car, simply put, will be one of the ones that sets the standard in a market for all other self-driving cars. So it's a race and it has to go fast, and like all the delays that make these data scientists, have to wait and so, to do new training, and so, all that stuff costs a huge amount of time then.	
11	P2	It's a lot of exposition here, but you'll have to keep up.	
12	P2	But that's why it's so important how you design an infrastructure. Because it's not just building as you've done before, but completely new requirements are set and we were the first to design such an infrastructure, which then became the first reference architecture that NVIDIA launched together with a company called Pure Storage at the time.	
13	P2	So we built it with Zenuity, and they're still running it, although they're constantly upgrading it then, with new software or hardware. So that's how it started, and then we've taken the copy-paste on it and resold it to other companies, in automotive, in pharmaceuticals, in other types of industries as well. And, and that's the thing, there's been a lot of talk about AI in Sweden. The hype has been enormous, but if you look among Swedish industry, surprisingly few have started to really run with it. These are the pioneers that I still want to say that Vioneer and Zenseact are. They have really been many years ahead of the rest of Swedish industry, in being up to some kind of production of AI.	AI-T-N
14	P2	There are many who test. Many people have realised that they have to do something, but I don't know what. What is the use-case? Are they going to improve an existing product, are they going to improve the internal process, or are they going to? To make stuff cheaper or faster save	AI-T-N PI-w-AI

		time, or are they going to come up with a new product? That's kind of the three main tracks we've seen anyway.	
15	P2	And we thought that, that when Zeseact and Vioneer had kind of invested in this and they were up and running. We thought, now everyone is coming, now it's full steam ahead in the Swedish industry.	
16	P2	Far from it, very far from it. So we decided to get involved in AI Sweden. And when it started, we went in as their core technology partner, and that has meant that we have... because we have invested ourselves in, it's important to point out that we don't just sell these solutions, but we rebuild for ourselves and offer them as a service. So if you're a company that wants to test and do a test-shot and kind of a proof-of-concept, you can do it with us on the same kind of equipment that the larger companies buy in. So we can offer both such extremely fast storage, and like then the fastest GPUs available on NVIDIA's platform called VDX.	
17	P2	We can offer that as a service, and that's also what we do together with AI Sweden, where we donate computing power to AI Sweden, so that Swedish industry, research, academia can come in and run projects in that environment, and in that way, we are helping to build up Swedish AI so that, I mean, it's in our interest to... if there is no market, then nothing can be sold.	BG
18	P2	Plus we're a relatively small company, 30 people, there are quite a lot of big global companies, a huge amount of resources that have much easier access to companies like Astra Zeneca and Volvo and Ericsson, than we do. So AI Sweden has given us an opportunity to show that there are actually Swedish companies that are even ahead of Dell or HPE or whoever it may be.	BG
19	P2	And it is also important for Swedish industry to know, or as well as for Sweden. And we think that the competence to build this kind of super advanced infrastructure is also available in Sweden, not only then like Berzelius which is now built by ATOS which is a French company. Sweden shouldn't have to go abroad for the expertise, but that competition is something that we should have within Sweden. Competitive advantage comes not only from the application of AI but also from everything around it, and then we come to what I mentioned earlier, which was this company we have started called [REDACTED].	

20	P2	And it's a company we've started with another start-up company that works with ML, operations and data flows. So that's it grossly simplified and for goodness sake don't ask me to go deeper into it. We have people who can do that much better. But when you make when investment in valuable infrastructure, super-fast GPUs and you're setting up this buffet for your researchers and data scientists, you want to use those resources in the smartest way possible.	AI-T-ML
21	P2	And what we found was that these tools either don't exist, or the tools that do exist are created by, for example, IBM. Now, IBM is a partner of ours, [REDACTED]. It becomes very OK if you are a region, for example Västra Götaland or something, and you want to invest in tools that take like 2 months to install and you need to get support agreements for several million. Okay, then maybe it's good. But if you're a smaller company, and you want to be able to use this kind of resources in the best possible way, we feel; there's nothing. Or what is there is designed for well, the old type of HPC environments then.	
22	P2	So we decided to develop our own software. So we have developed 2 softer ones now. One is software called IQ which is a time planner and resource manager. So that people working on AI development can nod as well as GPU resources wherever they are, only in the cloud or on their own, or it could be a gaming computer under their desk or a bigger one in the data center. So you can kind of manage these, and schedule them to work all the time and it may sound trivial, but I'll tell you that recently, we talked to global companies whose research departments are thus scheduling these kinds of jobs in Outlook or in Excel. And that's kind of not sustainable, but we see that the need for this kind of software exists.	BG PI-w-AI AI-T-N
23	P2	And the other software that we've created is more data management, data pipelining software. And it's the same thing there, both of those softwares are extremely light-weight. They don't take up a lot of space, can run in Edge if you want. And yes, it's competent software.	
24	I1	But they are developed by you at [REDACTED], or is it at by [REDACTED]?	
25	P2	So [REDACTED] is part of [REDACTED], so the same people. This is a joint-venture between us and a company called [REDACTED], which is on the AI start-up scene.	

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26	I1	So you could say, the basic principle is to provide the underlying infrastructure and now more recently you've also started to look at actual software solutions, rather than just providing external companies with back-end solutions.	
27	P2	Exactly.	
28	I1	But if you look at, because there was a little bit of this about how you've worked in the past, and how you optimize... So you noticed that there was a lack of software, and therefore you want to fill that gap. The process that you carry out, when you notice that "yes, but here we could improve something, here it is missing like this software." I assume that, or I guess it's a manual process where you sit together, discuss, reason about what can we do better? What, what is simply missing and how do we fill that gap?	
29	P2	Yes, that is absolutely the case. Exactly, that. What actually happened was a few years ago when we sold the first slightly larger environments to companies, where they had a lot of researchers who were going to share these environments. And there were no good tools, and NVIDIA said to us "No, we have no idea, we are not working on that."	
30	P2	So we had to look around the world for something. There was something that was like in Finland, but it didn't measure up. And yes, there was some stuff going on in Israel. Then there was IBM and it was like, well, you can spend as much as you've spent on infrastructure on a project, and then you can have 4 full-time employees running this solution. That's not sustainable either. So we said, there's really nothing good, we'll have to do it ourselves.	BG
31	P2	And then we had no developers at all. And now, well, it's not great that we only have 5 developers, but I mean, it's gone from zero to 5 so that yes.	BG
32	I1	Yes, but it's always like, even if there are few people, you can do a lot with just a few people.	BG
33	P2	We haven't sold our own software before either, but it's completely new to us, and we see... I mean, what also attracts us here, apart from the fact that there is a gap, is that with a proprietary software, you can reach a global market quite easily.	BG

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34	I1	Yes, but exactly, especially if there are no competitors like that. But if we look at the basic topic of this work, is how to replace the manual process of process optimization, with AI and smart systems. That is, the manual decisions you made by thinking and here you are missing a software. We could do this better, or if you sit with a hardware and your own infrastructure, and quantify the data. There you see that, okay, on this software or hardware we can provide our customer with so and so many operations, for example, in a week. And we'd like to reach a hundred percent of that instead, how do we get to that goal? How do we improve our own infrastructure to reach that goal? The internal development process is, of course, a process that all companies more or less manage manually these days.	
35	I1	Where you have an R&D department going through and reviewing the internal organisations saying, well here we have a deficiency, because that individual for example could do twice as much work if that person didn't do for example the secretarial part of the work. Just like doctors who have to manage their own records instead of having an assistant for example.	
36	I1	And what we see a lack of is, how would it be possible to replace the manual thought process with smart systems that take into account different factors, whether it's efficiency, time savings, financial resources. And so letting an algorithm or a smart program run autonomously and present suggestions, for example; you would benefit from instead of using 2 of that, or that storage device, you can have one of this instead, which technically is more expensive at the beginning, but it pays off in the end.	
37	P2	Absolutely. Yes, what we think would have been absolutely fantastic. If you could do that and also simulate different decisions, and present different paths. Absolutely, it's been super. Have you talked to Stena line about anything?	AI-T-N PI-F PI-T-AI
38	I1	Actually, no.	
39	P2	Already 3-4 years ago, their vision was to have a self-driving company, just like that, where you would automate every single process. And there, in our example that you're describing, it becomes, um... I'm maybe too close, I'm probably too much into it, but there it became so very easy as well. It was everything from how you made decisions about which trucks and loads to drive on and in what order to which people would get which tasks. Who	PI-F PI-t-AI

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		do you put in the bar on a Thursday? Based on what the age group looks like then? You don't put it like the oldest uncle in the bar then maybe if it's only young people.	
40	P2	And everything from that to, like, investment decisions for like paint maintenance and so on and so forth. I was just wondering if you had talked to them because they were pretty far along in their thinking. Then they haven't got as far on other parts in the actual implementation of it... But in their thinking of it, they had come very far. So that's where I would probably recommend that you talk to them.	PI-F PI-t-AI
41	I1	Yes no because it's very interesting, we had a previous interview where we discussed similar or the same area. There it came down to the ethical perspectives, that is, you have to quantify so much data so many different perspectives, for example if we take it from Stena Lines, where they have a bartender, or deciding which party is going to be at the bar based on age group.	
42	I1	But, but then if we only have if we have 3 on staff who are young age, one who is middle age and one who is older. And suddenly everyone in the visiting age group is just young people. And then the computer makes the decision that, "no, but we'll just use the young bartender", which will indirectly lead to, well, then the one with the middle-aged and older bartender will probably lose the job because it will be quite a skewed distribution.	EP
43	P2	But that's how it works. I agree with you, but at the same time, if you have, for example, a nightclub that caters to a younger target group, that's how it works. And on the other hand, you can see it as if AI had long ago said to Stena Line that "shit, you're losing out, you're losing out in this age range, they don't want to go with you anymore. Why don't they want to? So I mean, had there been smart enough systems, they would have already flagged that, "hey where does the 40 to 60 age group go?"	EP AI-T-N O-I-AI
44	P2	Or maybe 60 to 70, where do they go? You lost them? Yeah, I think I'm not so worried about this ethical part actually. Now, we're not talking about facial recognition of minorities, which is reprehensible in every way, but we're talking quite a lot of quantification here. So there's always one side and the other side, so yes.	EP AI-T-N O-I-AI
45	I1	No exactly, that's how it is. It's so exciting to hear this, on the one hand, how different experiences look at the issue of quantification in particular. How far can you go	AI-T-DL

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		because, like you mentioned earlier with deep learning, the more data you have the better the result. And that's true for all machine learning algorithms, that the more data you have, the better it is simply. And it's the same thing with if you have a process or a module or program that's going to process extremely many different factors, they need to have extremely much data that presents a, so basic structure, to the decisions you're going to make.	
46	I1	And then of course it has to quantify as much data as you can, and whether it's in the case of Stena Line, that you have age for example, or interests if that would be the case. Yes, things that we humans, if you like, don't consciously calculate into the decision in the same way. To what limit can you draw this quantification? What is okay to quantify and what is not, and how much would you really need?	AI-T-N
47	P2	I'm not so afraid of quantification per se, or worried. It is not the quantification itself that is the source of concern, but the evaluation of the data. It's the valuation of things that causes problems. That's where you get coloured. That's what worries me, how do you get an ethical AI like, how do you get a multicultural, or well, how do you get a our an AI that's not biased?	EP AI-T-N
48	P2	That's a much bigger problem. The valuation of the data probably.	EP AI-T-N
49	I1	No, but exactly. That's what's fundamental in process optimization in particular, then, perhaps? Where we want to improve something, or the internal processes where we don't know what factors are always at play. Then the question comes in, what factors do you need? And that's the big question mark that gave rise to this report. What is needed to achieve that goal in the end? What, what can be done better and so on?	EP AI-T-N
50	P2	Well, what I can say is that during this process improvement; we as a company, and we do work to help other companies to improve their processes with the help of our tools. A little bit then? But we are the cobbler's children to the fullest extent. Our processes are very much... We're just a small company, entrepreneurial. But we would have benefited so much from improving our processes through AI.	PI-C
51	I1	But if you reason on what would you say you needed to achieve those goals? You kind of have the infrastructure	

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		there, but what would that software look like for you, if you take that as an example? What, what would your vision of such a solution be?	
52	P2	Well, I see immediately in our part where we work with hosting, to rent out resources. That if we could have a much better way than we do today, to be able to see; what is being consumed, and when is it being consumed, and by whom is it being consumed? What kind of consumption is it like?	AI-T-N PI-T-AI
53	P2	I'm talking about CPU, GPU, RAM, disks, what speeds? We do that to some extent today, but in silos, as well. And then use that in our investment planning, for like; what do we need to buy and when? And then being able to, 6 months in advance know that we need to kind of add this. Partly that, and then I see other processes where some good tools are starting to emerge. But that's my own department, working with sales and marketing. Getting better at finding and reaching relevant customers. There are some tools like that where, in addition to this classic, size of company, number of employees, etc., where you can collect other data from other data sources and compile them...	AI-T-N PI-T-AI
54	P2	To be able to make relevant contact with companies. Those tools exist to some extent, but they could be a lot smarter, so there's an awful lot of time spent talking to people who are not, where it's not the right company for this building at all. And everyone suffers from that. We know ourselves how many emails and phone calls we get with things that are completely irrelevant. So I know that some parts of the market are super good at this.	AI-T-N PI-T-AI
55	P2	Well, if you take Business to Consumer, today we're really good at this, but business to business and in our niche, a little bit like that, it's not nearly as good actually.	
56	P2	A bit more complicated, sorry, but we are involved in a project at Stena Innovation Lab at Chalmers. Where we will now help a company that manufactures crankshafts with quality inspection. With the help of AI, that is. And that's where it's so easy to see, when they manufacture something and have a manual process to kind of inspect certain parts of this... gadget that you can put on. It becomes very, very concrete like? Well, this manual process we can automate easily. I think it's much more complicated, but it's like I said before, maybe because I'm so	AI-T-DL PI-C

		close to what we do. More complicated in like the kind of retail service company that we are.	
57	I1	Because that was it, when we did the preliminary research for this report, we went through different process areas on where the respondents see AI being used the most, and you can say that in manufacturing in quality control especially, it is by far the most used in the area of AI. Just because just, like you said, where you have a manual quality control for example. So you can replace it with a machine that can process and see flaws and misses in production so extremely much faster than what a human could do. And that's where, just like if you go back to deep learning earlier, where this image processing speed, and how smart the systems have really become for and managing image data. Where there's been a a gap you could say, where you see so much success in terms of deep learning and machine learning for for example future prediction and so on. Where you start to stare blind at what works and develop what already works quite well, and so lose interest in what you might not think of in the first place.	
58	I1	Of course, there are more difficult areas, such as process optimisation. How on earth do you go about optimising processes if you don't have all the factors at your disposal? After all, we have logical thinking. The brain is an extremely competent computer that can factor in so many different variables and data that it is difficult to replace it in the same way with a program.	
59	I1	And that's kind of the obstacle now that there are probably so many different application areas where you could have benefited from the same system, whether it's deep learning, or whether it's machine learning... If you only knew what was needed or had an interest in researching what was actually needed. But yes, it will probably take a few years before we get, as well as to especially decision making if we are going to that as an example. So, where we get to a point where decision making can be automated as well.	
60	I1	Yes, you want to be able to trust computers if you say so, but just as human factors play a role if something goes wrong... Then you want to find someone to blame for the problem. If you have a smart algorithm that makes a decision and then that decision leads to a loss of maybe 10% in turnover in a year. Who do you blame then? Is it the	

		development that takes the hit or the people who sold the system?	
61	I1	That's what we've seen now, that that's probably the big obstacle at the moment. You want to have someone in debt, and if you don't have that, how can you dare to continue development without having a fallback? So, where you can say, well, it went badly, we'll fire the person, for example, who has been working on the development. Then we start again. It's not so easy when you have a system like that instead, if you like.	
62	P2	Exactly, and that's why I think that fully self-driving cars are much further away than Elon Musk says... It's kind of for the reasons you say among others. So even so, even if we had the technology that self-driving car there, so when something happens, there needs to be a human there who is ultimately responsible. I think that's so sick, far away, if even, or well you should never say never. But I have a hard time seeing who will be responsible. What company that develops an algorithm would take full responsibility for that algorithm in all situations? for that.	PI-F EP
63	I1	No, but it is. It's probably far in the future...	
64	P2	But on the other hand, as a decision support tool, it's fantastic, and that's what we'll be talking about for the rest of our lives, I think. It's kind of how the decision support, is what gets better. But it will always be the human being who is ultimately responsible for making this crucial decision.	PI-F
65	I1	Yes, but exactly. But if we reconnect a little bit to the basic area that the use of AI for your internal use if you will... Since you've only recently started working with software. What is the internal use of machine learning or AI. Leaving aside these software products you've been working on recently. Have you used AI internally for decision support systems or similar?	
66	P2	No, I would say it was unused actually. We haven't used it. I would say no, that we haven't used it in anything internally.	PI-C
67	I1	If you look at your customers instead then, where you have provided the back-end systems and those customers have used your hardware for AI systems or smart modules. How would you say, as a sales person, that that implementation has impacted those companies? Do you see for example that, well we sold in this system to a	

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		customer, and it made their turnover in that sector increase by 500 percent for example or something like that?	
68	P2	Yes, but if we look at our customers for this type of system, they are... they are customers that would not exist if AI was not part of them. It's their main business as well. Take like Zenuity or Zenseact for example, without AI there is nothing. They're a software company that develops these kinds of systems. It's self-driving cars, that's what they do.	AI-T-N
69	P2	We also have customers who work with Text-recognition contract interpretation, automation. Well, it's no secret that DocuSign, which has development in Gothenburg, is one of our customers. And we have delivered their entire platform. So yes, that's also their business idea; automation. Astra Zeneca develops drugs on that type of platform.	AI-T-NN
70	P2	So for them, it speeds up, it's pretty clear examples of, of what AI can help with. But take research, we were there to make sure everything worked. And that they're using our equipment at this hackathon, the Baltic Sea Bird hackathon, which is ultimately about using AI, seeing these herring pigs, seeing how they behave, how many eggs they lay, how many they are. Because that ultimately says a lot about what their habitat is like, and what the water quality in the Baltic Sea is like and so on. It has a direct impact on something that was previously done manually by a scientist.	AI-T-DL
71	P2	Now, it was a hackathon, so it was a competition, but pretty quickly, those who were participants, could get the AI to recognize and count the eggs, recognize and see if it was a male or female, which pairs there were and so on. So it was awesome to see the direct implementations like that.	AI-T-DL
72	I1	But exactly, because that's what's so interesting to see, as well as the contrast about how smart systems can replace partly manual work. Whether it's reviewing transactions, or counting eggs in this case. And then in the future, maybe make decisions? How that would affect our view of that work? Because we get to a point where we're replacing, maybe a manual job where a person has been sitting and chewing data for 2 weeks straight, and then you replace that person with an AI, and then it takes that AI to process that data in 2 minutes instead.	

73	I1	It sets, as you mentioned before, a standard for what competitors, and what other companies, want to achieve. It's clear that if you know that, but it's possible to have an AI that processes all the data in 2 minutes instead of having these 3 employees that do everything in 2 weeks. It's obvious that you're going to want to strive for that optimized solution. And there is the question of what business, internal process development and decision making will look like in the future, once such systems are in place or made possible.	
74	I1	And what would that mean for those who are involved in decision-making in particular? This report will hopefully be a step forward in answering questions like that, even if the whole process itself will take much longer.	
75	P2	Absolutely, and what you are doing is very interesting. I hope you will send this when it is ready and possible to read. If it is. Then I hope so, it would be fun to read and see what you come up with? Especially if it's companies that are not in the manufacturing industry, then yes. It would be exciting to see. Especially for service companies?	
76	I1	Well, I can mention that from a previous interview, where we interviewed a person who works at a bank, there was the big dilemma, what to say? The first step in the digitisation process was to replace transaction reviewers, that is, people who sit and look through all the transactions and notice if something looks fishy, then you flag up that transaction, and then you have to review the transaction further. There, 2 million man-hours were replaced by a week of data chewing by an AI.	
77	I1	That then led to the question, well, but okay, how can we build systems that can actually make the decision on their own that, well this transaction is a sham transaction, or a money laundering transaction or whatever, and then flag it up. And the current situation is that you're still stuck with, so it's just like you say. It's just a decision support system where the transaction is flagged up by an AI and says yes, someone may review this transaction.	
78	I1	But there the current development question is already yes, but how do we get AI to actually make decisions themselves, and what are the factors that play into that decision-making? So there are companies that are already working on the development of handing over decisions to AI. That's where the question of ethics arose, because who is going to take the blame if a customer is turned off,	

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		for example, because a computer has made a decision incorrectly?	
79	P2	But yes, banks have been sensitive. When the EU came up with its recommendations on AI, one of the issues was that you shouldn't let an AI make decisions about loans and the like.	O-I-AI
80	P2	But on the other hand, I was in a draw, what is it 1.5 years ago? There it was their big, like look here how quickly we can make decisions on borrowers and do credit assessments on people.	O-I-AI EP
81	P2	They had a huge demo about it, but now in the EU, they say it's really sensitive.	
82	I1	Well, no, but exactly, but it's quite funny if you take some big banks as an example. If you apply for a credit card, for example. In some cases, the bank claims that we will process your case manually, and a manual processor will go through the application. And then you send the application, and 10 seconds later you get a pling, you are approved or not approved. And then you think, well, it's a bit quick that they've gone through everything, but yes... It's cool technology and it will be incredibly exciting to see how it develops over the next 50 years in particular.	
83	I1	As humans, we tend to underestimate how fast technology is advancing and how fast it is not.	
84	P2	I can very easily see, well, the ethical problems with just banking, and then you add what if they start running interconnecting some stuff with different health registries like? No, you can't take out a loan, you're going to die? Well, no, but you know, that's the thing that can be really hard. Then you start gene-screening people and you're going to have insurance that's linked to your DNA, and well, no. Exciting. It's a bit dystopian and all that, it is.	EP
85	I1	But if you finish with process optimization that is kind of the main area. How do you value a person's effort? I technically, so sure that human might be doing things, say 5% slower than what the computer program could handle. But if you replace all the people they worked with an algorithm, what is the value in their life if you put it that way, because then they will lose their job. What will they do after that? Could that lead to frustration? Could it lead to anti-technology, the demonstrations and so on where the robots replace the humans?	EP

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86	P2	Yes, but that's how it was when the spinning mills came into being at the beginning of industrialisation, that's how it was. When the automatic spinning mills started and the steam engine was the big threat and so on. But I think that's a natural process of industrialisation. And we're into, what is it? In the fourth industrialization? There are lots of jobs that existed 10 years ago that don't exist today. The challenge here is that it's going faster and faster. That's the big thing.	PI-P PI-F
87	I1	Exactly. You have to keep up with, like, that development and say, but OK, it's not a solution to just fire everybody. We have to find a replacement, or something that replaces the lost part. Whether it's jobs or whether it's time or whatever.	
88	P2	Yeah, but it's super interesting.	
89	I1	Yes, absolutely.	
90	P2	Yes, I hope this gave something.	
91	I1	I, it is terribly nice and has provided a lot of good info and views. It's great to hear opinions, both as well as how you've worked with it, how customers have worked with it, and how you see the future. So now it's really that we're going to go through everything. Initially, the interview will be transcribed.	
92	I1	Then that transcript will be sent to you to give you the opportunity to review if there is anything you have said that should not be included in the report. We will, of course, anonymise your name, company name and any information that could lead to your company name, your name or anything else being recognised in the report. But then we don't know all the factors that play into how what data is particularly sensitive for your company, for example. That's why you should have an opportunity to review and before it's actually used in the report.	
93	P2	Great.	
94	I1	After that, the report will be compiled using all the data from the different interviews and then it will be sent out to you who have participated in the study when it is compiled and reviewed. So you can see how it has turned out and so on. And then finally it will then be published to Lund University and be the basis for further work.	

95	P2	Yeah, but it's so much fun.	
96	I1	Yes indeed, but yes, that's how it looks. So I thank you enormously for your participation!	
97	P2	Thank you very much and good luck.	

Interview 3

Interviewer, I2: Philip, I3: Alexander

Participant: P3

Date: 26 April 2021

Line	Speaker	Statement	Code
1	I3	So now it works, perfect.	
2	I2	Yes then we have now even 2 recording, perfect. Exactly, we know each other already, so I don't need to say much about myself. I don't know, Alex, would you like to introduce yourself?	
3	I3	Yes, sure, my name is Alex, I did my Bachelor in Münster in Germany and now I'm doing the Master with Philip here in Lund and we're writing the Master thesis together and that's why I'm also here for the interviews, but I'm taking a more passive role, so I'm going to take notes and let Philip do the work.	
4	P3	That's great, you are definitely already CTO material now.	
5	I2	Um. Yeah, exactly we kind of covered the introduction of us. We'll introduce your role in a moment in the interview, or you introduce your role in the interview. Otherwise on the topic, our master's thesis is on the topic of artificial intelligence in internal business processes. In other words, everything that is handled internally by companies, so to speak, and does not lean outward. And thankfully you took part in our survey. The aim of this survey was, of course, to find out in which internal business processes artificial intelligence is actually used. And now the aim is to find out what added value it brings to the company. So the background to this whole thing is that artificial intelligence, as you've probably heard before, has become such a buzz word in the whole area of IT, and not everything that is labeled with artificial intelligence is actually artificial intelligence. We have a lot of different gradations in machine learning, natural language processing, whatever else we have there. So through the Survey, we have now sort of agreed on the internal process of process optimization that we will continue to look at this. Now I know you clicked, I think, on process optimization unsure. Are you guys probably not working on it? Just also because you guys probably don't optimize your processes with AI. Um exactly, but in terms of that maybe you still have a rough overview of	

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		artificial intelligence how you could apply it then in a real business. Exactly. So in any case, thank you very much for your participation in this interview. Just about yourself and your company or the company you work for. Would you like to talk a little bit about that?	
6	P3	I would be happy to tell Philip exactly what I have been up to in the last 5 years. Yes, I originally come from an enterprise software background and have worked for several small startups in the camping sector over the last 5 years. And all of them relatively successful, but always upgraded to the next topic without selling them, but always directly with the next big project. Then I also met Philip, for Alexander, when we worked on the Shared Camper. That was a customer to customer or peer to peer camper rental portal similar to AirBnB and we stayed in the camping industry and our investor actually thought that we understood well how to take a business idea, validate it and then make it bigger. And right now we are sitting for our investor in his own company which is 750 employees, accessories, supplier in the camping industry, market leader in the premium area and in the normal area so optimizing business processes. So we can work agile and we teach them more or less what you can gain from it. We sort out a few processes, we also build the apps for them. We build apps, software as a service solutions, cloud solutions, and on the other hand, we also advise them on how to use social media and everything that is somehow online marketing, because they have nothing to do with it. In other words, we are modernizing a classic medium-sized company. That's exactly where AI topics like to become a buzz word. But the technical department is rather cynical, so from the corner of machine learning is also just a bunch of IFs and ELSEs and exactly we are actually rather in the position that we have to drive people back, because they always think, you can certainly do everything with AI and yes, exactly there we are actually rather braking, which may be a bit funny but well, is just the buzz word character of all the things. We also have them down from blockchains a little bit, that's good as well. Yeah, so is that the level of information you guys need for your interview, or should I be more specific again?	BG AI-D
7	I2	We have prepared another question in the sense of "Who are your competitors?"	
8	P3	So then of course we have to talk about our mother company. The market is relatively well broken down, so in	BG

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		<p>their core area they are the market leaders, there is very little competition. So we work for ██████ which makes heating technology for motor homes. There is also ██████ as a competitor, they also do heating, but they only do that, ██████ is a bit more broadly positioned and if you look at the other broadly positioned, that is ██████. They mainly make refrigerators, they go into heating, air conditioning, ██████ on the other hand goes into refrigeration and that's also the majority of the market. So that's exactly what is relatively clear.</p>	
9	I2	<p>Exactly and that's where you guys have now sort of set up a company that's there advising in all areas and all things. All right.</p>	
10	P3	<p>Exactly, everything that is digital and that is hardware. Embedded development, they can actually do that themselves.</p>	
11	I2	<p>Very good and you just said that in the area of AI you have a kind of a breaking role. So you don't have any AI projects or tools that work with AI in any form in use at the moment?</p>	
12	P3	<p>Not in use, we have several experimental projects, that's such classic stuff like playing a little bit with TensorFlow, a fun thing for example we have a refrigerator product and they have to be configured differently and with TensorFlow actually recognize which type cooler that is and then select the appropriate configuration, so a fun thing we've already done. Next a purely experimental project was also yes, more or less just recording sounds from the air conditioner and determining if *WRONK KRONG KLONK* is a bad sound and then maybe recommending maintenance. That's how it went, but our internal processes are more like that, we're just modernizing, that is, for example, in the area of data mining, we say, we mean, but we're doing it in a traditional way. We first build a big set of IFs and ELSEs to say that's our baseline and if we have patience and it's really worth it, we would say we implement a little machine learning on it to refine it. But the important thing is to have a baseline that we can compare to, because we all don't think that you should just blindly rely on that, because you know what the technology level of most libraries are and you have to have a comparable baseline first.</p>	<p>AI-T-NLP AI-T-ML PI-C</p>
13	I2	<p>You were pretty interrupted just now, can you repeat that last sentence?</p>	

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14	P3	Oh yes, sorry I would like to point out. I'm near [REDACTED], which is of course new technological territory there with DSL. Exactly the last sentence was, we from IT are convinced that with machine learning projects or something like that we first need solid baselines raised by hand to compare whether the whole thing really works well for us and then of course also to ask the question how well does what we have built actually work? Do we actually need the next step or do we look at other places to see if we can apply it? Because actually every technician would like to play with it. But we're all just a little nervous about it. Yes, it's a little bit too hyped and then you apply it where it's baloney.	AI-T-ML PI-F AI-D
15	I2	Right exactly our approach to this thesis here. You mentioned it already, the technicians, what role do you play in this whole construct?	
16	P3	My title is Director on Technology, there are 5 of them in the whole [REDACTED] who actually report directly to the management. Yes, I'm the one for everything that is somehow software that is higher than embedded development. I'm now only coordinating, consulting, the last time I wrote productively used code is certainly 2-3 years ago, I have to sneak out now and then and at least write small scripts to make database queries or sort tables, otherwise I do nothing more, otherwise it's mainly consulting.	BG
17	I2	Very nice, very nice. The question here we still have now. Um, just name 2 tasks that you deal with the most.	
18	P3	At the moment its Enterprise Architecture. Exactly there it is about numerous sub-systems, which have been built up, which all have to be integrated into each other, there is actually also data mining, which they have dealt with quite separately. But otherwise, the way from embedded to cloud, that's one side and the other big topic is actually at the moment management of external providers, so external development service providers. I'm just spending a lot of time on it, exactly to then say we know our own enterprise architecture and we can tell others exactly what we want, so that we do not pay too much money for external projects, where knowledge is lost.	BG O-I-AI PI-w-AI
19	I2	Yes, very good. You just mentioned a little bit how you deal with the topic of digitalization. That you are only active in the digital area in general. Your definition of artificial intelligence is already given, this construct of many IFs and ELSEs. And also quasi really as a buzz word. To	AI-D

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		go into it very briefly what would you really say is AI and what is not AI simply name 2 examples?	
20	P3	I always find as soon as you understand it, most of the time it's not AI when you promote AI as general solutions for anything. I have to say, so I studied 20 years ago, we still built neural networks with very little depth, even if you look at such a neural network and its conditions, you realize at some point okay, I understand it that way too. I could map it through IFs and ELSEs. Yes so first and foremost I think most of us see AI as not a new technology, nothing that is somehow groundbreakingly different, it's actually always a facilitator. A way of looking at a query or a process in a more black-box way than we would have done otherwise and yes, thereby saving work and possibly actually gaining performance.	AI-D AI-T-NN
21	I2	So, more automation of manual tasks?	
22	P3	No, it's already from programmer analysis tasks, so to speak, you could certainly do a classic image analysis in a very detailed way. But we would be very happy for example if you could just say, here look these are the images you are supposed to learn from, do the rest yourself. It's something that a programmer, if he's not completely stupid, could also build himself, but it's just another form of library that makes your work easier and possibly also increases your potential, because you can do more than you would have expected. Exactly, but for us it is primarily a saving of work and nothing disruptive.	AI-T-ML PI-t-AI
23	I2	Exactly as a counterexample, you have something people call AI, where you would say sorry, but that doesn't belong in that direction at all.	
24	P3	Yes, because I just described it as making work easier, I'm extremely reluctant to say AI, because in most places it's machine learning for me anyway. A lot of things are just overestimated, so when you see Facebook's and therefore the smartest people that you can buy for money that to put an AD on, then a lot of people kind of see something really brilliant in there and then you get 2 times wrong ADs and realize so if that's AI now, then it's not a very smart one. Yes, and if you go behind and find out how many steps are involved, where you still classify things by hand or something, so that it somehow fits, then you are then I think relatively quickly not disillusioned, but you lose unnecessary respect and just have a little	AI-D AI-T-ML

		more respect for the work that goes into it. But you can understand it relatively easily.	
25	I2	Very good, thank you for that, and then we come to the main topic that we have chosen for this master thesis, which is really process optimisation. What we have in mind is to focus on the internal business processes, which is a series of activities that are really only carried out within an organization. But of course, we would go one step further and say that in your case, for example, you are many or several small companies working under one parent company. And therefore, the communication between these companies could also be defined as a quasi-internal process. Exactly, I don't think I need to define process optimization any further now. Simply to increase the efficiency and the effectiveness of an existing process. How do you work with processes in your environment in general? Do you model the processes, or do they just run as they are? Like it is the case in many smaller software companies, or do you really have an overview of which processes exist, which ones are running and how can they be analysed and improved step by step?	
26	P3	I have to ask which company processes we are talking about now, as a software company we have very basic software release processes or something, where I'm pretty sure that somewhere we actually use a ready-made machine learning tool for code analysis to find certain code base errors, I don't really know. Yes, I like it when it's transparent there at that point, that's why I see it as a tool box. For other enterprise processes and intra enterprise communication, we don't model at all. We are currently in the process of converting a relatively large number of processes to classic agile processes. Very classic agile, in the sense that everyone has tried agile in some way, but that is then a classic Scrum but and we are just pulling it into line. There is relatively little modelling and relatively little automation. Yes, what else do we have. We just said that there is a process for the selection of development service providers. There is also little, so the process is being modelled, but there is also little automation that is somehow interesting for AI. In this respect, I would also like to take a few keywords again, which could also affect it.	AI-T-ML PI-t-AI PI-C PI-F
27	I2	Are there any AI tools on this topic? Well, we don't define it in such a way that we use an AI tool as a replacement for a process in order to optimise it. But the use of an AI tool or Artificial Intelligence in general just to	

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		know how to optimise a process. Alex, correct me if I'm wrong on that.	
28	I3	No yes, exactly right. Maybe as buzz words in the topic of data mining, or process mining, in that direction. So, there is for example the tool from Celonis or so that you say okay, we have mapped our process somehow, I can see that always in section C quite a lot of time is lost and therefore we look at this section more closely and try to optimize it. You had also said that you work as consultants, then perhaps also at the company where you consult.	
29	P3	Yes, that's a good point, so with typical process optimisation in the industrial sector, there are certainly some points, but unfortunately, I'm not involved at all. That's why there is nothing at all in process mining, so I can't contribute anything. Yes, with data mining, we are still one step before that, so we are currently more in the data science part, where we say first measure the following and first determine fundamentally what, as I said, to establish a base line. As I said, if a finished result comes out somehow, because you use Google Analytics, which probably does machine learning somewhere for some classifications, that is also transparent for us. We don't actively use anything ourselves, but are just, if at all, beneficiaries of other technologies and are in the process of establishing a baseline. I have said that three times now. I think I should stop repeating that. So that is the step before yes.	AI-T-N PI-P PI-C PI-t-AI
30	I2	It is also a good insight for our work, so the result of the work does not have to be ok AI really brings a value here, but can also be, it is really still in its infancy and one does not yet know what really brings added value where. To come back to your first question, what we mean by processes in general, I had just given the definition, simply a series of activities that serve to simply bring some profitable added value in the company itself. So, everything you mentioned like software releases and other things are all part of that.	
31	P3	Okay, then I can only talk about the prototype topics that we have done with image recognition of products to configure them for example and actually also error detection, but all that prototypically. Even there, I have to say that error detection was a student project as far as I remember, but it was postponed for something more important and that is simply data acquisition for the time being, which is not very clever. The problem is how to get an LTE connection from my motorhome so that I can send it to some	AI-T-ML

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		cloud service where we collect the data to analyse it later. We haven't even decided how yet, but first of all, how do we get the data there?	
32	I2	What is the general concept of this? I haven't quite understood that yet. Which data should be sent where and what should happen with it?	
33	P3	Oh so when we talk about the RV we have a self-sufficient system similar to a home. That's why the whole area is called Smart RV, like otherwise Smart Home. You collect a lot of running data and at some point, you want to interpret it. It comes from the individual customer and at some point, the individual customer has to send his data to us, where we can use it further, and of course there is a cloud service that does that. Yes, so the classic thing is error tracking, like the air conditioning didn't work, combined with GPS data, where was the person? When was that? So, you can match, weather service, at that time it was so and so many degrees, then you can just say yes, that's also out of specification for the air conditioning, we can track that, that's an External Optimization. Internal is also something like, we have internal sensors for example in the motorhome and then you ask yourself things like, the measuring sensor there that has given the following value does that fit the outside sensor or is the positioning stupid. Spoiler, putting the temperature sensor for interior directly above the door, is indeed favourable from the cable length but not a good idea. We also analyse such things but actually not yet automated, but first by hand, because just the simplest analysis goes just like that and that's just low hanging fruit, which we can first take before we then want to optimize further. That is exactly how I see machine learning, we would rather see it in the area of the no longer so low hanging fruit, but yes second step so a real optimization when we have that established.	PI-w-AI PI-P PI-C PI-F AI-T-ML
34	I2	Right, that means that you are really in the initial phase of establishing this data mining. That is with sensors and various other technical devices simply first creates a large data pool, what is then done with it and how is still open. Exactly then you mentioned earlier as a process the code analysis of your internal developers, how do you proceed there, what was the process?	
35	P3	Yeah, so, that's where I'm now in the fortunate CTO position or Director of Technology position that I can say, guys solve this problem for me please, I would like to have a static code analysis. This has to do with the fact that we have of course also taken over existing products	BG PI-F

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		that were built by service providers who all have relatively different code bases. Now just when we maintain software, we continue to do that somewhere in the CI pipeline and so at least sometimes ourselves, if right now would not use a third-party tool. I don't know right now, we would probably use something ready-made for this in the near future, I definitely see potential, especially if you lack the expertise, because as I said you just took over an existing code base from someone else and no one wants to voluntarily learn Xamarin.	
36	I2	Not? Why not? No, please do not answer. Right there, it's not so much about increasing your own code quality, but more about comparing purchased or migrated code projects with your standards.	
37	P3	Yes, well, we also do that with our own. However, there is also a step with projects that we know, we can start much smaller, because we have already established our base lines, we don't have that with service provider products. That's why we treat them a bit differently, a bit more cautiously, and that's exactly where we're shooting at sparrows with cannons.	
38	I2	So this is about style guides, isn't it?	
39	P3	It is classical style guides, linting, in any case, but we are also courageous to say, so classical vulnerability analysis, which would not be done with typical static analyses, where you just give probabilities and say yes, it is probably not good, which gives more pointers. Exactly because, if one does not know the codebase, as well as the technology of the evaluation one cannot a hundred percent understand it. It is just simply directing the attention to the place, where it is probably most worthwhile to look. That's what we use it for.	PI-C
40	I2	Very good. If I look further into the interview guide on the topic of process optimization. I think we are so far through there. By not optimizing your processes with AI, the question of what types of AI do you use for that is kind of unnecessary. I don't know, but maybe you have dealt with this topic in general or with all the different specifications and definitions of AI. Do you have an overview there or any idea what would be used? So, you already mentioned machine learning, where was it?	
41	P3	We were kind of in error detection once as well as object detection.	

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42	I2	So you mean image recognition now?	
43	P3	Exactly, so product recognition through image recognition.	AI-T-ML
44	I2	Right, can you say again what exactly was the case there?	
45	P3	The case is simply to recognize different models that don't necessarily have serial numbers or don't have a QR code on them and then provide configuration.	AI-T-ML
46	I2	So, the customer takes a picture of it and then that gives you back the manual.	
47	P3	Exactly. The manual actually not, so in that case we have Bluetooth enabled refrigerators with for example assumed different adjustable temperatures and then you can just say, oh this is a 2 zone refrigerator I would like to have one zone set to -30 degrees and the other to 7 degrees because I want to transport my Corona vaccine with one part and use the other for beer for the transporters. Yes, exactly marketing action of ██████, vaccine transports, quite cool. Exactly so something has a Bluetooth connection and want to know what kind of device it is and then you recognize that just like that. Exactly otherwise you can stick a QR code on it, I think, but it's not done with older ones and so it is easier.	AI-T-ML
48	I2	Mhm exactly and then you had addressed Natural Language Processing sort of in the context of sound recognition?	
49	P3	Exactly, so I only met the working student at the very beginning for this project, I know that ran and that is simply the analysis of running noises for quality assurance and for preventive maintenance and predictive maintenance, I don't know.	AI-T-NLP
50	I2	Both probably.	
51	P3	So, right, suggest service intervals.	AI-T-NLP
52	I2	Is that then also data that is collected and sent to you now as a service provider or is it managed quasi directly in the vehicle and he gets a red light on the dashboard?	
53	P3	As far as I know, we wanted to do it internally for now. At the moment, we have the problem with the computing power in the motorhome, that it's not enough in some cases. We would very much like to do quite a lot of edge	EP PI-F

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		computing, just for data privacy reasons. Yes, at the moment we have to install a bit more power so that it really works. So, I think technically there is no other way than to send the thing to the cloud, analyse it, and send it back.	
54	I2	A lot has been done in this area.	
55	P3	Yes, it still feels like it's 5 years behind the smart home, but it's the smart home that always has to save energy.	PI-F
56	I2	But I mean I didn't hear about these ideas 5 years ago in this area.	
57	P3	Yes, cool, then I can congratulate you on the fact that we are leading the way. I mean, we are busy with it every day, so a lot of things don't surprise us, but I think it's really useful to have a comparison from the outside. Thank you.	
58	I2	And I have had a little bit to do with this area, so it is not a completely external view. Alex, you have ...	
59	I3	I'm sorry, I didn't understand that.	
60	I2	It's not really a very far outside view, because I've already had a little bit to do with it, but if I assess it like that, Alex has probably never had any contact with it.	
61	I3	I don't have a motorhome yet, but in general this is all relatively new and interesting for me, which is actually quite cool.	
62	P3	Mhm yes, now also smart home is also an old people technology in the sense of, must first have home to use it. I can congratulate you both though, if you have that, then at least somehow a standard is there and you don't have to, knock up walls to lay cables anymore. And maybe zWave and Zigbee have homogenized sometime.	PI-C PI-t-AI
63	I2	It's a cool idea to implement this in the mobile home, too.	
64	P3	Is also technically very exciting. The self-build solutions all use optical components and live with the fact that they consume much more power. Then you're just in such application scenarios that you first have to get to know, how often is a camper actually on a campsite and has 220 volt connection in the US. Then you can have a lot of fun and otherwise not. And then there are very interesting failover approaches, what you just do on the road, what you turn	PI-w-AI AI-T-NLP

		off. You can't do voice control if you're not on the Internet.	
65	I2	The comparison with the U.S. was a little bit interrupted, just from the Internet connection. Did you compare it to anything, or did you just say that the power supply is better on USA campsites?	
66	P3	No neither, I just said 220 volts here or USA 110, that's all it was. So, the difference is, I think, that in the USA you drive further and accordingly you have much bigger batteries with you, so that's kind of a factor of 3 roughly, because somebody is interested in what capacities they carry around with them. But technically it's the same, except for the availability and the cost of mobile access, which also make a big difference to what you can actually afford. But interesting to me just on the subject of AI or machine learning is Voice Control, is actually always a machine learning topic, even there we are actually quite blind boxy on the road in the sense that of course we build nothing ourselves. We actually have a store in the company that has built something itself and that also describes an interesting problem. It takes a lot of computing power to do a reasonable speech analysis and therefore to allow voice control. That means you have Alexa, Siri and Mr. Google and you need an internet connection for such things. That's a huge problem, especially in the Smart RV area, and that's why the only modern solution that works somehow is failovers, something where you say yes, when you're on the road, you no longer have voice control. We have a partner in the company who actually tried to build something themselves for exactly this reason, so that offline voice control also works. But that is very limited. But even there, we're just kind of black box customers in the sense of, we use what's ready and hope that that does it. Otherwise, we are looking for a workaround, with another black box.	AI-T-ML AI-T-NLP EP
67	I2	Yes, exactly very good, why should you also reinvent the wheel? Exactly because you have little or nothing to do with AI, it is then of course also quite difficult to ask what added value this has now brought for you or your customers. Perhaps we can then simply go into the points that we can perhaps link with process optimization and see, even without AI, whether you can say in comparison what added value it has really brought you or your customers to optimize a process, be it the code analysis what you might have done manually before and now automated. Or any other process that you've tackled in any way. And	

		maybe you can now draw a comparison from before to after.	
68	P3	Yes, so in that case it's relatively easy because just like I said we have had external service providers that have developed software and at that point you just have to say if you haven't done it yourself you don't know anything about the code quality we could just improve it that way and when we take it over we can give a relatively safe vote on how good or bad it is or where the work is at. I mean, such stone age issues actually, like saying hey, the framework deserves a major version jump otherwise we won't even get simple bugs fixed that's what's coming for us in any case. So, the kind of security, we have bought that in several of partly also machine-assisted ways. And that definitely brought a lot. In other places, we would then take a step towards it at some point in the future. We can already see this now when we say we take analysis data about our customer groups and application scenarios and at some point we certainly want to analyse them with machine learning. At the moment, the non-machine step is also already a big gain. Just the data collection itself just has value when you analyse it by hand. And so that's where we see it continuously going. As I said, you can pick the low hanging fruit by hand and hopefully we'll make everything else more automated. Yes, but you can already see the success at least in terms of the long hanging fruit.	PI-F AI-T-ML
69	I2	Exactly that has now an added value so to speak, is that a time saving for you, therefore of course money saving. Does that also have any other effects that are not money and time now?	
70	P3	With the company it's really only about money and time.	
71	I2	What about resources?	
72	P3	I don't think it's about saving resources. We don't have much to do with that. For us it's more about recognizing market segments. And to talk a little bit out of the box, RV accessories you don't sell to the end user normally, you always sell to an OEM, and just having the information about the customer, what the customer wants and not what the OEM wants, allows for a very different placement of the product and for example also a view into a different price range so. Customers are more likely to recognize the added value of the product than an OEM who somehow manages to sell his € [REDACTED] motor home with some kind of technology and the customer says yes,	PI-w-AI

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		I'd like something like this in the smart home - this segmentation alone is worth a lot. In the end, it's also about money.	
73	I2	Of course, in the end, everything still plays a role in improving your market value and increasing your own capital. But maybe you have what you just mentioned that the customer was so to speak this driver for this smart home also in the mobile home sector, that is so to speak I don't know, you can of course also call a change in strategy. Did you join the company at the time when this smart home idea didn't exist yet or before or after?	
74	P3	We kind of brought it with us, respectively, our big agenda is to push that forward.	
75	I2	Where did you guys get that idea from?	
76	P3	Well, partly it actually came from our investor who said, I see this area. These are then so classic results of ideation workshops, there is a whole range and some ran and, then we have these yes well, that is just once it was this idea to make the change of perspective from the OEM to the end customer and exactly then I should ask what do they actually want, what has just potential? And accordingly, they were looking for someone who says, I think we can do this better externally than you can do internally, and so we are bringing this change into the larger company.	
77	I2	So, you can also say that, as you said, if the customer or the end user then actually makes such requirements that this also coincides in the area of data mining, that you get the requirements first and then change your strategy or change your development environment and we are now focusing on it here. Whether this has been collected or analysed with AI or not, there is nothing to stop us from including it in process optimization in general. Exactly, but to take up the reference to AI in general again, you already mentioned a bit in the intro that not every implementation of AI is really profitable. Especially because it is currently used as a buzz word and no one can really give an exact definition of AI. Do you still have the feeling that AI will make things easier? So just the business processes or activities that currently exist. Of course, new activities will be added, which will then also be more complex.	
78	P3	Quite clearly. So, when I look at the fact that especially in the area of image recognition, TensorFlow is an awesome package, so there is really a lot of useful things	AI-T-ML

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		<p>happening that you can use afterwards, where it is a real reduction in workload. Now you always have to do a bit more work when you first have to filter, what is it useful or not? That's just the buzzword character that I hope will disappear pretty quickly so that we can have meaningful applications with it. There are meaningful applications for it, it's just costly to get people to understand that they don't push too long in that direction now if it's not applicable. You have to know a lot about it, so you have to know the limitations and what it's actually for, and then it's certainly a labour saver. It's always a bit disillusioning what it can do. But I think I've learned over the last few years that the most powerful skill of a programmer or an architect is to figure out what not to do. That saves most of the time, and when you have solved that, you have a lot of really good tools to solve the tasks you want to solve very efficiently. Hotdog recognition is a great thing for which we will find an application at some point. Until then, other object recognition is also quite nice. And maybe eventually we will find applications for blockchain too.</p>	<p>PI-t-AI AI-D</p>
79	I2	<p>Blockchain, cool funny topic actually, whether you're going to stone me right now or drive to Sweden to kill me, but especially in the area now on the road with such an RV, edge computing and Internet of Things. Aren't there use-cases for blockchain there?</p>	
80	P3	<p>I can't think of a single one.</p>	
81	I2	<p>OK. Maybe you can give it away. Were there use cases that somebody suggested to you where you then said no, it's not applicable for that.</p>	
82	P3	<p>There are always some kinds of attempts to put contracts in some blockchain or public ledger. Also, in the rental sector. Nah, so I had the impression rather that if such a proposal came, it would be rather that you would have paid someone research in the area. You and me, we worked in the area of rental software for something like that, because there are a lot of normal technical problems that you have to solve and somehow writing data into ledger is not worth much more. But that's why my personal highlight I still want to advertise, blockchain is not completely dumb. Kamu and Open Science Data and so I think something cool is just coming along. There I'm really looking forward to it, if we solve the reproducibility crisis in science research, but in other places I don't see it</p>	<p>PI-F</p>

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83	I2	Okay. Alex any comments on that, any questions?	
84	I3	Maybe again very briefly if you think 3 years into the future now and you say okay, we've harvested all of our low hanging fruit. What will be the first 3 areas where you say, ok here we start now with AI, Machine Learning Training or with Natural Language Processing or something like that. So where would you say that's where I would see the value first.	
85	P3	Preventive maintenance on the one hand, in market research quite clearly customer segmentation, will perhaps bring us to things that we might not have managed to find by hand. Although Cluster Analysis is also quite nice but there will certainly be something. A third one. User convenience issues, so there we're just building the foundation for something like classic, a person boards an RV, we recognize who it is. We have a database of their preferences, we have that. We also have the preferences automatically determined, things like very simply when do people go to shower? I would like to preheat 30 minutes before please. When do you definitely not go shower? I want to kill all the electricity consumption from boilers. So, the convenience area, that would be where we probably work the most, so my department will work the most there. Preventive maintenance is more embedded systems. And market segmentation is just online marketing is also important to us because it defines how much we can put into products and control. So, to spoil that as well. We talk about amounts like can I build a device for €████ and really save a lot, then it's pretty stupid or can I build something for €████ because the customers are willing to pay it. Because then I also have edge computing and many other topics that are also quite appealing and then you also have a bit more offline capability, maybe even for voice commands.	PI-F PI-w-AI EP AI-T-N
86	I3	Oh, a little bit in the direction of analysing users in order to save resources. So okay, I know he's always at the rest area from 12 o'clock at night until 4 o'clock at night or he's driving today, these routes are the most likely ones or something?	
87	P3	On routes, we were actually dreaming. I just remembered, yes, I saw a student project the other day, they propagated exactly that, so the topic of saving energy with some form of AI is totally attractive, we also see that. As I said, things like profile creation for existing behaviour. Yeah, I don't see it in the route planning area. So camper is always vacation, vacation is always	AI-T-N EP

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		extravagant or not norm, so very few people kind of always take the same vacation. So, in that respect it's a really hard field to make any predictions there.	
88	I3	Okay. Yes, that was the only question I had. Cool so Phillip do you have anything else?	
89	I2	I would just go to the wrap up which is scheduled for 5 minutes according to the interview guide but I think we can do it much faster. Right thank you very much for the interview. Cool Insights. Use cases that I couldn't even imagine before. Very interesting topic in any case. We can make something out of it for our master thesis.	
90	P3	This is the part that is really important to me. I was a bit sad that we are doing so little about it, but maybe it's also the insight that there are a lot of traditional companies that are a bit more sceptical about using it and are therefore reluctant.	EP AI-D PI-F
91	I2	That is a very good insight and I think if there is significantly more research done there. Which says AI please don't use it as a buzz word and don't just throw it in everywhere as icing on the cake, but just think about what you're doing, I think that's a better insight than just copying any literature. Thank you very much, I already said.	
92	P3	I would be happy. If you have a result, I would actually like to read it as well, if it is possible somehow.	
93	I2	Yes, of course you can definitely have the transcript of this interview, if you want it, to read over it and see what we should delete. I would now anonymize client names and other names that you mentioned of companies in general.	
94	P3	I think that's good.	

Interview 4

Interviewer, I2: Philip, I3: Alexander

Participant: P4

Date: 30 April 2021

Line	Speaker	Statement	Code
1	I2	Recording in progress. Alex is probably starting one too. Or already has.	
2	I3	In progress.	
3	I2	Exactly, we will send you the document again anyway, so you have already received the interview guide.	
4	P4	Yes	
5	I2	Did you read it?	
6	P4	Yes	
7	I2	Exactly, there are things like, it will be recorded, it will be anonymised, no names will be mentioned and whatever else. We'll send it to you again as a PDF file, because we've now found out that we need it with a signature. Yes, exactly, but of course it won't be included in the Master's thesis with a signature. Then it would no longer be anonymous. Just briefly about the background, what we are doing here we are writing our Master's thesis in a group of three, so me, Alex and Ludvig. But he only speaks English and Swedish. That's why we're taking him out of here. And our thesis is about artificial intelligence in internal business processes. In this case, internal means all processes that take place within the company and are not directed outwards, so things like customer support and other things are excluded.	
8	P4	You mean chatbots and so on?	
9	I2	Exactly. Chatbots could of course be included if you have a case like this: A parent company with various subsidiaries and there the companies communicate with each other with chatbots or whatever. Or a chatbot for the whole IT department, like "Hey, my keyboard doesn't work, how can I fix that? Of course, this could also be an internal business process. Mhm exactly there you participated in our survey with which we wanted to find out in which business processes, or in which internal business processes artificial intelligence is used the most. The	

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		<p>result was that we are focusing on process optimisation. I know, you did not specify anything there. However, that's not so bad - any input is relevant. The interview is about how artificial intelligence has improved some processes. Can you say something about that? Plus what improvements have really occurred. Of course, in the main business of any company, it's always about maximising profit or turnover, whatever you want to call it, but there are so many other business values. Just to name a few Customer Satisfaction or Employee Satisfaction or Cost Reduction or then also Sustainability and Environmental Awareness. Of course, you can always argue in some way that this is connected with profit maximisation and some kind of costs. But that's exactly the kind of thing we want to find out. We have already asked exactly whether we are allowed to record it. You did read the consent. Ok then, first of all, thank you for taking part here.</p>	
10	P4	No problem.	
11	I2	I don't think I need to say much about myself, you do know me. I don't know if Alex would like to introduce himself?	
12	I3	Yes, of course, why not. Alright, I did my bachelor's degree in business informatics in Münster, Germany. And then we came to Sweden last year and started the Master's degree in Information Systems together with Philip. We have now arrived at the Master's thesis and are writing it together and yes, we now deal with this topic. And we hope to gain a bit of insight into AI and companies in general and to find out where things stand at the moment. How are companies moving in the direction of digitalisation? The goals, wishes, hopes, fears, everything like that.	
13	P4	You guys are both in Sweden right now?	
14	I2	Yes, we are both here in Sweden at the moment. Currently in our own flats, but later we'll have a beer together again. Alright. Of course, it's difficult to find a reasonable definition in the field of AI or artificial intelligence. Everyone really looks at it a little bit differently. Various developers would say it's a nesting of thousands of Ifs and ELSEs and not really an intelligence. Of course, you have to differentiate. Internal business process I had already described all processes that are more or less directed inwards. Simply a series of activities that take place within a company in order to generate some kind of business value. Uh yes, then just tell us briefly about what you do.	

		Where do you work, what kind of company is it, what do they do? And as well what your role is in that company?	
15	P4	First of all, I have to introduce myself, I am Socrates, I used to work with Philip as a programmer. That's when we met and worked together for two years. I'm a physicist by training, so I've got nothing to do with programming, so I'm practically a career changer, and over the years I've now founded my own company. And I also have artificial intelligence in my company. Not in processes, but in the product. So differentiation is clear to me, what that is. Artificial intelligence and procured IF statements. So the difference is clear. For example, you can write a programme, a very simple programme, you can put as many IF statements in it as you want, it's simply a process. This is also artificial intelligence, actually. There is no model behind it and it is not a neural network, but it is artificial intelligence. But it's not machines. So for me, everything that has intelligence and is artificial and not human is artificial intelligence. Of course, in the field, when we talk about artificial intelligence in the normal way, we mean that there is a model behind it, a mathematical model. Most of the time it's a deep neural network. That is trained or supervised. I think you are familiar with the terms.	BG AI-D
16	I2	Yes.	
17	P4	This is trained, maintained and applied to certain situations to get predictions. That's the idea behind it. That you develop a pattern, but not with IF statement, but with pattern a trained model. Like this: In the company where I am now, we are three people, so we don't have processes where we apply this. But we will apply it in the product. We apply reinforcement learning in our product. You are referring to internal processes. I can give you an example. And really none of the companies I have worked for here in Germany use it. No modern things are implemented in Germany, the companies are a bit more conservative, so when something new comes along and it's not one hundred percent mature, then it's not adopted in the culture of the company. A colleague of mine works in the bank, in Switzerland, and there they actually use processes. One example I can give is to predict how long an employee will stay.	AI-T-N AI-T-RL PI-w-AI
18	I2	Okay.	
19	P4	So, that means they take all his data. They make a normal database with records and columns, such as age, gender, where they studied and so on. And then they try to predict	PI-w-AI

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		who will go next, for example, or who has a high probability of leaving. According to this trained model, because they also have data from their worldwide banks they can see: Aha, he will go within the next 6 months with a higher probability. He's good, let's talk to him, before that happens.	
20	I2	Yeah, sure. Yes, exactly. Back to your company then, so to speak. Can you tell us a little bit about what you do and where you use artificial intelligence? Whether it's a process or not? It might not matter at first.	
21	P4	So with us it's, you want to predict the price of a pair from the stock exchange. Whether that's gold, euros, US dollars, British pounds. Various futures like the SMP 500 etc. all have patterns. And you can programme these patterns quite easily, it works quite well, I have to say. Last year we had 50% on our capital with the bot, and we had 200 customers for whom it worked. We increased all our capital by 50%. Performance-wise, that's better than any fund manager. So the best fund managers make around 35%. Say a year.	BG PI-t-AI
22	I2	Mhm.	
23	P4	So if you make 35% a year as a fund manager, you're considered a superstar. And with the bot we managed to make 50. Now we're expanding that and so on. The processes and the data sets we have are very simple. Prices at a certain point in time. These 2 things. Price at a certain point in time in the past and then the different patterns are formed. And then on top of that you have to build clever models to recognise certain patterns to give certain positions to certain risks. That is, that is the concept in practice.	PI-t-AI
24	I2	Hm.	
25	P4	And we used different things, the one that works best is reinforcement learning. I don't know if you know that.	AI-T-RL
26	I2	Mhm.	
27	P4	I've built a bit of Q-learning into it. It works very well.	O-I-AI
28	I2	Have you used other methods before where you found they didn't work well?	
29	P4	So this is the beginning, I started working on this in 2016, before I founded the company. I started very simply with	BG

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		indicators and IF-ELSE. So it's very simple, if you do it well, it works. So you can also achieve performance with very simple indicators, practically pure statistics. And I'd say writing a good programme that does things also works quite well. But I believe that with reinforcement learning, when that is complete, when we do it completely, then it will be another step up in performance.	PI-P AI-T-RL
30	I2	Okay, all right, so it's sort of about algorithmic trading in your business.	
31	P4	Algo-Trading. I work for ██████████, I don't know if I sent you that.	BG
32	I2	Yes, you have definitely indicated that. That means we can do more research. Plus, I've been following you on Facebook for 4 years anyway.	
33	P4	Oh yes right.	
34	I2	I do notice a few things there. Exactly. What is your role in the company now?	
35	P4	So I am the CEO but also the main developer. There are three of us, we are all developers. These are two cousins of mine. Typical foreign family. But instead of a kebab shop, we have now founded this company.	BG
36	I2	Mhm, ok.	
37	P4	I program and the CEO part is practically only paper-work. So I am still a programmer.	BG
38	I2	Yes, okay, so your 2 main tasks are more or less administration of the whole company plus development.	
39	P4	Yes.	
40	I2	Something like that. Yeah, cool, sounds good. And of course the question of how do we somehow get that mapped to Progress Improvement? Of course, you can try to argue that, as you said earlier, if a person has all the power and achieves a 35% profit, then he is considered a god and you have now developed a solution that is even better. That is to say, it improves a process in general. But maybe we can also get different development processes involved, such as code analysis, quality control, automated testing, unit testing, integration testing, whatever. Of course, I don't know to what extent that is compatible with artificial intelligence or whether that already takes a	

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		lot of effort away from you, so to speak, maybe you can tell us something about it, do you have a completely normal programming workflow or do you have any specialities in it, even if they are manual now. I mean code analysis or whatever, doesn't have to have anything to do with AI.	
41	P4	Yes, of course, so we have an internal process, which is now let's just say Agile Software Development or Scrum or something clear, there are practically only three of us, or the two are mainly who programme the product, the other takes care of the website and social media. That's practically two programmers on the product. Of course, pair programming and so on is very simple, code processes and so on. That's done more between the two of us. We also have unit tests, so the framework that we built, we also integrated unit tests. The programming language we use is also a bit strange, it's the MQL-5 and MQL-4. It's a C++ like programming language. You have to take care of the memory management yourself, so it's very different from what you know from web development. It's a completely different world. And if you build a stable framework, then we do some unit tests. In the area now, where the recognition of patterns and so on are pure scripts, unit tests are not necessary, we don't do them either. You are constantly changing things there. The code is also, let's say, much narrower, you lose the overview in this area. Oh, there was a signal from the robot. Wait, I'll turn it off for a moment.	PI-C
42	I2	Shares are crashing.	
43	P4	You should buy Australia and Japan now.	
44	I2	Mhm. Thanks for that information. We can call it then now. Haha	
45	P4	Haha	
46	I2	Anyway.	
47	P4.	Yes, the process is much narrower with the scripts. A few scripts are also in Python, we also use the standard things there, then we do in the interface where we extract the data, train the model, model back, signals back, client-server. But then we don't do unit tests. Whenever we start something new, of course everything is wild, but there is no process behind it.	PI-C

48	I2	Yes. Ok, the whole thing is now more or less a project, which means there is no real project management or process management. Or do you manage something?	
49	P4	Yes, we have also developed a few extra programmes for semi-trading on the market. So Semi Automatic Trading has been developed. But these are autonomous projects based on a UI framework that we developed ourselves. Because there was little UI in this area. So, where the trader could really trade with a nice UI and could set things up. So we made a few things and put them on the market. They are all based on this UI and these are 2-3 projects. So at the moment we have 2 that are on the market. Own projects. We don't have anything to do with the other software, they are separate. But processes like, as I said, it's much easier in a small team. We are not in a huge team where we need processes.	BG PI-C
50	I2	Yes. Decisions are simply called over the table manually.	
51	P4	Exactly.	
52	I2	Yes, hands up yes ok.	
53	P4	We have a meeting a week where we discuss where we have been and where we want to be next week. It takes about an hour. If I develop something new or if the other developer develops something new, then he calls briefly - we're here in front of the PC all day. He calls briefly and says take a look at it. And if we decide, okay, that's a good thing, we'll take it into the project. Then, neatly written, everything again and then integrated into the project, I'll say.	PI-C
54	I2	Mhm. Okay, that really means that AI takes place in the product that you are developing there. What technologies have you just mentioned? Is it somehow based on an external service or does it all run on your servers and systems?	PI-t-AI
55	P4	So the new system we have now is called [REDACTED]. We will now go online with it, so until now we have implemented the scripts, compiled them and sent them to the customer as binary. So the new one. Now, we have is called [REDACTED], there we will together with a service, which is called ZuluTrade, uh, you send your trading signals and everyone who does that is this new social trading, that is, you as an investor follow a trader. And all that you do on your PC, sends and receives signals, because they are linked to the other system, are copied and then	BG PI-F

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		executed on the clients. The product will run on a PC. Possibly here at my place or then a server. The signals that it generates it will execute for yourself and send on to the client so that they execute that. But until now we didn't have it like that. Until now, everyone had their own server or their own PC and at home and after they registered with us, we sent them the software practically.	
56	I2	Mhm ok, that means it ran locally on the client's PC.	
57	P4	Correct.	
58	I2	Where does this software get its data from?	
59	P4	Everyone gets data from their broker. The broker provides all the data and also executes the trades.	
60	I2	The broker is now manual, right? I'm not really familiar with the subject.	
61	P4	So the broker, there is the SCM, which is a big server system where all the orders and all the positions from all over the world come together, but in between there are brokers. In the past, they introduced this at some point, the broker is the intermediary, someone who has the licence to execute orders in the NCN. It used to be with the telephone, you wanted to sell, you called; you might know that from movies from the 70s, two telephones at the same time. But at some point they got the internet. And everything is online now. Broker is a group of people that has a system that takes your orders. They then have the data, they then give it to you. And you have a programme that runs on your PC, most traders have MetaTrader5, which is a software that runs on Windows. You log in there with your data. Then you can trade.	O-I-AI
62	I2	Mhm. The first thing that happens is that I open the programme, log in and it downloads all the historical data so that I can see the statistics and somehow the curve in my programme. And then the programme makes suggestions as to what I should buy or sell or sends it directly to the broker to buy and sell. That all happens automatically.	
63	P4.	That's exactly what happens when you log in. The data comes super fast. Everything is directly there.	
64	I2	So what that means is that this whole AI framework and everything with AI behind it is actually executed on the customer's local machine.	AI-T-N

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65	P4	Until now, yes.	
66	I2	Yes, of course, exactly, the previous product. In the new product, of course, it is then simply outsourced to another computer, as I have now understood. Which actually only sends signals to the client, which follows others and also executes their signals.	
67	P4	There is an intermediate server, which is the one that receives the signals, copies them there and distributes them to all the other clients.	PI-F
68	I2	Exactly. Yes, how can we best compare this now? Have you, i.e. have you probably always further developed your bot? And have you made any statistical analyses or can you perhaps simply give a feeling to what extent which changes have brought which improvements? So especially with regard to the initial phase, where you really used IFs and ELSEs, plus then brought in artificial intelligence.	
69	P4	So with in the initial phase, as I said, we took indicators. These have parameters. And you can combine them with each other, i.e. combine indicators with each other and achieve different results with different parameters. There is an optimisation area in the development environment. Where you can optimise different data sets, so you can check your algorithm with back-testing. Let's say you have collected Euro vs. USD data for the last 2 years and developed a strategy with various indicators, in which you then put 3-4 parameters. One parameter runs from 2-8 with step 0.5, the other runs from 1-100 with step 10 and so on. Different parameters with different values. And you put all this in your system and say ok run me through all the different combinations, a typical optimisation work. Brutal force optimisation I say, do all the combinations of these parameters for these 2 years for Euro vs. USD, and tell me with which combination of parameters did you make the maximum profit? That's how we worked. It works. The big problem with this is overfitting. You probably know the term. It also exists in artificial intelligence, corresponding to overfitting the model. In practice, this means that you overtrain a model and it is perfect only for these data sets. And it fails with new data sets.	PI-P AI-T-N AI-D
70	I2	Mhm.	
71	P4	Because he has specialised so much for these hundred million records. Trained, trained, trained. He only knows	AI-D

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		<p>these now. But he knows them well. That means in these areas, in this category, he is very good. But he specialised too much, that's called over-fitting. And the problem is that when you optimise, even with parameters, you can see that I'm making 300% per year with this combination of parameters. That's great, I'll do that once, but then the next year you might also make minus. Too specialised. Then you start to think, ok, I have to be a bit smarter, maybe look for dependencies between the parameters. If they have dependencies, fewer parameters and so on, you start to go further and further and at some point you realise if it goes too much to IF statements, then I need something else. I need something that includes all the information in something else. To make this prediction, otherwise you die with IFs and ELSEs and with over-fitting. Then you do less parameters and less IFs and ELSEs. Then you have less over-fitting but the performance drops again because many, many situations are omitted. It's always a back and forth game. And because the others also use robots. In the meantime, we are not the only ones, there are 14 companies in the US that are very famous and have a lot of money from clients. They make investments, they do trading, they do everything. You're practically playing against them, too.</p>	<p>AI-T-N PI-C BG</p>
72	I2	Mhm.	
73	P4	So then you have to fight very, very, shall I say, to take a small part of the market. The market is constantly adapting and it's very, very hard for a robot to constantly, let's say, train that once and that's forever.	PI-C
74	I2	Ah, this applies to the robot, so to speak, that it is no longer up to date and you would therefore lose customers, or how do you mean that?	
75	P4	So. It's very easy to take indicators, take parameters, do optimisation and make a robot that wins. Very simple. It can be done by practically anyone who has a little bit of exposure to it. But you need something that is valid for a long time or for a certain position for a certain market with a certain volatility almost all the time. I'll say that. Yes, and for that you have to go deeper and deeper into the matter, always improve optimisation methods. The over-fitting. At some point you come to the point and say, wait a minute, maybe it's worth putting all this into a model? And make something good out of it? Yes, and then? At some point we reach this point. Trying out different things. But for us, that's Reinforcement Learning.	<p>PI-P PI-F AI-T-RL AI-T-DL</p>

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		Not even DeepQ-Learning. If you do it in a smart way, you get good results.	
76	I2	Now you have gone up a level, so to speak, and as you have just said, at some point you naturally reach the point where you have to lump everything together again and say ok, we have now trained this far and have now become better here and then the point comes where reinforcement learning perhaps no longer works quite so well, but you go a step further again. Have you already thought about what the next step will be?	
77	P4	So yes there, Deeper Reinforcement Learning and something else doesn't exist yet. We are already in the development phase in 2015. You have to do your own research. We make the applications of what is available.	AI-T-RL AI-D
78	I2	Alright.	
79	P4	We don't do our own research, we don't do academic work here in the sense of our own methods. We just try to understand what is available and apply it well. I have started to deal with DeepQ-Learning, which is in a completely different league than Q-Learning. And there are now tutorials where they analyse the papers. So they take a paper. They read it, try to understand it and then they do a ten-hour tutorial on it where they apply it properly. I think this new fashion is good now, instead of you trying to understand it yourself, because they are also very mathematical most of the time and maybe there is something good in it and you don't understand it. Well, I personally am a big fan of video tutorials. Thank God 2020 there are loads of them where everything is explained quite simply. We take that and try to adapt it for our needs.	PI-F PI-C O-I-AI P-w-AI
80	I2	Yes, now you have already mentioned that you are not the only ones who do this and that there are various other bots on the market. Are they all roughly on the same level? Where would you place yourselves? Just in the range of your competitors? And what would you perhaps say you do better and what do they do better?	
81	P4	What I have seen now for the competition, many also make 600% in one year. Which would be 12% better than us, but then the next year they make minus 50%. So I think there are a lot of people who make a lot and very, very good performance for a short period of time. But then in the long term it's called a big draw-down. You get	BG

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		out of the range if only the model works then. And then you make huge, huge losses.	
82	I2	Mhm. Do you think it's because they over trained it?	
83	P4	Exactly, I think we all have the same problem. Most people don't do artificial intelligence, most people do optimisation. And there is the over-fitting problem just like with neural networks. And I see that with them too; I was also trapped myself, I had seen 1000% in one year: I'm going to be rich. But that's not the case, because afterwards you take the same model, apply it to silver, but you trained it in gold and it fails when applied to silver. Or it also works in silver, works for 6 months then you go down. Draw down is the worst thing that can happen to you in trading. Because if your capital has lost 50%, you have to reinvest 100% to get to 0.	AI-T-N BG PI-t-AI
84	I2	Ah ok.	
85	P4	Larger draw-down periods are an absolute no-go. What I see with the competition is that they have very high performance, but also very large draw-downs in the meantime. And we don't have that. So our big competitive advantage, that is also what we advertise, and every trader understands that: Small draw downs mean you can increase the risk a little bit. And you can sleep a little bit better because you're not going to get up and have a 20% loss.	BG
86	I2	Ok good keyword what you advertised with, or still advertise with. How did you get your customers?	
87	P4	100% via social media.	BG
88	I2	Okay.	
89	P4	So. But now, of course, we have to make the transition from the old product, which will soon be phased out. We have to move them all into the new platform, which is 220 customers worldwide. That's also something good. We have clients all over the world. We have a regulated broker, everybody trusts, that means you're not restricted in Germany in terms of clients. Instagram and Facebook, the very most of Instagram. Instagram had practically made us. And that's without money, just work.	PI-F
90	I2	Okay, so really just posting and stories.	

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91	P4	Exactly. Posting, seeing who reacts, approaching people actively. Or actively approach people in trading groups. Get into conversation, explain what our product is. Our product is also free.	BG
92	I2	Yes.	
93	P4	Customers have nothing to lose. Others who have bots sell them. We win because we work with a certain broker and from the difference of the spreads he gives us a part. That is our profit. So it's a small profit in comparison to what others earn. Many who are even more aggressive in the market sell the bot for 100€ per month or something like that. If you have an equity of 1000€ and you want to go in with just a little bit of money at the beginning, you can't charge a hundred euros, because then you lose the small customers. Because then the software has to make at least 10% in a month. So that you can even cover the costs of the software.	BG
94	I2	Ok, you are more or less an algo-trading for the little man or can you say that you already have bigger customers here by now?	
95	P4	We also have bigger clients. But the little guy has the chance with us, because otherwise the others go to Goldman-Sachs and invest their money, of course they get less performance. So we don't control Goldman-Sachs. There are institutional traders, we are for retail traders.	BG
96	I2	Yes. Alex, do you want to ask the question directly?	
97	I3	Can you maybe say approximately how much volume is traded via your bot at the moment, maybe per month, so only if that's possible somehow?	
98	P4	Yes, it is about [REDACTED].	
99	I3	Okay, that's already a size. It's just that you can roughly estimate in which dimensions you're moving, because you're not directly competing with Goldman-Sachs.	
100	P4	There a customer goes in with [REDACTED].	
101	I3	Yeah yeah. Very interesting.	
102	P4.	Within 2021, when the new system comes in, we want it to be even easier and the environment of ZuluTrade, there are already a lot of investors in there. Then we will have another extra platform. Then we think we are already top	PI-F

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		100. That is our goal for the next few years. If you are top 100, then you also have other volumes and other profits, of course.	
103	I2	All right. Exactly the difference between before artificial intelligence and after artificial intelligence you described a bit. You also confirmed that it works better with artificial intelligence. So would you also say in general that the use of artificial intelligence in whatever form has made your work easier plus brings your customers more profit?	
104	P4	I don't know about easier, because the work has remained the same. The performance has improved, but the work has not become easier or more difficult - it's just a different job.	PI-t-AI
105	I2	This is the kind of development work you mean now?	
106	P4	Exactly the development work is still the same, testing what works, refactoring. Testing with real money and with a demo account. And then bring it to the customer at some point when it's mature. So nothing has changed now. The performance has to be better, of course, and we hope that it will be even better. And we are at the beginning of our real Artificial Intelligence . Neural networks as artificial intelligence, so to speak.	PI-t-AI AI-D AI-T-NL
107	I2	Yes, I had already noticed your definition. Right then, a quick look into the future. You have already briefly mentioned where your next step would be with Deep Learning. Or whatever you called it.	
108	P4	Reinforcement Learning	AI-T-RL
109	I2	Yes, exactly right. You said after that, or one step higher, there is no such thing at the moment, certainly not in the range of your bot.	
110	P4	Yes, well, I think in general there is nothing. Deep reinforcement learning is currently the spearhead of artificial intelligence. So the last things that were published in 2018 are really already on the market. Alpha-go and Alpha-0 and all these programmes that use that. The next big step would be G-AI. General AI.	AI-T-RL AI-D
111	I2	Okay.	
112	P4	A big step then has been taken by the team at Google. Where they might play both GO and chess with the same	AI-D

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		model. So that's already a big step, because you practically train a model and it works in two different places that have a completely different logic. That is already a first step towards general intelligence. So I think the next big step in this area is to train models that are applicable in 2 different areas or more. But there is nothing on that yet.	AI-T-N
113	I2	Yes. Yes, exactly what you just mentioned, then really train models that are applicable in several areas. Would you like to name 2 other artificial intelligence types or use cases that you think will revolutionise the industry in the next 3 years? Maybe just 1 if we can't think of anything else?	AI-D AI-T-N
114	P4	So if that's how I feel, yes, that's my personal opinion.	
115	I2	That's what we want.	
116	P4	Deep learning. So the very typical deep learning will, I say, establish itself like Excel. The reason for this is, of course, that there are now super fast PCs everywhere. That's one thing and the other thing is that there's a lot of data everywhere. In the next 10 years, we will have so much data, about 10 to the power of 3 times what we have now. Or even 10 to the power of 6. So and that's why when you have that much data, and deep learning has become super easy for the user, you can train models on an iPhone now. I think that by 2030, a system like this with deep learning, where you can train different processes or products, will be the multiplication table, so to speak, as well as Excel. That's the development that I think will happen. In general, I think artificial intelligence will have a very big impact in all products. So we will experience a very big revolution with this technology in our lifetime.	AI-T-DL AI-D PI-t-AI O-I-AI
117	I2	Yeah, very good.	
118	P4	We will experience a great technological singularity. If we think that again technological singularity okay yes.	PI-F
119	I2	Yes, exactly, Alex, do you perhaps have a final question or questions?	
120	I3	Maybe again, independent of the trading bot. Do you think the trading environment will change, that maybe the order management will be solved by AI, that you can maybe link the buyer with sellers, or eliminate the broker, or that I will simply change this whole environment	

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		through AI, which would then ultimately lead back to your product.	
121	P4	So you can't eliminate the broker, because that has to do with legal things. It's not just the technology behind it. It just has to do with regulation. There will be more regulation instead of less.	PI-F O-I-AI EP
122	I3	Mhm.	
123	P4	Therefore, the broker will not change. From the environment itself, more and more people will use bots, either semi-automatic or fully automatic. It's going in that direction, so as a tool there will definitely be supported software in the future.	PI-F O-I-AI EP
124	I3	Yeah.	
125	P4	Not only for the trader, for all of us there will be supporting software.	PI-F
126	I3	Maybe a short follow-up question, if you think 10 years into the future and, as you say, this access to this bot is super easy. Not everyone can win on the stock market if everyone uses different bots, so to speak, and there have to be bots that win and bots that lose. And that changes the patterns and you actually have to train your bot so that it is better against other bots. At the moment it is probably better against humans, which is also the comparison. Do you think that will be a big change for you, too, that you really have to take a completely different approach, like trading bots?	
127	P4	Of course, it's always a race, just like with the chess machines. In 1997, the first chess machine beat the human, that was the stockfish 2. Because stockfish 1 lost to the same human in 1996. They improved it and Stockfish 2 beat it in 1997. Today we are at stockfish 8. There are different people building different machines and now programming teams are fighting. So the highest level chess games are now between machines.	AI-D AI-T-N
128	I3	Mhm.	
129	P4	AlphaGo against Stockfish 8, against random people. They also run live, you can also see them, they play games there all the time. If you log on to Chess.com and click on artificial intelligence, you can see the 2 bots	AI-T-N

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		playing decently. So yes, there will be a battle between machines, also in trading.	
130	I3	So you think in the long run it will become more that the trading volume of machines exceeds that of humans?	
131	P4	That's already the case.	PI-C
132	I3	OK.	
133	P4	So most of it is invested and traded by machines at the moment.	PI-C PI-t-AI
134	I3	Interesting.	
135	P4	The human being is then only a supervisor so that nothing completely crazy happens. Something completely crazy has already happened. The Dow Jones fell by 30% within 2-3 minutes. Because two bots undercut each other. In a recursive manner. They fought so hard with each other, everyone was shocked. You could see it was a manipulation. A manipulation was behind it, you think. I'll send you the story in a moment.	AI-D EP
136	I2	Yes, it would be cool if you, if you find it directly. Otherwise, we can also search for it.	
137	P4	Yes, so it will be a battle of the robots. That's clear.	PI-F
138	I3	Okay, yes, interesting. Otherwise, I have no more questions.	
139	I2	No further questions. Right then, thank you very much for the interview. A lot of good insights, more process optimisation than you probably think. We can definitely take some things out that we can use and also some interesting statements especially here machine against machine and things like that. And also that Deep Reinforcement Learning is currently the spearhead of artificial intelligence. I don't think we've covered that in our theory part yet. I don't know to what extent Ludvig has dealt with it. In any case, good information, very helpful, thank you very much.	
140	I2	That would be the end of it. Have a nice day.	
141	P4	Thanks. You too. Bye.	

Interview 5

Interviewer, I2: Philip, I3: Alexander

Participant: P5

Date: 04 May 2021

Line	Speaker	Statement	Code
1	P5	Thank you.	
2	I2	Alright, Alex you started as well I guess?	
3	I3	Yes, yeah, Phillip will conduct the interview and I'll be more in the background. I'll turn off my video and just take some notes, so I'll be more on the sideline here.	
4	P5	Yeah yeah, just interrupt me when I answer questions. If something is unclear or something, just let me know.	
5	I2	We'll do that afterwards. Yeah, alright, so you said recording is great.	
6	P5	Yes.	
7	I2	You read the interview guide with the private privacy contract.	
8	P5	Yes.	
9	I2	We're not gonna put your name into our thesis. We are also not gonna put any of your company names or if you name some customer names whatsoever. You do have the option to get a transcript of the interview before we actually use it. So that you could say like, OK, please scratch that or something. If you want it, let me know.	
10	P5	I think for me it's probably fine.	
11	I2	Alright. Yeah, so then basically our work is about artificial intelligence in internal business processes.	
12	P5	Yep.	
13	I2	Because you can probably imagine that artificial intelligence is mainly used in something like manufacturing, automation process and whatsoever. But there is just little research out there for internal business processes and as an internal process we have decided that it is any activity of a company which is actually focused on the inside and stays within the company and does not include any other outside stakeholder.	
14	P5	Yeah, OK.	
15	I2	So then thankfully you have participated in our survey already. And that gave us some pretty good feedback on that. And the survey was basically to narrow down our	

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		scope of work on which internal business process we focus, and maybe also in which type of AI. Came out that the type of AI is really really different and in many different companies. So we're basically not really focusing on any type like machine learning, natural language processing or deep learning whatsoever.	
16	P5	Yeah yeah.	
17	I2	So our survey results forced us to focus on the process improvement within the company where we say like OK usage of artificial intelligence to actually identify and analyse the processes, you have to actually improve them.	
18	P5	Yeah.	
19	I2	So this is what our thesis is about, and we're trying to find out if and if yes, artificial intelligence has an impact on process improvement in general. So this is our topic.	
20	P5	Yep.	
21	I2	Consent is fine, record for permission is here. Then yeah, thank you before to participate in the survey and also here in the interview, uhm, let's just go into it. What can you tell us about the company you are currently working in?	
22	P5	Yep, so company I work for is [REDACTED]. I'm responsible for global expansion, so basically setting up new countries, starting new countries, expanding our business in different countries. Uh, what we do is kind of test. There's a couple of different. The topics that we cover most is call credit. It's basically you can top up any type of phone anywhere in the world as long as it's a prepaid phone. Uh, another part of our business is more on gift cards or prepaid cards, which is, for example, I don't know in Sweden, I guess it's the same, but in the supermarkets at the cash register, you have like the iTunes gift card, Google Play, those kind of things. So you can also buy those online on our shop and one other part, which I think is probably most important for us, at least for now, for our growth is prepaid credit cards or prepaid money cards. Popular in Europe is paysafe card. It's basically used for you could say three things. One is privacy, so people want to buy something somewhere, use a prepaid, or they use it for something and they don't want other people to know that they are using it. So it could be porn, could be gambling. Well, those are the bad examples, but it can also be that they just don't want, uh, they don't want their bank to know that they bought something, so they buy prepaid cards, buy with a prepaid card the thing that they want to do or want to buy to kind of hide it. And then you also have the ones where people don't have a credit card. But	BG

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		they cannot get it because they don't have the right income, they don't have the clear income statements. So they buy a prepaid card and they can still use this credit card, and the third one is people want to actually they have like cash income of cash flow or cash money and they want to convert that to online without putting it on a bank account. So then they go and that's not on us, but then they go to the shop, buy the cards and then use the cards online. So we are like the shop for that, the middle man you could say.	
23	I2	OK, so what is your role in this company?	
24	P5	Yeah, so my responsibility is yeah expansion but so we basically in a phased approach we start new countries. So we do research, we built the shop. We get all the assortments and we call extraction so we put it live and we make sure we turn the ads on, make sure people come through the web shop and buy them.	BG
25	I2	That's only for new countries or also for new customers like new cards that are available?	
26	P5	Uhm, it's a little bit of both, uh. If, for example, is a product is popular in a country that we're not active yet, then we also want to add that product, so we also have to make sure that we add that product. And also when we launch a country, it's in in my division for let's say, three to six months for the starts to make sure it runs smoothly. So it's kind of like starting it, but also yeah, more like managing the country for a short period of time.	
27	I2	Yeah okay.	
28	P5	All new services. So for example, what I'm working on now is bill payments, so for example, if you live in Sweden and you want to pay your bill in Germany or somebody in Germany most of the time, it's quite difficult to do that.	
29	I2	Yeah, Yep.	
30	P5	So what I'm working on now it's still going to take a lot of time, but to be able to do cross border bill payments. So we connect to a company who connects with all these kind of dealers. Let's say electricity company or the example that we're working on now is corridors from the US. So people living in the US to Mexico and later to other countries as well. Electricity company in Mexico, you're a family member, loved one in Mexico has the bill. You send the bill to your friend in the US and just by filling in their account number, you know what's the open saldo, you pay it and then it gets fixed.	BG PI-F

31	I2	OK.	
32	P5	So it's also new surfaces. So it's a bit wide.	
33	I2	Yeah. Uhm, so what would you say are your main two tasks that you probably do work with every day?	
34	P5	Uhm, so you could say that it's a combination of performance management, so I'm making sure like checking numbers adjusting, uh, adjusting the marketing spent. So maybe change the ad setup. Change the campaigns and one part will be research and another part is, uh, which I think is probably a bit more connected to what we're talking about now. More like internal stakeholders where we have to build a country, so if he shoots it but it's not live yet. I mean a shit load of things has to happen like my team specifically doesn't source the products that we have a category buying team to do that, the people who prepare the ads is the marketing team, the content has to be written and translated, that's the content team. So we have a lot of internal project management before a country is actually live and everything is fixed.	BG
35	I2	Yep. Good connection actually to the processes in general, and I mean, do you have like an overview of the processes you have, or does it just work as it comes?	
36	P5	Uhm, yeah, I don't really have an overview. But if I would look at a company.	
37	I2	Do you have any processes like visualized or modelled actually in your company? Or you have them like written in a To Do List, if this comes up, please check with the person.	
38	P5	Yeah, so we don't really have them written out, so most of the time it comes and goes or it's kind of like automatically.	
39	I2	Because everyone knows them?	
40	P5	Yeah, yeah, I think that's the case. It's also not. I mean in the end what we're doing very very basic. It's like we buy a code from somewhere. We put that code in the system. You buy a product, you get a code in your email. Kind of. That's simply what, what is our business.	
41	I2	Yeah yeah.	
42	P5	But of course, there are processes like buying these products, getting the invoice, paying the invoice. Putting like one, I think there's. I mean there's a process for when a product is launched, so we have a stepped approach like this, at this moment this person writes the content, this moment this person uploads the code so buys the codes and uploads the codes. There's a check was going on at a	

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		moment, is everything ready. Check, check, check yes, turn it on live so. But we don't really have any written outs now.	
43	I2	OK. Do those processes maybe differ from country to country or have you experienced anything like OK we couldn't use our regular selling service in for example Germany. I don't know.	
44	P5	Yeah. Yeah, but it's not like markets related. So for example, when we went live in Turkey and in the Emirates and in Saudi Arabia the prepaid cards are very much limited because you cannot gamble. You cannot watch porn because it's against the local law. Uhm, so there we had more difficulties because we need to find like different types of products. If there's more commercial difficulties, then we need to change our process.	
45	I2	Yea. So in this survey, I think you checked that your company does not work with AI.	
46	P5	No no. At least not sophisticated.	
47	I2	Sure, do you use any tool, I don't know for researching, marketing or data analysis which has at least any or at least some connection to artificial intelligence?	
48	P5	Uhm it's more like calculations, so yeah, it's like we use a, we use Tableau for our reporting right, but it's more like reporting what you've sold. There are some calculations in that of course, but uh, you could say. Our Google ads. It runs on the on the Google bidding system. Which we are also in the process of automating that. Preferably what we want to have is that automatically when we add products to our shop. That. Let's say the AI already knows like, OK, this product has these characteristics. It's black, it's yellow. It's big, it's small. This product has a has a connection with these kind of search terms, so you actually want automatically that the Google ads program says OK, then I would put these ads with these search terms. I would target these ads on young people because they these products are for young people and other products for old people, or if we add call credits, for example, we want in Germany you would like the system to say hey, that's good that you added call credit in Germany, but you should also add Turkish call credit in Germany because there's a lot of people in Germany searching for Turkish call credit because they are family or something like that.	BG PI-F
49	I2	Yeah.	
50	P5	Yeah, I think that would come close. Yeah, that'll come close.	
51	I2	Scratch that in the transcript.	

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52	P5	No, it's true, right? I mean to be honest, in my in my work we have to, uh, the migrant flows are super important, because that's a. And it's not only like, let's say the old migrant flows. It's also new, like workers or students flows because most of the time. People move to another place, even if it's temporary or for a longer time, you don't really start in the beginning you might get a prepaid card you know you prepaid phone, because here I go when we were in Australia we had a prepaid phone. Or I think you had one.	BG
53	I2	Yeah, I think I did, yeah.	
54	P5	Yeah, so for us for us the migrant flows are super important.	
55	I2	Yeah, OK. On those Google search terms. Do you have any influence on them or does Google do this automatically?	
56	P5	So, so you can go as crazy as you want there, so you can do it all manual. And that's kind of what we're doing now, although we get some help from Google and you have, I think there is programs. I mean, I'm not specialist in this, but I think there's programs that you can use. So what we're going to use is SA360, search ads 360, I guess. Which will give all kinds of like advices and it taps into a, Yeah, bit more into automation. Probably what we need to do is it's more like make a taxonomy of our products right. It's a what is it for? For who? What are the terms related to that product we need to give them some input.	PI-F PI-w-AI O-I-AI
57	I2	Yeah, and those information you get from where? Like probably the search terms and the advertisement differs from market to market.	
58	P5	Yeah, yeah. So at least from product to product you could say. But also from category to category so I mean the simplest one is buy product online, right? that you can fit for anyone, but I mean I don't know how it is in German. For example, there's different names for example for call credits, so some of them is called airtime or you call it top up or reloads or recharge. So there's a lot of different terms. Uhm? That just includes. And we get some information from our suppliers. So when we get the products, they most of them know their products so they tell us like we know for example this product is super popular in Italy. OK, great then and it's mostly used by young people. And when they use it, they mostly use it on gambling or on gaming.	
59	I2	So you do not do like your own market analyses?	

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60	P5	Uhm. And then we did more on, like, uh, so analyse the country like what kind of what is the population? There is something difficult, but there are also numbers on, for example, how many people have a prepaid phone. That data is there, but for example for prepaid credit cards that data is very limited. It's kind of like a. I wouldn't say it's a hidden business, but it's not really out in the open. It's not really. Not really, not really out there.	BG
61	I2	Yeah.	
62	P5	Uh, so we do. We do our own research. Uh, sometimes it can also be like checking what people advise each other on forums. But I live in country X, uh, I want to pay a bill for my family in Mexico. What do I do? Empiricism had to give some information there. So you see, as like communities helping each other.	
63	I2	Yup. Uhm. You probably also do not have any or did you work with AI and in some extent in your previous company?	
64	P5	And I think that's probably more interesting, so at my previous company we were running everything on an auction platform, so we had a kind like the old eBay so you know Groupon right? We did Groupon but then in auction way so you have the you have the product. Soon they'll go to Germany again. You have the product, and the auction runs for two minutes and then who ends up with the highest bids gets, gets it for that price. And that was a bit more interesting I would say in terms of AI we were building our own and others. Basically the backend that decided how long should an auction run.	AI-T-ML
65	I2	Based on what data?	
66	P5	Yea so that's the thing. First, it was all like manual, so it was more like we had like, oh, I think at some point where like 15 people just planning all the auctions. And slowly, over time we started to automate automate automate based on basically we try to do based on any data like weather. But most the time, how many people on the website? What time is it? What is the price that we're aiming for? So then it would just try and say like OK if you want 50 euros for this product and you know the weather is shit outside while normally it's summer, so people are inside. You have 20% more traffic on your websites. That means that the auction should run for three minutes or five or two? That was quite interesting actually. It was in terms of AI I think that that's what came closest to from my experience, yeah.	PI-T-AI AI-T-ML
67	I2	Yeah OK, uhm. So just quickly back to your current company. Uhm. What comes closest to AI I think is the	

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		Google ad and keyword search. Do you have any idea how it would be different if Google does not improve the ads like automatically, I'll give you several keywords.	
68	P5	Yeah, so maybe the way we do it now is it's all, uh, it's more like you could say logic like what do we think people will search for? Uh, now Google also has some programs as you can test like how, how big is the search volume for certain words or combination of words. But let's say if that was not there, I think there's a lot of companies out there who would just do it based on their gut feeling. So they would have to decide like, OK, I think people will search for winter sports gear in October. And I'll probably search for skis combined with a hat, I don't know, but these guys, yeah, it's more like gut feeling.	
69	I2	Yep.	
70	P5	So if it was not there, probably companies would probably build it themselves.	
71	I2	And what would you say then the audience, uhm, like in terms of numbers? Do you have any experience with that? Like maybe in the beginning when you started at your company, you did it maybe also differently, and then you gained new markets and new knowledge. Do you have any. Something like how does it differ from back then to now in terms of I don't know followers, clicks, visitors, whatever the index numbers on ads are.	
72	P5	Yeah, I mean uh, well can you maybe repeat the question. Like what number indicates?	
73	I2	Yeah, yeah, first of all what next numbers are you using to measure the performance of your product?	
74	P5	Yep.	
75	I2	Compared in market categories and whatsoever. First question.	
76	P5	So that's first, so that will be how we basically do this. I mean, there's a lot of numbers, but it comes down to how many sessions on our website. So how many people come to the website? And then you could say the full conversion from how many visitors are there to how many actually place an order. So that number is of course highly important. There come a lot of steps in between, because maybe they have to make a profile first. How many people make a profile? How many people that make an order? When it comes down, my suggestions are users, orders, uh, and let your user like number of customers and then down to like the financial number. So what is the GMV we call it, the gross merchandise value. So what is the the face value of the product and how much do we earn on a product. So those things we measure and it	BG

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		differs a lot per country. So some countries are like. Conversion can be, I would say, quite high. It's like 15 to 20%, so we attract a hundred people, twenty place an order. Uh, but other countries we attract a hundred people and only five place an order.	
77	I2	Yeah, you put them then away from the market or do you leave them there because everything is electronically anyway, so it doesn't matter actually.	
78	P5	Yeah, we always start to improve. I think that's, uh, that's great, we will always dive into it and try to understand like hey, why? Why are these people dropping out? At what point are they dropping out? Maybe we've overpriced ourselves. That happens. That we think, OK, we add like a service fee or we want to earn I don't know two euros per order, but we went to Poland and the purchasing power of people is way lower, so we can ask for two euros, but then nobody is buying it.	PI-P PI-C
79	I2	Yep.	
80	P5	So we have to reduce the prices. Make it a bit better, speed of the websites, that the types of payment methods that we offer is also super important. Uhm yeah. So those things are. We would it can be, that we decide to stop a country, but most time that means like we just minimize the efforts, we just let it run. Uh, don't spend too much. It'll grow automatically, slowly.	PI-P
81	I2	Yeah, and do you have any cost with that? If you offer a product in a specific country?	
82	P5	Yeah, so we have. I mean, of course the cost of the product. Most of the time we purchase it. Other times we if for example you would top up a phone, it can go automatically. So then we don't really have a cost. We just earn a margin on that. The biggest cost for us two most on the payment sites well and marketing spends, but in terms of processes. Maybe that's also good for processes. The whole payment process. So for me, when you click on pay to when you actually have finished your order, a lot of things happen in between. So we have an integrator. So for example, somebody that offers the credit card so you can pay with a credit card. Uh. And what we also have is a risk check. So based on certain indicators we have an external risk check that checks like OK. Is this credit card person or combination of these is that high risk? Then it might say like okay you shouldn't accept this, this person or this payment because they will perform a charge back and then you lose your money.	PI-P AI-T-N
83	I2	Yeah OK.	

84	P5	Right, and that's not internal, so this external, but that's also quite an automated system.	
85	I2	OK, uhm why would you lose the money on a charge back? Because they have the prepaid card and can actually pay with it and there's no chance to get money back from the person?	
86	P5	Yeah. It's difficult, it's quite difficult. So we would have to say we send the code out right? So the code when the code is gone, it's gone. We cannot really take that back.	
87	I2	OK, yes.	
88	P5	So the one the person who gets the code can use it. And when somebody follows the charge back, it's quite difficult because you have to prove that you gave that person the money and it can take like a lot of documentation.	
89	I2	Yeah, OK.	
90	P5	Or sometimes it's stolen credit cards. Then yeah, that's it. So these kind of companies are more like an insurance. They can check. This was called riskified, so you can look them up. They're just out there. Based on a lot of knowledge that they have. They have knowledge from all the other companies also and they already know that a card has been used or misused somewhere else. It's in their system and they say, hey somebody trying to pay with this card, but it's already a bad card, so don't accept it. Or sometimes it says. There's also a lot of false positives I should say, yeah, so people who are actually blocked, but were actually a good customer. Uh, it blocked me once because I paid with my own credit card, and then I paid with another credit card that I have from my bank. And then it was like, hey wait, this guy is now in a short period of time buying two things with two different cards. Now then it's like, no, you can't. You should check this person.	AI-T-N
91	I2	Yeah well that happens for us a lot especially here because the Germans are usually not used to pay every single item with a credit card. Uhm, so they also blocked my credit card I think 2 times now. [REDACTED]	
92	P5	Oh yes, and that's probably your own bank right saying like hey, this looks dodgy.	
93	I2	Yeah.	
94	P5	And then says, like hey, we freeze your card, yeah, so that's uh yeah, Germany is a special case. That's in terms	

		of banking and finance that's different there. Yeah, but still yeah, these kind of things happen, right?	
95	I2	Yeah, but I mean then the risk analysis is kind of an important feature, especially for you guys. And did you have it implemented when you started at the company?	
96	P5	Yeah, yeah, so I I've only started one year ago so it was there. But definitely when the company started, I think it took a while before they had had that implemented.	PI-P
97	I2	OK, and then they actually lost money and had a lot of, uh, that's to do to get their money or keep their money.	
98	P5	Yeah yeah, and they started quite basic right? So for example last year when I joined. We have a limit, so we say if somebody orders over 300 euros in a day, no. If somebody orders over 300 in a day, after that it goes and the customer goes into investigation because then we want to check at least if it's correct.	PI-P
99	I2	OK.	
100	P5	Well, we set 300. The system was built on 300, not 300 euros. Just 300, so you could also have 300 crowns. I think it's Zloty so that that was that.	
101	I2	Which is not that much.	
102	P5	That's something I found out when we started in Poland. I think It's been awhile, but I think 300 Polish Zloty is like 60 euros I think so yeah.	
103	I2	Yeah, I mean 300 crowns in Sweden is like 30 euros. Even less, 28 or something	
104	P5	Something, yeah, so people get, luckily we're not that big in Sweden, but people would get blocked if they would. So any order of like 400 crowns would be already immediately investigations so it's super terrible customer experience, but nobody really. Yeah, well nobody was ever looking into that, they just launched a couple of countries then never looked into it.	
105	I2	Did you then actually get complaints about it?	
106	P5	Yep yeah yeah for sure.	
107	I2	OK, so this is how you found out?	
108	P5	Yeah, so for me it was easy because, uh, I could see how many people, is something I wanted to check as well, when I saw that conversion is low. I can see why it's happening and in which step people drop out. So I have one indicator on how many people get into investigation. Uhm, so I saw immediately in like Poland for example. There was quickly it went to. It was like 30% of people already went into investigation. What's going on, why?	PI-P

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		And then we saw ah were hitting the threshold of 300's. Yeah OK.	
109	I2	Yeah.	
110	P5	But you know, the problem is that the money is being taken from the account and as a customer you don't get the codes. So you're like. Hey, what the fuck I'm scammed so it's like they took my money and I don't get what I wanted.	
111	I2	Oh, so there's no like, OK, uhm, we put it directly on hold. Now we get your money, but you don't get anything. I mean, you could implement it like OK if it happens for the first time, you get kind of like a warning and then some person could look into it manually or something.	
112	P5	No, not the first one. You go on hold, you get an email from us. I think that's already automated as well. Saying OK, sorry for your and our protection. We just need some more details and sometimes just answering the emails already enough because then we know there's a person behind it. Because what we also have is like fraud attacks which are kind of like AI as well. They test our system. Uh, so they have a program. They use a VPN. They see how far they can get in one country with one card and they kind of like make a measurement of OK. These are kind of like the thresholds of this company and then they build the bots you could say to exactly stay in between those thresholds. So somehow they get a hold of a long list of credit cards and then they start purchasing all kinds of different things, and when they notice that they're blocked, then they use a new card, a new email address, a new VPN, new country, and then they do it again two times and then they'll take the next, but it can go up to quite high numbers.	
113	I2	Was that is the only occurrence that you know of where you. First, the question like did you solve the problem with the 300?	
114	P5	Yeah yeah yeah yeah.	
115	I2	OK so you put like OK in different markets and different countries we calculate it on a currency value or?	
116	P5	Yeah, yeah, yeah. So you could say we made the AI a bit smarter saying like hey, listen don't look to 300 but look at exactly yeah look at the equivalent.	PI-P
117	I2	So you improved the process. I mean it's a manual process improvement. It doesn't really matter but it was based on data so.	
118	P5	Yeah, you could say theoretically. You would want the system to come up with this, uh, if you build it in the in	PI-F

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		the in the ideal way, then it says like, hey, listen. I see that in this country or not, even yeah, you probably want to prove it, but I see it in this country. If we take the risk measurements a little bit lower, you will probably have 100 more orders a day of which maybe two are fraud, but you can take that risk shall I do it and I just say yes.	
119	I2	Yep, OK, kind of like a combination of manual and automatic, but OK, was that the only problem you had which led to a process improvement? Or did you also have any or can you refer to any other situations you can think of.	
120	P5	Yeah I mean you could say our whole launching of a country or of a product, there was some like the process was we kind of know that we all have to do something, but it's not organised and we made that like a stepped approach like OK first, we need to get the list of what products. Then the category manager has to buy those products. Of course in that buying process you also have processes but. When a product is or during their buying the products, we make sure that other teams start translating it. The translation we put back into the system. The threshold has to be added and at some yeah it was. I mean you could say it's a process. It's a stepped approach. It's less technical, but it's more project management. I mean, you could say that the I mean the automation of the Google ads. That's an ongoing process still, but that's also.	PI-P
121	I2	And the previous process, how was that actually then improve?	
122	P5	Uh, I think the improvement was mostly because we made more clear who would have to take which role and when.	
123	I2	Ah OK.	
124	P5	So it was like an organizational process and we actually made the process simpler by taking a lot of people out	PI-P
125	I2	Yeah.	
126	P5	Because we had like a big group of people who are all doing somehow some work for launching a product. And we said, like yeah, you know what? In the end it's only four people who have to manage this and they might need some other people but in the end there's these four.	PI-P
127	I2	They can delegate the work, yeah.	
128	P5	Yep, yeah.	
129	I2	Yeah, OK, so this came up like OK it takes too much time. We have to think of something to make it easier.	

130	P5	Yeah.	
131	I2	And then you sat down I don't know in a meeting and talked about it and talked about it?	
132	P5	Yeah, so yeah. So uh, it was also a bit driven by hey listen, we don't know what products are going to be launched next week or the week after or not even a month after. How can we make that clear and all. So yes, we got into. Well it took some iterations but it started with me and the person responsible for category management. Of this first drawing on a whiteboard, what is actually all the steps that happen. Where is the pain right? Where is this going wrong and can we create a team that's then being held responsible for launching 20 new products every week? Uhm, so that's also a bit that helped the process making people responsible for and end number.	PI-P
133	I2	Yep. OK.	
134	P5	Yeah, but it was very manual.	
135	I2	Yeah, sure, I mean. I mean, every process can be manual. It doesn't really come. The results of the thesis can also be like OK, nobody is actually using AI for this. Uhm, they all do it manually and it worked pretty well.	
136	P5	Yeah, yeah.	
137	I2	Good or actually, or at least try to automate several steps in that process, but not the complete process itself.	
138	P5	Yeah, true. And also what I've done is that it's still not optimal, but to have like a good tool, right?	
139	I2	Yeah an analytical tool of course.	
140	P5	And so we use Asana, it's more like a project management tool. It's not ideal, but it comes maybe at least closest to what actually works for us. To at least show like hey, this product is in this part of the process. Next person or in action is this one.	
141	I2	Yeah. Back to your product in general you said here you are buying them and then you are offering them.	
142	P5	Yeah.	
143	I2	They do not have a buyer yet, so how do you say how many products do we need? In which country do we need? How many or for whom of which product? If you're out of stock, what happens then?	
144	P5	Yeah, that's oh that's a really good point. The out of stock process. That's also one that still needs to be optimized. Uh, but so first we do research in the country so we check competition. We check well before we used to go to the	PI-P PI-F

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		country. Go to the shops like the supermarkets and everything. Check like hey what's in the kiosks? Like what kind of products are there? Uhm, we have a couple of suppliers who don't know other suppliers or they already active in multiple countries. Uh and otherwise we just have to search for it. So we sometimes would check the competition or ask our business partners. It's a bit of a small world like it's kind of like everybody knows each other in this in this business. But it can also help that for example if a product is offered that the supermarkets and we don't know. I mean they have physical cards, but we don't know who's offering that. And then we find a way to know somebody in the supermarket who can tell us where it's from and then step by step we get there. Or really really long time ago, how this company actually started. Was there was no digital call credit, so they had people going to the store with a big bag of money and say hey each month, I just want to buy a 2000 Telecom prepaid 10 euro gift cards and they scratched it and then made the photo of that thing and when you bought online you get the photo.	
145	I2	Yeah, that's the way to start a company, yeah?	
146	P5	And that's how it's done. It's guys. I think it's still funny and a good story. I mean, they just went there and if you do it in bulk and you have, let's say cheap labour to scratch and take a photo, it doesn't take that much time.	
147	I2	No.	
148	P5	Add it's quite possible to do that. The only tricky business is, so we had we had a guy actually drive to Poland to buy in like kiosks, a bag of 25,000 euros like. That's a long time ago. That's a long time ago, that's you could say that's also a process improvement.	PI-P
149	I2	That is actually a good process improvement that this is now digital.	
150	P5	Yeah yeah, yeah.	
151	I2	OK, yeah, you're choosing based on his Oracle numbers.	
152	P5	Yeah, so I did search volumes right so we can just check on Google like how many people search for, buy these credits in Country X and you can check how many people are searching for that.	BG
153	I2	Yeah.	
154	P5	That already gives a quite good indication of how popular a product is.	

155	I2	No OK.	
156	P5	Because the first thing people do is then just Google it.	
157	I2	Yeah, yeah of course. And then they probably end up either on the page from the supermarket. OK, buy it in your local store or they end up on your page.	
158	P5	Yeah, so most of the time the products that we sell, it's not super common that there's the big brands advertising on it. Of course if you talk about Google Play or iTunes then then yes but smaller products.	BG
159	I2	Alright, so Spotify for example?	
160	P5	Yeah, Spotify and I don't think if you Google for Spotify gift card, I think Spotify themselves are not advertising on that. They offer it, but they don't. It's for them. It doesn't make sense to sell that. So when you search for buy Spotify a gift card or prepaid gift card. Most of the time it's us and one competitor who come above Spotify, right? Because it's in the ads and then yeah.	
161	I2	Probably yeah. Probably.	
162	P5	You can do a test if you, I don't know, you probably speak a little bit of swedish now, but if you go over.	
163	I2	Absolutely not.	
164	P5	Of your colleagues, so I don't know, but you can still search in German. See what happens. Just Google like a paysafecard online kaufen. You'll probably find us.	
165	I2	Yeah I can try that. Yeah, OK, mentioned before the out of stock.	
166	P5	Yeah, yeah, so that's I think that's a funny one because it's since the year I've been there that's still the most horrible process that we have because you could say there is no process. What happens is, for example we buy 1000 codes we put them in a system, then it's actually the number of sales that somebody is tracking to know when it's going to be out of stock. We don't really have a table where this table is only codes of paysafecard and we know you only have 5 left. Now we actually have to do it the other way around. To see OK, I know I uploaded 1000.	
167	I2	Yeah.	
168	P5	I know that we've sold 600 now, so we're probably at the end getting at the end of it. So there's no alerts if the product doesn't go all offline automatically when it's out of stock. So we have people sometimes buying and then it's out of stock and then they like they buy but a system	

BG: Background • AI-D: AI Definition • AI-T-X: AI of type X •

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		cannot send the code, so then nothing happens and then they start complaining.	
169	I2	Yeah.	
170	P5	That was in the past when we start getting complaints that's the moment that we need to take it out of stock on the website. And I was like no.	
171	I2	Yeah, well, that's also not a really good process.	
172	P5	That was really really really terrible and we're building a new backend system and it will be fixed in there, but I still don't understand. [REDACTED]. Uh, we have [REDACTED] months and some of our processes are like this.	PI-F
173	I2	Yeah OK, I would probably make me start like packing everyday. Hey we only have 100 codes. Let's take it of-line and reorder or so.	
174	P5	Yeah, that's what I mean. That that's what happens now, the small process improvement is still manual, but at least we have. We just made an Excel that calculates for us and then every day all the information gets in there and at least you can see, OK, it's turning orange. We always sell 50 a day so you know you bought 500 in 10 days you're out. So probably in seven days you want to have new stock, so you have to buy in three days for example because it takes time. So this is, let's say the slight improvements, getting better and then also the funny thing around that is that when it went out of stock we would still have the ads turned on because that's a different system and then somebody would put in a slack channel. Hey, this product out of stock and then hopefully the person on the marketing side would see that and turn off the ads.	PI-P
175	I2	Yes.	
176	P5	If not we would just run ads. Sometimes we had that for like a week. People think I want to buy Spotify cards. They come to the website. They see it's not there, they go away and use lose money for nothing like this. That's it's literally the dumbest thing that we have.	
177	I2	Yeah, OK, I don't know, what would you say how many customers you repelled or lost through those processes?	
178	P5	Uhm. Many. Many, is it a bit difficult to say because we have a couple of big countries. They're not all the same. Uh, yeah, let's say probably at least [REDACTED] a month, I would say. Over the whole company and I and I think now we're bigger, but I think it was probably the same number a year ago, but then we were half the size so.	PI-P

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179	I2	Yeah, OK.	
180	P5	You could say that at least there's an improvement, yeah, but sometimes it can be really bad, right? Super popular product or then it can be all of a sudden one week like [REDACTED]	
181	I2	Do you have any bad reviewing for that?	
182	P5	Yeah, yeah, I mean at checkout trustpilot. We have a really good score because we have a shit load of happy customers. Uh, but there's definitely people in there saying like I got scammed by this company because I bought something I didn't get it so this kind of things. Yeah, we get. We get better so yeah.	
183	I2	Yeah, but customers who have done actually purchased it and didn't get it, do they get their money refunded or?	
184	P5	Yeah.	
185	I2	Do they get the payment card or whatsoever gift card when you are actually back in stock.	
186	P5	Both, we let them choose	
187	I2	OK.	
188	P5	Do you want it or not? And if they think we're not fast enough or maybe what also happens sometimes, we have people who don't. They want to be as secret as possible, so they get the codes on the website. Uhm, so when you buy with us you get if it's a code and it's not automatic top up. You get the codes in the page but also in your email. But if you just use if you use a fake email address, that's fine. If that's the case you can also still buy with us 'cause you get the code in the website, but if you don't get the code in the website and you have used a fake email address.	BG
189	I2	Yeah sure.	
190	P5	They you're screwed. So we have people contacting us saying I use this email address, but then the emails with another the email address, so it's very tricky. Like can we trust these people? Or you use the credit card, but maybe you've never charged back. They just charge back. You can just pull it back.	BG
191	I2	Yeah. How can they actually then register in your system when they only have a fake email address which doesn't even exist?	
192	P5	Yeah, we're going to have two things we don't really even have an account functionality yet, so we don't have accounts.	

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193	I2	OK.	
194	P5	But in the future we will. But then we will still offer people to just buy with us, because yeah, those people want it.	PI-F
195	I2	Yep, OK.	
196	P5	Yeah, who are we to say you need to have an account or whatever, as long as you pay with us and this is the way you want to do it, yeah. For us it's fine.	
197	I2	So like, yeah, your business model is like OK you get this gift card valued with ten euro and you pay 11 or whatsoever?	
198	P5	Yeah, yeah exactly yeah. So I was like you pay for two things. The convenience that you don't have to go to the store or in lockdowns, which of course are great for us.	
199	I2	Yeah.	
200	P5	You cannot go to the store. So you have to buy it online and one a bit for like the surface that we help you to not be as visible where you don't want to be. So it could also be, let's give a different example that sounds less dodgy, you want to watch Netflix but you don't want to have Netflix have your details and your payment details. You just want to watch it for a month or two. You buy gift cards, you use the gift cards, you use a, you know, a new Hotmail address that you just made. You have an account. You can do whatever you want and when it stops, it stops and they can send you emails like please get your subscription or come back blah blah, but you don't want that so you just turn it in a fake email.	BG EP
201	I2	It's really weird because like personally I would think that there is no market for that. But as you said, you made quite a huge amount of money and have quite a huge amount of active customers. And also unique customers.	
202	P5	It's huge, it's huge. But those unique customers, you could say. If a customer comes back every time with a new fake email address.	BG EP
203	I2	Yeah, OK, sure there is the invisible number you cannot see.	
204	P5	Yeah, yeah, but I don't know what is the number of people who do that. Can be big, it's come up but in the end we have a really strong customer base. So we can spend a lot on acquisition on new customers because we know that like let's say 20 no let's say 10% of the customers we achieve in the first month, 10% will come back in the third month as well.	BG
205	I2	You can see that based on their email address data OK.	

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206	P5	Yeah yeah yeah. So the the email address is like for us a unique customer ID for now. When we start profiling then it's different.	PI-F
207	I2	Sure.	
208	P5	Yeah, maybe small addition to that. You could say that's also a process improvement. Now we just turn on ads and anybody can see the ADs. So also our customers that we have and that we know that they want to come back with us, so it's a bit silly, right? We pay again for them to come back to our website. So when we have more the profile setup, we can do more audience checking. So we could say OK, this customer, we don't have to pay for the AD to be shown to this customer because it already comes back every month. He is just lazy. He doesn't want to type in [REDACTED], he just types in buy Paysafecards in Google.	PI-F PI-t-AI
209	I2	Mhm.	
210	P5	But if we pay for it, then we lose another whatever 5-6 euros. If we don't, then it will probably go anyway, because they want to go. OK, so we are gonna exclude them from advertisements.	PI-F
211	I2	OK. Also, good idea. But yeah, so every single process improvement you named like out of stock, and checking before if we have not enough stock or like thinking about, it could go out in a couple of days. Uhm, and what else do we have? Bring me up to date. What was it? I don't have any notes here.	
212	P5	Ah that's fine, you mean anything that we improved right?	
213	I2	Uh the 300 currency issue.	
214	P5	Yeah, the risk tool. The launch of new products.	PI-t-AI
215	I2	Yeah, step by step instructions on how to do that. What would you think what was the value you gained from that within your company?	
216	P5	So, uhm. Some are like customer experience, right? So the experience of the customers is way better because they don't get blocked. Uh, so if I would go deeper into value that will probably give a better like relationship with our customers. The work process for launching a new product or country, whatever. Yeah, that's definitely speed but it was also a bit like employee satisfaction. Because there are people who are frustrated, right? So it's like I don't know what's going on, when do we have to start, you come to me now. I already planned my week, I'm busy and it just brought so many like comments, everybody knew I have to do this. You said which one would	PI-t-AI PI-P PI-C

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		be most valuable, not in terms of money, but I would say that was definitely a success story.	
217	I2	Yeah.	
218	P5	Yeah, so and of course the stock, and that's more like, yeah, you could even say that's like a compliance, or based on safety measurements rights, because we could lose money as well there because people would buy and you have to give the money back on this.	EP PI-w-AI
219	I2	Same as the implementing the safety system before accessing anyway.	
220	P5	Yeah, yeah.	
221	I2	Yeah, all right. Uhm. OK, you are going to do a lot of things to improve your processes in the future with implementing a new system. You base basically all your decisions on data you have from analytic tools or?	
222	P5	Yeah. Yeah, so I would say that we are very data driven company. Yeah, so it's either based on yeah like I mean you call analytics too. The thing that is most important for us is called analytics like Google Analytics where you can check the customer. Or we do it based on search volumes like decisions which country is next. Also most the time. Yeah, I would say most of the time based on data and we have a bit of a gut feeling or we have like our suppliers or partners saying like hey why are you not going to the Gulf states or to the Emirates or Saudi Arabia because it's booming. We sell off products there, probably when you launch you're also going to sell a lot of products there. So we kind of get us like indications or which is also quite interesting I think. We have the worldwide call credits live. And automatically that gives us clear indications of where at least that those products are popular. So one of our biggest success countries is Puerto Rico, which is a country kind of part of the United States. Somehow. It's I think a territory I think they call it. But they have their own I think they have their own currency. Or they do U.S. dollars, but at least there's a lot of people buying from the US call credits in Puerto Rico. And I guess it's all like family members who top up their family phone with money that they've earned in the US. And then they send it to their other companies so that you can use call credit to purchase in supermarkets. Or go to the cinema. So there are that kind of call credits that evolved a bit into a wallet which for us of course is super interesting because then they are going to top up way more often.	BG AI-D PI-t-AI
223	I2	Yep.	

224	P5	So those kind of things. Because we have it live for us it's easy, we have 170 countries. Almost all, well let's say the biggest carriers.	BG
225	I2	That would have actually been my next question yeah.	
226	P5	Yeah, so we've integrated to who offers us that. We have connections with all these carriers. So we can just offer that quite easily. We have it live. We have campaigns running on it, a bit on a lower scale, but that also gives a lot of information on like which corridors are big, Netherlands, Morocco, US corridor or you could know that from migrants data, but it's always nice when you actually see it being turned into money. And then OK, this is probably a good indication to start doing a bit more in that country, maybe there's other credits that you want to buy there?	BG PI-C
227	I2	So yeah, very interesting. Kind of like a wrap up now. Would you say you will implement any AI solution within your company? And if yes, what could you think of what it would be?	
228	P5	Uhm? Yes, I think so, but it will take a while. Uhm, because what I see is that we're moving a bit towards is more creating a wallet. So, uh, you would have your wallet where you can top up your money. You can use it. You might have it connected with the credit card. You can buy inside this wallets. You can buy all these kind of products. You can top up phones. You can maybe send money to other people, to their bank accounts or to another wallet if they have the same wallet. And I think when we are there then then we need to get like more. But I would say it's more like data science kind of AI so. Because we need all this kind of indication of what people use it actually for. I mean, it could just go as far as that we know that. You, Phillip have a German wallet, but you actually spend all the money in your wallet in Sweden, so we already know you're in Sweden. We know that you pay each week in the University your coffee, so we actually put an ad in the coffee place, right? That's the insane way of thinking how this could work. Or even better, we make sure that the coffee guy at the counter says Oh yeah, Phillip. Cool you're back. Well, your wallet gave you a discount on this coffee. This kind of thing so.	PI-F AI-T-N PI-w-AI
229	I2	Huh, OK.	
230	P5	Uh, and I think for that you need a lot of computing power you cannot do that manually.	AI-D AI-T-N
231	I2	No, it's a lot of data and the analysis will take forever.	

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232	P5	Yeah, exactly.	
233	I2	And also it's not real time then, because when you find out that I buy my coffee, in Sweden I'm already gone then.	
234	P5	Yeah, but you come back the next day and we know that.	
235	I2	Maybe. At some point I won't.	
236	P5	So this is one of the reasons why a lot of people don't want to use a credit card for all things right?	
237	I2	That's the reason why I use it for everything that everyone knows where I am.	
238	P5	Yeah, exactly. Most people out there trust me who do not want to be checked at all on these kind of things here.	EP
239	I2	I heard that now that this business is booming. I just thought the paysafecards that underage kids buy it in supermarkets in Germany to actually go for gaming. And to buy their additions in games.	
240	P5	True, Yep, Yep.	
241	I2	Which they're not allowed to by law because the age and stuff like that.	
242	P5	Paysafecard is 16 plus	
243	I2	Yeah, OK, that depends where you buy it and from who you buy it.	
244	P5	That's true.	
245	I2	If you buy it in a kiosk around the corner, he probably doesn't care.	
246	P5	He should, but he probably doesn't care. No, that's true that that's also another reason that people buy it with us, right? So for example, you now say paysafe, but it's same with the PlayStation? Yeah, if you're 16 or 17, you cannot get a credit card, right? You need to be 18 plus. So how can you put money on your PlayStation account?	EP
247	I2	Yeah.	
248	P5	You need to ask your dad who says yeah fuck off, go get your own.	
249	I2	I bought you the PlayStation go away.	
250	P5	Yeah. Or the dad is like, I don't want to have my credit card connected to your PlayStation accounts because I know you're gonna buy 10 games. And then the dad buys a card on our website and gives it to the kid.	EP
251	I2	Yeah makes sense. Uhm yeah, OK Alex, do you maybe have some final questions?	

252	I3	Uh, no I think we've covered all the questions from my side.	
253	I2	Great. Took way longer than.	
254	P5	It's fine, it's fine for me it's fine. I don't mind. I think it's a nice subject.	
255	I3	Yeah, there were a lot of interesting points like I mean even as you said, you don't really use AI that much as of now or like more like third party AIs in that matter. But like that's also like as Philip said, a conclusion where we ended up in other interviews too that like companies work data driven but don't apply data driven solutions like with artificial intelligence yet.	
256	P5	Yeah.	
257	I3	Yeah, that's definitely a statement. That's also really like worthy.	
258	P5	I think of what's most what I noticed with a lot of companies. This one, previous one. I mean, even the company that we both worked in with Philip is that for some reason it's difficult for them to decide like, yes, I want invest this money into this solution. While, whatever, these two people can still do it.	AI-D AI-T-N PI-w-AI
259	I3	Yeah.	
260	P5	When they actually know the value or see the value then it can be arranged quite quick but before that.	AI-D AI-T-N PI-w-AI
261	I2	When there is a value of course.	
262	P5	Yeah, that's also true. Yeah yeah, you need to know that there's a long term value. I think that's probably the point. I notice that with a lot of companies that you can and a lot of businesses do run on really, really, really shitty processes. You can do that for a long time.	PI-C PI-P PI-F
263	I2	Yeah, how long is the your company in business?	
264	P5	Yeah, so it's been around for a long time, 2004 I think. But in, let's say the current shape that it's been since 2016-17.	BG
265	I2	Yeah alright.	
266	P5	But for example, we have, uh, in Germany, so [REDACTED] is our like global brand. But in the Netherlands we [REDACTED]. Now in Germany [REDACTED]. That's our website. And in France we have [REDACTED].	BG
267	I2	Yeah.	

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268	P5	So we have a couple of like local labels that I think are like in guthaben they've had it since 2008 or something. So that's, uh, that's really one of our big ones.	BG
269	I2	Yeah.	
270	P5	And if you go to the website, you're going to see it. You're gonna be like how the hell did they make so much money with this crappy website?	
271	I2	I'll check that out later.	
272	P5	Yeah, you should just check it out, you'll laugh.	
273	I2	Yeah, but I mean it's probably the audience which is not really interested in the layout and experience of the page. It's like I wanna type in here my email and I wanna buy that.	
274	P5	Exactly. That's it, I don't want it look great, it just has to be fast, safe, simple.	BG
275	I2	Yeah.	
276	P5	That's our slogan.	
277	I2	You probably do not accept bitcoins, right?	
278	P5	No, not yet, I'm also doing a bit next to global expansion, because that's kind of running. I'm also doing like business development, so the bill payments, for example, is one of it. Uhm, and I do think that maybe for us it's a bit early, but I think we will do more with crypto currency.	AI-T-N PI-F O-I-AI
279	I2	Yeah.	
280	P5	Not sure yet how, when, in what way. But I think it kind of taps into our like anonymity thing. So I think it's quite connected to us as a company as well.	EP
281	I2	Yep, definitely. Yeah alright, great insights.	
282	P5	Nice.	
283	I2	Great information. Thank you for the interview.	
284	P5	No worries. Thank you.	

Appendix B

Interview Preparation

Abstract

We, Ludvig Åman, Philip Heidenreich, Alexander Sippel, students at the Lund University in Sweden, are going to investigate Artificial Intelligence (AI) in Internal Business Processes within our master's thesis. AI is and will be an important technology now and in the future; however, most people see it as a buzzword and that might be the reason why many projects fail in implementing AI successfully. Especially, in Internal Business Processes, processes that facing towards the company itself and not outside, little research has been done. Organisations are still unsure on when and how to implement AI and we aim at contributing to this research gap. Since AI will influence our future, we want to create one of the first steps to create guidelines and or a framework on when and how to use AI in business processes. A previous conducted survey gave us an overview on the usage of AI in different Internal Business Processes and where AI is used the most. Based on these results we are focusing our thesis on process improvement. The purpose of this interview will be to get insights and a better understanding on how AI is implemented in today's organisations and on how it generates business value. The results will hopefully help us and thereby other organisations to know where to implement AI and how to use it successfully.

Definitions

Artificial Intelligence (AI): The computerised imitation of human problem solving. As such, the term AI is a concept that covers a wide array of subfields like Machine Learning, Robotics, Natural Language Processing, etc.

Machine Learning: A subfield of AI, where an algorithm is not programmed to execute a series of commands that directly leads to the solution of a problem but instead is trained by a high number of examples to detect patterns that enable it to solve similar problems.

Internal Business Process (IBP): A series of activities that are necessary to complete a business goal. Internal Business Processes are the inner workings of an organisation that enables it to provide their value proposition to the customers. In contrast, external Business Processes are herein understood as processes where the results are directed at stakeholders outside of the organisation (e.g., customers or suppliers).

Process Improvement: The process of examining, optimising, and changing business processes with the goal of improving the effectivity or efficiency.

Business Value: Any type of value that is generated through business activities with the goal of long-term profit maximisation.

Interview Guide

Introduction (~5 minutes)

- Formal consent about the privacy contract (see page 3: Privacy Contract)
- Short presentation of the topic and research background

Participant/company information (~10 minutes)

- What does your company do?
- What is your role in the company?
- How do you experience digitalization in your company?

Process Improvement (~15 minutes)

- How does your company approach processes and their optimization?
 - (e.g., process modelling/mining)
- What types of AI are being used by your company? In process improvement?

Outcomes (~10 minutes)

- Has AI generated (business) value for your company?
- Did AI help optimise processes in your company?

Wrap-up (~5 minutes)

Privacy Contract

Information Agreement

The interview will take around 45 minutes. The research group does not anticipate that there are any risks associated with your participation in this interview, however you still own the right to stop, pause or withdraw from the research at any time.

We kindly thank you for participating in the research project.

Ethical procedures from Lund University require that the interviewees explicitly agree to being interviewed and are made aware of how the information taken from this interview will be used in the research project. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation.

We therefore ask of you to read the accompanying information sheet and then sign this form verbally to certify that you approve the following:

- This interview will be recorded, and a transcript will be produced
- You will be sent the transcript and given the opportunity to correct any factual errors
- The transcript of the interview will be analysed by the research group
- Access to the interview transcript will be limited to the research group, academic colleagues and researched with whom the research group might collaborate as a part of the research
- Any summary interview content, or direct quotations from the interview that are made available through the academic publication or other academic outlets, will be anonymized so that you cannot be identified. Care will be taken to ensure that other information in the interview that could identify yourself, is not revealed
- The actual recording of the interview will be kept until the research project has been approved and closed by the research committee at Lund University
- Any variations of the conditions above will only occur with your further explicit approval
- The recording, transcript and other data extracted from the interview will be stored on encrypted data-drives

If you have any further questions or concerns about this research and how it is, or will be used, you can contact the research group. The contact information can be found below.

I have read, understood and I consent to the agreement above.

Date and Signature

Appendix C

One of the earliest KBES called MYCIN was created in the 70's at Stanford University (Buchanan & Shortliffe, 1984). The KBES was used to diagnose what type of bacteria had entered the patients' blood and could cause infections in the patient and their wounds. MYCIN further present the human doctor with recommendations for prescription of medicine for the patient (Buchanan & Shortliffe, 1984). What follows is a short example taken from the Q&A module from MYCIN during a process, to show how the system applied rules and reasoned in order to reach its conclusion.

In the example below, formatted in blue, the doctor has created the WM for the case by examining the patient and feeding the data into MYCIN. MYCIN concluded based on the input data, that the bacterial infection in the patient most likely was E.coli and presented the doctor with a therapy recommendation. The conclusion and response from MYCIN can be seen below:

INFECTION-1 is BACTERMIA

*<ITEM-1> E.COLI [ORGANISM-1]
<ITEM-1> KLEBSIELLA [ORGANISM-1]
<ITEM-1> ENTEROBACTER [ORGANISM-1]
<ITEM-1> KLEBSIELLA-PNEUMONIAE [ORGANISM-1]*

[REC-1] My preferred therapy recommendation is as follows:

*In order to cover for items <1 2 3 4>
Give: GENTAMICIN
Dose: 119mg (6.0ml) q8h IV for 10 days [calculated on basis of 1.7mg/kg]
Comments: Modify dose in renal failure.*

(Buchanan & Shortliffe, 1984, pp.70–71)

The doctor could then proceed to question MYCIN to analyse the systems reasoning and decisions, should the doctor have any doubts or unclarities. The values displayed as (*N.N*) is the *Certainty Factor (CF)*. The CF values between -1 and 1, where -1 is certain negativity and 1 is absolute confidence. Below is a short Q&A session between the doctor and MYCIN. *** text marks the question asked by the doctor to the Q&A system, which is followed by MYCINs response:*

(1) ** Is ORGANISM-1 a Streptococcus?

No. The identity of ORGANISM-1 is E.coli (0.74) Bacteroides (0.7) Klebsiella-Pneumoniae (0.4) Pseudomonas-Aeruginosa (0.22) Enterobacter (0.21) Proteus-Non-Mirabilis (0.19) Serratia (0.03) Salmonella (0.02)

(2) ** Why did you rule out Streptococcus as a possibility for ORGANISM-1?

RULE033 could have been used to determine that the identity of ORGANISM-1 is Streptococcus. However, clause 2 of RULE033 [“the morphology of the organism is coccus”] was already known to be false for ORGANISM-1, so the rule was never tried.

(3) ** How do you know that CULTURE-1 was from a sterile source?

I used RULE189 to conclude that this blood culture was taken from a sterile source. This gave a cumulative CF of (1.0). The last question asked before the conclusion was made was 7.

(4) ** What does GU manipulation tell you about the identity of an organism?

The rules listed below use:

whether the patient has had a genito-urinary manipulative procedure to conclude about:

the identity of the organism

156, 165, 190

Which do you wish to see?

**** 156**

(5) RULE156

IF:

1) *The site of the culture is blood, and*

2) *The gram stain of the organism is gramneg, and*

3) *The morphology of the organism is rod, and*

4) *The portal of entry for the organism is urine, and*

5) *The patient has not had a genito-unrinary manipulative procedure, and*

6) *Cystitis is not a problem for which the patient has been treated*

THEN:

There is a suggestive evidence (0.6) that the identity of the organism is E.coli

(Buchanan & Shortliffe, 1984, p.74)

In the Q&A above, the IE has come to the conclusion that the bacterial infection was caused by E.coli (*with 74% confidence*). During (2) MYCIN has deducted that RULE033 was to be neglected due to one of the criteria in the rule not being fulfilled, hence storing that fact in the WM of the system until the conclusion was drawn and presented. KBES has further been developed over the years to performs task varying from playing chess to diagnosing what type of cancer a patient has and should be treated for (Leondes, 2002).

Job Title
Consultant
Sales
Business Manager
Working Student
Lead Software Developer
Finance Specialist
Director Marketing
CEO
Expansion Director
CTO
Principal Solution Architect
CTO
Senior Consultant
Data Scientist
Senior Business & Functional Specialist
AI Evangelist
Advisor
CX Team Lead

Do you consider your company as “data-driven”?

No

Yes

No

Yes

Not sure

Yes

Yes

Yes

Yes

No

Yes

Yes

Yes

Yes

Yes

Yes

Yes

No

How do you define AI?

extrapolation of information from data

Automation

Automated processes, data-driven detection of sales opportunities

automated decision making based on huge amounts of data

Efficient data management via self learning algorithms; mit Skynet

future

Assistance to personal work

Future

Self learning data system that makes decision based on self learned insights

automated intelligent descision making

Solve problems and take decisions automatically based on collected data

Currently AI is an alias for machine learning. And that's an elaborate way to have a big amount of ifs and elses.

AI helps companies speed up processes.

Any artificial pattern to imitate (aspects of) natural intelligence

Recreation of the human intelligence in often an even higher level of intelligence.

Machine learning way of coding by experience & data

Intelligence by machine learning

Systems or systems of systems, that can calculate and compute the most effective yet safest action, and execute it.

Do you think AI usage will grow over the upcoming years?

Yes

AI Management

My company does not work with AI

Dedicated IT/AI department

Dedicated IT/AI department

Differs across Business Units

Others

My company does not work with AI

Dedicated IT/AI department

Differs across Business Units

My company does not work with AI

Others

Dedicated IT/AI department

Others

Dedicated IT/AI department

Dedicated IT/AI department

Dedicated IT/AI department

Dedicated IT/AI department

Others

Dedicated IT/AI department

Extent of AI usage [Research & Development]	Extent of AI usage [Human Resources (HR)]	Extent of AI usage [Finance & Accounting]	Extent of AI usage [Legal (Compliance)]	Extent of AI usage [Strategy Management]	Extent of AI usage [Project management]	Extent of AI usage [Process improvement]	Extent of AI usage [Manufacturing]
(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)
4	2	3	2	2	2	4	5
1	1	1	1	2	2	2	2
4	(Unsure)	(Unsure)	(Unsure)	1	1	3	(Unsure)
5	4	5	2	2	1	3	4
4	1	4	4	3	2	3	2
5	1	2	2	5	4	5	3
(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	5
4	1	5	3	4	5	5	5
3	4	4	3	2	2	4	5
4	2	1	1	2	1	1	(Unsure)
2	(Unsure)	(Unsure)	(Unsure)	2	(Unsure)	(Unsure)	(Unsure)
5	5	5	5	5	5	5	5
3	1	4	(Unsure)	2	1	1	2
2	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	2	(Unsure)
4	1	2	3	1	1	5	1
1	4	4	1	4	3	3	3
3	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)	(Unsure)

Other processes

Business Intelligence, Performance Marketing, Advertisement

Sales B2B, B2C

Would you say AI in general has reached its peak of usage?

No

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