TAMPEREEN TEKNILLINEN YLIOPISTO
TAMPERE UNIVERSITY OF TECHNOLOGY

TEEMU TERHO
ARTIFICIAL INTELLIGENCE TRANSFORMATION AND IMPLE-
MENTATION FRAMEWORKS

Master of Science Thesis

Examiner: Prof. Samuli Pekkola

ABSTRACT

In modern days there are many new technologies that are being implemented into organizations to gain competitive advantage and keep up with the evolving landscape. Artificial intelligence has become one of these new technologies and it even has been said to be one of the general purpose technology as likes of steam engine, electricity and internet. Usually reaping full benefits of new technologies has been troublesome for organizations. Therefore finding a working framework that would help with this burden and aim to increase the probability of revenue increase and cost cutting benefits is needed. There are many factors that have to be weighed in to generate a working AI framework for the organization.

The aim of this research was therefore to answer the questions how organizations can start their AI journey and how they can implement AI initiatives. This can be answered by developing and AI transformation framework and a more detail AI implementation framework. Development of the model was conducted with Design science research methodology. DSR-methodology was built on literature reviews and empirical part that was done by subject matter interview.

In the study two frameworks were developed that answer the research questions. A four stepped process was developed for the AI transformation process that can be followed to meet strategic alignment. AI implementation framework was also developed with consideration on approach, team, tools and methodology. These frameworks developed in this study are intended to be used with AI endeavors in Finnish companies.

TIIVISTELMÄ

Teemu Terho: Tekoäly transformaatio ja implementaatio viitekehys
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Avainsanat: tekoäly, viitekehys, koneoppiminen, konenäkö, luonnollisen kielen käsittely, tekoäly transformaatio, tekoäly implementaatio

Nykypäivän organisaatioihin implementoidaan paljon uusia teknologiat, jotta saavutetaan kilpailuetua ja pysytään mukana muuttuvassa toimintaympäristössä. Tekoälystä on tullut yksi näistä uusista teknologioista. Tekoälystä on myös sanottu että se on uusi yleiskäyttöinen teknologia kuten sähkö, höyrykone tai internet. Yleensä uusien teknologioiden hyötyjen maksimoiminen on ollut haasteellista organisaatioissa. Sen johdosta toimivan viitekehyksen löytäminen, joka helpottaa hyötyjen maksimointia ja tähtää kulujen vähenemiseen ja liikevaihdon kasvamiseen on tarpeen. On olemassa monia seikkoja joiden painoarvoa pitää arvioida jotta voidaan kehittää toimiva tekoäly viitekehys organisaation tarpeisiin.

Tutkimus vastaa kysymykseen kuinka organisaatiot voivat aloittaa tekoälyn hyödyntämisen organisaatioissaan ja kuinka he voivat implementoida tekoälyä organisaatioihinsa. Kysymyksiin lähdettiin kehittämään tekoäly viitekehystä ja käytännönläheisempää tekoäly implementaatio viitekehystä. Mallit kehitettiin käyttämällä Design science research metodologiaa. Metodologian havainnot pohjautuvat kirjallisuuskatsaukseen teoriasta ja empirian osalta alan ammattilaishaastatteluihin.

Tutkimuksessa kehitettiin kaksi viitekehystä, jotka vastaavat tutkimuskysymyksiin. Tekoäly transformaatio malli Neljä portainen prosessi-malli, joka auttaa strategisella tasolla tekoäly kohteiden löytämistä. Tekoälyn implementaatio malli auttaa tekoälyn implementoinnista lähestymistavan, tiimin kokoonpanon, teknologian ja metodologian osalta. Tutkimuksessa kehitettyjä viitekehyksiä tarkoitus on helpottaa tekoälyn käyttöönottoa suomalaisissa yrityksissä.

PREFACE

Starting my academic journey through the Finnish schooling system with a brief visit to the Swedish system has come to an end for now. This thesis is the last leg of a long journey and it has been a memorable one. Last leg writing this thesis has been a great experience and I would like to thank my employer that has enabled me to generate ideas around an interesting topic with some great individuals around the globe.

I'd like to offer special thanks to the following individuals Johan Matinmikko, Anne Nahkala and Heli Valtari for providing me with time and tools needed to develop this study. Professor Samuli Pekkola who enabled me to work with a strict timetable and supported in the development of the study in many ways. Last but not the least I would also like to thank my friends and family for the support they have provided throughout these years with my various endeavors. One goal is now reached and it is time to move to the next one.

In Helsinki 13.4.2018

Teemu Terho

TABLE OF CONTENT

ABBREVIATIONS AND MARKINGS

AI	Artificial intelligence
BCG	Boston consulting group
DSR-methodology	Design science research methodology
IT	Information technology
NLP	Natural language programming
SME	Subject matter expert

1. INTRODUCTION

AI is described to be the next big technological megatrend. (Gartner, 2017) There has been a growing interest in the field of AI as yearly publications have continued to increase nine fold from the year 1996 to year 2017. (AI Index, 2017) Global organizations like Spotify, Apple and Amazon have entered the AI space with their own products. (Apple 2017, de Waele, 2015, Amazon 2017) Tech giants like Baidu and Google are investing heavily in AI and estimates for investments range from 20 to 30 billion dollars in year 2016. (Bughin 2017 pp. 4) BP, Infosys, Wells Fargo and Ping An Insurance are also some of the big companies already adopting AI to solve their business problems efficiently. (Ranshbotham et al. 2017)

This study started from the organizational need to offer a working model for Artificial Intelligence (AI) transformation within client organizations. Trough research it was shown that general IT and analytical frameworks exist (Gourevitch 2017, Berman 2013) and in recent studies specific adaptation of an AI implementation process model had been presented in only very few instances and they all are very new and the Solita framework was published when the research evolved to the point where it would generate disturbance of the methodology used. (Solita 2018, Bughin 2017) Therefore thesis aims to develop a transformation model that will take account the unique attributes of AI perquisites, AI projects and processes.

From the business transformation perspective AI is said to have a big part in future business models and generate change in different industries based on writings of MIT professor Erik Brynjolfsson and MIT scientist Andrew Mcafee as they describe AI as the most important general-purpose technology of our era. Previous general purpose technologies have been such technologies as computers, electricity and internet. (Brynjolfsson & McAfee, 2017) Based on trends and research focusing on the AI agenda is currently relevant and justifiable and research in this topic has increased in the last years. (Brynjolfsson & McAfee, 2017, Gartner, 2017,AI Index, 2017) Especially when discussing the business value that AI actually generates and how it can be adapted to businesses and processes there has not been vast research, but it is said by researcher that AI delivers value to those who are in the frontier of digital adaptors and also encourage proactive strategy. (Bughin 2017 pp. 4, Ransbotham 2017) Therefore it is interesting to dive deeper into the underlying factors affecting AI initiatives in organizations. As noted above some models have been presented trough expert organizations but academic approach to the issue is missing.

Frameworks generated will be a visual picture that include in text format the factors of organizations target states that enable efficient AI implementation within the organizations. This will help selected organizations involved with their AI endeavors and ensure smooth transformation and implementation for the technology as its usage is not common at this point of time.

2. RESEARCH METHOD AND SETTING

In the following chapters, the methodology of the study is presented. Methodology how interviews were conducted is also explained.

2.1 Research methodology

Research methodology selected for this study will be Design science research methodology for information system research. Methodology can be described as the following:" a system of principles, practices, and procedures applied to specific branch of knowledge." (DMReview, 2007) The reason for using design science research approach is that it aims to:" … create things that serve human purpose (Simon 1969)." Design science research method is presented in figure 1.
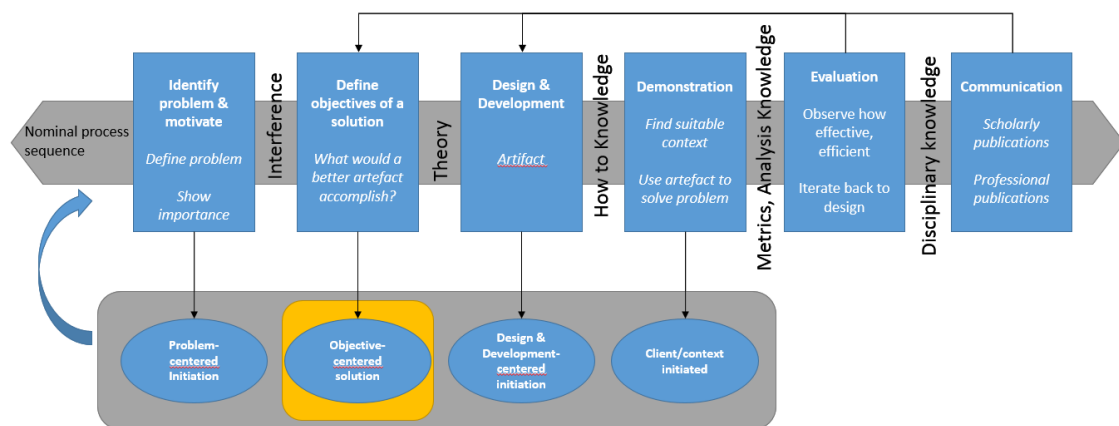
Figure 1. Design Science research methodology (DSR-methodology) Process model (Peffers et al. 2007)

Peffers et al. (2007) present four possible research entry points: Problem centered initiation, objective centered solution, design and development centered initiation and client/context initiated. In this research entry point will be objective centered solution as the aim is to generate a working framework as a strategic tool for AI transformation. The approach aims to generate something for individuals to use in the future.

There are three characteristics that methodology aims to fulfill; principles, practices and procedure. (DMreview 2007) Design science research method is also distributed in six activities that will guide the research study process. (Peffers et al. 2007)

The first activity is problem identification and motivation. This process will start from objective centered solution approach and therefore the main research question is de-

scribed as follows:" What are the typical initiatives to start the AI journey and what perquisites have to be in place?". It is advised by Peffers et al. (2007) to atomize the concept at hand and in this study it is done by adding one supporting questions that will help to understand the complexity of the main question. Supporting question is:" How AI initiatives should be run?" These principles will help to motivate why the framework is needed the current situation by highlighting the grown interest or significance of the task. The other stages of the model by Peffers et al. (2007) are presented below.

Second stage is to define the objectives for a solution. This will ensure that the end product is understood and the steps how to get there can be done. Establishing this will help demonstrate the value of the new artifact.

Third stage of the methodology will be creation of the artifact. Artifact in this instance will be a developed model to address how artificial intelligence process should be run efficiently. Model aims to find tasks that are important for Artificial intelligence process implementation and add this knew knowledge to a working technology transformation and implementation framework.

Fourth stage is the demonstration part and it will be conducted by conceptually testing the methodology on imaginary case on paper. This part of the research will be done with use cases found from interviews.

Fifth stage and the evaluation of the model will be done by weak market testing that will gather a panel of professionals in this field who will grade the developed model. This will give the model the validation so it will meet the scientific criteria's of a model.

Sixth stage will present the model and distribute the knowledge why the model should be used in the future artificial intelligence projects and what benefits will arise from this model. So conclusions will be discussed trough results and conclusions made of the model.

The design science framework can be seen to initiate from the question:" What would a better artefact accomplish?". Aim of this study has started from a need that can be satisfied by an artefact in this case a model for running a successful artificial intelligence transformation. This starting point aligns with the recommendations of Peffers et al. (2007)

The study is following the DSR-methodology and the following chapters are grouped under the phases. Connections and the development of the model can be seen in figure 2.
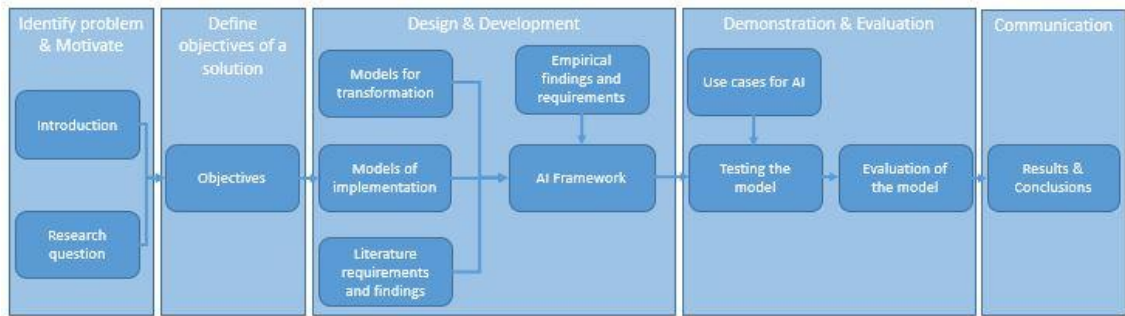
Figure 2 presenting the DSR-methodology in research context

Figure 2 works as a tool that ensures that methodology is met in academic regard. It will also ensure that it meets the object centered solution of creating something new in form of an artifact. The following chapters describes the way of how interviews were conducted. Selection criteria for interviewees is presented and their position and field of expertise stated briefly. The finding methodology and analysis method is presented. Finally the findings are presented.

2.2 Interviewee selection for empirical findings and results

To qualify as subject matter expert (SME) and be interviewed for the study certain criteria had to be met. The criteria was set to ensure that the quality of the research would also meet high qualification. Firstly the interviewee had to be experienced in the field of AI by being part of several AI projects. Also these projects had to be proven by academic record or by internal evidence. Secondly they also had to have good knowledge of the AI space and how AI is implemented and developed.

Aim for interviewee amount was set higher but finding interviewees who would meet set criteria was no easy. Therefore only four interviews were conducted that gave answers to the presented questions. The interviewee profiles are presented in the table 1 below.

Table 1 Interviewees

Code	Job Title	Field of expertise
Researcher 1	AI researcher	Industrial
Researcher 2	AI researcher	Healthcare
Consultant 1	Data Scientist	Financial Services
Consultant 2	Principal AI scientist	Generalist

2.3 Interview execution

Interviews were conducted by structured interview questions and they are presented in Appendix A. Structured approach was chosen so that SME's were able to give their own input and discussion would also take account their points of views that present new information to the researcher as there were no pre-set categories which to choose. (Jakovic, 2005 pp. 268) Structured interview questions were selected as to ensure that main research questions would be answered and the discussion would stay on topic. First the interviewees' position and relationship with AI was stated. As the field is relatively new in this regards there was some add-on questions asked and presented to ensure that the specific question got answered. This was done in cases when it was needed to clarify the question or something of interest had arisen and needed specification. This was due to a lot of overlap with terms in the AI space.

Three of the interviews were conducted by phone and recorded as there was no chance for face-to-face interaction that was the preferred choice. One interview was held in person. The interviewees were all located in different countries. United States, Spain, Denmark and Finland. So the represented answers offer geographically disperse efforts in the field of AI. The interview length was from 30 minutes to 1 hour so tape-recorder was used to turn it into a transcript as advised by Jankovic. (2005 pp. 270)

3. IDENTIFY PROBLEM AND MOTIVATE

This chapter aims to generate understanding of the reasons why the problem presented needs solving and why it is important. This chapter will work as the foundation for the first phase of the DSR-methodology also the importance of the AI framework artifact is presented. In figure 3 it has been visualized the current phase as a darker box corresponding to the DSR-methodology.
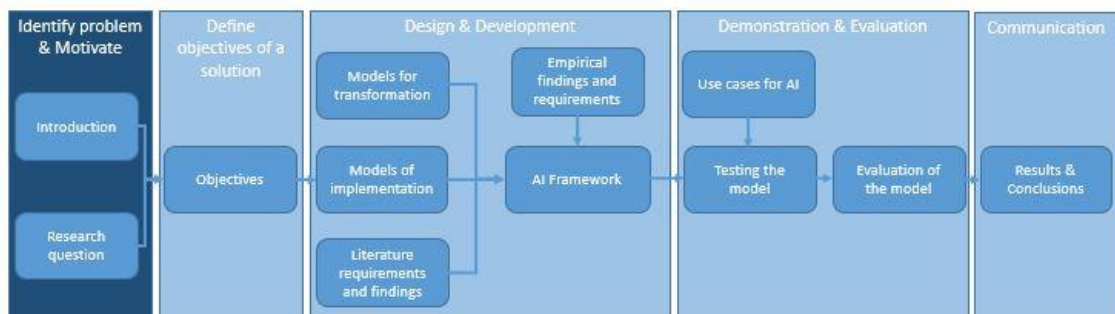
Figure 3 Phase 1 Identify problem and motivate phase

3.1 Research question

There are many studies around Artificial Intelligence done by academics with different approaches. Artificial Intelligence is a broad term and interpretation of it varies so the actual research that has been conducted still leaves new and interesting viewpoints and scopes to be researched. (Russell & Norvig 2010, p. 1-2) The Artificial Intelligence implementation journey into organizations has not covered as implementing Artificial Intelligence in business problems is relatively new. As the Gartner (2016) Hype Cycle for emerging technologies shows machine learning that can be seen as a part of AI, has reached the peak of inflated expectations it is relevant to study what is happening with machine learning in the AI field. Especially the scope of using AI in financial services, manufacturing and retail leaves a lot of room to study AI in a good setting. Therefore the focus of this study is about Artificial Intelligence transformation in low maturity organizations and studying the use cases that can be conducted in this setting. Scope of cases is further limited to use cases in three sectors manufacturing, financial sector and retail. Use cases provided by interviews will generate other possibilities from their respective fields and this is therefore not limited.

The study examines the characteristics of Artificial Intelligence and its implementation. The main question that the study aims to find answer to is:

- What are the typical initiatives to start the AI journey and what perquisites have to be in place?
- How AI initiatives should be run?

By the questions presented above it will allow the generation of an AI framework. The support question aim to give new insights and to generate more deep understanding of the main question.

Scope of the study will focus on computer vision, natural language processing and machine learning as the three main categories based on studies show that these technologies have been invested the most and therefore offer more material for research. It is important to note that boundaries regarding the technologies are not exclusive and therefore in this study other technologies have also been named and presented as they also utilize machine learning within their implementation. (Bughin 2017, pp. 7-12)

4. DEFINE OBJECTIVES OF A SOLUTION

This chapter will define the aim of the solution and how it will be used in the future. This part will also answer to the question what would a better artifact accomplish. This phase is presented in the figure 4 that follows the DSR-methodology.
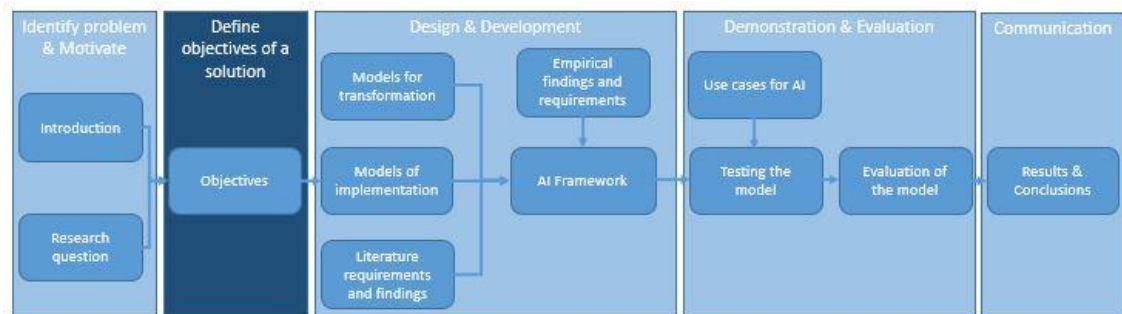
Figure 4 Phase 2 defines objectives of a solution

4.1 Objectives

Objective for the work will be generating two AI frameworks. Frameworks would work as a tool for organizations to understand the different factors within their own organization that affect AI initiatives. Frameworks objective is to help understand what perquisites have to be in place for organization to benefit from using AI and what actions have to be started so it can reach the target state.

Objective for the AI transformation framework is to describe how to find the initiatives for AI as an approach. It also aims to bring out the pieces that have to be in place or taken into account when doing AI initiatives successfully. Working as a process structure with steps that can be followed to achieve AI transformation success.

AI implementation frameworks objective would be to give indication when running AI initiatives would be possible within the organizations. Helping them to set steps and goals for AI and their own digital maturity and therefore assure efficient and successful AI initiatives to reach the described future target state. Objective is also to guide how the implementation is run in terms of team composition, approach, methodology and technology selection.

5.   DESIGN AND DEVELOPMENT

In this chapter the fundamentals of the artifact are presented. Artificial Intelligence (AI) is discussed bringing understanding what initiatives the model would allow to implement and what characteristic they hold. Transformation and implementation models are discussed to work as building blocks for the model. These fundamentals will generate base for the research and build the basis for the artifact model that is being built. Literature review and empirical interviews for professionals were conducted.

To apply the DSR-methodology to generating an artifact for implementing AI initiatives a framework of building blocks is presented in the figure 5 below. This phase and chapter follows the design and development principles of the artefact. These topics in chapters offer information that enables to generate the artifact that is a transformation and implementation framework for AI initiatives.
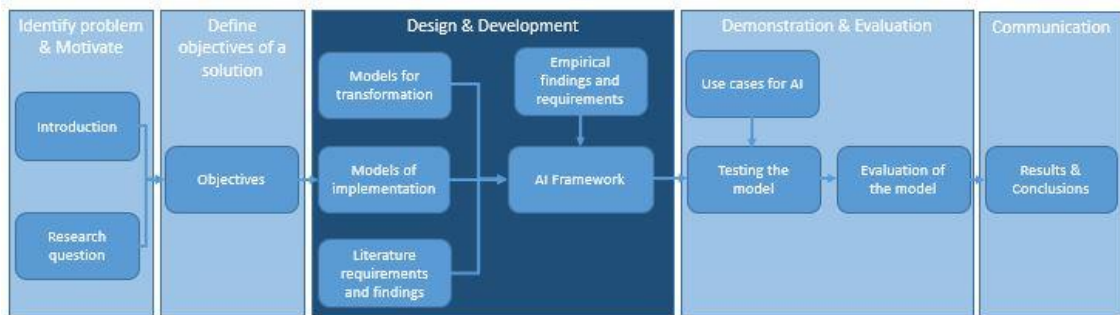
Figure 5 Phase 2 Design and development

5.1 Literature requirements and findings

The following chapters discuss the findings from literature review that was conducted for the study. Literature part also presents requirements, which are presented in the chapters.

5.1.1 Artificial Intelligence

Artificial Intelligence has become hyped technology as big data has enabled vast amounts of data to be actually implemented into AI and machine learning capabilities in ways that have been impossible earlier due to limited data and the inability of processing analyzations for vast amount of data in milliseconds. (Bean, 2017) For example, the Artificial Intelligence has had fundamental change in the fields of accounting and auditing in organizations as processing documents by automation has developed drastically. (Kokina, 2017)

It is hard to draw exact lines when talking about AI technologies. Creating a technology list that would be mutually exclusive and take into account all possible technologies is impossible, as many new technologies are actually combination of many technologies. (Bughin 2017 pp. 7) In the following chapters the most important and common technologies are shown as they give most interesting approaches regarding the scope of the research. First the fundamental approach to AI is discussed.

As the AI field is relatively new there is still a lot of research opportunities to be dwelled upon. The first time Artificial Intelligence is presented in history in 1965 in Dartmouth Conference and it can be seen as the starting point of the research in the field of Artificial Intelligence. (McCorduck 2004) Artificial Intelligence has many definitions and approaches and some of these are presented in the table 2. (Russell & Norvig 2010, p. 1-2)

Table 2 Artificial Intelligence definitions gathered by Russell & Norvig 2010

Thinking Humanly *"The exciting new effort to make computers think… machines with minds, in the full and literal sense." (Haugeland, 1985)* *"The automation of activities that we associate with human thinking, activities with such as decision-making, problem solving, learning…" (Bellman, 1978)*	**Thinking Rationally** *"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985)* *"The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)*
Acting Humanly *"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990)* *"The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)*	**Acting Rationally** *"Computational Intelligence is the study of the design of intelligent agents." (Poole et al., 1998)* *"AI … is concerned with intelligent behavior in artifacts." (Nilsson, 1998)*

In table 2 AI is defined into four main categories; Acting Humanly, Thinking Rationally, Acting Rationally and Thinking Humanly. These definitions derive from different interpretation of how Artificial Intelligence is understood and they will be described below in more detail.

Acting humanly has its foundations from the Turing Test. Alan Turing's test included presenting written questions to the computer and if human could not interpret, if the written answer was done by machine or human machine the Artificial Intelligence level would have been achieved. (1950 Turing) With modern understanding, the computer would need the following capabilities: Natural language processing; communication in English, Knowledge representation; to store information, Automated reasoning; using stored knowledge to formulate answer and make conclusions and Machine learning; adapting to changing circumstances and pattern detection and extrapolation. With later addition to the traditional Turing Test also a total Turing test has been established that would also need the capabilities of computer vision to see objects and robotics to move physical objects and move around the premises. These six capabilities compose the most of AI study field at the moment and can therefore be used to limit the presented technologies in this study to the six presented here. (Russell & Norvig 2010, p. 2-4) It is important to note that these technologies overlap and use the same principles to work like machine learning so creating a clear line between these is not possible. (Bughin 2017 pp. 7) Main focus of the study will still be in Machine Learning, Computer Vision and Natural Language Processing as described in the initial research context.

Thinking humanly lies in the middle of computer sciences and psychology as a cognitive science. Artificial Intelligence in cognitive sciences aims to construct precise and testable theories of the human mind. (Russell & Norvig 2010, p. 2-4)

Thinking rationally aims to solve problems logically. The aim is to "Think right" that is based on an irrefutable reasoning process. So there is a difference in human and rational concepts and that needs to be understood when talking about AI. (Russell & Norvig 2010, p. 2-4)

Acting rationally means to generate a rational agent that aims to act as correctly as possible to generate the best outcome. In situations where there is uncertainty, it aims to generate the expected best outcome. Rational-agent that is developed in this way of thinking in terms of AI has two advantages; it is more general than "laws of thought" and secondly it is more scientifically applicable as it is not based on human behavior. The six capabilities described in the Turing Test also apply to agent acting rationally. (Russell & Norvig 2010, p. 2-5)

In this study acting rationally definitions will be used as the aim of implementing AI initiatives aim to act correctly to ensure best expected outcome. As the methodology created in this thesis is aimed for human use in a business setting it is paramount that the aim is to understand the weaknesses of AI but in theory always thrive for the most educated prediction or best outcome when talking about implementing AI in business.

5.1.2 Narrow and strong AI

In the field of AI there are two distinctive approaches and they are called "Strong AI" and "Narrow AI". (Kurzweil 2010 pp. 451-459) Kurzweil (2010 p.459) defines Narrow AI as follows: "Narrow AI refers to artificial intelligence that performs a useful and specific function that once required human intelligence to perform and does so at human levels or better." Kurzweil also states that Strong AI means artificial intelligence that exceeds human intelligence level. (2010 p. 451) Narrow AI has become the dominant force of these two as it is successful of solving useful practical problems and has been more practical to demonstrate in academic papers. (Goertzel, 2014)

Narrow AI also known as Weak AI is mostly used in today's AI products for consumers. For example Apples Siri is a good example that it works in a certain field really well. Siri is a combination of many narrow AI applications also known as Hybrid AI. (Greenwald 2011) Narrow AI has certain capabilities and by design they are narrow, they don't try to understand everything but to perform a specific task and if the task changes in significant manner new programming could be needed to perform the task. Narrow AI has significantly been able to improve functionality in limited tasks. (Voss 2017)

Strong AI also known as Real AI is from technological perspective being human like in decision making in general and this goal is still quite far away. Voss even states that it is not possible to move from Narrow AI to Strong AI incrementally. Same vision is also shared with Gary Marcus a professor from New York University. (Itu News 2017 , Voss 2017) Therefore within this study when addressing AI it means Narrow AI as there are no Strong AI applications present.

5.1.3 Machine learning

Machine learning is part of Artificial Intelligence and it has been around since the 1970, but as with AI in general also machine learning has taken big leaps in progress due to increase in computing power. (Louridas & Ebert 2016) Machine learning can be understood through two definition of Machine Learning. Arthur Samuel in 1959 (Samuel 2000) quotes that Machine Learning is:" Field of study that gives computers the ability to learn without explicitly programmed." This quotation has been the basis for machine learning for quite some time. More modern and specific approach for Machine learning has also emerged by Tom Mitchell. It tries to quantifies the aspects of machine learning trough variables:" A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E." (Mitchell, 1997). Machine learning is the most invested technology within the AI landscape and many of the other technologies lean on machine learning. (Bughin 2017 pp. 29)

Machine learning can be divided to Supervised and Unsupervised learning. (Mitchell 1997) In figure 6 the most common strategies in Machine learning are categorized under unsupervised and supervised approaches.
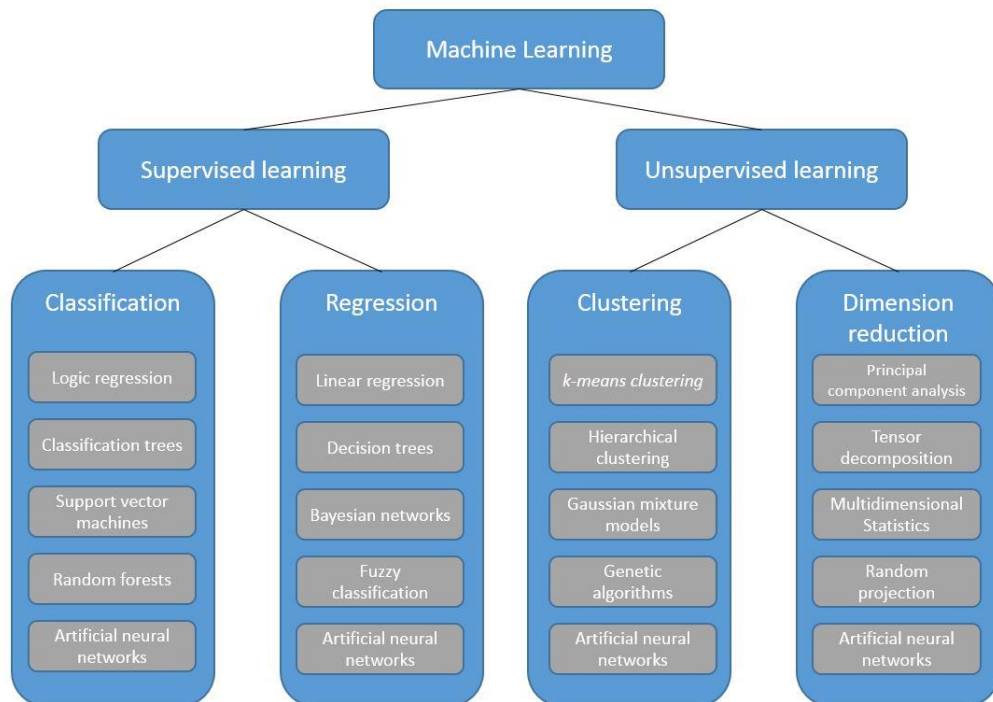
Figure 6 Machine learning approaches adapted from Louridas & Ebert 2016

As the figure 6 shows there are many individual approaches under the supervised and unsupervised strategies within machine learning. All strategies base themselves on different kind of algorithms that can be applied in different dataset.

Supervised learning focuses on tasks that have the correct answer for a specific data set that is available. It can be used to solve similar problems with the data if the problem at hand is also similar and has good causality regards the original dataset. (Louridas & Ebert 2016) Describing supervised learning in more detail that it observes certain input-output pairs and learns a function that maps route from output to input. More specific approach to the algorithm is that on a given training set of N in combinations of X-values and Y-values meaning input-ouput pairs of $(X_1, Y_1), (X_2, Y_2), \ldots (X_N, Y_N)$ where each Y_j is generated by an unknown function $Y = f(X)$, discover a function h that approximates the true function f. (Russell & Norvig 2010 p.695) Within supervised learning cross-validation can for example estimate the success of the algorithm and give guidance of the validity of the result.(Hastie 2008)

There are two type of options to choose from within supervised learning that are classification and regression. (Louridas & Ebert 2016) Classification algorithm is used when the output *y* is one of an infinite series and it can be further divided into Boolean classification

if it only has two values. (Russell & Norvig 2010) Regression algorithm is used when output y is a number it means that regression algorithm tries to find conditional expectation or average value. (Russell & Norvig 2010)

Unsupervised learning in layman terms "learning without a teacher". In unsupervised learning the algorithm does not have the right answers or degree of error. The dimension X presented in the supervised learning setting can be much higher and results in much higher and properties that are researched are more complex. Due to these characteristic Unsupervised learning does not have a success factor in same manner as supervised learning and validation for the result is therefore harder. (Hastie 2008)

Unsupervised clustering aims to solve problems where the category labels are not known and discerns multiple categories in collection of objects. (Russell & Norvig 2010. pp.817) Dimension reduction in unsupervised learning is the task of reducing random variables within consideration. (Roweis 2000)

5.1.4 Natural language processing

Natural language processing (NLP) can be defined as "(NLP) …processing uses and supports text analytics by facilitating the understanding of sentence structure and meaning, sentiment, and intent trough statistical and machine learning methods." (Lu et al. 2017) Generally NLP enables computers to perform text analytics. Python or Java are examples of language that have exactly defined language models compared to natural languages like English where it can't be characterized by definitive set of sentences. (Russell & Norvig 2010. pp.860-861)

AI is widely applied into NLP by leveraging following technologies like recurrent neural network, deep neural networks and recursive neural networks. Vendors with NLP products are Basis Technology, Synapsify and Lexalytics. (Lu et al. 2017) NLP can for example translate obscure legal documents into layman terms and enables bots to stand in for customer service agents and redirect customer to the needed information. (Marr 2016)

5.1.5 Knowledge representation

Knowledge representation aims to store the knowledge that it has gained through hearing or knowing. When discussing knowledge representation it is important to mention ontology. Ontology is the model of hierarchy that organizes the world under different categories. (Russell & Norvig 2010. pp.437-473)

Building an ontology that would be able to comprehend and control any domain is called general-purpose ontology. This general-purpose ontology challenge has not yet been met

with AI solutions even though there are some frameworks that are robust to handle many events. (Russell & Norvig 2010. pp.467-468)

5.1.6 Automated reasoning

Automated reasoning has its basis from the decision theory that aims to choose the most desirable immediate action of the possible alternatives. Automated reasoning agent will choose from variety of decision models. Automated reasoning agent makes decision based on available context based on the established beliefs. This foundation makes it possible to make a decision in situation where logical agent is not able to make a decision due to conflict of goals and uncertainty. (Russell & Norvig 2010. pp.610)

In very varying variables automated reasoning makes it possible to sustain positive and sustainable development. Techniques based on AI like decision tree and neural networks will enable more accurate decision making. Example vendors from this field are Pegasystems and Informatica. (Lu et al. 2017)

5.1.7 Robotics

Russel and Norvig (2010 p.971-973) describe robots as a physical agents and they consist of effectors and sensors. With these capabilities, the robot is able to manipulate the physical world. Robots can be divided into three main categories manipulators, mobile robots and mobile manipulators. These describe the older understanding of what robots are and thinking about an industrial robotic manipulator working in a factory to stack bags on pallets or unmanned aerial vehicle match the description.

More modern and accurate approach has to be included when thinking about the modern robot especially in regards to AI. Robotic process automation (RPA) describe by the patent description is "Methods, systems and apparatus, including computer programs encoded on a computer storage medium for automating a manual processes…" (Bataller et al. 2017) Many programs like UIpath, Blueprism and Automation Anywhere are examples of automation programs where robots perform process automation. (Lu et al. 2017)

RPA automates human interaction with the machine trough algorithms and programs. RPA functions to support efficient business processes and is widely used in situations where human work generates too much costs. Related to AI agenda RPA enables the processing of was amounts of data otherwise not easily feasible. (Lu et al. 2017)

5.1.8 Computer vision

Mathematical techniques have been developed to generate three-dimensional shape and appearance of objects in imagery. Models of images are usually developed in physics by means of radiometry, optics and sensor design or by developing it by computer graphics.

Computer vision aims to describe the world as humans see it in one or more images and reconstruct the elements like shape, illumination and distribution of color. (Szeliski 2010) Computer vision can also be defined so that it aims to represent by computational models the human visual system. More advanced definition to computer vision is that it aims to automate systems which can perform similar tasks that humans can do. (Huang 1996) Deep learning is one of the most advanced and dominant techniques in the field of computer vision. (Lu et al. 2017)

Russell and Norvig describe some of the foundations that computer vision is based on. Perception connects the information agents that inhabit the world by enabling sensors to interpret and respond to the agents. Many sensorial modalities are available for computer vision agents for example vision, hearing and touch that are also senses that humans also possess. Object model is something that describes two or three-dimensional objects like trees, cars, etc. Rendering model tries to comprehend the actual physical stimulus that is based on processes like physical, geometrical or statistical. Feature extraction is based on the sensor data and is able to do this by applying simple calculations to data available presented by the sensors. Recognition does use visual and other available information to make connections and is able to conclude distinctions by these connection. Reconstruction is the task of building a geometrical model of a picture or multiple pictures. (2010 p.928-929)

Example of AI system, which has computer vision abilities, is Microsoft Azure. Microsoft Azure can utilize AI to interpret a picture that it has been given and draw conclusions what it represents by analyzing the picture. Another example of what can be done is to read the text inside the picture by Optical character recognition and these use cases are examples of AI in action with computer vision and the underlying techniques. (Microsoft 2018)

5.2 Models of transformation

In the next chapter the basics of digital transformation are presented. Chapter also presents more deeply the AI perspective from the transformation angle and the success factors and challenges related to these projects. One of the reasons why digital transformation should be pursued is that data-driven companies have generated the most stock holder value in the last years the big tech giants like Apple, Facebook, Microsoft and Amazon. (Gourevitch 2017)

5.2.1 Technology roadmap for transformation

Technology management plays an important role to meet the growing demands of business objectives. (Phaal et al. 2004) Technology road mapping as a framework will provide a tool to keep technology aligned with the business objectives so that the overall aim to provide business value is not forgotten. (Phaal et al. 2001) Project is defined by set of

actions where:" human capital and financial resources organized in a novel way to undertake a unique scope of work within time and cost constraints, achieving quantities and qualitative objectives." (Turner, 1999) Simultaneously when generating the transformation map, organization should pursue the data standardization process, and generate ways of working that will ensure creation and management of data in a manner that data gained is valid and integrity is ensured. (Gourevitch 2017)

Definitions for technology roadmaps are described as follows; Technology roadmap aims to characterize in visual format the combination of a certain technology products and business planning. (Phaal et al. 2001) Technology road mapping is a tool that will provide structured strategic and long-range planning. (Phaal et al. 2004)

Generally many personnel involved within organizations understand the strategic importance of new technologies to gain competitive advantage and delivering value. Managing these advanced technologies generate new challenges as the technologies become more complex due to vendor management, technical complexity or increased cost. Technology roadmap enables the company to stay on track with the main objectives of having the understanding of the information, processes and tools underlying the technology to benefit from the technology. (Phaal et al. 2004) When thinking about the technology strategy it is important to note that it is not an independent strategy form the overall organizations strategy but an integral part of enabling benefits of that strategy trough technology. (Matthews 1992, Bitondo & Frohman 1981)

5.2.2 Technological transformation models

When thinking about the AI transformation journey it should be understood that it is a part of bigger picture of digital transformation trend and it follows the same principles of analytics as one wave of digital transformation. (Bughin 2017 pp. 32-33) Digital Transformation has been a hot topic for a while now and implementing a new technology has many effects on possible products, business processes, sales channels and supply chains. (Matt   2015)

There are some models for digital transformation and analytical transformation. Based on these models and the interview findings it is possible to generate more specific AI transformation model into the intersection of AI and Digital Transformation. It has to be understood that organizations have to have certain perquisites in place to perform AI transformation. Advanced analytics has the same guiding principles regarding the data that have to be followed. For AI as a new technology no new exact for AI transformation models exist in academic regard. Bughin et al. (2017 pp. 23) have also presented an AI specific transformation model that is built on their previous analytics transformation model. Based on these finding an observations transformation models for analytics can

be used as guidance for AI model as they are based on the same principles as new technologies. (Bughin 2017 pp. 23, Gourevitch 2017)

Four steps that get organizations started on their analytical transformation journey are as follows. Deciding a business unit as grounds for proof of concept. Requesting the teams to find possibilities within key functions to test validity. Initiate a process within the organization that utilizes the following steps: experimentation, measurement, sharing and replication. Collaborate, find interested parties in the analytical field, and open up data. These principles can be steps of a model for AI also. (McAfee 2012)

Boston Consulting group (BCG) has developed a five-staged model for analytics. Model takes into account the key issues that have to be addressed to achieve analytics transformation within the organization this model is presented in picture Figure 7.
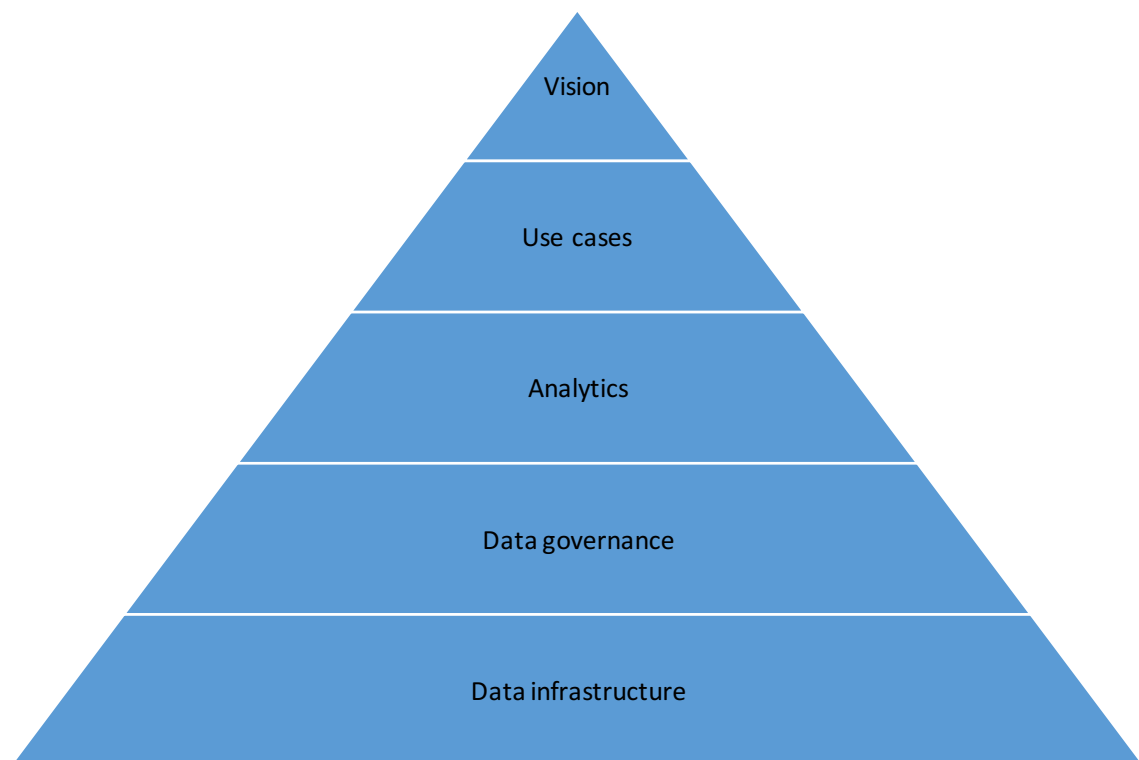
Figure 7 BCG Analytics transformation model with key themes (Gourevitch 2017)

The model for analytics has to align the overall vision with the underlying steps. Vision step in this model tries to capture the importance of the change for the organizations. Also the scope has to be understood. Is the transformation aimed for the whole organization and change the business model or focused on improving efficiency in certain areas. (Gourevitch 2017)

Use cases have to be understood what are the most information initiatives tasks at hand. These tasks must have viability and it has to be understood with analytics and AI initiatives that data availability, value generated, regulation, technical difficulty and customer benefits have to be understood. (Gourevitch 2017)

Analytics step describes the situation of assembling the analytics structure. Thinking the current analytics infrastructure decision have to be made what to out-source and what capabilities should be done by the organization. (Gourevitch 2017)

Data governance step is the validation that the gained information can be trusted. Improvement initiatives for the data also have to be established. (Gourevitch 2017)

Final step is to ensure data infrastructure is established that it will support the future initiatives. Technological decision should also be made what role does the legacy systems play, is the system cloud base and should a data platform be established. (Gourevitch 2017)

Mckinsey Consulting (Bughin 2017) has also presented their own approach to the AI transformation journey quoted from their Analytics framework with their own add-ons with the main elements similar to analytics and digital transformation. This model is presented in figure 8.
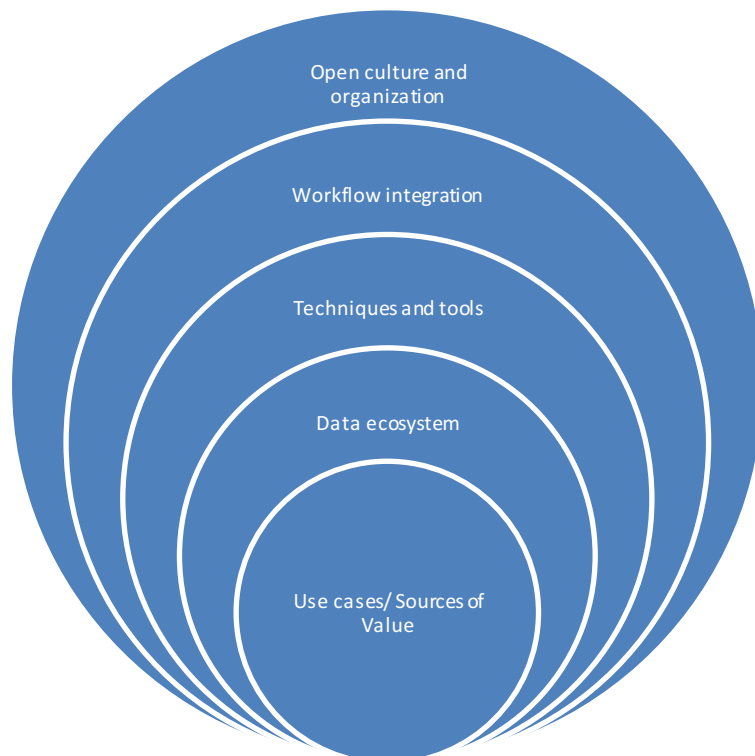

Figure 8 Mckinsey AI transformation model (Bughin 2017 pp 32)

Bughin et al. (2017 pp. 32-33) approaches the situation from the use case phase that Gourevitch et al. (2017 pp. 32-33) describe as the second step after establishing the vision. Sources of value are found trough creation of business cases that are viable and needed.

Data ecosystem is the second step that aims to address the current data governance and infrastructure. Focus in this step would be to break the silos of data and identify the most important data areas. (Bughin 2017 pp. 32-33)

Third step takes into account the specific techniques and tools where agile process approach could be recommended. Agile software development means software development method that advocates adaptive planning, evolutionary development, early delivery ad continuous improvement and it encourages rapid and flexible response to change. (Agile Alliance 2013) Finding specific fit for purpose tools is essential and finding the right capabilities. Capabilities can be in-house unit or collaborating with an AI partner. (Bughin 2017 pp. 32-33)

Fourth step addresses workflow integration and finding the gaps where AI fits. Also generating collaboration with the human AI connection to establish optimization to generate benefits. (Bughin 2017 pp. 32-33)

Fifth and final step in this model addresses establishing open culture within the organization and adopting the new ways of working. Building trust with the organization to AI and generating learning for personnel to utilize the AI potential. (Bughin 2017 pp. 32-33)

Berman (2012) represents set of capabilities that are essential for digital transformation within organizations. These capabilities are presented below.

- Business model innovation; Building customer value as a core competency across industry, revenue and enterprise models.
- Customer and community collaboration; Driving customer centricity into each part of the enterprise and using social networking tools to engage
- Cross-channel integration; integrating all customer touch-point across digital and physical channels
- Insights from Analytics; Integrating information across all sources (internal, external) and taking full advantage of predictive power of advanced analytics
- Digitally enabled supply chain; Optimizing all supply chain elements, effectively integrating cross enterprise
- Networked workforce; Getting the right skills aligned around the right business opportunities

Berman's (2012) model takes into account the more high level digital maturity initiatives. For example business model innovation step can be seen to work on very high strategic level. This approach would possibly result in major overhaul of the organizations approach to making their business viable.

These models present the main factors for digital, analytics and AI transformation. Agile approach for process implementation of AI is presented by Bughin (2017). Common process run approach for analytics is also agile. (Larson & Chang 2016) Bughin model is the only one with specific AI transformation approaches.

5.2.3 Common success factors

Common attributes can be found from all three models. It can be seen that the Vision that starts (Gourevitch 2017) the BCG model has partly the same goal as the finals steps of Mckinsey (Bughin 2017 pp. 32-33) and Berman model meaning networked workforce and open culture and organization surrounding the transformation model. So it can be stated that enabling a commitment and vision within personnel and organization around the AI initiative is vital.

BCG and Mckinsey model take into account the use cases that have to be found and also McAfee et al. (2012) present the importance of finding the right initiatives to pursue for AI that meet the requirements of business value, important process and sufficient data to analyze and generate it.

Data and Analytics play important part in all the presented models. (Gourevitch 2017, Bughin 2017 pp. 32-33, Berman 2012 pp. 20-21) So it can be seen that analytical skills within the organization including data controls and infrastructure has to be established for successful AI implementation. Data has to be trusted and there has to be enough of it to generate efficient applications with AI. Even though the algorithm would be really good without sufficient data the AI algorithm is not able to make good predictions. (Ransbotham, 2017) Data ecosystem in McKinsey model describes the same issues that are addressed with data infrastructure and governance in the BCG model. For AI and analytics to succeed good data gathering, controls and availability have to be established before moving along with any of the models. In table 3 the common factors and differentiators within the models are presented.

Table 3 Common factors within the transformation models

	Bughin 2017	**Gourevitch 2017**	**Berman 2012**
Vision	X		
Use Cases	X	X	

Data ecosystem /Data governance / Data infrastructure	X	X	
Analytics/ techniques and tools	X	X	X
Open organization and culture/ Networked workforce	X		X
Digital supply chain			X
Customer community collaboration			X
Workflow/Cross-channel integration	X	X	
Business model innovation			X

Based on the table common ground can be found from use cases, data ecosystem/data governance/data infrastructure, analytics/techniques and tools, organization and Workflow/Cross-channel integration. Analytics/Techniques and tools was the common factor within all the models. So it can be understood that Analytics plays an important part in technology transformation journeys.

The common factors presented in table 3 work as foundation for building the artifact later on in this chapter. The common factors present something that is considered and can be agreed on when talking about a new technology.

The common success factors found from literature listed in table 3 can be seen as requirements for AI transformation model. The most important factors that have been found are the ones that can be found at least from two frameworks. These requirements are presented in the table below.

Table 4 Requirements found from literature

Requirements
Use Cases
Data ecosystem
Tools
Culture
Workflow

These requirements work as a base for the AI transformation. These requirements also support AI implementation model in terms of approach. Implementation and transformation are connected so certain overlap was predicated.

5.3 Models of implementation

This chapter describes the methodology how AI initiatives are run within the organization when they are initiated. Also technologies meaning software language used in AI are briefly presented. The implementation chapter aimed to answer the four categories of how an initiative can be approached, what tools are needed, what team composition has to be in place and what methodologies should be used. Team composition and approach was conducted through empirical study presented later due to limitation on academic literature in specific AI regard.

5.3.1 Programming languages used in AI

Most common languages that are used in development of AI are R, Python and Java. These are the most dominant technologies when focusing on machine learning application. C++, C and other programming languages are also used with machine learning, but they are not the most common adaptation of programming languages. (Puget 2016)

R programming language has statistical computing elements and graphs. Linear and generalized models and nonlinear regression models are examples of statistical computing that R language is able to do. These mathematical models are also used in machine learning. (Hornik 2017, Louridas & Ebert 2016)

Python is used in varieties of AI implementation from Strong AI, machine learning, natural language and text processing to neural networks. (Atabay 2016) There are many

frameworks for python to adapt to AI for example PyML:"that is an interactive object oriented framework for machine learning that is written by Python" (Ben-Hur 2010). By recent studies of year 2018 Python has been voted as the most common language by Stack overflow survey that also indicated that machine learning is an important trend that frameworks and languages associated with these efforts have gained popularity. It is also said that the programming community's view is positive of AI efforts. (Stack overflow 2018)

Java language is adapted to AI as it has very good features in maintainability, portability and transparency with the Java Virtual Machine Technology. Java has also a vast amount of tutorials of AI programming online. (Shevchenko 2016)

When approaching the decision of AI many options are possible. Which language should be chosen can be therefore seen to be based on the task at hand and personnel's skill set.

5.3.2 Agile software development

Agile software has become present in many companies as turbulent and constantly changing environment requires new ways of working. (Truex 1999) Agile project development can be seen to offer solutions to project management dilemmas as it:" … offers solutions to common, persistent problems: poor estimates, slipped timelines, products languishing in an almost-done state, and risk & scope management:" (Karlesky & Voord 2008, pp 247) Aim of agile is to reduce the up-front planning and strict control and value more informal collaboration, coordination and learning. (Dybå 2014 pp. 277) Juricek (2014) describes the agile process in following methodology parts: Active user involvement, empowered team to manage from down –to-up, flowing requirements, quick, small, incremental releases and iterations, complete first, then move to the next, test early and often and finally collaboration between all stakeholders. Agile principles described before are ways of managing projects and personnel's in IT development. (Juricek 2014)

There are many adaptation of agile and its principles but basic foundations for the methodology can be found from the agile manifesto. (Abrahamsson 2003, Beck 2001) Four basic principles described by the agile manifesto that works as a basis for agile methodology that work as the back-bone of agile are (Beck 2001):

- Individuals and interactions over process and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following plan

These guiding principles aim to unify guiding principles of management and strategic context, release contexts meaning estimations and daily iteration. These principles are being iteratively and collaboratively leaded will ensure agility within the project. (Juricek 2014 pp. 173) There are differences compared to agile vs. traditional software development and the most important ones are described in the table 5.

Table 5 Comparison with Traditional and Agile software development adapted from Hoda et al. (2008)

Categories	Traditional	Agile
Development Model	Traditional	Iterative
Focus	Process	People
Management	Controlling	Facilitating
Customer involvement	Requirements gathering and delivery phases	On-site and constantly involved
Developers	Work individually within teams	Collaborative or in pairs
Technology	Any	Mostly Object Oriented
Product Features	All included	Most important first
Testing	End of development cycle	Iterative and/or Drives code
Documentation	Thorough	Only when needed

Table concludes that there are many differences between the traditional model that could also been seen as waterfall method that has been used in software development. (Juricek 2014 pp.172) Empowering personnel and releasing project from cumbersome restraints can be seen to be enabling efficient ways of working with agile.

There are many adaptations within agile that have merged as their own methodologies. Such as eXtreme Programming (XP), Crystal, Scrum, Adaptive Software Development, Dynamic Systems Development Method and Feature-Driven Development. (Abrahamsson 2003)

It can be seen that modern agile methodologies have been a used and sufficient model for new technologies. Scrum specifically has been seen as working model used in analytics and therefore agile methodologies with its specific traits like iterative model, object oriented and most important features first can work as building block for the artifact.

Requirements found from literature for the implementation part of the framework are listed below.

- Agile methodology
- Programming language preferred choice Python

These two requirements contribute to AI implementation framework. Findings are used in the approach and tools section of the AI implementation framework.

5.4 Empirical findings and requirements

Following chapters present the empirical findings and requirements found through interviews. Interviews were conducted for subject matter experts within the AI space.

5.4.1 Interview analysis

Interview analysis was conducted following the structured method presented by Jankovic. The analysis was done by following the principles associated with structured interviews. Content analysis as part of qualitative analysis method. Systematically preparing the material gathered and analyzing the material by categorizing. (Jankovic, 2005 pp. 270) The main classifications were selected to be sentences and these sentences fall under three categorizations; Running AI initiatives, Perquisites for AI initiatives and Use case for AI initiatives. Categories are derived from the main research questions.

Not all material gathered is presented in this study. The most important and relevant findings are presented. The methodology used ensured that material could be categorized efficiently as interviewees saw the questions someway differently. Therefore categorizing findings under right topics was important. The methodology is presented in figure 9 below.
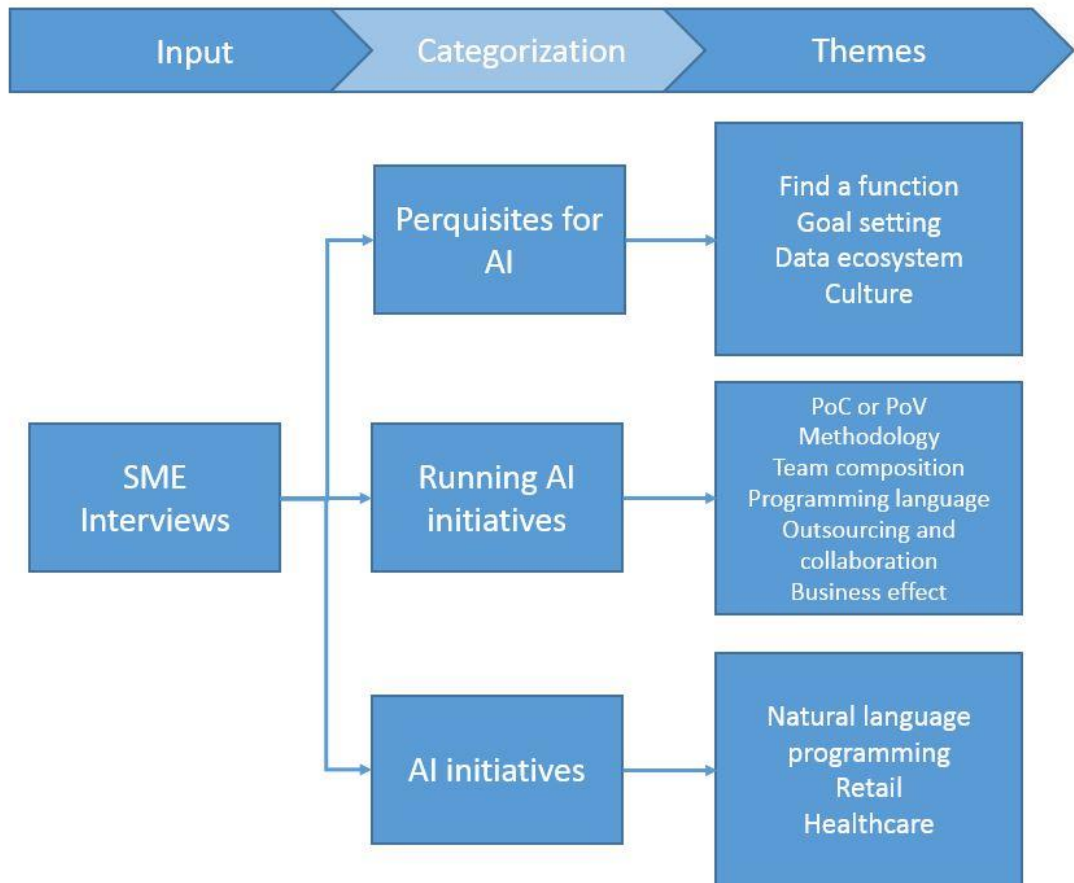
Figure 9 Interview analysis categorization used

It can be seen that the approach is further divided into themes. Themes were built from the interview findings to find common topic for the quotes and findings presented. This approach was chosen to clarify the main findings and further more makes it possible to compare to literature view findings in the same level.

5.4.2 Empirical research

This chapter will go through the interviews and categorize them in relevant topics. Empirical interview part will contribute on building the model based on findings that are combined with the literature review findings. Interview approach will give realistic understanding of the AI space and give more hands on direction how to run the initiatives.

Perquisites for AI

When thinking about the state of current organizations the digital maturity level has to be on a high level to be able move to the more sophisticated systems like AI. Through interviews these perquisites were asked so it could be understood what systems, people and actions have to be in place to start the AI journey.

Find a function

AI researcher 1 :*"Organizations have to be proactive when locating the data and thinking one step ahead of the curve. What will the next generation of AI products be how this data can be collected. That is something that has to be taught beforehand to be efficient digital organization. Building these capabilities and vision is important."*

AI researcher 1 :*"The forefront where AI is leading where the value generated is the biggest. Tasks of recognizing something that are trivial in some ways. Automotive industry is an interesting case as they could be said that they are in the forefront and also healthcare."*

AI researcher 1 :*"The task should also be something that human can do or decide in one second, that is a good rule of thumb by ... (person's name)... understand what can be done."*

Finding these AI initiatives could be troublesome and knowledge of the business is needed. Therefore collaborating with people who have understanding of the business and asking some simple questions will help to narrow it down where a possible AI initiative could be found. Going to functions or places where the value is big and finding tasks that could be done by human in one second. This will greatly help to narrow down the possibilities where capabilities can be built.

Set a goal

AI Researcher 1 :*" To have a clear goal what to do and be able to evaluate the value of the solution before diving into the development. So it is justifiable to commit to the endeavor."*

Consultant 2 :*"Then a part form data I would say clear assessment of the project objective to make sure that the expectations of AI are aligned with what can be delivered...."*

Ai researcher 2 :*"One thing I believe is a concern when we are doing these projects we lead with PoC we don't always have a target label so we don't know what we are looking for. So in the scenario that I pointed out before (regarding a loan approval example) that is a example of where we have the label; do we approve it or not. But if we go in there as exploratory analysis it can be rather difficult to narrow it down to a project that can actually lead to delivering value to the company. Of course we can do some clustering and safer their customer base and we actually have to define value before we go in and create this project. I think that is a success factor that we have a goal before we start."*

Defining the initiative in detail is essential based on the answers. Researching the business value in the initiative is needed and goal state has to be set. It is essential for success of the project to be measured in terms of success or failure and also take care of expectation

management. Defining value and validating the viability from the solution will inform the client or organization what is actually possible. Interviews also point out that if there is not a selected goal state and value defined in the beginning, running blind will result in bad outcomes.

Data ecosystem

AI researcher 2 :*"Digital maturity so all these Ai software's and projects we can do basically requires that the inclement of the organizations are mature in the digital sense."*

Consultant 2 :*"One of the important things during an AI project is, I want to say that data is very important, all data that you have and the more understanding of the data you have is basically the factor of success of any AI project."*

AI Researcher 1 :*"Data of course is essential, but I'd like to clarify that especially annotated data is needed to be successful in these endeavors."*

Consultant 1 :*"The first parameter is the availability of large amounts of data enough power computation to handle it, enough quality of the data to generate added value."*

AI researcher 2 :*"They have the right databases, they use the right software they record different stuff and they are already digital. If they are into digital, there is a lot of work to do before they can dive into AI. "*

It was unanimous that the data is the fuel that is needed to move forward with the AI initiative. If organizations are missing data it is not possible to move forward with the initiatives or realize value from the efforts. It was also stated that only having was amount data is not enough it has to be annotated and the metadata has to be accurate. Data quality issues are important. Data ecosystem with correct databases and data collection processes have to be sophisticated and efficient. Importance of data was mentioned trough the interviews in many regards as when talking about a use case it was mentioned that data is needed, so importance in this regard can't be underestimated. Data quality is vital so organizations that does not have the correct methods in place might be forced to think about buying relevant data from vendors if available.

AI researcher 1 :*" Who in their right mind in the former automotive industry would place cameras in every single car they have in their fleet. Front and back. Now this move by Tesla is enabling their efforts in pursuit of self-driving car."*

Thinking about data that should be stored in a way that assures quality and availability of data for the future is vital. Thinking about the next wave of products is essential and collecting data for that purpose is a trademark for digitally savvy organizations. Thinking a head with a digital roadmap is important and storing data for the next use case in mind is therefore recommended.

Culture

Consultant 2: *"Then a part form data I would say clear assessment of the project objective to make sure that the expectations of AI are aligned with what can be delivered. And also culture fit and to see how the AI technology is wanted to be used is it gonna augment humans is it going to be use to … to do some mandatory tasks that nobody wants to do, … I was surprised to know that all turnover in monotonic practices is very high because people get tired of the repetition after two or three years, how AI can help them actually to take over after they have setup their project that repetitive part and once they take care of the only interesting and challenging part. We may see that Ai is helping This is important to clarify what is the role of the AI and is it a good culture fit and is there enough data to train the AI."*

Consultant 1: *" Level of priority as well what the organizations wants to dive into these and does not have other more important."*

Other factors that have to be in place is the culture fit. What does the company want to accomplish from fundamental view from with AI. Goals and culture fit are connected as it affects how the personnel perceive AI. It could be something that is enabling them to do their work better and automating redundant tasks or it could be seen as something that is replacing their tasks and work. Therefore, the culture fit has to be built in so that misconceptions of the technology do not prosper.

As a summary the needed requirements are collected from the themes that helped to organize the findings. Requirements are listed below.

- Culture
- Data ecosystem
- Find a function
- Set a goal

These findings work as a basis for the transformation framework. These were selected from interviews trough analysis as they were the most common themes mentioned by at least two of the SME's interviewed.

Running AI initiatives

In the next chapter the fundamentals how the actual project is run are discussed. Discussion is based on answers and views gathered from the interviews. The details are more focused on more concrete level of how the initiative is run when the organization level requisites are established.

POC or POV

AI researcher 2 :*"One thing I believe is a concern when we are doing these projects we lead with PoC we don't always have a target label so we don't know what we are looking for. So in the scenario that I pointed out before (regarding a loan approval example) that is an example of where we have the label; do we approve it or not. But if we go in there as exploratory analysis it can be rather difficult to narrow it down to a project that can actually lead to delivering value to the company. Of course we can do some clustering and safer their customer base and we actually have to define value before we go in and create this project. I think that is a success factor that we have a goal before we start."*

Consultant 1 :*"The second point is more related directly to the client in a traditional consultant or advisory work you build something deliver it and leave it running within the client. To be able to maintain this type of technologies clients also need adequate profiles to run these. This is why this is probably one of the reasons besides amount of data computing power have made so that a lot of solutions around machine learning solution are provided as services as API's, given a company a provider to play. "*

Usually the AI initiatives start with proof of concept (PoC) or proof of value (PoV) approach. PoV or PoC is a way of goal setting. This aims for early feasibility and proof of the solution working. Capabilities can be developed further but the business case has to be validated with PoC or PoV. Approach for AI projects should be fast feasibility of the initiative and this is done by PoC. Initiative could later on be developed further and increase the capabilities. Value of the initiative can be addressed before starting to assess the possible feasibility in regards of data. This can assure future incentives and thinking a head of the curve in regards of the next wave.

Methodology

Consultant 2 :*"We are running agile methodology… scrum is in agile, we have the notion of sprint we have three week sprint with different projects, in terms of tooling we are using Qira for task management and sprint definition, we use constants for documenting the work we do and basically any communication between the team and we use each lab to postpone management system we are also building a more mature devops environment that would have continuous delivery. We are moving more specifically within the AI model within the manage models the platforms that I mentioned to you DVC or pachyderm to be able to look after and do sort of visual control of our training data and for our models."*

AI Researcher 2 :*"In our research group we would use something similar to scrum not exactly scrum as it is very strict. We would have the daily stand ups meetings and we did assign points for some of the task that were missing to do."*

Consultant 2 :*"Mostly we use scrum methodologies when possible to be completely franc the more projects advance in technologies shortest are the pretties. Clients are going through PoC or proof of value than full AI implementation within the beginning. Most of*

the engagement that are run are shorter than 2 months, PoC or PoV show that there is an actual business case and significant earning to gain they have to cope with their internal compliance, infrastructure, governance, political focus or not. "

AI researcher 1 :*"Hopefully we could do something like the scrum methodology so we would like to have a kind of, (let's) call him project leader or scrum master, we don't have to do all scrum."*

Answers show that the actual AI initiatives should be run with the agile methodology an all the answers revolved around specifically scrum. Approaches to scrum varied as some implemented more strict guidelines how to run the project as some run it more freely. Using agile methodology seems to be the go to choice in the AI projects and bring the needed structure to the development and in this regard running an AI project does not differ from running a regular software project.

Team composition

Consultant 2 :*" We have experts of AI scientists from different subdomain of AI, we have experts in NLP, information extraction, deep learning, vision network and machine learning, computer vision and image processing, mathematical basically data scientist with strong mathematical background. We have also team of software engineers who are supporting the software development aspect, project manager for each project, a person like …(Persons name)…as a technical lead a manager for all data scientist to manage all the technical and management of product delivery and people. Overseeing all the strategy and the structure and how we run and govern the business over here.´"*

Consultant 1 :*" Size of the team usually a good thing to have is a technical lead, in a more data science profile a more senior guy, if there is a lot of data involved a lot of data bases handling a data engineer with a senior profile. We complement this type of team with architecture people (data architect). …. With the data visualization part from more junior type of profiles. We usually don't include a lot of management we expect the management be form he client facing team. We might add some people to work as translator between the business and technology."*

AI researcher 2 :*" We need someone who can facilitate as a project owner and the team involved. Then we need to have someone responsible for maybe the data and someone with the algorithms and someone with the visualizations. So basically three different personnel's of course we could (have) more of each but that is at least to my extent what is needed. So someone who is really good with databases, someone who is really good with algorithms and someone who is really good at presenting the results. "*

In terms of recommending team composition, it can be stated that three types of personnel are needed to actually develop the AI initiative from AI capacity point of view. Data scientist, data engineer and data visualization. Data scientist takes charge of the algorithm,

data engineer handles the data ecosystem and data visualization person takes care of visualizing the findings.

Programming language

AI researcher 2 :" *My personal preference would be Python and I know that there are a lot of good tools coming out of R and typically the very good statistical tools are developed in R and later transcribed into python. But python is just ... it has more abilities than R does. It has the abilities to do so much more, it has the ability to do web-pages and scrape the internet. You can do so many things with Python whereas R is more just a statistical tool able to generate machine learning models as well. If we go into some of the more distributed models spark in ml if you have a lot of data that is the way to go. If you have a lot of data you are not able to calculate it on single machine. If you want to do something like a...*"

Consultant 2 :" *From a logical point of view we are agnostic, of course not everybody know everything so we try to cover as many technologies a possible nevertheless of course specifically machine learning techniques python would be our choice number one, as it is the most common within the team.*"

AI researcher 1 :" *Python and tensor flow. That is the building block for our research in programming language wise.*"

Making assumptions on the programming language used trough user interviews does not relate to all the possible projects within AI. In these cases the most common was Python programming language. R-language that has many machine learning algorithms available and are in some regards the most advanced in mathematical field was also mentioned but based on the answers the actual programming language plays a role but adaptation to different situation and languages is the key with AI. So embracing the teams' competences and leveraging those for the best fit for the project is the approach used.

Outsourcing and collaboration

AI researcher 2 :" *Trough my ways in academia I have been using amazon web services to host virtual machines and virtual deep learning serves to run big neural networks. That has been a huge help. That was basically before our university got our own deep learning servers implemented. And that time it was huge help to have these resources available. I know that Microsoft has made their machine learning servers as google has made some as well. I have not been able to personally try those out.*"

Consultant 1 :" *Microsoft has a lot of suitable API's that we can use and they already*

contains many good and robust models. Yeah we are constantly working with boutiques and big players like Microsoft ... a lot of API's exits already."

In general building a AI initiative from your own data and from scratch is a time consuming process. API's are application programming interface that enable using blocks of code that do a specific task and by using these block it is possible to build an AI initiative faster. Leveraging the computing power of cloud computing is also a part of AI when running a complex algorithm with big dataset. Different platforms can be used in these situation as the answer suggest but not so many approaches to what specifically would be used is not present in the answers excepts Microsoft. The understanding of these models is more limited in this regards at the moment based on answers.

Business effect

Consultant 2 :*" AI related to robotics has replaced a lot of manual labor, a lot of repetitive tasks have been taken over by robots. So some will say that is a major concern as we are making a lot of people unemployed, but on the other hand, we don't look it like at that we look it at like instead of people doing repetitive tasks, they are able to free up their minds to do more advanced tasks that AI's have trouble doing so actually they get to do more exciting things."*

AI working as an enabler for professionals to focus on more challenging and interesting tasks. This a will enable more innovated approaches and can be seen to indicate effectiveness and could even mean increases in revenue through more sophisticated tasks or products.

Consultant 2 :*" We are in pilot face with different client accounts, and already we have seen a lot of interest and quantification of the impact specifically in terms of AI saving time and effort, ... Also Ai enabling people to scale time. Regarding the time and effort the typical contract would take 1 h 30 min to review and get the all the information by a person now it can be with the AI tool that takes 20 minutes. On the other hand it enables us to scale in other practice because of this time consuming aspect we have only been able to (process) take a sample data and verify them now with AI you can scale to look at not all but majority of cases because you are gaining more efficiency, there are some cases when the AI for this solution could mature can be automatically processed or only with an exception, or that sampling can be done on AI works on the documents, so it enables us to scale form samples to all the population for example. "*

AI researcher 1 :*" To my knowledge it has not changed the business model per say for now, I think that it will do so in the future. A lot of companies out there are still very immature in their digital sense so it does not have a big impact ton their business model."*

Cost saving initiatives in terms of time, money and accuracy are present with the answers. The idea of AI gearing personnel with better tools to do their jobs affects the result in a

positive way and this is something that is complementing the current business models. Fundamental thinking in terms of strategic approach to business model has not yet been changed based on the answers given as the digital maturity plays an integral part in this regard. Answers allude that in the future AI will have an effect on the highest level also.

Requirements for implementation from the empirical analysis can be summed up in a list below. These themes were the most important requirements and enable the building of the implementation model.

- PoC or PoV
- Methodology preferred Scrum
- Team Composition
- Programming language
- Outsourcing and collaboration
- Business effect meaning value gained

These requirements establish a strong understanding of the current global landscape of AI. Its usability in different contexts is also presented so the premises for AI transformation framework is set.

Initiatives for AI

In the next section the initiatives presented from subject matter experts are discussed. Categorization is done by the themes that suit the most the answers given. Therefore there are industry and technology summarization and industries summarization themes. Answers were presented by the interviewees in this context so it is decided to keep that connection present in the findings.

Natural Language Processing

Consultant 2 :" *The field of AI most interested one is from a more technical foundational work another one from solution building capabilities: From solution building capability point of views I am very much interested in work what is … all the work that can be captured under documented intelligence. And by it I mean the whole of the capabilities and technical methods and algorithms that enables and alias you to digest and understand documents NLP within the documents structure of the documents and to be able to fix them answers questions over them and whatever it is possible with documents. That is from a solution point of view. From a foundational enabling technology point of view I would say in general NLP but deep learning is the one that I'm most interested in and it has the most potential in the upcoming years because we have seen the beginning of deep learning it has been a very hot area and it still a niche in the whole Ai space but it has the potential to be more of a what we do in the AI space and impact a larger sub space of AI. "*

Consultant 1 *:" We are currently focusing a lot on how to extract data from structured sources, this is a common problems. People have for example PDFs stored somewhere and they have much more information stored than in their systems. The most out of the data as they can want us to extract the data automatically using techniques and putting this into their systems. Compliance, regulations or business knowledge for example. This point there are several technologies to extract information, let's say the name of a counterparty that exists in document in a contract after going through some basic image recognition for character recognition etc. you need to extract some data points for example the counterparts name. At that point you might go for standard regular expression type of techniques text mining to try to identify the name of the counterparty or you can feed a machine learning algorithm a lots of examples where the machine already know the name of the counterparty and can learn by itself what are the patterns in some kind of way how it can extract the name of the counterparty. If you have a very standard type of document, where you know that the first name of document is the name of the counterpart you might not go for a machine learning but a geographical identification of the space where the name is located or a text mining where you know counterparty is written in a certain point. In this case the machine learning would be very fancy but would give out as good results as classical text mining would. "*

As present in the answers there are some cases where it is not advised to move forward with AI initiatives as there are ways of doing it more cheaply and as efficiently. It is important to understand that not all thing should be done by AI but to emphasize that the business value measured is present.

Initiatives that were pointed out from consultants were connected to NLP usage. The usage in this regard seems to be making time consuming review and information extraction tasks automated and increases efficiency quite a bit based on the answers. Therefore it can be said that using AI in tasks that are time consuming and tedious seems to be beneficial. Perquisites that are present in these cases are that there is enough volume to make the analysis and the format is graspable by data. These initiatives can be seen usable in many contexts. Initiatives are not only limited to certain industry. NLP related tasks with documents could be something that could be searched for when starting the AI journey for the first time, as there are many approaches for this context.

Healthcare

AI researcher 2:" *During my field of study I have been working with medical data that is a field of interest of mine, it is a field where you have a lot of subjectivity in the doctors. We have seen that if you work with maybe scans or tumors and you ask 10 doctors highlight or draw on the scan where they see the tumor in order to do the cuts. You will see 10 different drawings. You will see a lot of overlap and some subjectivity as doctors say*

that they want to cut a little bit deeper here and want to do this and this because of my expertise. So what we can do with Ai we can collect data not from just one or two researches or doctors we can collect it from hundreds and even hundreds of thousands doctors and we can create a computer not to overtake the doctors stop but to simply guide the doctor in the most subjective way. Medical field is one that I see a lot of potential within and another is the text analysis that is coming up a lot we can see apple Siri and googles, Alexa from amazon as they are able to catch both speech and text so good at the moment. "

AI Researcher 2:*" Projects that I have done already during my research I have been implementing a cardiac monitoring device that is put on the skin and it measures the heart. I have been doing some deep learning where it analyses your heartbeat as you go and it will tell you if something is out of the ordinary ... you have some kind of arrhythmia. Within the health care industry my expertise lies and that Is where I have been doing projects and epilepsy monitoring devices. "*

Healthcare industry seems to be the one where academia has been moving forward with AI applications. There it can be argued the value is present and the tasks seem to be those that have data present in some form. Value for human health is eminent and therefore these applications have been economically feasible. Learning from these endeavors in academia it is important to bring the same ideology to focus on industries and tasks that have a huge value present.

Retail

AI researcher 1*:" The one major thing that will be affected by AI is services. Services are actually moving workforce back to the factories to work and deliver services one example is Amazon. The employees are not working in the Amazon go store but in the storage department and re-stocking the products."*

AI researcher 1*:" Setting up cameras in store to limit theft, but actually there is the possibility to follow human behavior and for example what product is most commonly taken from the shelves and where it is located. What kind of heat map is generated, what effect does the text in products have, so basically collecting and recording human decision and logic how to act... Collecting data how humans act. This will enable to collect data for another new use case what is used now, and generate data for the second wave (of AI). What is the data used within the next generation of AI products?"*

The initiatives answered above are cases that are present in the consumer space. Therefore these can be seen more easily by people and understanding of these approaches is more common.

Consumer products and retail space has many use case as there is a lot of data that is being collected through loyalty cards and camera feeds. This enable that there are many possible initiatives to use AI.

5.5 Summary

Findings from *the empirical research brought valuable insight for the building of AI framework as it highlighted the most valuable aspects from implementers and workers point of view. Same fundamentals were found as trough literature but the level of detail was more sophisticated. Hands on experience with AI projects opened up discussions with broader point of views about the actual steps of developing* and implementing AI.

The perquisites for the interviewees were set high and it limited the availability of interviewees but assured quality answers. Summary what the fundamentals were are presented in table below following the analysis method.

Table 6 Literature review main requirements and findings

Categorization	Requirements
Requirements for AI transformation	Find a function Goal setting Data ecosystem Culture
Requirements for AI implementation	PoC or PoV Methodology Team composition Programming language Outsourcing and collaboration models Business effect
AI initiatives to support evaluation	Natural Language Processing Healthcare Retail

6. AI FRAMEWORK

This chapter builds the AI framework from the finding that were presented from literature review and the empirical research. The intersection between these two approaches for the same research questions will generate a framework that will form from taking into account the most important factors of AI and the common factors presented in findings.

Development for this framework starts from the business first perspective that was also present in literature models presented in table 4. It was also very much emphasized through interviews that finding the source of value is a good starting point and the main findings are derived from the summary table 6. When interpreting the similarities of the requirements found from the different sources it was possible to derive the most important topics. Categorization of the topics under specific theme was conducted by using umbrella terms that fit the wanted parts into the scope. Therefore the first step with AI framework is called finding a function phase that is not in the same way presented in literature review but it can be seen as a part of use cases phase.

Function finding

Finding a function is derived from the use case stage of literature review and from the interview answers describing finding the function that has value. Interview discussion evolved around how AI initiative can be found and it was pointed out that starting with data is not the most efficient way of tackling this dilemma. When specifically asked how the AI journey can begin and where it was emphasized that source of value with certain characteristics has to be found.

Finding a function stage enables that the AI initiative is focused within the organization where the value gained from AI is the biggest. This ensures that the task presented is valid for business purposes first of all. This stage does not assure that actual AI projects could be implemented as it is not sure if data and supporting infrastructure exists. This will present use cases where it economically viable to execute. It also generates the possibility to think about the possible steps how in the future the ecosystem could support achieving this goal. How and what data should be collected in the future if it is not possible to develop an AI solution to this function right now.

If found function meets the other requirement presented later it will be the focus as it will generate big value and it is possible as there is enough volume in terms of tasks and is expensive to do in other ways. This methodology works in cost reduction tasks quite straightforwardly but in AI tasks that aim to increase revenue accurate prediction have to be made.

In finding a function three measures have to be met there has to be value in that process, it could be done by human doing that part of the task in one second and enough volume. If these fundamentals are met it can proceed to phase two of the framework. Tasks can be joined together so the one second decision limit is not restrictive in that sense but complexity of the initiative will grow if this limitation is not met. The task should also aim to be in some ways trivial so there is something to for AI.

Data ecosystem

Importance of data was present in all the interviews and played a big part in discussions regarding AI. Data was also present in two of three frameworks presented trough literature review therefore the importance of it can be justified and it can be include in the framework. (Bughin 2017 pp. 32-33, Gourevitch 2017 pp. 32-33)

Data was discussed in many levels and it has to be understood that these data fundamentals have to be present to gain the optimal benefits from the AI initiative. Some are mandatory but some of them would be recommendable. Certain AI initiatives could be done but it would be really troublesome and time consuming.

Organizations should have established a good data infrastructure to capture, store and collect the data within the organizations. (Bughin 2017 pp. 32-33, Gourevitch 2017 pp. 32-33) Interviews pointed out that it takes a lot of time to process the data and clean it to the level that it can be used with AI initiatives for example in machine learning algorithm to generate a learning model.

It is mandatory that data has to be annotated in that sense as it was presented by AI researcher 1 that it can be used for AI without annotation the data provided could be useless. The context for the data in a sense and validation has to be present so it can be used in AI initiative in meaningful context. For example the data can be validated by time and that can give context to it when planning work schedule.

In general the organizations digital maturity effects the viability of data ecosystem in AI initiatives. Data warehousing and data lakes using cloud services are something that is high on the digitalization and these ways of controlling and governing data enables the realization of full benefits from AI initiatives.

Use case/Goal setting

Through interviews and literature it was emphasized that setting a goal prior to dwelling into function and data is needed. Literature review discusses this part under the use case section and specifics that there has to be a solid use case and with use case there should be desired state. (Bughin 2017 pp. 32-33, Gourevitch 2017 pp. 32-33) Finding a function and establishing the data ecosystems support a goal can be set but the starting point should not be just to play with data and hope that something pops up.

When setting a goal for the initiative it should start by specifically understanding the value generated. Specifying what is the value going to be and will it be a cost reduction or revenue increase initiative. It should also be stated what is the purpose of the AI initiative.

When the function is chosen and value presented a clear understanding of what is actually done and in what manner. What is the end state that the AI initiative will achieve. This will help to keep the project on track and actually calculate the value. Trough literature review findings and interviews the early feasibility approach has to be used when setting a goal. Aiming too high with the AI initiative sophistication without early feasibility will result in bad results and not having a clear target will also result in not realizing the value in a budget.

Culture

Culture was presented as an important aspect when thinking about perquisites that have to be met for organizations to fully realize the AI potential. It was presented in literature review by Berghman (2017) and Bughin (2017) in their frameworks. So its importance can be argued with AI initiatives as well.

Talking about the culture aspect of AI within the organization is important. Talking about the role of AI is needed to communicate efficiently with the workforce and minimize resistance. Is it going to replace human labor or will it work as a tool to enhance the performance of personnel. These two fundamentals ideologies have to be considered when thinking about AI's role in organization.

Embracing culture that sees AI as an enabler will ensure that expectations of value generation will be realized. AI has to work as a tool that will enable workforce to achieve new heights. The picture below describes the AI framework developed.
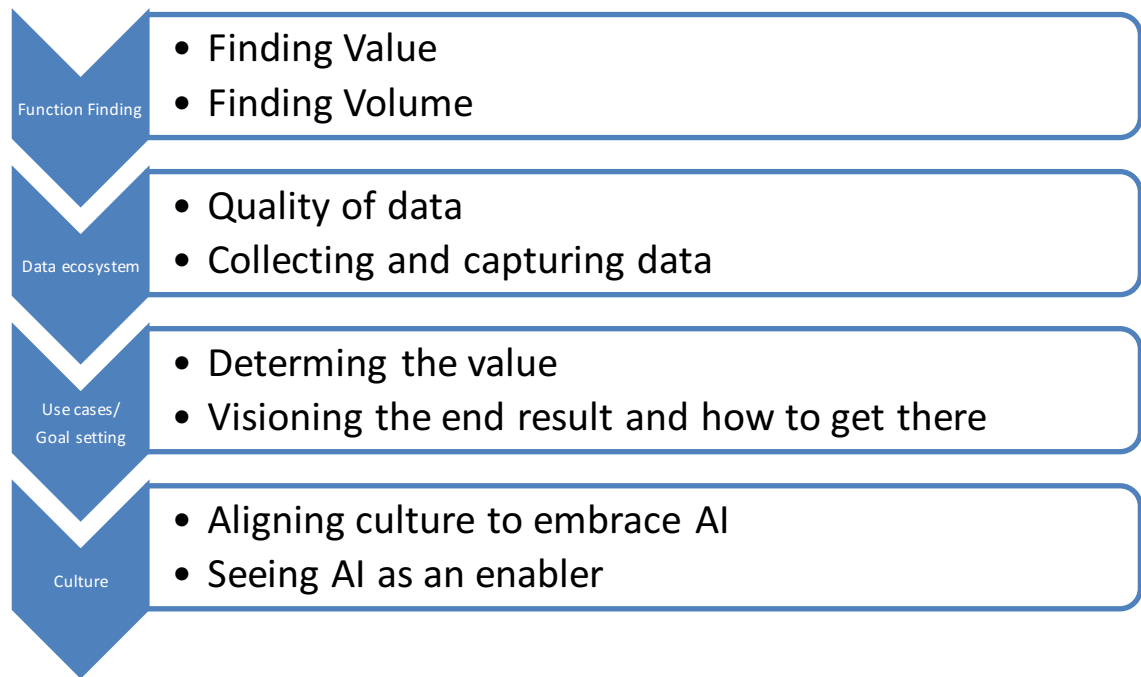
Figure 10 AI transformation framework

Framework gives organizations a strategic tool that helps to take into account all the factors that have to be established to realize AI's potential. Following the framework will offer step-by-step approach with the implementation framework how AI initiatives succeed and how they can be run on strategic level. Framework works as iterative so that when some of the requirements described in the step are not met going back to the step one of finding a function can be done.

Implementation AI framework

This part will describe how actually the initiatives can be run. The steps that have to be taken account. Steps described were conducted from literature reviews and empirical research presented above. Running AI framework takes into account more in detail the actual implementation of AI projects.

Proof of Concept (PoC)

PoC approach is used when implementing the AI initiative. This was presented in interviews by consultants as this approach will ensure early feasibility and value realization. In literature it was called as an use case phase. In literature the level of detail how and why was not present in that sense and it was possible with SME interviews make this model more detailed. (Bughin 2017 pp. 32-33, Gourevitch 2017 pp. 32-33) Therefore a more detailed implementation map is presented after this framework.

Agile Methodology

Talking with the implementation part it was evident with the literature part that new technologies are done following the agile methodology as it has a proven track record with software projects. (Juricek 2014, Truex 1999, Karlesky & Voord 2008, pp 247) Trough all of the interviews it became evident that agile has been the de facto way of working with AI and especially utilizing scrum. This will give the structure to efficiently coordinate team of individuals and still enable personnel with tools and freedom to succeed with the task.

Team Composition

Team composition is based on the interview findings. Selecting the team can be seen as one crucial part of success for the initiative. The literature review did not give answers to this regard due to lack of research in this field. Three type of personas were derived from the interviews. Person with skills understanding algorithms, second person with skills in regards of databases and data management and finally a person with good data visualization skills was needed. These personas could be described as data scientist, data engineer and data visualist. This setup helps to ensures that the AI initiative would be successfully executed. It was also mentioned that a person working as a project manager would be in some case needed. Project manager role could be versatile as sometimes it would mean working as a translator between client and team in terms of technology and also keep in charge of the project management tasks such as structure, timetable and deliverables.

Programming language

Language wise interviews pointed to python. In this regard it is important to note when choosing a programming language that the skill set with the individuals working has to be taken into account and that should be the first parameter. So qualified workforce with sufficient skill in programming is needed and it does not have to be limited to certain programming language. Literature review also pointed out that Python is now the most common programming language in the community so consensus in this regard can be made. Also other parts in regards of tools and techniques how Python can be used is included in this part.
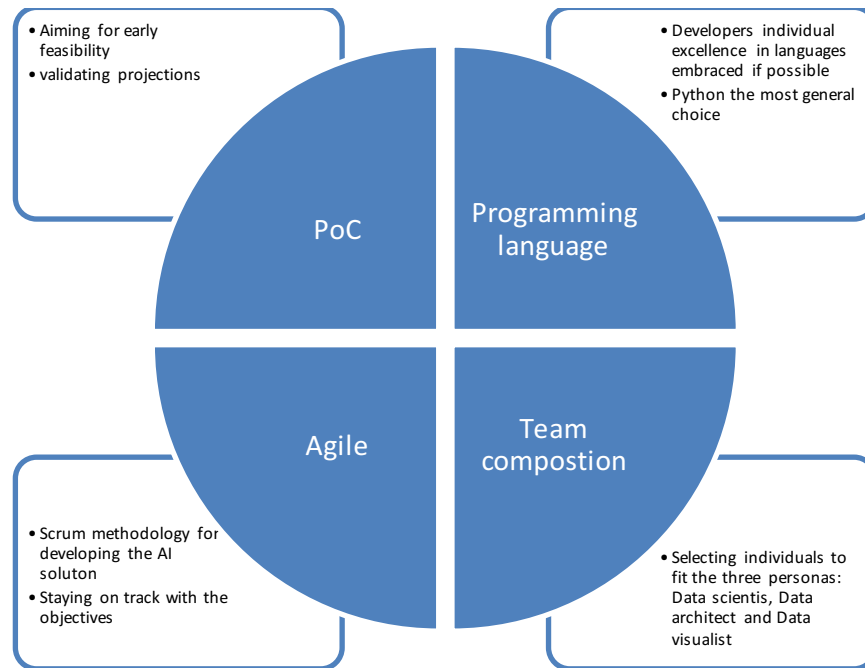
Figure 11 AI implementation framework

The picture above presents the findings for the actual implementation stage of AI initiatives. After the transformation framework is done the actual implementation framework can take over and guide the daily operations of the initiative. So the presented model will be two phased model. One for more strategic alignment of AI transformation and the follow-up phase has focus on the implementation of AI initiative.

7. DEMONSTRATION AND EVALUATION

Examples of AI in daily lives are implemented for example into our mobile phones in the ways of Apple's Siri as voice recognition platform that works as a personal assistant (Apple 2017) or Spotify's machine learning algorithm that creates personalized lists for persons to listen. (de Waele, 2015) The rise of automated online assistant's chatbots can be seen as the forerunner application for organizations to implement the AI wave. (Orf 2016)

Use cases for AI in organizations can be more complicated to spot compared to those seen in our daily lives. Understanding how to build business value with AI is more complex in the following chapters' examples with selected sectors are given.

In this part the proposed model is also tested in a conceptual way. This enables to evaluate and think about the possible issues when implementing the model. This will also fulfill the design science research methodology approach.

Following the DSR-methodology this chapter demonstrate how AI initiatives can be done by using the built artifact of AI framework. This phase of the research is presented in the figure 12.
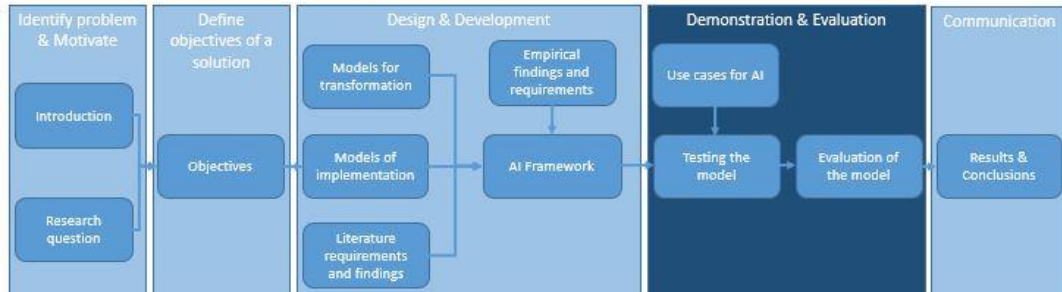

Figure 12 Phase 4 Demonstration and evaluation

7.1 Use cases for AI

Trough literature and empirical findings there are use case where AI could be implemented. These are presented in three categories that were prioritized by scope.

Manufacturing

AI is able to tackle many of the challenges currently present in manufacturing like variable quality and yield, inflexible production line design, inability to manage capacity and rising production cost. AI would address these problems through enabling better design cycles, remove supply chain bottlenecks and reducing waste and materials. (Ng 2017) Todays manufacturing landscape is competitive and has to be more agile to meet the market demands of customers. Custom production is the new mass production and new robots in the production lines with improved re-configurability or workers are given better automation tools. (Pedersen 2015 p.282)

World's largest industrial robot maker Fanuc is speeding up manufacturing by creating robots that utilize reinforcement learning to complete task that was earlier done by precise and time consuming programming. Fanuc's robot uses deep reinforcement learning when it performs tasks for example when it visually records the process of moving cylinders from a box full of cylinders placed randomly and would result in success or fail when performing the process. Capturing the process by video will allow the robot to visualize and analyze the process what it did correctly and what it did wrong. By dividing the repetition to success and failure it will learn and improve by time to do the task. The knowledge captured helps the deep learning model or large neural network to improve every time until it masters the task. (Knight 2016)

In modern day manufacturing the real time manufacturing execution system is being used. AI helps the human end-user more easily to use the system by narrowing down the data that is needed, meaning that it only represents the needed boxes that have to be filled and adjusts the view based on the rule based behavior embedded into the system. It also prevents mistakes as it compares the current feed to earlier feeds and brings up notifications if an abnormality is spotted. AI based system would also take care of the vast amount of scheduling the jobs by the rules and parameters set and would reduce the work of the managers. (Green 2017)

Semiconductor maker used advanced analytics to review data from every step of the assembly line to generate new ways of working. Machine learning was used to in-collaboration with self-driving warehouse robots to minimize inventory levels and improve the overall storage process. (Bughin 2017 pp 53-57)

Retail

AI has already a foothold in the retail industry applying AI through their whole value chain. AI helps the customer in personalizing the experience and gives insight to the shopping processes. (Kumar 2017)

NVidia has a device called Focal planted on all of their carts and it will enable some of the retail processes to work more efficiently. The device will inform if a product on the shelf is out of stock. This will enable efficient resupply of the products. The same device will utilize the location mapping to generate a heat map trough the in-store layout. For

example this will help to understand the customer's behavior and walking patterns to locate relevant products for relevant people in correct aisles. Computer Vision and deep learning will be the underlying technologies to solve these issues. (Focal Systems 2017)

Amazon with many ventures in AI has also aimed to disrupt the Retail space by opening an amazon go store in Seattle. By computer vision, sensors and deep learning it offers a checkout-free shopping by noticing with sensors when products are taken from the shelves and who is taking them. These are then added into your virtual basket that is managed by an app. (Amazon 2017) Amazon is not the only one in the check-out free space of retail as IMAGR company introduces an application utilizes computer vision to recognize the products from pictures and enables to control a virtual basket by the application. (IMAGR 2017)

German e-commerce retailer Otto was able to cut the surplus stock due to analyzing transactions with deep learning. It gained insight what customers will buy in the future before actually making the order by previous customer transactions. Carrefour and Target have applied beacons in-stores to gain valuable data about customer behavior and purchase habits. Machine learning will analyze the data and generate more personal advertising campaigns to customers as they are shopping. (Bughin 2017 pp. 42-46)

Dynamic pricing can also be utilized in modern retail stores. Changing prices real-time based on different factors will enable inventory levels to be optimized and revenues to be maximized. (Bughin 2017 pp. 42-46)

Financial services

Financial services utilize AI in many ways and are one of the adopters that based on research is the industry that will benefit the most. Applications range from chatbots, credit scoring applications and in marketing applications. (Ransbotham 2017, FSB 2017 p.14)

Aim of automating the credit scoring process within financial institutions speed up the process and possibly reducing incremental risk. Scoring models for credit base their assumptions on customer transaction history, specifically regression and decision trees are used in determining current credit score. AI could add to this by using data from other sources than transaction data like social media and text messages to measure credit worthiness. Credit scoring for example can be conducted with artificial neural network and generated better results than legacy methods. (FSB 2017 p.14, Bahrammirzaee 2010 pp. 1179).

Other example of AI usage in Financials is in managing insurance policies. Algorithms within machine learning within the insurance industry enable predictions that are more accurate and improve profitability. Adding to this functions like claims processing and

underwriting are also possibilities for change with NLP. With NLP they are able to highlight the important aspects from the data sets regarding the customer and enable claims worker to be more efficient. (FSB 2017 p.14)

Within portfolio management AI can be also used to find indicators of price decreases or increases and capitalize on the vast amount of historic data. AI unit might make accurate analysis of the portfolio at hand, but it is important that also there is a team working with the AI that is also capable to understand the premises how the analyzing was conducted. (FSB 2017 p.18)

Europe is now implementing Markets in Financial Instruments Directives (MiFID II) and management has to meet these directives. NLP could be leveraged to understand the legislation directives, transfer it to nonprofessional terms, and generate decisions tree based on rules made from the data. (FSB 2017 pp. 20)

7.2 Testing the model

All the use cases presented above and in the interviews are examples of demonstration cases where AI framework could be tested. The first phase of the AI framework also known as AI transformation framework will be conceptually tested as the second phase called AI implementation phase is more hands and daily operations on detailed level and testing it on paper will not demonstrate the viability of the solution.

Partly fictional use case was selected for doing the test. Partly fictional as all the factors are not known therefore some assumptions have to be made. Primarily test use case is based on the NLP example presented in the interviews by consultant 1 as it is a real life example with some detail of the process and it is not industry specific. Some alteration had to be made so that all the approach parts will be addressed. The selected use case is applicable in many industries and organizations. Some client detail are added to enable testing the model in all of its aspects. The use case selected is presented below and alterations can be made for testing purposes.

Use Case selected:*" We are currently focusing a lot on how to extract data from structured sources, this is a common problems. People have for example PDFs stored somewhere and they have much more information stored than in their systems. The most out of the data as they can want us to extract the data automatically using techniques and putting this into their systems. Compliance, regulations or business knowledge for example. This point there are several technologies to extract information, let's say the name of a counterparty that exists in document in a contract after going through some basic image recognition for character recognition etc. you need to extract some data points for example the counterparts name. At that point you might go for standard regular expression type of techniques text mining to try to identify the name of the counterparty or you can feed a machine learning algorithm a lots of examples where the machine already*

know the name of the counterparty and can learn by itself what are the patterns in some kind of way how it can extract the name of the counterparty. "

The use case in this regard can be said to work on unstructured data. Unstructured data is selected as is argued in the context that this could be done maybe even more efficiently by other means that are not AI initiatives, when the data would be structured.

When thinking about the first step of finding a function within the organizations meeting the two demands of volume and value. Volume in this instance can be argued as it is said that there are a lot of PDF's that have data stored in them and not inserted in the system. Value has to be considered in this case a bit differently. It is not stated that there is valuable data but it is stated that there is more information there than what is present in the systems. Conclusion has to be made that this information in the files is valuable for decision making in a certain function. We can say that this information in the documents could be from unstructured sales documents and information details that are not present in the system. The value in this case could be finding the business knowledge regarding clients in more detail. It could mean finding purchase patterns and products of interest that are not present in their system. This value can be then calculated in generating more sales and limiting the time of sales personnel of doing the same thing by hand. Value generated can be more accurate sales resulting in revenue increase and cost savings so that sales personnel's time is not spent on redundant task and can concentrate efforts more into productive tasks.

Next step will be to ensure that there is enough data in a format that can be addressed. Sales data is scattered through personnel computers in unstructured format and in this instance organization has established a working data warehousing system that is able capture and process the data needed. Organizationally in this case the quality of the data is okay and the annotation can be done by comparing it to sales data that have been successful in the system or in other cases material provided that could be e-mails confirming the sale through these sales initiatives. This point out that data can be validated and confirmed trough outcome that would result in two options sales or no sales. This will enable to teach the machine learning algorithm what data points resulted in sales and what efforts have not. If this kind of annotation data is not available, this organization should not pursue the effort in this manner. Ensuring data capabilities after the function finding is crucial, as it will enable that moving forward with the initiative is even possible. Ensuring that the data meets the quality demands and IT infrastructure is in place to keep the AI initiative running. Data has to be annotated and there should be enough of for the algorithm to learn the required output. So training data can be generated or extracted. Organizations that have low data maturity and don't have data warehousing and data lake systems in place will not necessarily be able to proceed with the initiative but are able to start making adjustments and thinking about collecting data for future use. If this proves in this

instance two challenging it is always possible to return to the first phase and find a new function and see if it will develop further in the framework.

Third step will be visualizing and calculating the end goal and result. This part will ensure that the function found will be economically viable and follow the principle of early feasibility. In this case this would be exactly calculating the level of operation for the AI initiative to be successful how much time it will save for sales personnel and therefore bring costs down and what effect it would have on increased revenue. In this part the level of AI's performance is predicted and aim for product that is functioning at a level that it is sustainable in economic figures is aimed first. What is the AI initiative going to achieve and how that will be accomplished.

Organizations sales personnel use about 7,5 hours weekly per person for adding the data into the system from these unstructured sources and some don't even do it at all. There are 1000 sales personnel working in the organization. In terms of personnel cost not having to do it will save approximately 7500 hours in a year if this could be automated. 1890 hours could be the estimate how much one employee works in one year so the savings would be work of approximately four employee's salary in one year. Four full time employees' in the sales organization will earn approximately 240 thousand euros so the economic viability has to be measured for this value. The value of the AI solution bay pack time has to be addressed as any other investment. This figure would be then tested for the development costs of the AI initiative for feasibility. If feasibility target is met in regards of developing the solution it can be seen to be viable to pursue the AI initiative. The initiatives viability will come down to the development teams costs versus the gain of cost savings of time consumed by personnel from sales and other functions on the tasks that are made redundant, also risk factor for the initiative to succeed and fail and whether it will meet the time frame set for return on investment on the organization. After this stage is done, the AI Implementation Framework can be used further.

7.3 Evaluation of the model

Following the DSR-methodology the presented and constructed model has to be tested to meet the scientific needs of the model. Evaluation for the model was conducted by weak market test by presenting the model with the solved use case to a potential client organizations key person. Due to the limitations of the time and research

This individual assessed the frameworks from three perspectives. The theory and empirical background, usability and general assessment. Theory and usability focused on the sources that were used and the concepts that were presented. Usability was evaluated with use cases and the interviewee's personal reflections on similar projects. General assessment focused on the artefacts and how they fit the purpose intended by assessing relevant factors affecting the model. Assessment quotes are presented in the appendix B.

Theory base was assessed to be pretty good as the topic at hand was really new in terms of academia. Especially applying knowledge from digital transformation was appraised to be a good way to expand otherwise limited background.

Usability was assessed to be really usable as a high level framework for AI initiatives. Giving valuable insight into AI.

General assessment concluded that frameworks developed was a very important and topical subject at the moment. It was also said that it is good to acknowledge the specific nature of AI transformation.

It can be said that the frameworks developed were considered to be successful by a weak market test. It is important to acknowledge that due to time and resource limitations a real life use case with the frameworks was not done that affects also the evaluations validity.

8.   RESULTS AND CONCLUSIONS

The following chapters communicates the results and conclusions of the generated arte-fact. Chapter communicates the results through research questions, discusses the results, discusses validity of the research and offers future research methods. This phase of the research is presented in the figure 13.
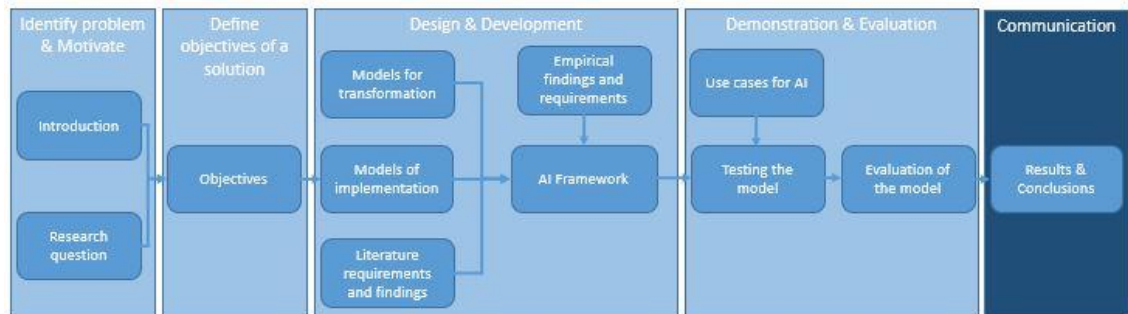

Figure 13 Phase 5 Communication

8.1   Answering the research question

The main research question being:" What are the typical initiatives to start AI journey and what perquisites have to be in place?" This question was answered mainly by the artefact called AI transformation framework. The use cases for starting the journey were also collected and were presented in the chapters. The framework was also tested on paper with use case collected from the interviews. The transformation framework was discussed in theory in chapters 5.1, 5.2, 5,5 and 5.5. In the results the frameworks was presented in 6 and the usability of it was evaluated and tested in 7.3. Use cases were presented in result chapters 7 and 5.4. The resulting artefact for AI transformation from chapter 6 is pre-sented in figure 14 and it was described as highly usable high level framework.
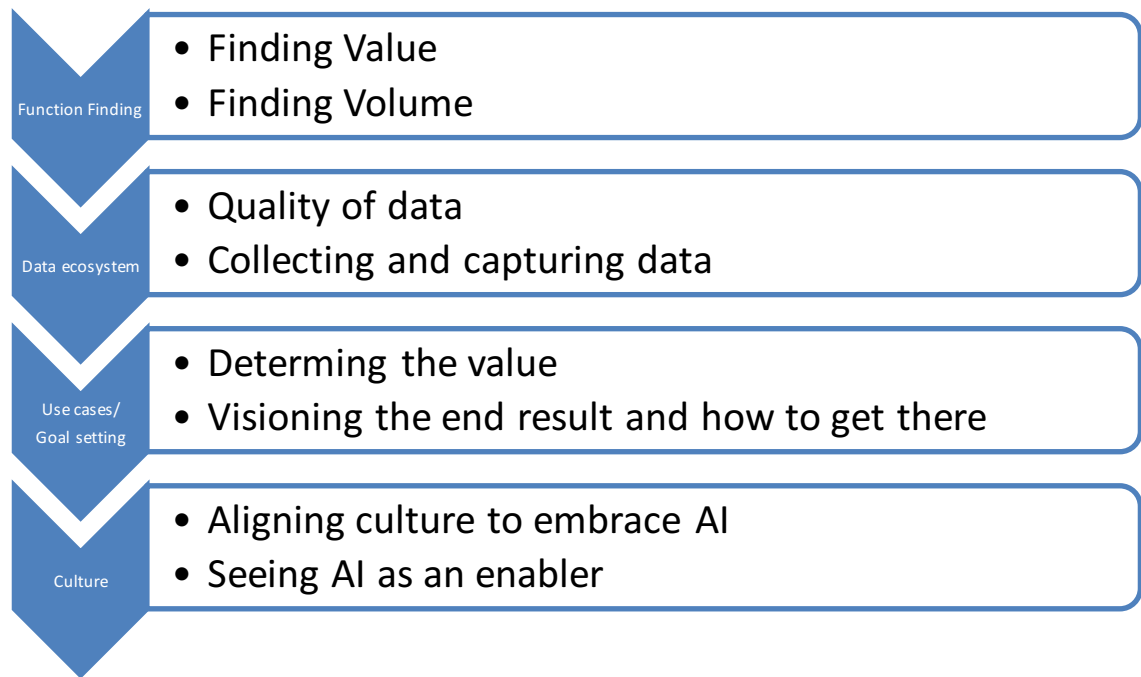
Figure 14 AI transformation framework

Supporting research question "How the AI initiatives should be run?" generated its own framework as trough the research it was identified that it would work successfully on its own. When the initial research question and supporting question had overlap, the end result ended up being two artefacts as the AI transformation framework could be tested. Testing of this model was not conducted as the test in imaginary case was not deemed possible and the implementation framework would need a real-life test to be validated. The theory was built on 5.3 and empire was presented in 5.4 The result was presented in the chapter 6. The result of the artefact in chapter 6 for implementation is presented in figure 15 below.
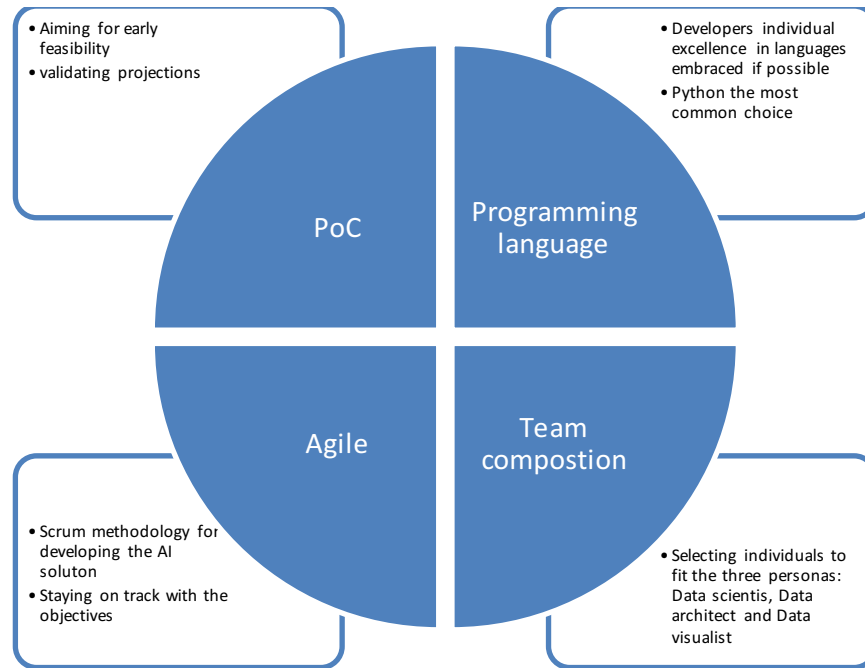
Figure 15 AI implementation framework

The Frameworks presented in figure 14 and 15 were artifacts that were developed. These two models were developed based on findings from literature reviews and empirical interview research. Research follows the DSR-methodology in development of the artefact as it builds on the stages presented in the DSR-methodology aiming to generate something concrete in this case a framework that person can use. Figure 16 provides understanding how the model is built on following the methodlogy presented.
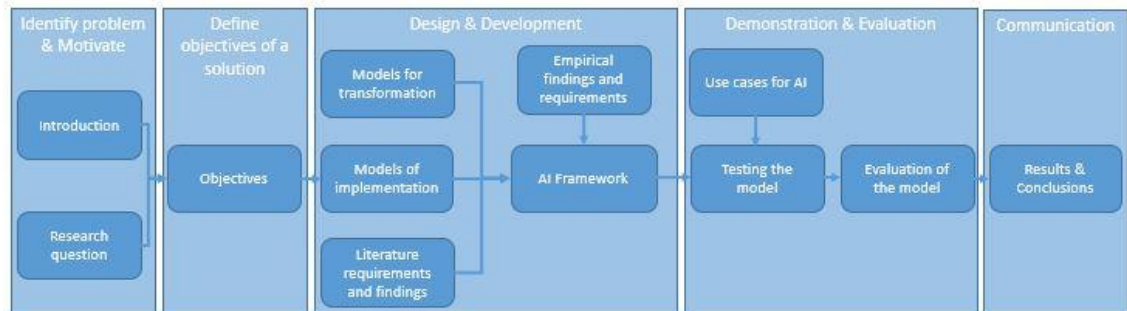

Figure   16   DSR-methodology   adaptation   for   the   research

It can be seen that the models presented give a broad scope how AI works in this setting. The research also answered the questions that were presented in the beginning. The most important part of the research was the AI transformation framework that generates a step-by-step process how to move forward with the AI transformation.

8.2 Discussion of the results

When thinking about AI and the theory presented it gives you a vision of the current AI landscape. The landscape is changing so when comparing the principal work in AI and if

it's outdated for just a couple of years it might not be the most relevant resource of information. AI as a word at the moment is so vast that it is hard to grasp it without prior knowledge or extensive research. Connecting this word to transformation framework provided to be much harder than anticipated due to limitedness of material. Companies are at the moment working to implement it and academia is therefore some steps behind as organizations want to keep up with the competition and the work done in this regard is not public.

Consulting companies where the ones that provided limitedly public models in one case for AI transformation or new technology. Considering this they have to assure and provide understanding of the topic as an experts of the field and as their main domain is selling human capital the "know how" with references have to be presented. Therefore developing an AI framework was an interesting and relevant task to do as it offers a tool to move forward but actually it develops the understanding of the AI domain to the level that is needed to help the transformation.

When talking about the research topic in with different organization and company members the response has been good as everybody is racing to understand AI. The topics relevance is probably now in its peak and information available quite scarce. Therefore actually moving forward with clients with the framework generates real value from the get go as it streamlines the thinking process where the focus should be. In evaluation the frameworks presented were said to be highly usable.

These artefacts generated work in the subject matter expert setting that can be seen to prosper for the next years and take advantage of it. This is something that many stakeholders agree on at the moment.

8.3 Validating the success of the research

When validating the success level of the research, sources for research have to be evaluated. When thinking about the literature review sources they are very diverse and there are articles, books and other scientific publications. Due to the newness of AI in this regards there were not so many relevant research publications as would have been wanted for the theory part. These findings can be found in chapters 5.1, 5.2 and 5.3. There were some articles and forums that have collected the most recent data regarding the AI subject. These were used to bring out the most relevant information in the field on the expense of lowering the scientific standards of the literature material.

The empirical part provided really relevant information to the subject at hand. This was due to requirements of the level of expertise regarding the interviewees. This ensured that the gathered material was of high quality. The amount of interviewees was low due to the level of expertise needed, so this might also affect the results as more interviewees with level of expertise required might have changed some things or new thing would have been presented. The group interviewed were a global mix representing four different nationalities and two continents so in this regard the information retrieved is globally relevant.

Expertise was validated due to academic record or internal project results and contributions. Empirical results were presented in the chapter 5.4. Interviews conducted were also done by following appropriate qualitative interview methods that also validates the study.

Following the DSR-methodology ensured that the academic perquisites would be met. Ensuring that the artefact developed would be something that would be aimed for human use. Following the model was straightforward but due to time constraints testing and implementing an actual project with the frameworks developed was not possible. This generated challenges in the evaluation and demonstration parts. Demonstration had to be done on paper and actual real-life test was not possible. Demonstration in real-life would have generated more validated model.

Evaluation of the model was done by a possible client organization individual by a weak market test. Weak market test generated good results that further validates the model. Evaluation part can be therefore be seen to be successful as also the business context relevance of the academic study was relevant.

There was also some new research published and more stronger presence in the media in the field of AI relevant to the study so a longer writing period might have given new answers. Public interest and new publications still validate the relevance of the study as being something that is currently an interesting topic in many regards

8.4 Further research questions

For further research actually implementing the framework in real-life organizations is the logical next step. The follow up would answer the question "Does the model work how it was supposed to?" and if it does not what is the direction it should be developed further. This is something that could be built on the premises of this study. Iteration testing would follow the DSR-methodology really well.

Also in future it is going to be interesting to follow how AI is being used and in which domain. This would be made possible as new research surfaces. Therefore the research could be more scoped in the future. When the maturity of the subject has developed a specific industry could be chosen with a specific technology. Technology like computer vision, could be selected or even both. This would ensure more relevant model for situation where approach and stakeholders are known and a more specific intersection of sciences would be needed.

Making the same research again in later stage could be partially interesting as more material surfaces. More SME's could also be interviewed to provide more validated results. The other factor affecting this research idea is that the relevance of the topic may diminish and that factor has to be evaluated in that point of time.

Diving deeper into the AI implementation framework would also be interesting to see how for example Agile Scrum methodology evolves in detail around AI initiatives. Is there something unique presenting it self when scope is really in the details.

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APPENDIX A: INTERVIEW QUESTIONS

General

What is your job description?

How do you define artificial intelligence?

Do you have or know some framework for this?

What is the field of AI that you are most interested in?

Technologies

Most common technologies used in AI in terms of approach? (Computer Vision, Machine Learning, Knowledge representation?)

Recommendation in regards of programming technology decisions? (R, Python….)

Outsourcing and collaboration methods?

Use Cases

Specific industry that is in the forefront of AI?

Use cases that you have done with specific technology/industry?

Projects

What are some perquisites to take into account when doing AI projects?

Methodology that has been used when running the projects? (Agile….)

Unique success factors and challenges of AI projects?

What capabilities are needed to be an AI organization?

What kind of team do you have when running and AI project?

Business problems

Can you describe what effect has the AI had on business in certain use cases?

Has AI had an effect on the business model?

Have you used transformation frameworks to help organizations to understand the AI journey? If yes what has been used?

APPENDIX B: EVALUATION

Evaluation of the study.

Evaluation of the study in terms of Theoretical background:

"Given the circumstances of limited academic research in this specific field I consider the theoretical background to be pretty good. Applying knowledge from digital transformation agenda is a good way to expand the otherwise limited background."

Evaluation of the study in terms of Usability:

"As a high level framework I find this highly usable. There are challenges whit implementation and this framework gives answers to those."

General assessment of the study:

"Very important and topical subject selected. It's good to acknowledge the specific nature of AI transformation."

The assessment was conducted by a professional who works in the consumer products and retail space in Finland as a lead engineer.

As a free word regarding the study it was considered that the phases presented relevant answers to the most important and biggest challenges presented. The work methodology was also praised for being scientifically valid.