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Keywords:
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Creating a holistic change management method for Artificial Intelligence implementation in business processes

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"In the sphere of business, AI is poised to have a transformational impact … the bottleneck now is in management, implementation, and business imagination."

ERIK BRYNJOLFSSON AND ANDREW MCAFEE, "The Business of Artificial Intelligence" (Brynjolfsson & Mcafee, 2017)

ABSTRACT

The goal of this research is to provide a holistic change management method to implement Artificial Intelligence (AI) in business processes. A holistic change management method, in the context of this study, is referred to as a method that incorporates every aspect of change from people to processes to strategy. The change management tool, the Matrix of Change, is used as a starting point for the creation of this method. The goal of the research is motivated by the increased interest and application of AI in business processes in practice, which is only predicted to rise. This study investigates requirements a holistic change management method to implement AI should have. The requirements identified are: AI vision, process identification, continuous feedback, AI leadership and AI governance. Based on these insights, the Cycle of Change for AI is created. This method contains three components and two feedback loops. It starts at component 1 'AI Vision', which aims to establish an AI Vision in the company and define an AI governance framework. This is followed by component 2 'Plan of Approach', which aims to identify processes and its interactions by filling in and interpreting the original Matrix of Change. Within this component, metrics to monitor the execution of the plan of approach are defined. Furthermore, leadership which is accountable for managing aspects of the plan of approach is established. This is followed by component 3 'Evaluation & Monitoring', this component provides continuous improvement and detect faults in the execution of the plan of approach. The method contains two continuous feedback loops: a single loop which gives continuous feedback on the plan of approach and a double loop which aims to reassess the AI vision if necessary. This provides change agents with a continuously improving holistic change management plan to implement AI in business processes.

List of Figures

Figure 2.1. Object Clustering 7
Figure 2.2. Artificial Neural Network 8
Figure 2.3. Streams of AI 9
Figure 2.4 Principles of Responsible AI 12
Figure 2.5. Functions of Matrix of Change graphics 17
Figure 2.6. Horizontal and Vertical Matrix 18
Figure 2.7. Transition Matrix 18
Figure 2.8. Satisfaction Ratings Matrix 18
Figure 2.9. The Matrix of Change for MacroMed 19
Figure 2.10. MoC for implementing an OCR solution 21
Figure 3.1. The Engineering cycle. 23
Figure 4.1. Complexity of humans and AI in decision-making situations 28
Figure 4.2. Coding scheme 32
Figure 5.1. Cycle of Change for AI, pre-validation 45
Figure 6.1. CoC for AI 49
Figure 6.2 Final version Cycle of Change for AI 50
Figure 6.3 CoC for AI (theoretic CDSS case) 53

List of Tables

Table 2.1. Main characteristics of AI agency 5
Table 2.2. Overview Machine Learning 6
Table 2.3. AI applications Virtual Agents & Embodied systems 8
Table 2.4. AI Problem Solving applications 9
Table 2.5. AI Knowledge and reasoning applications 10
Table 3.1. Execution process systematic literature review, ... 24
Table 4.1.Categorized practices used to implement an AI transition in business processes mentioned in literature 26
Table 4.2. Description interviewees 33
Table 4.3. Management techniques AI transition interviewees 34
Table 4.4. Vision execution requirements interviewees 34
Table 4.5 Categorized practices and vision requirements for AI implementation 34
Table 5.1. Requirements for CoC for AI 43
Table 6.1 Identified existing practice(s) and its constituent processes 51
Table 6.2 Identified target practices and its constituent process 52

List of abbreviations

Abbreviation:	**Stands for:**
AI	Artificial Intelligence
ANN	Artificial Neural Network
ART	Accountability, Responsibility, Transparency
BPR	Business Process Reengineering
CDSS	Clinical decision support system
CIO	Chief Information Officer
CoC	Cycle of Change
DevOps	Development and Operations
DQ	Design Question
EC	European Commission
ERP	Enterprise Resource Planning
EU	European Union
FG	Finished Goods
GMAIH	Governance Model for AI in Healthcare
IR	Interview Respondent
IT	Information Technology
JIT	Just In Time
KPI	Key Performance Indicator
KQ	Knowledge Question
ML	Machine Learning
MoC	Matrix of Change
OCR	Optical Character Recognition
QFD	Quality Function Deployment
RQ	Research Question
WIP	Work In Progress

Reader's Guide

This section gives a reader's guide of the structure of the thesis:

- **Chapter 1.** Introduction

In this chapter, the research topic of this paper and the research questions are introduced.

- **Chapter 2.** Artificial Intelligence and Matrix of Change

This chapter gives insight into the background knowledge needed to understand the thesis. Special attention is given to the definition and application of Artificial Intelligence and the Matrix of Change. Furthermore, a theoretic AI case description is given with the Matrix of Change.

- **Chapter 3**. Research Design and Methodology

This chapter describes the research design and methodology. Information is given on the Design Science method, which serves as the backbone of the thesis, and on the methods used to answer the research questions.

- **Chapter 4.** Practices and methods to conduct an AI transition in a business process

In this chapter the literature review and semi-structured interviews are executed and analysed to identify which practices or methods to implement an Artificial Intelligence transition in a business process are mentioned in the literature and in practice.

- **Chapter 5.** Designing the CoC for AI

In this chapter requirements and best practices for an AI transition method are identified. With this knowledge, the Matrix of Change in its current form is assessed and improved to be viable AI transition method.

- **Chapter 6.** Validating the CoC for AI

In this chapter, the method created in Chapter 5 is validated and assessed. The method of validation is an expert feedback session, used to assess if the method designed is understandable, complete and useful to fulfil its purpose. Knowledge gathered from this validation is used to improve the method. Furthermore, a case description is presented of the final version of the CoC for AI

- **Chapter 7**. Conclusion & Discussion

This chapter summarizes the thesis paper, answers the research questions and summarizes the main contributions. Furthermore it discusses the implications and contributions of the research results for researchers and practitioners. It also addresses the limitations, validity, and reliability of the research.

- **Chapter A.** Appendix

This chapter contains documents and figures which are placed in the appendix.

Table of Content

1 Introduction 2

1.1. Motivation 2

1.2. Research questions 3

1.3. Thesis outline 4

2 Artificial Intelligence and Matrix of Change 5

2.1. Artificial Intelligence 5

2.1.1. Autonomy 5

2.1.2. Adaptability 6

2.1.3. Interactivity 8

2.1.4. Artificial Intelligence applications in business 9

2.1.5. Artificial Intelligence Ethics 12

2.1.6. Conclusion Artificial Intelligence 14

2.2. Matrix of Change 16

2.2.1. How the Matrix of Change works 16

2.2.2. Building the Matrix of Change 16

2.2.3. Interpreting and using the completed Matrix of Change 19

2.2.4. Illustrative case of Matrix of Change for an AI transition process 21

2.2.5. Conclusion MoC 22

3 Research Design and Methodology 23

3.1. Research methodology – Design Science method 23

3.2. Problem Investigation Stage 23

3.2.1. Systematic Literature review (Knowledge Question 1) 24

3.2.2. Qualitative study interviews (Knowledge Question 2) 24

3.3. Method Design Stage (Treatment Design) 25

3.4. Method Validation Stage (Treatment Validation) 25

4 Practices and methods to conduct an AI transition in a business process 26

4.1. Literature review 26

4.1.1. AI vision 27

4.1.2. Process identification 28

4.1.3. Metric specification 29

4.1.4. AI leadership 29

4.1.5. AI governance 30

4.1.6. Conclusion literature review 31

4.2. Semi-structured interviews 31

4.2.1. Background semi-structured interviews 31
4.2.2. Meaning of Artificial Intelligence 35
4.2.3. Management techniques used for AI implementation 35
4.2.4. AI vision 36
4.2.5. Continuous feedback 37
4.2.6. AI leadership 38
4.2.7. AI governance 39
4.2.8. Conclusion semi-structured interview analysis 40
5 Designing the CoC for AI 42
5.1. Method design approach 42
5.2. MoC in the modern context 42
5.3. Requirement specification 43
5.3.1. Requirement 1: AI Vision 43
5.3.2. Requirement 2: Process Identification 43
5.3.3. Requirement 3: Continuous feedback 44
5.3.4. Requirement 4: AI leadership 44
5.3.5. Requirement 5: AI Governance 44
5.4. The Cycle of Change for AI 45
5.4.1. Step 1: Vision 45
5.4.2. Step 2: Plan of Approach 46
5.4.3. Step 3: Evaluation & Monitoring 46
6 Validating the CoC for AI 47
6.1. Validation Approach 47
6.2. Evaluation Results 47
6.2.1. Understandability 47
6.2.2. Completeness 48
6.2.3. Usefulness 48
6.3. CoC for AI – post-validation 48
6.4. Final evaluation results 49
6.5. Final Adjustments 50
6.5.1. Human-Centered Intelligent System adoption case 51
7 Conclusion and Discussion 55
7.1. Research Contribution 55
7.1.1. Theoretical contributions 57
7.1.2. Practical contributions 58
7.2. Validity, reliability and limitations 58

7.2.1. Validity 58
7.2.2. Reliability 59
7.2.3. Limitations 59
7.3. Future research 60
8 References 61
Appendix 64
A.1. Description systematic literature approach 64
A.2. Interview Protocol 65
A.3. Information sheet semi-structured interview 66
A.4. Informed consent form semi-structured interview 67
A.5. Expert session information sheet and evaluation criteria & questions 69
A.6. Informed consent form expert session on AI implementation in business 71
A.7. The Governance Model for Artificial Intelligence (AI) in Health Care 73

1 Introduction

This chapter introduces the research topic of this paper. This starts by describing the problem, combined with the situation and complication surrounding the problem in Section 1.1. Furthermore in Section 1.2, the design problem and the research questions are introduced. Finally, Section 1.3. presents the thesis outline.

1.1. Motivation

In recent years there has been a rise of the application of Artificial Intelligence (AI) in various business processes, this has become a prominent driver for change in varying industries (Agrawal, Gans, & Goldfarb, 2018). The adoption of AI is only predicted to rise in upcoming years, as the application of AI techniques is starting to live up to its potential with businesses starting to reap benefits from its techniques in practice (Gartner, 2020). Examples of well-known AI applications today are chatbots, facial recognition and machine learning among others. However, according to a poll conducted by Deloitte, 47% of the leading adopters of AI indicate that the difficulty of integrating AI with existing processes and systems is their top challenge (Deloitte, 2017). This sentiment is echoed by Plastino and Purdy (2018), noting that the potential competitive advantage of implementing AI in business processes is equaled by the challenge of integrating AI in the existing business model and minimizing risk. To tackle this issue, a holistic change management method is necessary to integrate AI applications with existing business practices.

In this study, research is done on creating a holistic change management method for AI implementation in business processes to aid change agents in managing an AI transition. The term change agent is defined as: 'The individual or group that undertakes the task of initiating and managing change in an organization […]" (Lunenburg, 2010, p.1.). The creation of the holistic change management method for AI implementation is done with the Matrix of Change (MoC) as a starting point. The MoC is a change management tool created by Brynjolfsson et al. in 1997, which helps change agents anticipate complex interrelationships between changing processes holistically. It does this holistically because it considers *people* by conducting stakeholder evaluation, *processes* by identifying existing and target processes and *strategy* by interpreting the complete MoC. Because the MoC is a holistic change management tool that has not yet been researched in the modern context of AI transition within a company, it is an interesting research avenue to further explore. To assess the viability of the MoC and to find best practices for conducting an AI transition, a systematic literature review and semi-structured interviews is conducted. The outcome is used to assess the current state of AI transition methods and assess what the requirements are for a 'viable' AI transition method. The method is considered 'viable' if its completeness, understandability an usefulness are considered sufficient (Prat et al., 2014). These insights and requirements, in turn, are used to design a pre-validation version of the holistic method for AI implementation in business processes. This version is then validated in an expert feedback session. The insights gathered from the expert feedback session are used to assess and improve the pre-validation method of the Cycle of Change (CoC) for AI. This is all input for the creation of the post-validation version of the CoC for AI. This version is validated one more time with an expert feedback session, this feedback is assessed and the final version of the CoC for AI is created. This study is finalized with a discussion and conclusion section. Within the discussion and conclusion section, the research questions is answered and the research contributions of this study is given. This is followed up by a section assessing the validity and

limitations of this study. The study is finalized by giving recommendations for future research on the topic.

1.2. Research questions

This thesis paper's goal is to gather insights from theory and practice to analyze requirements and driving mechanisms for a viable AI transition method. The new insights are used to assess the MoC as an AI transition method and uncover the current state of knowledge on AI transition both in research and in practice. Based on this assessment, a holistic change management method for AI implementation in business processes to aid change agents is created. A holistic change management method, in the context of this study, is referred to as a method that incorporates every aspect of change from people to processes to strategy. The research question (RQ) formulated for this thesis to reach the aforementioned goal is the following:

RQ: How to create a holistic change management method for Artificial Intelligence implementation in business processes?

To be able to answer the RQ, the design science method by Wieringa (2014) is used. The design science method is a solution-based researching approach which focuses on solving design problems. It does this by providing a guideline for designing and investigating an artifact that interacts and provides improvements in its problem context. To assess what practices and methods to conduct an AI transition in business processes are already available, two sub-questions in the form of knowledge questions (KQs) will be answered. KQs are questions that *ask* for knowledge about the world (Wieringa, 2014). The first KQ, KQ 1., will be answered by conducting a systematic literature review. The second KQ, KQ 2., will be answered by conducting a semi-structured interview. The KQs are the following:

KQ 1. Which practices or methods to conduct an Artificial Intelligence transition in a business process are mentioned in the literature?

KQ 2. Which practices or methods to conduct an Artificial Intelligence transition in a business process are used in practice?

The two KQs are the basis for answering the Design Question (DQ), and in turn the RQ. DQs are questions that *call* for a *change* in the world and solves the design problem (Wieringa, 2014). The design problem is formulated by using the design problem template by Wieringa (2014),

Design Problem:

Improve the AI transition from a current business process to a target business process with an AI application
By assessing and (potentially) redesigning the MoC
That satisfies the following requirements: easy to use, understandable, useful, and gives complete and holistic view of the change management process
In order to help change agents conduct the AI transition within the business

In order to provide a solution for the design problem, the following DQ is formulated:

DQ: *How can the Matrix of Change be (re)designed to be a viable Artificial Intelligence transition method?*

The DQ is answered by following the steps specified in the treatment design and treatment validation phase specified by Wieringa (2014). This starts by specifying requirements for the method design, which are based on the insights gathered from the two KQs. The requirements and insights are combined to design an initial CoC for AI method, which is validated in the treatment validation stage. After describing the validation process, the final CoC for AI method is presented and the DQ is answered. The insights gathered from the two KQs and the DQ are used to answer the RQ.

1.3. Thesis outline

The thesis is structured as follows: Chapter 1, Introduction, presents the motivation for conducting the thesis (Section 1.1.) and the research questions answered in this thesis (Section 1.2.). Chapter 2, Artificial Intelligence and Matrix of Change, gives an introduction to the concepts of AI (Section 2.1.) and the MoC (Section 2.2.). Chapter 3, Research Design and Methodology, introduces the research methodology called the Design Science method used in this thesis (Section 3.1.). Furthermore, it explains the methodology used for the literature review and the semi-structure interviews (Section 3.2.), the method design (Section 3.3.) and method validation (Section 3.4.). Chapter 4, Practices and methods to conduct an AI transition in a business process, presents the findings of the literature review (Section 4.1.) and the semi-structure interview-analysis (Section 4.2.). Chapter 5, Designing the CoC for AI, starts by explaining the method design process (Section 5.1.), followed by an assessment of the MoC in the modern context (Section 5.2.), then the requirement specification for the method is given (Section 5.3.) and finally the first version of the CoC for AI is presented (Section 5.4.). Chapter 6, Validating the CoC for AI, starts by explaining the validation approach (Section 6.1.), followed by the evaluation results (Section 6.2.), the presentation of the post validation CoC for AI (Section 6.3.), the final evaluation results (Section 6.4.) and the final adjustments to the method combined with a practical application of the method to a case (Section 6.5.). Chapter 7, Conclusion and Discussion, presents the research contributions of this thesis (Section 7.1.), assesses its validity, reliability and limitations (Section 7.2.) and suggests future research opportunities (Section 7.3.). Chapter 8 presents the list of references used in this thesis and the Appendix contains information supplementary to this thesis.

2 Artificial Intelligence and Matrix of Change

This chapter provides information on AI and the MoC. Section 2.1. gives an introduction to AI and its main characteristics, it categorizes AI applications and provides examples of its practical use in business and shortly presents the ethics of AI from three perspectives. In Section 2.1.6. a conclusion on AI based on Section 2.1. is presented. Section 2.2. explains the workings of the MoC and demonstrates its use with an illustrative AI transition case. Section 2.2.5. presents a conclusion of the MoC based on Section 2.2.

2.1. Artificial Intelligence

The term Artificial Intelligence (AI) is hard to pin down with an exact definition, because the field of AI is very broad and different approaches to AI provide differing definitions. The word Artificial "Intelligence", wrongfully suggests that the "intelligence" of the artificial agents can equal the multifaceted intelligence of a human. The following definition of Artificial Intelligence is used in this paper used: "… the discipline that studies and develops computational artefacts that exhibit some facet(s) of intelligent behaviour." (Dignum, 2019, p.10.). These computational artefacts displaying facets of intelligent behavior and are autonomous are referred to as artificial agents (Floridi & Sanders, 2004). Artificial agents have the capability to conduct flexible actions to meet the objectives of its design (Dignum, 2019). To put it in simpler terms: artificial agents have the ability to do the right thing at the right moment within the boundaries of the objectives of its design. The flexibility of AI systems is described from an agency perspective by Floridi (2013). The author describes three main characteristics of an agent which are autonomy, adaptability and interactivity as summarized in Table 2.1. The following sections give an in-depth look into artificial agents from these perspectives.

Table 2.1. Main characteristics of AI agency, adapted from (Floridi, 2013)

Characteristic artificial agent	***Definition***
Autonomy	An artificial agent that is capable of reactive and proactive action and has task autonomy and goal autonomy, but only in a limited and well-defined context.
Adaptability	An artificial agents that has the capability to learn (with machine learning) and interact with virtual agents and embodied systems.
Interactivity	An artificial agent that has the ability to perceive and interact with other (virtual) agents.

2.1.1. Autonomy

When talking about the *autonomy* of an artificial agent, it refers to the capacity it has to make choices independently with respect to its environment (Dignum, 2019). An autonomous agent is *proactive* – meaning it takes initiative to fulfil its design objectives without explicit external command (Wooldridge & Jennings, 1995). Artificial agents are only autonomous in contexts that are limited and well-defined and they are never autonomous for all tasks and situations. Within the concept of autonomy of an artificial agent, there is also a distinction between task autonomy and goal autonomy. *Task autonomy* refers to the ability of a system to form new plans and adjust its behavior to fulfil a specific goal or choose between goals (Dignum, 2019). *Goal autonomy* refers to the ability of a systems to start a new goal, change existing goals and stop active goals (Dignum, 2019).

2.1.2. Adaptability

The *adaptability* of an artificial agent refers to the capacity to learn from input based on its own experiences, interactions and sensation (Dignum, 2019). This input can in turn be used to react in a flexible way to changes in the environment the agent operates in. An adaptable artificial agent is *reactive* - it has the ability to perceive, respond, learn and adopt to its environment (Wooldridge & Jennings, 1995). Central to the concept of the adaptability of an artificial agent is machine learning (ML), which is the foundation for most AI solutions. ML is a method that learns from data, this data is gathered from various sources including social media, transport infrastructure sensors and sensors in factories. When applying ML techniques on this data, ML models can be trained to make inferences and predictions based on relationships found in the data. Therefore the 'machine' (artificial agents) 'learns' from data and in turn, other autonomous artificial agents and/or management can use this information in decision making.

There are three main approaches to ML, each applying its own objectives, techniques and (training) data requirements. These three main approaches include: supervised learning, unsupervised learning and reinforcement learning.

Each approach has its own distinct objectives, (mathematical) techniques and (data) requirements as illustrated in Table 2.2. The next sections give a more in-depth look into how each ML technique works and is implemented.

Table 2.2. Overview Machine Learning, adapted from (Dignum, 2019)

Approach	***Supervised learning***	***Unsupervised learning***	***Reinforcement learning***
Objective	Make predictions	Discover structures	Make decisions
Possible techniques	• Regression • Probability Estimation • Classification • *Deep Learning*	• Cluster analysis • Principal Components Analysis • *Deep Learning*	• Markov Decision Processes • Q-Learning • *Deep Learning*
Training requirements	Labelled data		Reward function
Possible challenges	Human errors, need for human expertise to correctly train the ML model	Lack of transparency, computational complexity	
Application examples	Identify spam, sales prediction, credit card fraud detection, image and object recognition	Customer segmentation, image categorization, recommendation engines	Playing a game (e.g. AlphaGo), Natural Language Processing

Supervised learning

Supervised learning is currently the most common ML approach and is a powerful tool to make predictions. Its goal is to optimally learn a function describing the links between its input and output data (Talabis et al., 2015; Dignum, 2019). To accomplish this, the ML algorithm first needs labeled data for training (training data set) to infer relationships to create a prediction function *f(x)* (Talabis et al., 2015). The prediction function *f(x)* gets used as a basis to predict the classification of new unlabeled input values *x*. This is done by making use

of statistical methods like regression (for continuous functions), probability estimation (for probabilistic functions) and classification (for discrete functions) (Dignum, 2019). Regression and probability estimation can be used to predict, forecast and find relationships within quantitative data, for example the relationship between an advertising budget and the sales of a company (Talabis et al., 2015).
Classification includes techniques like neural networks and decision trees, they can recognize patterns by analyzing qualitative data. This can in turn be used to predict qualitative responses like whether a credit card transaction is fraudulent or not (Talabis et al., 2015).

Unsupervised learning

The unsupervised learning approach is nearly the opposite of supervised learning as this approach has no information about the output of the data and the training data is not labeled (Talabis et al., 2015; Dignum, 2019). The goal of unsupervised learning is to discover structures based on common elements within the input data (Talabis et al., 2015; Dignum, 2019). *Cluster analysis* is the most popular unsupervised learning approach, this includes techniques like K-means clustering, hierarchical clustering and probabilistic clustering. K-means cluster analysis is the most common unsupervised learning technique, used for finding groupings or hidden patterns (clusters) in data which can be used for exploratory data analysis (Talabis et al., 2015; Dignum,2019). The cluster analysis algorithm works by iteratively dividing a set of data points ($x_1,\ldots,x_n$) into one of the K (K_1 ,…, K_n) clusters identified. The data points placed in a K-cluster contain similar features identified by the unsupervised learning algorithm (Talabis et al., 2015; Dignum,2019). An example of the clustering of objects by form and color can be found in Figure 2.1. Another approach to unsupervised learning is *principal component analysis*, which is used to reduce a large set of variables to a smaller set of representative variables - the "principal components" (Talabis et al., 2015). With the information gathered from this analysis, patterns in data can be identified and its differences and similarities can be expressed through their correlations. Because the data cannot be presorted or preclassified, unsupervised learning algorithms are more complex and the processing time is higher than the supervised learning approach (Talabis et al., 2015).

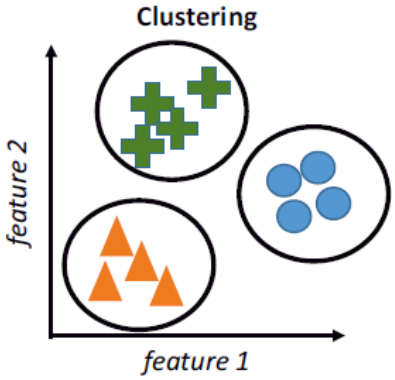

Figure 2.1. Object Clustering, adapted from Dignum (2019)

Reinforcement learning

The domain of reinforcement learning deals with an artificial agent learning from the sequential decision making in an environment to optimize a given notion of cumulative rewards (Francois-Lavet et al., 2018; Dignum, 2019). An artificial agent utilizing reinforcement learning learns from its mistakes to get better at a certain tasks. This is done by a reward system. So it is essential to correctly define the reward function and the objective of the artificial agent to attain its goals for this method.

Deep learning

For more complex domains, deep learning algorithms are particularly useful. Deep learning algorithms are based on *neural network models*, which consist of multiple simple and linked units – or '*neurons'* (Dignum, 2019). This type of algorithm attempts to artificially simulate the brain. Processes in the brain therefore get used to understand and explain concepts of an Artificial Neural Network (ANN) which is a central concept within deep learning. An ANN is a complex, uni-directional network of connections between 'neurons' of different strengths, as depicted in Figure 2.2. The ANN contains input and output nodes, these nodes are connected through *hidden nodes* – which are trained to minimize empirical errors to create more accuracy for the outcome of the task it serves (Francois-Lavet et al., 2018) .

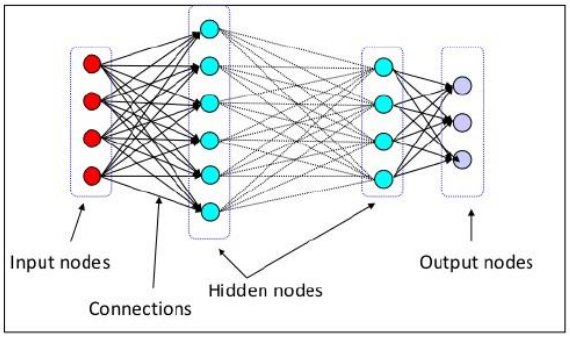

Figure 2.2. Artificial Neural Network, adapted from Dignum (2019)

2.1.3. Interactivity

The *interactivity* of an artificial agent indicates its ability to perceive and interact with other agents, either human or artificial, with their own capabilities and goals (Dignum, 2019). These interactions are very powerful, because the combination of human and machine intelligence enhances creativity which allows for meaningful insights which could not have happened without this interaction (Dignum, 2019). To get most out of this human-machine interaction, it is important to be conscious about where the strengths and weaknesses of the human and the machine lie (Dignum, 2019). An useful framework to assess this is the classic HABA-MABA framework – which stands for Humans Are Better At – Machines Are Better At (Fitts, 1951). When a team has clearly assessed in a certain context what aspects humans are better at than robots, and vice versa, an optimal strategy can be formulated to make optimal use of this interaction.

From the perspective of AI system interactivity, there are two categories according to Dignum (2019): *Virtual Agents*, which are software systems with no direct representation in the physical world and *embodied systems*, are artefacts containing AI technology that *do* have a physical presence in the real world. Table 2.3. gives an overview of possible applications of each category.

Table 2.3. AI applications Virtual Agents & Embodied systems

Virtual Agents	**Embodied systems**
Personal digital assistant	Robots
Intelligent systems	Autonomous vehicles
Networked multi-agent systems	Smart household appliances
Avatars/ characters in games	Specialized hardware

2.1.4. Artificial Intelligence applications in business

When implementing AI applications in business processes, the effort does not just lie in the development of the method itself. It also lies in finding the right method, preparing the data (cleaning and labeling data) and integrating it in current (legacy) systems in the organization. The key applications of AI mentioned in this section are by no means an exhaustive list of AI application in business, but is meant to give a rough idea of what is possible with the application of AI in business processes right now. To categorize the different types of AI applications, the streams of AI provided by Dignum (2019) will be used as seen in Figure 2.3. below. The categories within this method are by no means mutually exclusive, there are AI applications that fit in more than one of the categories found below.

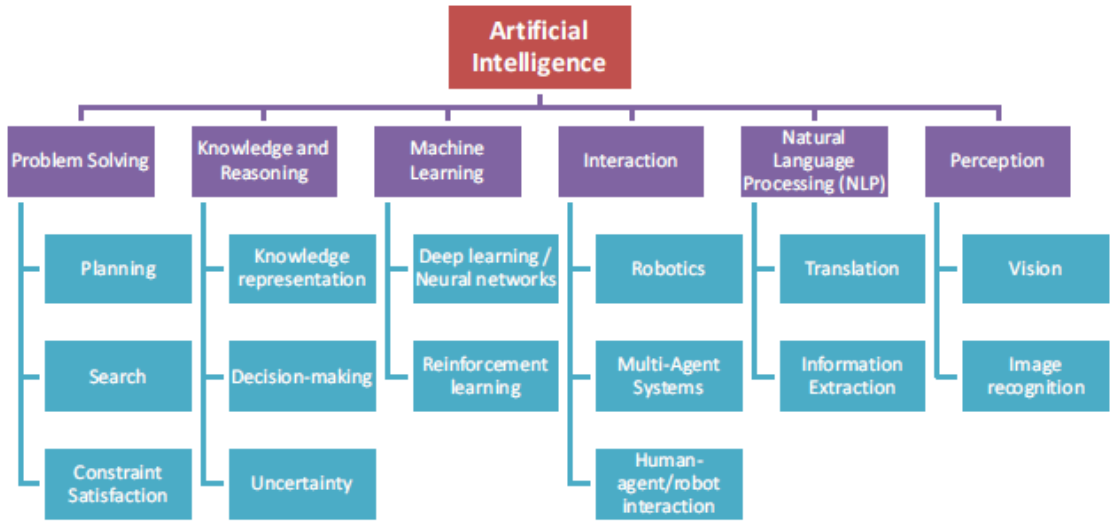

Figure 2.3. Streams of AI, adapted from Dignum (2019)

Problem Solving

According to Dignum (2019) there are three streams within the 'Problem Solving' category of AI: Planning, Search and Constraint satisfaction. By implementing AI solutions of this category, problem solving can be assisted by AI capabilities. This gives decision makers a broad spectrum of possible solutions found by problem solving AI algorithms, which decision makers can evaluate if it is interesting enough to pursue or implement. This human-AI-interaction can give unique insights and solutions that a human on its own does not have the capacity to come up with. Table 2.4. below gives an overview of a (non-exhaustive) overview of possible applications of AI problem solving techniques.

Table 2.4. AI Problem Solving applications

Sub-category	***Applications***
Planning	Provide optimal planning with ML (i.e. public transport, HR planning)
Search	Self-improving search engines with ML
Constraint satisfaction	Solve optimization problems with clearly imposed constraints (i.e. for supply chain management, finance)

Knowledge and Reasoning

There are three streams of AI-led solutions for the Knowledge and Reasoning category: knowledge representation, decision making and uncertainty. AI offer the tools to improve

decision making and innovate current business processes. As mentioned in the Section 2.1., human-AI-interaction can give unique insights. AI has the capability to analyze and interpret huge amounts of data which can improve knowledge and reasoning efforts. Table 2.5. gives insight into possible AI applications that support knowledge & reasoning capabilities in business.

Table 2.5. AI Knowledge and reasoning applications

Sub-category	***Applications***
Knowledge representation	- Semantic Content-Integration - NLP key sentence *(product development)*
Decision making	- Personalized products (product development) - Identify new sales leads - Creation of analytical sales impulses and product recommendations - Personalized marketing - Identification & prevention of customer churn - Cash flow analysis
Uncertainty	- Surveillance processes - Optimizing KYC processes (e.g. onboarding, account opening, continuous validation) - Control processes like fraud, risk, money laundering, sanctions & embargo validation) - Optimizing risk - Forward looking risk management (integration external data) correlation - Anomaly detection (the capability to automatically detect errors or unusual activity in a system.)

Machine Learning

The subcategories of ML according to Dignum (2019) are Deep learning/ Neural networks and reinforcement learning. In Figure. 2.3. of Section 2.1.2. some applications of this method have already been given. The foundations of this method is to "teach" a computer model to predict and draw conclusions from a dataset. This category is the foundation for many of the AI solutions in the Interaction, NLP and Perception category of this section.

Interaction

For the Interaction category there are three subcategories: Robotics, Multi-Agent Systems and Human-agent/ robot interaction (Dignum, 2019). Solutions within this category entail solutions with human-to-robot, robot-to-human and robot-to-robot. Robots programmed with AI capabilities can take over varying simple and repetitive tasks from humans, increasing productivity and reducing costs. A list of possible applications of AI based solutions of the interaction category can be found in Table.2.6..

Table 2.6. AI Interaction applications

Sub-category	***Applications***
Robotics	- Modularization of products (product development) - Automating Product information and processes (product development) - Automate unpopular tasks - Automate uneconomic tasks
Multi-Agent Systems	- Intelligent automizing back office processes (e.g. processing credit contracts, covenants, balance analysis, documents of real properties)

	- Intelligent automizing back office processes (e.g. processing credit contracts, covenants, balance analysis, documents of real properties) - Digital multi-channel communication, self-service by intelligent assistants (voice & chat) - Intelligent input processing (like e-mail classification, routing & responding) - Unification & integration content and multi-channel use (e.g. web, bot, communication)
Human-agent/robot interaction	- Software "agent" to participate in a conversation (e.g. chatbot, digital assistant)

Natural Language Processing (NLP)

The NLP category has two sub categories: Translation and information extraction (Dignum, 2019). NLP solutions can be helpful in many ways, it can analyze, translate and interpret text in documents and other textual sources. It can interpret spoken (human) language & commands, translate it and synthesize speech responses. Table 2.7.. gives an overview.

Table 2.7. AI Natural Language Processing applications

Sub-category	***Applications***
Translation	- Speech translation - Text translation - Speech synthesis
Information extraction	- Language detection - Sentiment analysis - Key phrase extraction - Entity recognition - Speech recognition - Contract validation and compliance

Perception

Within the category of Perception, there are two subcategories according to Dignum (2019), namely Vision and Image Recognition. With help of AI powered software, applications within this category have the capability to interpret the world visually through images, cameras, and video. Table 2.8. gives an overview of a number of its applications.

Table 2.8. AI Perception applications

Sub-category	***Applications***
Vision	- Object detection - Face detection, analysis, and recognition - Optical character recognition (OCR)
Image recognition	- Image classification - Semantic segmentation - Image analysis

2.1.5. Artificial Intelligence Ethics

This section is by no means an exhaustive list of the ethics and limitation of Artificial Intelligence (AI). However, it is important to emphasize the ethical implications of the adoption of AI, because it is a technique that can have a potentially significant negative impact on users' right of privacy and fairness when it is not implemented ethically. In this section, a short insight will be given into the ethics of AI from three perspectives, the corporate, governmental and academic perspective. For the corporate perspective the six responsible AI principles of Microsoft are given. For the governmental perspective the responsible AI framework of the European Union is given. For the academic perspective the 'ART of AI' principles by Dignum (2019) is used.

Corporate perspective

For the corporate perspective, the six responsible AI principles of Microsoft (Microsoft, 2021) are presented. The company Microsoft has been chosen because it is a company that has been a frontrunner in the software industry for years, and has also entered the AI software market with their cloud platform 'Microsoft Azure'.

The six responsible AI principles by Microsoft include: Fairness, Reliability & Safety, Privacy & Security, Inclusiveness, Transparency and Accountability. These principles are classified into two perspectives: 'Ethical' and 'Explainable' as seen in Figure 2.4. The Ethical perspective implies that AI assertions should be inclusive and enable accountability. So the creators of the AI system should be accountable for their decisions, and not discriminate. The Explainable perspective asserts that the collaborators of the AI system should ensure that the system can reasonably justify its conclusions and decisions – it should not be a 'black box'. Besides this, the AI system should comply with industry standards, government regulations and company policy. An auditor should be able to have the tools to validate if the AI system is in line with the mentioned regulations and policies. The AI system should be transparent and trustworthy.

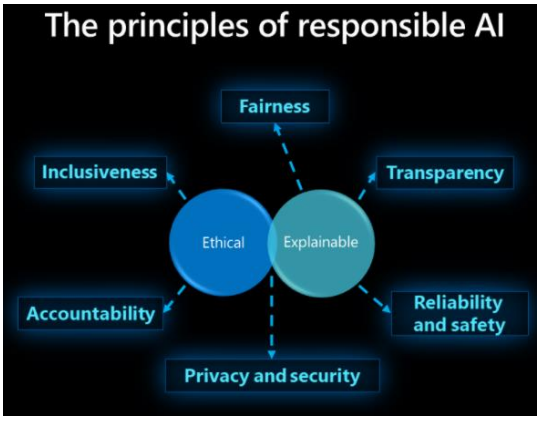

Figure 2.4 Principles of Responsible AI, adapted from (Microsoft, 2021)

Accountability

People that design and deploy an AI system should be accountable for it. Organizations should work within a framework of AI governance that meets clearly defined legal and ethical standards. Besides this, organizations should establish an internal review body which provides insights overview and guidance which help reflect the organization's AI journey.

Inclusiveness

To be inclusive means considering the experience of all humans, which should help empower and engage all people. Meaning that inclusive design practices should be implemented, helping developers address and understand potential ways AI could unintentionally exclude people. These inclusive design practices should benefit all parts of society, regardless of gender, physical ability, ethnicity, sexual orientation, or other factors

Privacy and security

AI systems should respect privacy and be secure, data holders are obligated to protect the data used in an AI system. Privacy can be improved by adding noise and randomizing data which helps conceal personal information used in the AI algorithms.

Fairness

According to the Fairness principle, people should be treated fairly by the AI systems. This entails that AI systems should not incorporate any bias based on ethnicity, gender, religion or other factors resulting in unfair (dis)advantage to a specific group of people.

Reliability and safety

An AI system should be reliable and safe, which means that every AI system should be tested and validated rigorously before it is released. It should perform according to its design in practice and respond safely to new situations. The system should also aim to be resistant to intended or unintended manipulation. Furthermore, AI systems should be monitored and tracked closely to enable proactivity when the system is not working as it should.

Transparency

AI systems should be understandable, therefore the AI system should be transparent. Everything from the data and algorithm used to train the AI, to the final model generated should be recorded. Furthermore, users of the AI system should be made aware of the purpose of the system, how it works, and what its limitations are.

Governmental perspective

For the governmental perspective, the Ethics Guidelines for Trustworthy Artificial Intelligence authored by the European Commission (EC) have been chosen. Within this guideline, the EC specified seven key requirements a trustworthy AI system should possess (Commission, 2019). These key requirements are based on the ethical EU principles of respect for human autonomy, prevention of harm, fairness and explicability. When the following seven requirements for an AI system are met, the system can be deemed trustworthy. A condensed overview of these requirements have been made in Table2.9., because they are quite similar to the responsible AI principles set out by Microsoft.

Table 2.9. Ethical guidelines Trustworthy Artificial Intelligence, adapted from European Commission (2019)

Requirement	***AI systems must…***
Human agency and overview	- Empower human beings - Provide proper overview mechanisms, - Have a human-in-the-loop/ in-command approach
Technical Robustness and safety	- Be resilient, secure & safe - Be accurate, reliable and reproducible - Have a fall back plan
Privacy and data governance	- Have full respect for privacy & data protection - Have adequate data governance mechanisms
Transparency	- Have transparent data, system and AI business model - Be transparent about its limitations and intentions - Inform humans that they are interacting with AI
Diversity, non-discrimination and fairness	- Avoid unfair bias - Foster diversity

	- Accessible to all
Societal and environmental well-being	- Benefit all human beings, including future generations - Be environmentally friendly - Take into account its social and societal impact
Accountability	- Have mechanisms ensuring responsibility & accountability - Enable auditability, enabling assessment of data, algorithms and design processes.

Academic perspective

For the academic perspective, a look will be taken at the ' ART of AI' principles by Dignum (2019). The acronym ART stands for: Accountability, Responsibility and Transparency. These are also three areas that have been touched upon in the corporate perspective (Section 2.3.1.) and governmental (Section 2.3.2.). This shows that the views about AI ethics from the three perspectives are quite similar. For the academics perspective a short overview is given in Table 2.10. of what the 'ART of AI' entails.

Table 2.10. ART of AI principles, adapted from Dignum (2019)

Principle	***Description***
Accountability	- AI system should be explainable - Justifiable development decisions for the AI system - Requires moral & societal norms involving all stakeholders
Responsibility	- Refers to the responsibility of people towards the AI systems - Includes responsibility of making & governing AI guidelines, rules and the impact the AI system has on the whole socio-technical system
Transparency	- The mechanisms of AI systems must be able to be described, inspected an reproduced - Choices and decisions made for the creation of the AI systems are explicitly known - Stakeholders should be involved in decision making for the AI system development

2.1.6. Conclusion Artificial Intelligence

This section describes AI as computational artefacts containing some facets of intelligent behaviour (Dignum, 2019). These computational artefacts operating with AI capabilities are referred to as artificial agents (Floridi & Sanders, 2004). Three characteristics of artificial agents are identified which include: autonomy, adaptability and interactivity (Floridi, 2013). Autonomy refers to the autonomous capability of reactive and proactive action in a limited, well defined context of an artificial agent. Adaptability refers to the capability of the artificial agent to learn and interact with virtual agents and embodied systems. Interactivity refers to the ability of the artificial agent to perceive and interact with other (virtual) agents. Furthermore, ML is defined as a core aspect of an artificial agent, which is a method for the artificial agent to learn from various sources of data. Four approaches to ML are identified: supervised learning, unsupervised learning, reinforcement learning and deep learning (Dignum, 2019). Supervised learning algorithms learn from labelled data and are used to predict, forecast and find relationships within quantitative data. Unsupervised learning algorithms learn from unlabelled data and is used to discover structures based on common elements within the input data. Reinforcement learning algorithms learn from its mistakes to get better at a predefined goal its meant to execute. Deep learning algorithm is used for more complex domains and

solves problems by artificially simulating the brain in an ANN. This chapter also presents a categorization of six streams of AI which include: problem solving, knowledge and reasoning, ML, interaction, NLP and perception. Problem solving AI is used to assist decision makers in solving problems in the categories of planning, search and optimization problems. Knowledge and reasoning AI helps agents to improve on knowledge representation, decision making and risk management. ML algorithms is used to "teach" a computer model to predict and draw conclusions from a dataset. Interaction AI provides solutions with human-to-robot, robot-to-human and robot-to-robot interactions. NLP AI provides solutions which can analyze, translate and interpret text in documents and other textual sources. Perception AI has the capability to interpret the world visually through images, cameras, and video. This chapter is finalized with presenting AI ethics from three perspectives: the corporate, governmental and academic perspective. The ethics chapter concludes that AI implementation should be assessed based on six principles before implementation: accountability, inclusiveness, privacy and security, fairness, reliability and safety and transparency.

2.2. Matrix of Change

The Matrix of Change (MoC) (Bynjolfsson et al., 1997) is a change management tool for business process reengineering (BPR) created in 1997 by three MIT researchers. BPR is characterized by implementing fundamental change with deliberate planning and a broad organizational focus (V. Grover, 1995). The MoC is a tool that has such a broad organizational focus which assists change agents in deciding *how quickly* a change should occur (pace and nature of change), *in what order* the changes should take place (sequence of execution), whether to start a *new department or site* (location), whether the systems proposed are *coherent and do not intervene* with each other (feasibility), and sources of value added (stakeholder evaluation). This change management tool is inspired by two concepts, the concept of Quality Function Deployment (QFD) and the House of Quality. QFD is "an overall concept that provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development and production" (Chan & Wu, 2002, p.463) . The House of Quality, which is the basic design tool of the QFD management approach, is "[…] [a] conceptual map that provides the means for inter-functional planning and communications" (Hauser & Clausing, 1988, p.63.).

2.2.1. How the Matrix of Change works

The MoC aims to present a way to graphically capture and display the connections between (reinforcing and interfering) practices and organizational activities in an organization. This is done by filling in the MoC by following a four-step plan as mentioned by Brynjolfsson et al. (1997):

Step 1: Identify existing and target practices and processes
Which business practices matter most for the company's business objectives?
Step 2: Identify System Interactions
What are the interactions amongst these business practices?
What are the possible transition difficulties from one set of practices to the other?
Step 3: Identify Transition Interactions
What is the degree of difficulty in shifting from an existing to a target practice?
Step 4: Survey Stakeholders
How do various stakeholders feel about retaining existing practices and implementing target practices?

This knowledge can be used by change agents to more intuitively design a smoother transition by seeking points of leverage within the completely filled in MoC. This is possible because the MoC reveals the process interactions that can provide guidelines for the sequence, feasibility, pace and location of the change. After deciding on the broad outlines of the new system and the corresponding transition paths with help of the MoC, the changes can start to be implemented locally.

2.2.2. Building the Matrix of Change

The MoC system consists of three matrices representing: the current organizational practices (Matrix 1), the target organizational practices (Matrix 2), and a transitional matrix that

bridges the other two (Matrix 3), as seen in Figure 2.5. Matrix 1 and 2 contain 'separable blocks', which can be used to indicate the stability of the system. Matrix 3 contains a grid on which the transition difficulty can be displayed. Furthermore, this system is complemented by a set of stakeholder evaluations to give the relevant stakeholders an opportunity to state the importance of the practices to their jobs in the 'incentive compatibility' section. The MoC is constructed by the four step plan as mentioned in Section 2.2.1. The example used in this paper is based on a transition within a large medical products company "MacroMed" from the original paper by Brynjolfsson et al. (1997). Note, however that this is a very old example dating from the 90s which is just for explaining purposes, an application of the MoC in a more modern context is given in Section 2.2.4.

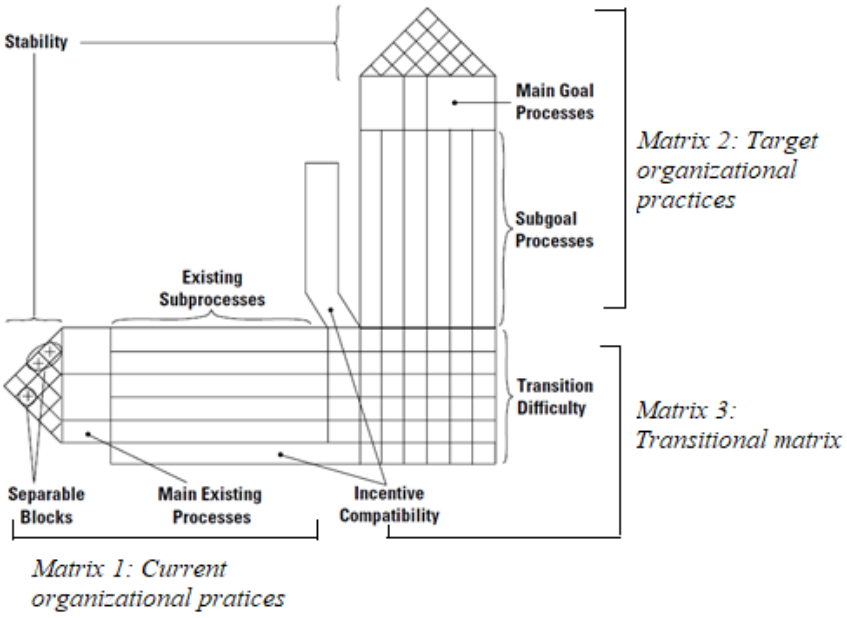

Figure 2.5. Functions of Matrix of Change graphics, adapted from Brynjolfsson et al. (1997)

Step 1: Identify Critical Practices and Processes

The first step in the MoC creation process for the responsible change agents is to create a list of *existing practices* within the business, these practices should be broken down into *constituent processes* as seen in Table 2.11. So for example, an existing practice at MacroMed is "Hierarchical structure to clearly define roles and responsibilities", and its constituent processes are "Vertical communication flow" and "Six management layers". A process within the MoC is defined as "a structured, measured set of activities designed to produce a specified output, […] a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs." (Brynjolfsson et al., 1997, p.40.). A second list describes the new or target processes, as described for the MarcoMed example in Table 2.12. In this example, the explanations are kept simple on purpose.

Table 2.11. Existing Practices and constituent processes at MacroMed, adapted from Brynjolfsson et al. (1997)

Existing practices	**Constituent processes**
Run an efficient, low-cost operation	Designated equipment, separated by type Narrow job functions
Meet product requirements (quality and quantity)	Large Work In Progress (WIP) and Finished Goods (FG) inventories Piece-Rate (Output) Pay
Hierarchical structure to clearly define roles and responsibilities (Vertical structure)	Six management layers

Table 2.12. Target Practices and constituent processes at MacroMed, adapted from Brynjolfsson et al. (1997)

Target practices	**Constituent processes**
Energized, empowered organization	Flexible equipment using information technology Greater job responsibilities
Zero nonconformance to requirements	All operators paid same flat rate
Elimination of all non-value adding costs	Low Just In Time (JIT) inventories Few management layers (3-4) Line rationalization

Step 2: Identify System Interactions

The second step is to fill the previously identified practices and constituent processes into the MoC, as seen in Figure 2.6. Connected to the filled in practices and processes is a triangular matrix. These matrices contain a grid which connect each process. These grids contain plus and minus signs at the junction, these are used to identify complementary (+) and competing (-) practices. The complementary processes reinforce one another, whereas the competing processes work at cross-purpose. This means that doing more of one process, it increases return to another process that it complements. When there is no evidence to support either reinforcement or interference between processes, the space at the junction is left blank.

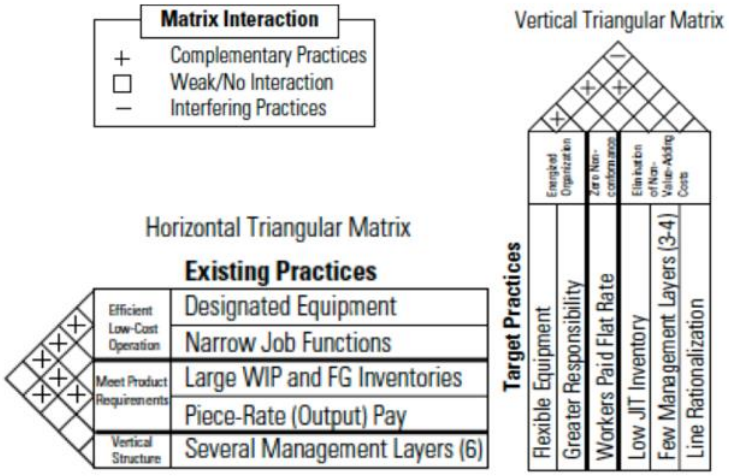

Figure 2.6. Horizontal and Vertical Matrix, adapted from Brynjolfsson et al. (1997)

Step 3: Identify Transition Interactions

The third step is to construct the transition matrix, which is a square matrix combining the vertical and horizontal matrices as seen in Figure 2.7. This square matrix helps to determine the degree of difficulty of shifting from an existing to a target process.

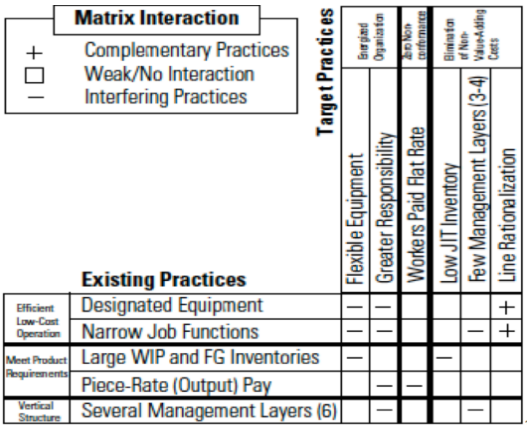

Figure 2.7. Transition Matrix, adapted from Brynjolfsson et al. (1997)

Step 4: Survey Stakeholders

In the fourth and last step in constructing the MoC, the change agents scored how they felt about retaining existing processes and implementing target practices. Every change agent evaluates the process and each scores the process on a five-point Likert scale anchored at zero. With a value of "+2" indicating a very important processes, and a value of "-2" indicating a strong desire to change the process. A value of "0" indicates indifference, and can be omitted in the MoC. In the example in Figure 2.8. a five-point Likert scale was used, but other variations of scoring are possible too.

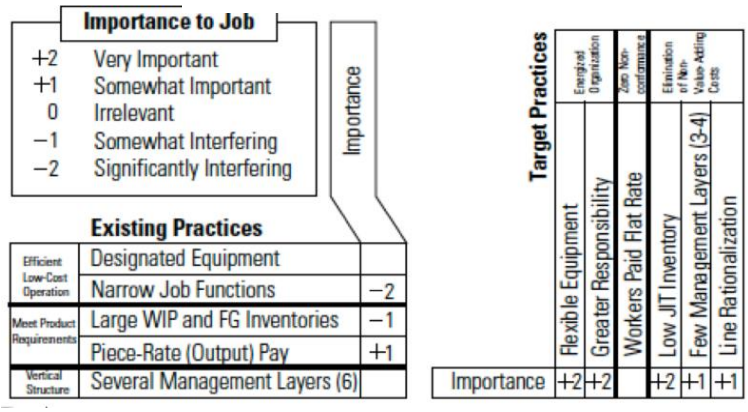

Figure 2.8. Satisfaction Ratings Matrix, adapted from Brynjolfsson et al. (1997)

2.2.3. Interpreting and using the completed Matrix of Change

Now the MoC is complete (Figure 2.9.), it is ready to be interpreted and used for answering questions regarding feasibility, sequence of execution, location, pace and stakeholder evaluation. The questions identified per question type by Brynjolfsson et al. (1997) can be found in Table 2.13.
To help the user interpret the MoC, an in depth look at the five types of questions found in Table 2.13. will follow in the next section..

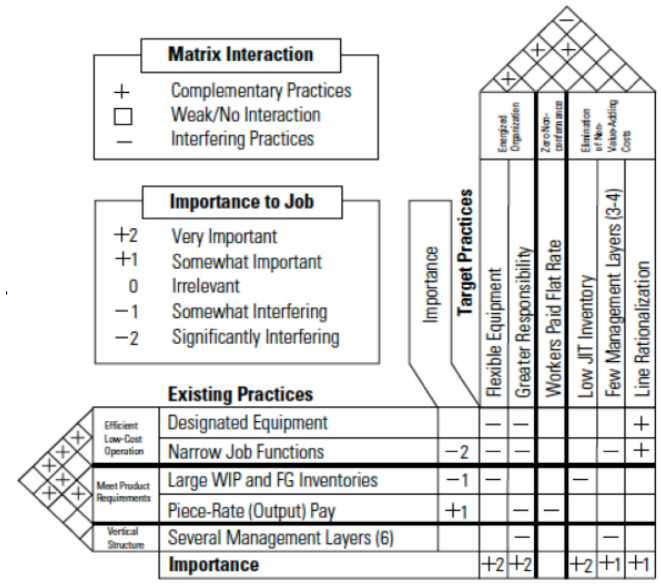

Figure 2.9. The Matrix of Change for MacroMed, adapted from Brynjolfsson et al. (1997)

Table 2.13. Overview possible questions derived from MoC, adapted from Brynjolfsson et al. (1997)

Question type	Question
Feasibility *(Coherence and Stability)*	- Does the target set of practices constitute a coherent, stable system? - Are the current practices coherent and stable? - Is the transition likely to be stable?
Sequence of Execution *(Where to Start and When to Stop)*	- Where should the change begin? - How does the sequence of change affect success? - Are there reasonable stopping points?
Location *(In house or greenfield)*	- Are we better off instituting the new system in a greenfield site? - Or can we reorganize the existing location at a reasonable cost?
Pace and nature of change *(Fast or Slow, Incremental or Radical)*	- Should the change be slow or fast, incremental or radical? - Which blocks of practices, if any, must be changed at the same time?
Stakeholder evaluation *(Strategic Coherence and Value Added)*	- Did we consider the insights from all stakeholders? - Did we overlook any important practices or interactions? - What are the greatest source of value?

Feasibility (Coherence and Stability)

To determine the coherence and stability of the system, a look should be taken at the sign (+ or -), strength and density (amount of positive or negative interactions in the matrix) of the interactions. When a system of practices within a matrix has numerous reinforcing relationships (high density of + relationships), the relation is coherent and therefore also stable. Whereas a system of practices with high density of competing (–) relationships, is inherently incoherent and unstable.
The *existing system* at MacroMed was quite stable, as can be seen in the 'existing practices' part of the matrix Figure 2.9., because the existing practices matrix has a high density of + signs.
The *desired system* is also quite stable, it has a high density of neutral signs (i.e. blank fields), but it contains a single competing relationship. Implying it could require more effort to keep the desired system working together, with the MoC therefore predicting that a higher level of

coordination is necessary to implement this change. This can be remedied by thinking up new, noncompeting processes or by proposing alternatives that are at least neutral.
The *transitional state* was dominated by a high amount of interfering (-) relationships, indicating a high degree of instability during the transition. This indicates what happens in practice when one department wants to implement a change

Sequence of Execution (Where to Start and When to Stop)

To decide on a sequence of execution there are three places in the MoC you can start looking at, the transition matrix (in the middle), the existing practices matrix (at the left) and the target practices matrix (on top). Wherever you start looking to decide on the sequence of execution of the change management process, it is important to get a holistic view at the change management process, and take all three matrices into account together.
Its easiest to start looking at the *transition matrix* for processes that are complementing existing ways of doing business. This can help building a bridge from the current system to the target system, and provide an early 'win' in the transitioning process which can help breaking down the old routines and company culture even faster.
When looking at the *existing practices matrix*, special attention should be given to the 'key' processes (processes with numerous reinforcing interactions) within this particular matrix. When this key process of the old way of working transitions to the new way of working, a cultural shift to the new way of working is initiated. This is because the people are forced to adapt to this change.

Location (In house or greenfield)

To decide whether to develop a new process further in house or on a greenfield (within a new department or with new management), a closer look should be taken at the transition matrix. When there are multiple interfering relationships in the transition matrix, it means that the proposed change will be disruptive. In this case, a 'greenfield' transition can be interesting. With a greenfield transition old mental models can be broken, and the radical transition has more chance to succeed.

Pace and nature of change (Fast or Slow, Incremental or Radical)

Deciding on the pace and the nature of change of the transition can help with implementation planning of the change (Gallivan, Hofman, & Orlikowski, 1994). To decide whether a change should be incremental or radical, a look should be taken at the transition matrix. When there are multiple interfering relationship, a radical and fast transition is suggested. When there are multiple positive or neutral relationships, a slow and incremental transition is advised.

Stakeholder evaluation (Strategic Coherence and Value Added)

Preferences and expectations of the stakeholders get made explicit by conducting regular stakeholder evaluations. These evaluations can help management to anticipate responses to change and is also an aspect that can be taken into account within the MoC. When the employees and stakeholders give low marks for an existing practice, they are likely to support the change. The other way around, when the existing practice gets high marks by the stakeholders, the proposed change is likely to be unpopular. When this happens, management needs to strategically incentivize the stakeholders to support the change or take another course of action if stakeholder resistance is too big.

2.2.4. Illustrative case of Matrix of Change for an AI transition process

Optical Character Recognition case

For the illustrative case description, a simple theoretical case of implementing an AI service of Optical Character Recognition (OCR) will be described. This case is based on a project the researcher has done for a Dutch technology company. In business, a lot of paper work has to be processed, categorized and documented. This is usually a simple and tedious task that in some cases is still processed manually. OCR can provide a solution to speed up and automate processing documents so employees that usually do work on this task have more time for other tasks. This can also increase process quality and reduce cost.

Step 1: Identify existing and target practices and processes

The *existing practice* identified is 'process documents manually'. The *existing sub-practices* identified include: 'physical document review', copy data from document manually' and 'insert data in enterprise resource planning (ERP) system manually'.

The *target practice* identified is 'OCR document processing'. The *target sub-practices* identified include: 'OCR assisted document review', 'Copy data from document optimally' and 'insert data in ERP system digitally'.

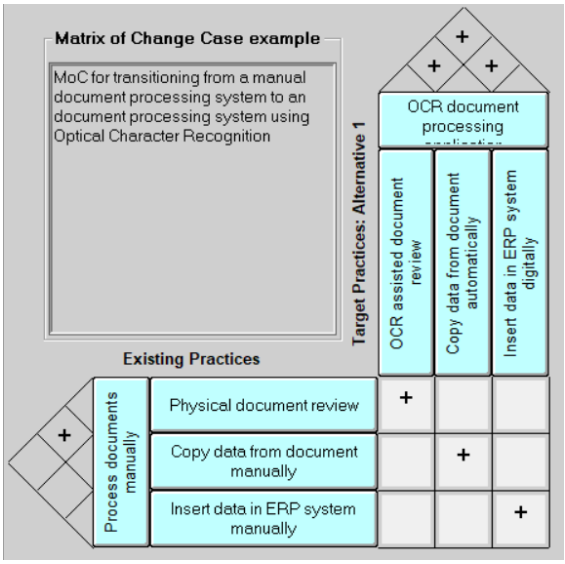

Figure 2.10. MoC for implementing an OCR solution

Step 2: Identify System Interactions

The interactions among the *existing sub-practices* are all neutral, except the interaction between the sub-practices 'physical document review' and copy data from document manually'. This is because these two practices can be combined, by first reviewing the document in question and then copying it. The interactions among the *target sub-practices* are positive between all the sub-practices. This is because the OCR document processing system automates all tasks.

Step 3: Identify Transition Interactions

The degree of difficulty in shifting from the existing sub-practices to the target sub-practices is identified as a positive interaction. This is because the OCR document processing system takes over the existing practices. However, retraining will be necessary on educating current employees how to work with the OCR document processing system. Furthermore, certain roles that used to do the process documentation manually will likely have to be adjusted to add value in another way.

Step 4: Survey Stakeholders

In this theoretical case, all the stakeholders that interact with the existing practice of processing documents manually feel like the existing practice should be discontinued. This means that there are no stakeholder objections against the adoption of the OCR process documenting tool.

Interpreting the MoC case example

As seen in Figure 2.10., the MoC gives a simple overview of the changes that have to happen in the system. When assessing the *feasibility* of this change, it is clear judging from the transition and triangular matrix that the transition is going to be feasible. The new system will be stable because it has multiple positive interactions in the triangular matrix, and the transition matrix also only has positive or neutral interactions. The *sequence of execution* is quite simple, because there is only one existing practice and one target practice. No changes in the *location* have to be made, it can stay in-house because off-the-shelf OCR solutions are widely available. The *pace and nature* of the change can be slow and incremental, because the MoC indicates positive interactions in the transition matrix and triangular matrix.

2.2.5. Conclusion MoC

This section describes the MoC as a change management tool that implements fundamental change with a broad organizational focus and deliberate planning. The MoC is used by following a four-step plan and filling in the MoC graphic designed by Brynjolfsson et al. (1997). The first step is identifying existing and target practices and processes. The second step is identifying system interactions. The third step is identifying transition interactions, and the fourth step is to survey stakeholders interacting with the processes that will change. The completed MoC can be used by change agents to assess five aspects of the change: pace and nature of change, sequence of execution, location, feasibility and strategic coherence. This chapter concludes with a simple theoretical case of implementing an AI service of OCR to demonstrate the MoC in an AI context.

3 Research Design and Methodology

This chapter presents the overall research methodology. First giving an introduction to the Design Science method in Section 3.1. Second giving insight into the problem investigation stage, including the methodology used for executing the systematic literature review and the qualitive interview study in Section 3.2. Third the method design process is introduced in Section 3.3. Lastly, the method validation process in explained in Section 3.4.

3.1. Research methodology – Design Science method

The goal of this thesis is to create and validate a holistic method for AI implementation in business processes, based on the MoC by Brynjolfsson et al. (1997). To reach this goal, a research method is necessary that has a solution-based approach with a focus on design problems within the field of information systems. For this purpose, the Design Science method by Wieringa (2014) is used. This method aims to design and investigate an artifact that interacts and provides improvements in its problem context and answers the RQ. This is done by first answering the KQs, which will be answered by conducting a systematic literature review and semi-structured interviews. This is followed by answering the DQ, which ultimately results in an artifact that provides improvements in the implementation of AI in business processes.

The Design Science method goes through three main stages, which are covered in depth in its corresponding chapters, which include: problem investigation (Section 3.2.) , Treatment design (Section 3.3), Treatment validation (Section 3.4.), as depicted in Figure 3.1. below. The exclamation marks indicate design problems, and questions marks indicate knowledge questions.

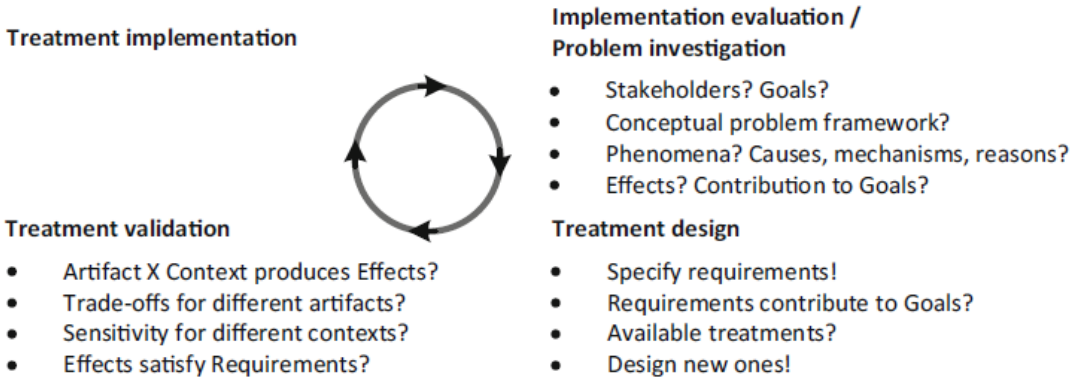

Figure 3.1. The Engineering cycle. (Wieringa, 2014, p.27.)

3.2. Problem Investigation Stage

Before designing an artifact that answers the DQ, it is important to clearly identify and explain what exactly the problem is and who the problem owners and stakeholders are. This happens in the Problem Investigation Stage, which take place in Chapters 1, 2, and 5. Chapter 1 identifies the stakeholders (change agents) within the problem context and identifies the goal of the research and the artifact. Chapter 2 introduces the conceptual problem framework and phenomena surrounding the stakeholders and the topic of AI and the MoC. Chapter 4 investigate the causes, mechanisms, reasons and effects of the problem, by answering KQ 1 and 2.

3.2.1. Systematic Literature review (Knowledge Question 1)

To answer KQ 1 a systematic literature review is conducted. The method of conducting a systematic literature review by Kitchenham (2004) is used. The author of the method defines a systematic literature review as a means to identify, evaluate, and interpret the available research relevant to a specified topic of interest (Kitchenham, 2004). The systematic literature review will be conducted in three stages: *planning*, *execution* and *result analysis* as visualized in Table 3.1.

Table 3.1. Execution process systematic literature review, adapted from Kitchenham (2004)

Stage	***Task***
1) Planning stage	- Define research goals - Define keywords - Define inclusion and exclusion criteria - Select academic database
2) Execution stage	- Collect academic literature based on set criteria - Screen the papers - Final selection
3) Reporting stage	- Perform literature review - Report on relevant information that answers the Knowledge Question - Conclusion of the review

In the *planning* stage, the research goal of the literature study is clearly defined and summarized in KQ 1. Based on KQ 1, keywords and inclusion and exclusion criteria will be defined. When this is done, an appropriate academic database is selected. In the *execution* stage, academic literature is collected based on the criteria set in the planning stage. The papers are then screened, special attention is given to whether the paper is peer-reviewed and helps in answering KQ 1. After the collection and screening of the papers is done, a final selection is made. Finally, in the *reporting* stage, a literature review on the final selection is conducted. Special focus will be on answering KQ 1 to find relevant information to ultimately solve the Design problem.

3.2.2. Qualitative study interviews (Knowledge Question 2)

To answer KQ 2. semi-structured interviews are conducted with practitioners that have implemented AI techniques in business processes. When conducting a semi-structured interview, a pre-determined set of questions is asked in a conversation style wherein the interviewer can ask additional questions, change the content or order based on how the conversation flows (Oates, 2005). The main goal of the interview in this research is to find out which practices or methods are used to conduct an AI transition in practice (KQ 2.). This information can be used for creating an artifact that fits the needs of practitioners conducting an AI transition in their business. To be eligible as an interview candidate, the candidate needs to have experience in managing an AI transition or implementing an AI application in an organization.

The interviews are coded and analyzed. The analysis starts off with deductive coding, and is followed up by an inductive and open coding approach as described by Babbie (2013). During the deductive coding process, themes and codes are developed before the interview based on the literature review and research questions. After the interview is done, an inductive & open coding process takes place to create and add new codes based on insights gathered during the interviews. To follow this up, axial coding is conducted to reanalyze the results of open coding to identify the most important and general concepts (Babbie, 2013). Insights gathered from this study are used to answer KQ 2. Before the interviewees participate in the semi-structured interview, the researcher sends the Interview Protocol (A.2.), to give full disclosure about the content of the interview before participating. Besides the interview protocol, the researcher sends the Information Sheet Semi-structured interview on AI implementation in

business (A.3.), containing a summary of the purpose of the research and ethical implications of participating in the semi-structured interview. Furthermore, the researcher sends an Informed consent form semi-structured interview on AI implementation in business (A.4.), which the interviewee is asked to agree to before the interview is conducted. This form makes sure the interviewee knows what participating in this study implies and how the information from the interview is used

3.3. Method Design Stage (Treatment Design)

After specifying the research problem and identifying its problem context by having conducted a systematic literature review and the semi-structured interview in the problem investigation stage, the process of designing the artifact starts. In the Treatment Design Stage, requirements for the artifact are set before designing it. These requirements are derived from answering the Knowledge Questions in the problem investigation stage. After the requirements have been specified, the researcher creates a pre-validation version of the CoC for AI based on the requirements and the information gathered in this study. The steps and design choices made for the pre-validation method are discussed.

3.4. Method Validation Stage (Treatment Validation)

After the pre-validation method is designed in the method design stage, the method is validated in the method validation stage. In this stage, the effectiveness to contribute to stakeholder goals and requirements of the designed artifact in the problem context is assessed. This is done by conducting an expert feedback session. Before the expert participates in the expert feedback session, the researcher sends an expert session information sheet containing the evaluation criteria & questions (A.5.) and an informed consent form (A.6.). These documents contain information on the purpose of the research, its ethical implications and asks the expert to formally verify he/she understands and agrees with participating in the research.

During the information session, the researcher gives a presentation to introduce the method. After a discussion and brainstorm session about AI, change management and the CoC for AI, the expert fills in the evaluation criteria form and gives answers to the evaluation questions. The evaluation is based on three factors for information systems evaluation as mentioned by (Prat, Comyn-Wattiau, & Akoka, 2014): understandability, completeness and usefulness. The insights collected from the validation method are used to improve the designed artifact and to stimulate academic discussion on the artifact. After the improvements gathered from the validation method are implemented, a final summative evaluation round of the final version of the artifact is conducted by presenting the applied changes to the method to the expert. A discussion follows, the insights gathered from this discussion is evaluated (possibly implemented) and can be used for recommendations for future research on the artifact. At the end of this stage, the final version of the CoC for AI is presented and demonstrated with a theoretical AI implementation case.

4 Practices and methods to conduct an AI transition in a business process

In this chapter a systematic literature review is conducted to answer KQ 1. and a semi-structured interview analysis is conducted to answer KQ 2. With the information gathered from this literature review (Section 4.1.) and the semi-structured interview analysis (Section 4.2.), practices and methods to implement an AI transition in a business process are collected and categorized. The findings of the literature review are summarized in Section 4.1.6. and the findings of the semi-structure interview analysis are summarized in Section 4.2.8.

4.1. Literature review

The literature review is based on the systematic literature review tactics of Kitchenham (2004) and has as research goal to find out which best practices and methods to implement an AI transition in a business process are mentioned in the literature. The description of the approach of the systematic literature review containing information on the choice of scientific database, keywords specified, inclusion and exclusion criteria and the actions to conduct the literature review is presented in appendix Section A.1.

In the literature review, nine practices and zero (change management) methods specifically to implement an AI transition in a business process are identified. Find below in Table 4.1. the overview of the practices identified during the systematic literature review. A low amount of individual contributions of 14 research papers dedicated specifically to the research of AI transition is identified in the literature review. Furthermore, there are no methods found specifically meant to implement an AI transition in a business process, this displays that research done on the topic is generally lacking.

Table 4.1.Categorized practices used to implement an AI transition in business processes mentioned in literature

Identified categories	**Identified Practices**	**Authors**
AI vision	Define solid AI planning and vision	Alsheibani et al. (2020), Attaran & Deb (2018), Awalegoankar (2019), Jarrahi (2018), Kakatkar et al. (2020), Paschen et al. (2020)
	Design an organizational structure which is supportive for AI	Alsheibani et al. (2020), Attaran & Deb (2018), Awalegoankar (2019), Black & van Esch (2020), Desouza et al. (2020) , Grover et al. (2020) , Grønsund & Aanestad, 2020, Jarrahi (2018) , Plastino & Purdy (2018)
Process identification	Define processes clearly	Attaran & Deb (2018), Awalegoankar (2019), Desouza et al. (2020), Kakatkar et al. (2020) , Paschen et al. (2020)
	Build an integrated AI system	Awalegoankar (2019), Black & van Esch (2020), Plastino & Purdy (2018)
Metric specification	Define metrics clearly	Attaran & Deb (2018), Awalegoankar (2019), Black & van Esch (2020),
AI leadership	Establish an AI leader	Awalegoankar (2019), Black & van Esch (2020), Plastino & Purdy (2018), Attaran & Deb (2018),
	Recruit AI talent and train AI capabilities current staff	Alsheibani et al. (2020), Attaran & Deb (2018), Awalegoankar (2019), Black & van Esch (2020), Grover et al. (2020), Plastino & Purdy (2018)

AI governance	Define AI governance	Attaran & Deb (2018), Awalegoankar (2019), Grover et al. (2020), Plastino & Purdy (2018)
	Initiate and maintain foundational data capabilities	Alsheibani et al. (2020), Awalegoankar (2019), Attaran & Deb (2018), Black & van Esch (2020),

4.1.1. AI vision

The AI vision category contains two practices which are 'define solid AI planning and vision' and 'design an organizational structure which is supportive for AI'. The practices within this category focus on defining and designing a new vision for the future of the organization, a future wherein the company works together with AI applications.

Define solid AI planning and vision

Before initiating the AI implementation process, it is important to define a solid planning and vision as a basis for the AI strategy (Awalegaonkar, 2019). To do this, it is necessary to first define the key business objectives of the organisation and then assessing where AI can have a positive impact and then assess its constraints to drive value (Attaran & Deb, 2018). On top of this, a clear AI business case aligning with existing strategies and its relative benefits should be made (Alsheibani et al., 2020; Attaran & Deb, 2018) . The business case should be communicated clearly wherever necessary across the organisation, presenting the reasoning for implementing AI in current business processes (Attaran & Deb, 2018). Clearly communicating this information across the organisation in an early stage gives the employees the time to anticipate the potential changes AI could bring to their current work. Furthermore, a solid AI strategy with responsible business practices enhances brand perception and trust in the company (Awalegaonkar, 2019).

Design an organizational structure which is supportive for AI

To get optimal return on AI applications, it is necessary that the organizational structure is supportive of AI. This organizational structure should enforce a human-AI symbiosis, meaning humans and AI should forge interaction to leverage and strengthen each other's unique capabilities (Desouza et al., 2020; Jarrahi, 2018). This should advance the complementarity of humans and AI in the organizational decision-making processes, characterized by uncertainty, complexity and equivocality (Jarrahi, 2018). AI can help extend human's cognition regarding complexity, because it can process and analyze large complex amounts of data. On the other hand, humans excel in offering an intuitive holistic approach in dealing with equivocality and uncertainty in organizational decision making (Jarrahi, 2018). Resulting in intelligence augmentation, wherein AI systems augment human capabilities, not replace it (Jarrahi, 2018; Plastino & Purdy, 2018). This complementarity of humans and AI is summarized by Jarrahi (2018) in Figure 4.1. The cooperation between humans and AI follows a human-in-the-loop pattern, meaning that human supervisory control over the AI algorithms is necessary for it to ensure it meets the organization's requirements and the changing environment it operates in (Grønsund & Aanestad, 2020).

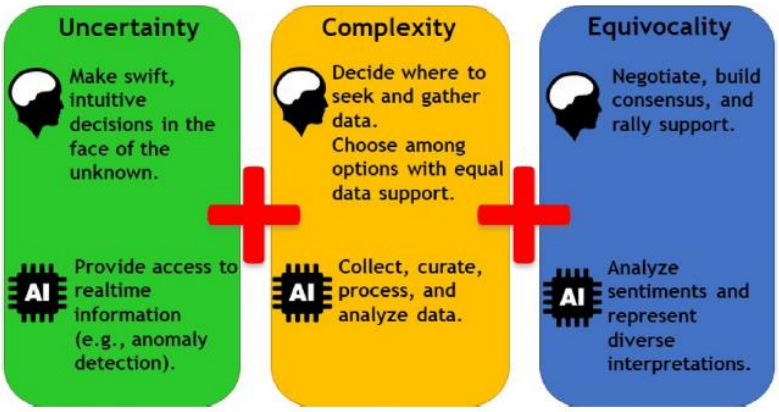

Figure 4.1. Complexity of humans and AI in decision-making situations, adapted from Jarrahi (2018)

4.1.2. Process identification

The process identification category contains two practices which are 'define processes clearly' and 'build an integrated AI system'. The first practice stresses the importance of defining the current business practices before implementing AI capabilities. The second practice extends on this, by stressing the importance of integrating the new processes with AI capabilities into an integrated AI system.

Define processes clearly

When implementing new AI capabilities, the business processes should be defined clearly to be able to capture value out of the capabilities (Awalegaonkar, 2019; Kakatkar et al., 2020; Paschen et al., 2020). This helps to make targeted changes and gives insight into what departments or workflows have to be altered when an AI capability is implemented. Furthermore, it helps with identifying what process is a good candidate for improvement with AI capabilities and keep employees working within the specific process involved (Attaran & Deb, 2018).

Build an integrated AI system

A best practice to implement AI applications in business processes mentioned in the literature is the use of an AI tool which is fitting for the specified process and building an integrated AI system. To get optimal results from an AI transition, it is essential to implement an AI tool which is fitting for the specified process (either packaged or custom built) to enable a stable process (Awalegaonkar, 2019). To integrate AI well within business processes, attention should be given to data management tools for AI applications. This includes making decisions on how to manage and include cloud-based data lakes, integrating data engineering workbenches with AI governance and model management among other things. The change agent should build an integrated AI system and get AI applications that are able to complement this system (Black & van Esch, 2020). To do this prerequisites like maintaining a large accurate data set, integrating external with internal data sets and the ability to integrate and ingest varying internal data sources need to be met (Awalegaonkar, 2019). Making use of available AI cloud services like Microsoft Azure and Amazon Web Services can give the opportunity to scale AI capabilities rapidly, with low computing costs and without having to create big internal IT structures in house (Plastino & Purdy, 2018).

4.1.3. Metric specification

The metric specification category contains one practice ‘define metrics clearly. This practice states the importance of specifying metrics to enable the monitoring of the AI implementation process and the newly implemented AI application.

Define metrics clearly

To keep change agents and employees interaction with the AI application accountable, it is necessary to define metrics that track the progress and impact of AI applications in the business (Attaran & Deb, 2018; Awalegaonkar, 2019; Plastino & Purdy, 2018). AI capabilities not only have influence on changes in business processes, they can also have significant impact on business performance (Attaran & Deb, 2018). Therefore it is essential to define metrics that can be used to quantify and monitor the effect AI applications has on business performance. Special care should be taken to ensure that the chosen metrics correctly reflect the impact the AI application has on the business processes (Attaran & Deb, 2018; Plastino & Purdy, 2018). Selection of ‘bad’ metrics that do not reflect the effect of AI correctly, can result in misjudgement in the way the AI application performs. This can in turn result in mismanagement of the AI applications.

4.1.4. AI leadership

The AI leadership category contains two practices which are ‘establish an AI leader’ and ‘recruit AI talent and train AI capabilities of current staff’. The first practice assigns an AI leader to communicate the changes AI will bring and leads the AI transition. The second practice focuses on educating AI capabilities and recruiting AI talent, which can help recruit or educate AI leadership if it is not yet present at the company.

Establish an AI leader

To conduct an AI transition within a business process, it is necessary to appoint an AI leader or champion (Alsheibani et al., 2020; Attaran & Deb, 2018; Awalegoankar, 2019). This AI leader is responsible for managing the execution of the AI strategy, communicating the progression of the strategy execution to top management and stimulate a culture open to AI adoption (S. Alsheibani, Cheung, & Messom, 2019; Attaran & Deb, 2018). Furthermore, it is necessary to get support from top management by appointing roles like Chief AI, Data or Analytics Officer that can help champion the AI transition (Attaran & Deb, 2018; Awalegaonkar, 2019). Support from higher management helps to provide the necessary funding of the AI transition and ensures high-level organisational support for the transition (Attaran & Deb, 2018). Another reason why establishing an AI leader is valuable is because it is important for something as new and abstract (for several organizations) as AI to be made understandable and championed by a person that is held accountable to lead the change (Black & van Esch, 2020). This helps to reduce the barrier people that are new to AI have to adopt this technology.

Recruit AI talent and train AI capabilities of current staff

To correctly implement and maintain AI capabilities in business processes, it is important that the human resources have the right AI capabilities to do this (M. Alsheibani, Cheung, Mazoon, 2020; Attaran & Deb, 2018; Plastino & Purdy, 2018). Employees should be formally trained within teams, in this way employees can learn to cooperatively work and grow in the

use of AI capabilities (Awalegaonkar, 2019). Furthermore, resources should be invested in hiring and maintaining the right AI talent to forge a self-enforcing AI culture within the organization (M. Alsheibani, Cheung, Mazoon, 2020). The mentioned 'AI talent' does not just include employees with the right AI technical skills, but also recruiting or developing employees with expert judgment, creative thinking and communication skills that complement AI technologies (Plastino & Purdy, 2018).

4.1.5. AI governance

The AI governance category contains two practices which are 'define AI governance' and 'initiate and maintain foundational data capabilities'. The practices within this category focus on defining AI governance and ensuring foundational data capabilities to promote fairness and reduce bias. This category aids in upholding the AI ethics standards mentioned in Section 2.1.5. and demonstrates the importance of good data and AI governance.

Define AI governance

It is essential when implementing AI applications to define and maintain a solid AI and data governance program (Attaran & Deb, 2018; Plastino & Purdy, 2018). This helps cultivate an enterprise culture of AI democratization within the organization and helps enforce a human-AI symbiosis by increasing the use of real time AI insights to drive business decisions (Awalegaonkar, 2019; Jarrahi, 2018). Another reason to define clear AI governance practices is to guarantee that the consistency and quality of the data sets is on an acceptable level to reduce the chance of bad use of data (Attaran & Deb, 2018) and reduce the chance of biases created by the AI algorithms (Black & van Esch, 2020).

Initiate and maintain foundational data capabilities

A requirement for managing a good AI transition is to maintain and initiate foundational data capabilities (Awalegaonkar, 2019; Black & van Esch, 2020). This means that the organization needs to be adept at managing and structuring data maintaining data capabilities like cleansing, maintaining, consuming and managing business critical data (Awalegaonkar, 2019). This demands the organization to invest human and financial resources in maintaining good data quality, data governance and data management frameworks before being able to fully capitalize on AI capabilities. Besides this, it is essential that the organization has clear operating models for the consumption and generation of data to provide transparency and overview on the data being consumed (M. Alsheibani, Cheung, Mazoon, 2020). This can be used to assess and improve on the existing organizational culture in terms of AI compatibility of the current businesses processes.

Before implementing the AI capability in a business process, it is important to determine the range of factors that may affect the process being modelled and making sure no important factors are being missed (Attaran & Deb, 2018). This is a process that constantly needs to be monitored, if an analytical model or AI capability is not delivering useful information for the business, moves on to engineering another model. After the AI capability has been implemented and integrated into business processes, practical tests and accuracy measurement of the model have to be performed to constantly check and monitor the model quality.

4.1.6. Conclusion literature review

The literature review identified nine practices to conduct an AI transition in a business process, these nine practices are divided in five categories. The *first category*, AI Vision contains two practices. The first practice identified within this category is to define solid AI planning and vision, this provides the basis for an AI strategy, defines key business objectives and enables the creation of a business case for AI implementation. The second practice identified within this category is to design an organizational structure which is supportive for AI, meaning identifying business processes where AI can aid humans and adjusting these processes to create a human-AI symbiosis. The *second category*, process identification, contains two practices. The first practice identified within this category is to define processes clearly, this helps in identifying if AI provides improvements for the current process and helps to make a targeted change if the choice is made to implement AI. The second practice identified within this category is to build an integrated AI system, this means that the new AI application should be well integrated with the current business processes. The *third category*, metric specification, contains one practice. This practice is to define metrics clearly, this enables metric accountability and effectively tracks the performance of the implemented AI application. The *fourth category*, AI leadership, contains two practices. The first practice identified within this category is to establish an AI leader, this AI leaders is responsible for communicating and executing (aspects of) the AI strategy, which helps stimulate the openness for AI adoption within the company culture. The second practice identified within this category is to recruit AI talent and train AI capabilities of the current staff to stimulate an AI culture. The *fifth category*, AI governance, contains two practices. The first practice identified within this category is to define AI governance, this helps cultivate consistent quality data practices and helps cultivate a company culture that works well together with AI. The second practice identified within this category is to initiate and maintain foundational data capabilities, which refers to managing and structuring data maintaining data capabilities.

4.2. Semi-structured interviews

Within this chapter, the execution and analysis of the semi-structured interviews is described. The goal of this chapter is to answer KQ 2., which aims to find out what practices or methods to implement an AI transition in a business process are used in practice.

4.2.1. Background semi-structured interviews

The interviews for this study have been conducted between May 18th 2021 and June 8th . Because of convenience and the Covid-19 pandemic, the interviews have been conducted online via Microsoft Teams. Interview candidates and organizations have been contacted via e-mail, LinkedIn and via connections within the researcher's direct network. The interview candidates need to have experience in managing an AI transition or implementing an AI application in the organization. The target for the amount of interviews was a minimum of 5 and maximum of 10 interviews. However, only an interview count of 4 has been achieved due to a low response rate and time constraints.

Qualitative study approach

The semi-structured interviews were conducted online via Microsoft Teams, and recorded (with verbal consent) with a recording device. During the interview, the researcher made notes on paper of terms that potentially could be used for coding and gave a quick overview

of the topics discussed during the interviews. The interviews have been transcribed by using an AI leveraged audio translation site, Otter.ai, this software transcribed the audio verbatim. The transcription of the software was quite accurate, the transcription got read and used as input for the coding process. The interview analysis followed a mixed approach of deductive and inductive coding as described by Babbie (2013). Before carrying out the interview a deductive approach was taken to identify themes likely to be discussed based on the systematic literature review, based on this (deductive) codes have been created. This helps the researcher ask more pointed questions during the semi-structured interview. After the interviews had been conducted, an inductive approach has been taken to observe the frequency of words, patterns and contexts mentioned in the interview to further extend and improve the codebook. The open coding method (Babbie, 2013) has been used to generate coding concepts and categories. This in turn, has been used to identify practices and methods used to conduct an AI transition in business processes and answer KQ.1.
After the open coding process is done, the researcher makes use of axial coding (Babbie, 2013) to classify the codes identified in broader categories and determine relations between them. This helps to get a more comprehensive view and helps to determine possible relationships between categories and codes which might get lost when just open coding is done. The coding scheme is presented in Figure 4.2. below.

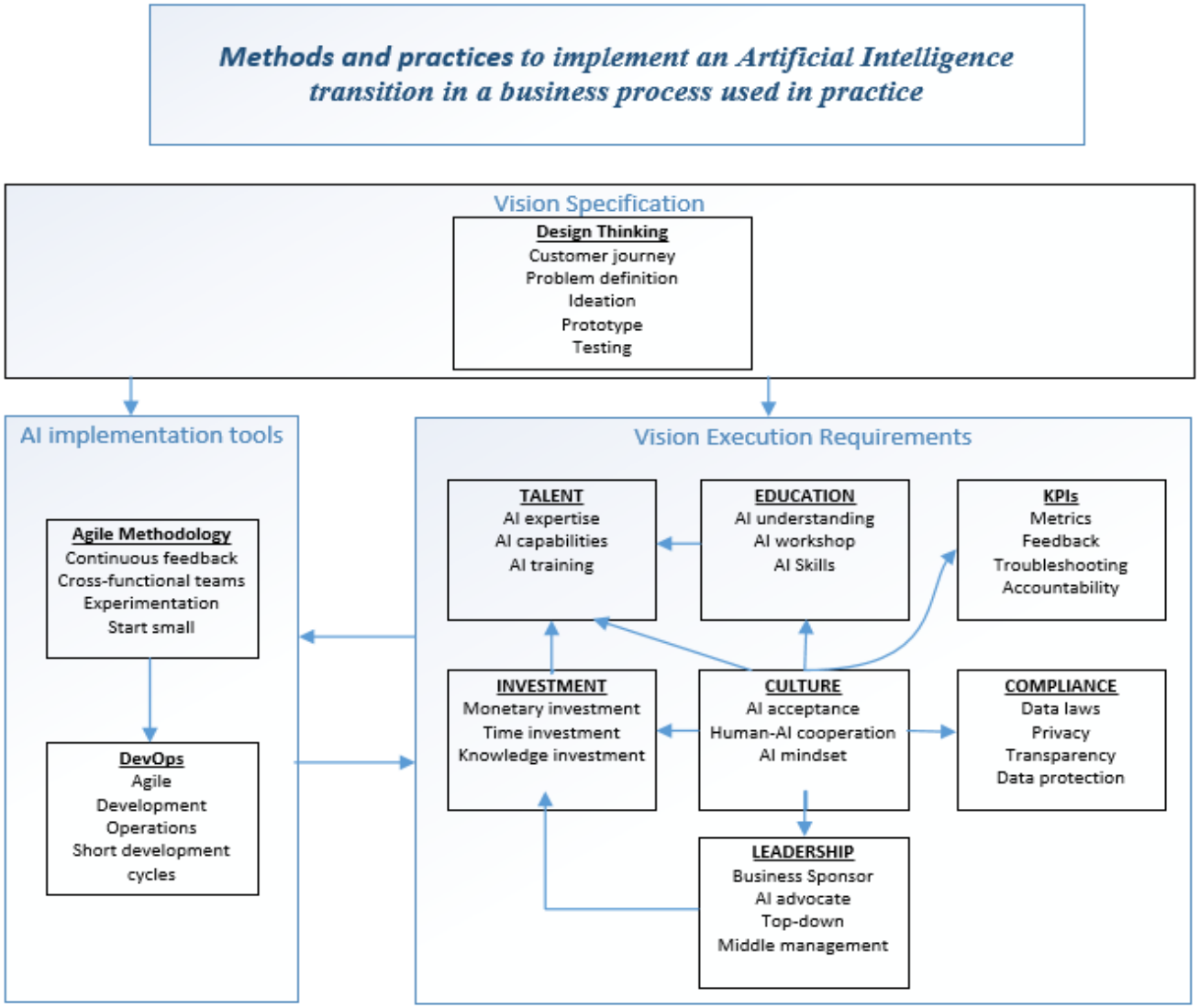

Figure 4.2. Coding scheme

Content of the semi-structured interviews

Before starting the interview, the interview protocol (Section A.2.), information sheet for semi-structured interview (Section A.3.) and an informed consent form (Section A.4.) have been sent via e-mail. This is done to give full disclosure to the interviewee about the content of the interview, the ethical implications and the rights of the interviewee. The interview protocol gives a framework of the main questions that will be asked, because it is a semi structured interview, the interview is more loosely structured. This allows for the interviewees to express themselves more freely and gives the interview more of a conversation-like flow.

Ethical Implications of the semi-structured interviews

As mentioned, an information sheet and an informed consent form have been sent to the interviewees before the interview. The information sheet contains information on the purpose of the research, benefits and risks of participating, procedures for withdrawal from the study and privacy and personal data. After the interviewee has read and understood the content of the information sheet, the interviewee agrees on the content of the informed consent sheet. The informed consent form contains seven questions verifying that the interviewee knows the implications of taking part in the study and how the information gained from the interviewee will be used in the study. The interviewee has the choice to send the consent form physically to the researcher or consent verbally on record.
The content of the information sheet and the informed consent form have been approved by the Ethics Committee of the Faculty of Behavioral, Management and Social Sciences at the University of Twente.

Description semi-structured interview respondents

For this interview, four respondents that fulfilled the requirement of having experience in managing an AI transition or implementing an AI applications in an organization have been found. The interview respondents are diverse, two from consulting, one from the service industry and one from a governmental organization. Furthermore, the respondents vary in age and professional experience. This gives, even with the low response rate, a broad vision of the viewpoints of AI practitioners. Find below in Table 4.2. an overview.

Table 4.2. Description interviewees

Code	Function	Experience	Organization Pseudonym
IR-1	Senior consultant	5 years	Manufacturing Consulting
IR-2	Junior consultant	2 years	IT Consulting
IR-3	Chief Information Officer (CIO)	20+ years	Service industry
IR-4	IT manager	10+ years	Governmental organization

Main topics semi-structured interview

The main topics the interview focuses on are the following: Meaning of Artificial Intelligence, Management Techniques for AI transition, AI transition KPIs, Challenges to managing AI transition, Best practices managing AI transition and Future of AI according to practitioners. These topics give a broad insight into the current state of AI transition management according to practitioners. Besides, these interview topics touch on similar topics as in the systematic literature review. This helps to give a multi-faceted perspective on the topic in question. Find below in Table 4.3. an overview of the insights gathered on

management techniques to conduct an AI transition according to the Interview Respondents (IRs).

Table 4.3. Management techniques AI transition interviewees

Management technique	**Interviewee**
Agile Methodology	IR-1, IR-2 and IR-4
Design Thinking combined with customer journey	IR-2

In Table 4.4. the requirements of executing the Vision as mentioned by the interviewees are presented.

Table 4.4. Vision execution requirements interviewees

Vision requirement	**Interviewee**
Leadership – Have a business sponsor	IR-3, IR-4
Investment – Need support from top management	IR-2, IR-3, IR-4
Education – Employees interacting with AI need basic AI capabilities	IR-2, IR-3, IR-4
Talent – hire right talent to execute vision	IR-1, IR-4
Compliance – Privacy, transparency and protection	IR-1, IR-2, IR-4
Key Performance Indicators (KPIs) – Set clear KPIs for executing the vision	IR-1, IR-2, IR-3
Culture – Forging Human-AI symbiosis	IR-3

In table 4.5. the vision requirements and management techniques identified (in italics) are categorized based on the identified categories in Table 4.1. of Section 4.1. The category ‘metric specification’ has been changed to ‘continuous feedback’, because metric specification is an important aspect of ensuring continuous feedback as mentioned in the Agile methodology and KPIs sections of this chapter.

Table 4.5 Categorized practices and vision requirements for AI implementation

Identified categories	**Identified Practices and *vision requirements***
AI vision	Define solid AI planning and vision Design an organizational structure which is supportive for AI *Design Thinking combined with customer journey* *AI vision identification* *Culture – Forging Human-AI symbiosis*
Process identification	Define processes clearly Build an integrated AI system
Continuous feedback	Define metrics clearly *Agile Methodology* *Key Performance Indicators (KPIs) – Set clear KPIs for executing the vision*
AI leadership	Establish an AI leader Recruit AI talent and train AI capabilities current staff *Leadership – Have a business sponsor* *Talent – hire right talent to execute vision* *Investment – Need support from top management*

AI governance	Define AI governance Initiate and maintain foundational data capabilities *Education – Employees need basic AI capabilities* *Compliance – Privacy, transparency and protection*

4.2.2. Meaning of Artificial Intelligence

The idea the practitioners have of how Artificial Intelligence is defined differs per interviewee, but there was some clear overlap in their definition. All the interviewees felt like AI is meant to be a human assistant which can take over or assist in a small aspect of a human job. *IR-3* noted that AI is not a stand-alone entity that is able to 'fix everything', as some people in his organization felt like it would do. Implementing and working together with AI is hard work according to the IRs, it requires a lot of preparation with strategizing how best to introduce the AI application in the current work flow for it to be accepted. *IR-1* said that the meaning and goal of AI is to recognize, analyze and execute simple tasks in his domain of manufacturing, *IR-2* and *IR-4* mentioned that the meaning and goal of AI is mainly to execute tasks that require a lot of repetitive data analysis, which is hard to do for humans. Humans can use the outcome from this data analysis to decide what to do with it. The view the interviewees have on AI is similar to the definition of AI in Section 2.1., which states that AI is an computational artefact that exhibits some facets of intelligent behavior in very specific (mostly computational) areas. Furthermore, the interviewees also viewed that cultivating a human-AI symbiosis is of great importance for AI to be effective in an organization, as identified in Section 4.1.1. and Section 4.1.5.

4.2.3. Management techniques used for AI implementation

Talking to the interviewees, no one go-to management technique specifically meant for AI implementation was mentioned. The interviewees did however touch upon management techniques like the agile methodology, Design thinking and DevOps they had used for AI implementation. In some cases, the interviewees use a combination of the management techniques mentioned before.

Agile methodology

A management technique mentioned by *IR-1* and *IR-4* is the Agile methodology. This methodology stimulates constant experimentation, continual process improvement, flexible response to change and cross-functional teamwork. The 'starting small' aspect of the experimentation phase was seen as important to *IR-4*. This helps the team or department to get used to the application during the testing phase, and get feedback fast which helps to improve the application. The fast and continual feedback is done by conducting stand-ups, which are short recurring meetings giving status updates on the projects employees are currently working on. Furthermore, cross-functional cooperation was seen as essential to make AI implementation work within the organization. This can be done by getting feedback and input on the new AI application from several layers and roles within the organization, which helps with discovering requirements for the AI application from several perspectives.
A management technique mentioned by *IR-2* which is closely related to Agile methodology is DevOps. This is short for "Development" and "Operations", which especially focuses on the software development and IT operations aspects. This technique is meant to continuously deliver high quality (AI) software by shortening the development cycle within the system.

This method contains several aspects from the Agile method containing aspects of continuous improvement by experimenting and its feedback loops. *IR-2* mentions that aspects of this technique get used to develop a stable system by automating repeatable steps within the software practitioner's workflow. However, varying organizations have not adopted a DevOps way of working, this makes it hard to implement at organizations according to *IR-2*. Because this management technique aids in providing continuous feedback, its added to the 'continuous feedback' category.

Design Thinking

A management technique mentioned by *IR-2* is the design thinking technique, used to understand the customer journey. The design thinking technique has five stages, which starts with trying to understand the (user) problem and the current assumption in the 'Empathize' stage. After that, the current problems and assumptions get summarized in a problem statement in the 'Define' stage. After this, a brainstorm session to find a solution to the problems will be organized in the 'Ideate' stage. After this, the solutions to the problems found in the Ideate stage will be finetuned in the 'Prototype' stage. Lastly, the prototypes found in the previous stage will be tested in practice and decided upon if the protype is worth scaling up to be implemented in the organization in the 'Test' stage. *IR-2* mentioned this technique helps to create a target vision for the end product. This vision can be used to make the employees get used to the potential change the AI application will bring, because it involves the end users of the AI tool in the design process. Because this tool help identifying the AI vision, this tool is added to the 'AI vision' category.

4.2.4. AI vision

The interview analysis has added two practices and one vision requirement to the 'AI vision' category. The first practice is mentioned in the 'Design Thinking' section which is a tool that helps to identify the AI vision. The second practice is 'AI Vision identification', which is a requirement that all interviewees view as important for AI implementation. An AI vision requirement mentioned by the interviewees is 'Culture', to execute the AI vision the culture should be accepting of AI and presenting the employees that will work with AI with an AI vision helps with this acceptance.

AI Vision identification

A requirement for successful AI implementation that was shared by all the interviewees is that it is important to define an AI vision. This is necessary so that the employees know what they are working towards and why they have to make a change in their working behaviour. The creation of this vision can be assisted by techniques like design-thinking according to *IR-2* to clearly define the critical challenge or goal for the change. The use of agile sprints in this context has also been used, mostly the ability to quickly experiment with prototypes and refine systems on the go is very useful to create a realistic vision according to *IR-1* and *IR-4*. *IR-2* mentions it is important to spend time with the employees or stakeholders that are the end users of the new AI application. Noting that paying attention to specifying how the ideal journey or process will look like, so the person that uses the AI as end product, is very important. According to *IR-3* it is important to clearly define use cases of the AI application or strategy. This is necessary to get everyone on board with the idea by letting them know what to expect. This helps the employees to accept the new way of working more quickly.

This use case should be clearly defined and align with the broader corporate strategy. According to *IR-2* it is necessary to create a digital roadmap to clearly visualize the vision. Within the roadmap, the envisioned AI initiatives should be to current business practices in the organization. This gives a clear overview of the envisaged changes AI implementation brings, which also helps for the AI acceptance within the organization and gives a clear guideline for the employees of what is expected. The identification of an AI vision is also an important aspect for a successful AI transition based on the insights gathered from Section 4.1.1. of the literature review, that is why this requirement is added to the 'AI vision' category.

Culture - Forging Human-AI symbiosis

To fully profit from the capabilities of AI applications it is necessary to have a company culture that is able to interact, adopt and learn with the AI capabilities. One point the interviewees agreed on is that having an AI-accepting culture is essential for making AI in an AI empowered organization a success, and this takes time. It is hard work and takes a lot of time, because you have to prepare the organization for the AI change that will be coming for them to accept it as told by *IR-3*. The interviewees mentioned that when the company culture is open to accepting AI, an effective cooperation between AI and humans can be reached. This is the crux of the concept of 'Human-AI symbiosis' mentioned in Section 4.1.1. and Section 4.1.5. *IR-3* mentioned that before AI capability gets developed within the company culture, it is necessary for upper management to provide a business case to the employees. This is to clearly make known to the employees why working together with AI can help make their work easier. Because providing an AI business case is an aspect of AI vision identification, this vision requirement is added to the 'AI vision' category.

4.2.5. Continuous feedback

The interview analysis has added one practice and one vision requirement to the continuous feedback category. The practice identified is making use of the Agile methodology, which stimulates continuous feedback and process improvement. The vision requirement identified is KPIs, which helps increase employee accountability and a healthy feedback loop.

KPIs - Set clear KPIs for executing the vision

To accomplish the requirements for executing the vision, clear KPIs for executing the vision are needed according to the interviewees. It is essential to have clear KPIs to have a healthy feedback loop, according to *IR-1*, which is useful for continuous improvement and troubleshooting when an aspect of the AI application is underperforming. KPIs can also help the employees to feel accountable for the progress made on AI implementation as noted by *IR-3*. Well-defined KPIs also help to reach a goal in a more focused and structured manner, preventing fragmentation in the implementation process according to *IR-2*. Furthermore it helps to monitor the (lack of) progress of the AI implementation. *IR-2* did note it is important to keep re-evaluating the KPIs set on effectivity, it is possible that during the AI implementation process certain KPIs have to be reimagined, added or removed. According to the interviewees, the KPIs that have to be adopted differ per department, business sector and project and have to be decided upon accordingly. The need for KPI specification and monitoring is also identified as important for an AI transition in Section 4.1.3 and makes it part of the 'continuous feedback' category.

4.2.6. AI leadership

The interview analysis has added three vision requirements to the AI leadership category. The first vision requirement is 'leadership', which calls for a business sponsor to execute the AI vision. The second vision requirement is 'investment, which calls for support from top management for (monetary) investment for executing the AI vision. The third vision requirement is 'talent', which calls for hiring and educating AI talent to execute the AI vision.

Leadership - Have a business sponsor

An essential point brought up by the interviewees is to have the support of leadership from the top to implement an AI transition. This entails that somebody in the higher management hierarchy will function as a 'business sponsor'. Meaning that someone from higher management should be actively advocating and promoting the change the AI transition brings to the business. This will help accelerating the AI transition change process and acceptation of the new technology. According to *IR-4* it does not help for someone from lower to middle management to spearhead the change, usually they do not have the authority to be able to fully realize the change. *IR-4*, and also *IR-3* propose that the change should start top-down, starting with support from the highest level of management, moving down to the lower parts of management. This ties back into the importance of having a vision, when the upper management has established a clear vision, it is easier for lower and middle management to follow the lead. So it start with authority from the top, after that, more autonomy from lower and middle management is possible to execute the (AI) vision. The importance of leadership in the AI transition is also pointed out in Section 4.1.4. of the literature review and subsequently added to the 'Leadership' category.

Investment - Need support from the top

The topic of investment brought up by the interviewees is actually an extension of the previous point of leadership. After the leadership within the company has established a vision to implement an AI transition, they need to follow it up with (monetary) investments. Without the follow up monetary investment, the envisioned change is unlikely to materialize according to *IR-3*. The interviewees agree that implementing AI is not just about talking about it and having a vision, but also a follow up with cash invested at the right places within the company. *IR-4* mentioned that it is essential for the executives and higher management of the company to have a solid understanding of the basics of AI to ensure they make the right investments, and that this knowledge is mostly lacking. Basic understanding within higher management is, however, essential to invest in the right technology or human solution to build reliable and scalable AI applications to optimally profit from its capabilities. Making the right investment decisions is not just investing as much money as possible towards the new AI solution according to *IR-2*. It is also about investing time and effort in forging a new company culture with new management practices, which also means investing in the right AI tools and data infrastructure and education on how to work with the new AI tools and data infrastructure. The aspects of investing in data infrastructure and AI education are also deemed important in Section 4.1.4. and Section 4.1.5. According to *IR-2* it helps to invest in creating new roles like data engineers and architects if these roles do not exist yet. This helps in strengthening the expertise in the field of data science in the company, which is fundamental in making optimal use of AI capabilities. According to *IR-3* it is important that the employees work in a culture that is open to adopting AI, this starts with support from the

top and investing in AI education for the employees. Because investment and support from the top is related to leadership, this vision requirement is added to the 'leadership' category.

Talent – hire right talent to execute AI vision

As mentioned in the Section 4.1.4. of the literature review, having the right talent present at the company helps to execute its (AI) vision. Hiring the right AI talent is a fast way to boost the AI knowledge level, and this employee is also able to familiarize the company and its employees with AI. At the organization of *IR-4* the choice was made to hire an employee that is already knowledgeable of AI and AI applications. This employee was able to support the company's initiatives to apply AI in their business process by cooperating with the stakeholders within the department. *IR-4* felt like hiring this employee greatly enhanced the AI adoption and the acceptance within the department. As mentioned in Section 4.1.4., this newly hired talent can also aid in the AI acceptance within the culture by organizing workshops in-house or in cooperation with an AI consulting firm specialized in executing these workshops. Besides the advantage that hiring AI talent is able to help execute the AI vision, this talent can also help with establishing the vision in the early stages. This is something *IR-1* mentioned, because in practice, a lot of employees (also in higher management) do not have the required knowledge to establish a realistic AI transformation vision for its company. Because executing the AI vision is the job of the AI talent, this vision requirement is added to the 'leadership' category.

4.2.7. AI governance

The interview analysis has added two vision requirements to the AI governance category. The first vision requirement is education, which calls for the employees working with AI to have basic AI capabilities and be conscious of AI ethics. The second vision requirement is compliance, which stresses the importance of being compliant with AI regulations.

Education – Employees need basic AI capabilities

As mentioned in the 'Investment' section, education is essential for executing the vision. Before being able to make effective use of the capabilities of the AI applications, the employees need to be able to understand the applications and how to work with it according to *IR-3* and *IR-4*. Therefore, sufficient training and skill building of AI is necessary, which needs investment and support from the top as mentioned previously. One way to operationalize this is by organizing an AI workshop to explain the basics AI applications and how to work with it for the employees, according to *IR-2*. This workshop can be organized by employees in-house or via an AI consulting firm specialized in giving these kind of workshops or assisting in implementing AI applications and training AI capabilities. Furthermore, employees need to be educated in working together with the new AI applications according to *IR-3*. This ties back in creating a human-AI symbiosis mentioned in Section 4.1.1. and Section 4.1.5. of the literature review. What this means is that current jobs that interact with processes that will obtain a new AI application need to be adjusted to work together with this AI. It takes time to learn and an education program needs to be created to optimally prepare the employee to interact with the AI application. Besides being educated in working together with AI, it is also crucial to be educated on the dangers of AI according to *IR-4*. This include making employees conscious of concerns like privacy, security, fairness,

reliability and transparency. Because this vision requirement focusses on educating employees working with AI in a conscious way, its added to the ‘AI governance’ category.

Compliance - Privacy, transparency and protection

Besides having the right prerequisites in place to correctly execute the broad scope of the established AI vision, it is also important to zoom in on the aspect of data compliance according to the interviewees. The interviewees mentioned that it is important to manage the data well when you want to work with AI applications. This starts with being compliant with the European Union (EU) law and Dutch data protection law (when in the Netherlands) according to *IR-4*. This means that the company’s data needs to be secure and comply to the privacy standards set by the aforementioned government bodies. Besides following the standards set out by institutions, the models should also have as little bias as possible and should be non-discriminatory, and should be tested as much as possible to make sure bias and discrimination happens as little as possible according to *IR-4*. Furthermore *IR-1* noted that the data needs to be categorized correctly to be most useful for analysis, which means that the technical infrastructure and data warehousing should be in order with high clarity. This in turn gives more overview into the data architecture of the organization, which helps with being compliant with the regulations and at the same time profit from the clarity and overview it brings for the organization. *IR-2* noted it helps to have agreed upon practices in the form of a protocol for sufficient model documentation. The protocol helps to reduce human errors and model documentation helps to troubleshoot if something is about to go wrong or needs to be updated. Besides this, it is important to educate the employees on the data regulations and protocols according to *IR-2*, so everyone feels accountable and as little human error is made as possible. The importance of data compliance is also mentioned as an important aspect for AI transition in Section 2.1.5. and Section 4.1.5, which makes it part of the ‘AI governance’ category..

4.2.8. Conclusion semi-structured interview analysis

The semi-structured interview analysis identified the importance of having an AI vision and a clear AI business case before executing an AI transition. Furthermore, two management techniques to conduct an AI transition in a business process and seven requirements to execute an AI vision are identified. The management techniques identified are the Agile methodology (part of the ‘continuous feedback’ category) and design thinking (part of the ‘AI vision’ category. The Agile methodology is characterized by continual improvement, short feedback cycles, flexible response to change and cross-functional teamwork – focussing on *executing* the AI vision. While design thinking is characterized by empathizing with the end user(s) and understanding the customer (or stakeholder) journey – focussing on *understanding* the (potential) need for AI. The first requirement is culture, to successfully implement AI a human-AI symbiosis needs to be forged to create a AI-accepting culture (part of the ‘AI vision’ category). The second requirement is KPIs, they are necessary to enable continuous improvement and fault detection in the AI implementation process (part of the ‘continuous feedback’ category). The third requirements to execute an AI vision is leadership, meaning the AI transition should be supported by a business sponsor (part of the ‘AI leadership’ category).

The fourth requirement is AI talent, to execute the AI vision, the organization needs to hire or educate AI talent that knows how to work with AI applications (part of the ‘AI leadership’

category). The fifth requirement is investment, the AI transition needs to be backed with monetary investment and support from top management (part of the ‘AI leadership’ category). The sixth requirement is education, implying that the employees need to be educated in working with the new AI application (part of the ‘AI governance’ category). The seventh requirement is compliance, the organization needs to have practices in place that ensure privacy, transparency and protection standards in relation to data and AI are upheld (part of the ‘AI governance’ category). All in all, according to the interviewees it is essential to have the right leadership, investment strategy, education, talent, compliance and the KPIs that match these requirements to create an AI accepting culture with human-AI symbiosis.

5 Designing the CoC for AI

In this chapter, the method to solve the design problem and the DQ is presented. First, the method design process will be explained in Section 5.1. Second, in Section 5.2., the MoC in the modern context is assessed based on the literature review and semi-structure interviews of this research. Third, in Section 5.3., all the knowledge gathered from the literature review and the semi-structured interview analysis is integrated to identify a set of requirements for the CoC for AI. Lastly, in Section 5.4. the designed method is presented. In the context of this research, a method is an artifact of well-defined activities for solving a specific problem to achieve a certain goal (March & Smith, 1995). The method created is based on the specified requirements, research insights and the original MoC by Brynjolfsson et al. (1997).

5.1. Method design approach

For the method design process, or treatment design as Wieringa (2014) calls it, special attention is given to the treatment design section of the engineering cycle made by Wieringa (2014) as seen in Fig. 3.1 of Section 3.1. This means that the method design process starts with specifying the requirements which help contribute to solving the design problem. These requirements are specified in Section 5.3, which are based on the information gathered from the structured literature review and the semi-structured interview analysis. Within the requirements specification, arguments are given why the requirements contribute to solving the design problem. This is supplemented with the available treatments to this problem found in the literature review and the interview research. At the end of this chapter, a method is designed which is based on the requirements set and contributes in solving the design problem.

5.2. MoC in the modern context

After having conducted the literature review (Section 4.1.) and the semi-structured interviews (Section 4.2.), no methods similar to the MoC have been identified. There is also no mention of anything related to the change management concepts similar to the MoC like BPR, QFD and the House of Quality. This indicates that the MoC or any of its related concepts does not play a role in the modern context of AI transition. The emphasis in modern literature and in practice for conducting an AI transition (as of 2021) are on management methods with small iterations, like the Agile methodology. This is in contrast with the BPR concept the MoC is based on, which focuses on static planning. Furthermore, this research identifies there is a lot of focus on identifying an AI vision before executing it. The MoC provides in some degree assistance in identifying the vision, by visualizing the current processes and target processes. However, the MoC misses a dedicated ‘ideation’ phase to specify the (AI) vision. Another aspect missing in the MoC based on this research is ‘metric definition’ and ‘continuous feedback’, which is essential for enabling accountability and fault detection. This research also identifies that the identification of change of leaders that are accountable for managing the AI transition for the processes or sub-processes is essential. A specific aspect that identifies this kind of leadership in the current MoC is lacking. Lastly, the current MoC is a very rigid planning tool that lacks flexibility. A way to counter this rigidness and account for continuously changing working conditions, like a continuous feedback loop, is missing in the current MoC.

5.3. Requirement specification

A requirement is a desired property of an artifact in order to reach a certain goal (Wieringa, 2014). In the context of this study, the desired goal is to improve the transition of implementing AI applications in business processes. After a thorough analysis, the researcher has come up with five requirements the method should contain, summarized in Table 5.1. The requirements include: Vision, process identification, metrics, leadership and continuous feedback. These aspects all have to be present within the method.

Table 5.1. Requirements for CoC for AI

NR.	Requirement	Literature	Interviews
R1	**AI vision** - *The (AI) vision should be defined clearly before implementation*	Section 4.1.1.	Section 4.2.3., 4.2.4., 4.2.11.
R2	**Process Identification**- *Business processes and their interrelations should be defined clearly*	Section 4.1.2.	
R3	**Continuous Feedback** - *The artifact should support feedback cycles and identify metrics, to be improved continuously and monitored*	Section 4.1.3.	Section 4.2.3., 4.2.10.
R4	**AI leadership** - *Establish change leaders for the processes that need to be transitioned*	Section 4.1.4.	Section 4.2.5., 4.2.7., 4.2.8.
R5	**AI governance** - *Uphold data standards and minimize algorithmic bias*	Section 2.1.5. and 4.1.5.	Section 4.2.9.

5.3.1. Requirement 1: AI Vision

All the interview respondents noted that it is essential to have a clear AI vision before implementation, this view has been echoed by contributors in literature in Section 4.1.1 and from the interview analysis in Section 4.2.3., Section 4.2.4. and Section 4.2.11. The main advantage of defining a vision before implementation is that the change agents and stakeholders of the company know what the change is meant to look like before it happens. This helps with the acceptance of the AI technology and helps change agents pinpoint what exact changes they will need to make to reach the vision. Therefore, clearly identifying the vision before executing the change management process of AI implementation is a requirement for the method. Within the scope of this research, two available approaches for identifying a vision have been found, which include: Customer Journey and Design Thinking.

5.3.2. Requirement 2: Process Identification

The need for defining the business processes to be changed and its (possible) interrelations with other processes is mentioned in the literature review in Section.4.1.2. This is necessary because AI can have far reaching consequences in the workforce, some roles might change and some roles might not exist anymore when AI gets implemented. So when a change management team wants to execute the AI transition, it is necessary for them to have an overview of the current business processes and the current processes that will be impacted by the AI transition. Therefore, a requirement for the method is set that it should give overview into the business processes and their interrelations. An available approach identified for this within the study is the Matrix of Change (Brynjolfsson et al., 1997).

5.3.3. Requirement 3: Continuous feedback

When implementing a new (AI) technique, changes in the way of working happen quickly. Therefore it is essential to continuously monitor these changes and report on it. This can be done by implementing recurring moments meant to give feedback and suggest improvement on the current way of working based on metrics or KPIs. This is mentioned in the literature in Section 4.1.3. and in the interview analysis in Section 4.2.3. and Section 4.2.10. This makes it an aspect to take into account when adopting AI applications. Therefore the method will have the requirements that it has a continuous feedback loop which continuously monitors and improves the change management plan set out. Available approaches found within this study that include metric monitoring are the Agile methodology and DevOps.

5.3.4. Requirement 4: AI leadership

For the implementation of AI Section 4.1.4. of the literature review and Section 4.2.5., Section 4.2.7. and Section 4.2.8. of the interview analysis, displayed the importance of leadership. An AI transition can bring a lot of changes within the company and in the way the company is structured culturally and technically. To guide the cultural change to create a human-AI symbiosis, the employees which will interact with AI in the future need to accept the AI transition change – this is where good leadership comes in. A prerequisite for a change leader to execute change is a clear vision according to insights from Section 4.2.5. A vision can help the employees visualize the change that is to come, the leader has the role to guide the employees which will interact with AI in the future towards this vision. Furthermore, according to the literature review and the interview research done in this paper, it is important to have somebody accountable for executing the vision. Therefore the requirement is set to establish change leaders for the processes that undergo an AI transition.

5.3.5. Requirement 5: AI Governance

Before a new AI technique is implemented in the current business processes, it is essential to define an AI governance framework to uphold data standards and reduce algorithmic bias according to Section 2.1.5. and Section 4.1.5 of the literature research and Section 4.2.9. of the interview analysis. This helps cultivate an enterprise culture of AI democratization within the organization, furthermore it guarantee that the consistency and quality of the data sets is on an acceptable level to reduce bias and the chance of bad use of data. The application of an AI governance framework also helps to reduce human errors, model documentation for example helps to troubleshoot if something is about to go wrong or needs to be updated. When creating an AI governance framework, the aspects of accountability, inclusiveness, privacy, security, fairness, reliability, safety and transparency as mentioned in Section 2.1.5. should be taken into account.

5.4. The Cycle of Change for AI

After thorough analysis and synthesizing the findings of the structured literature review and the interview research and following the requirements set for the method, the pre-validation version of the CoC for AI is found below in Fig. 5.1.

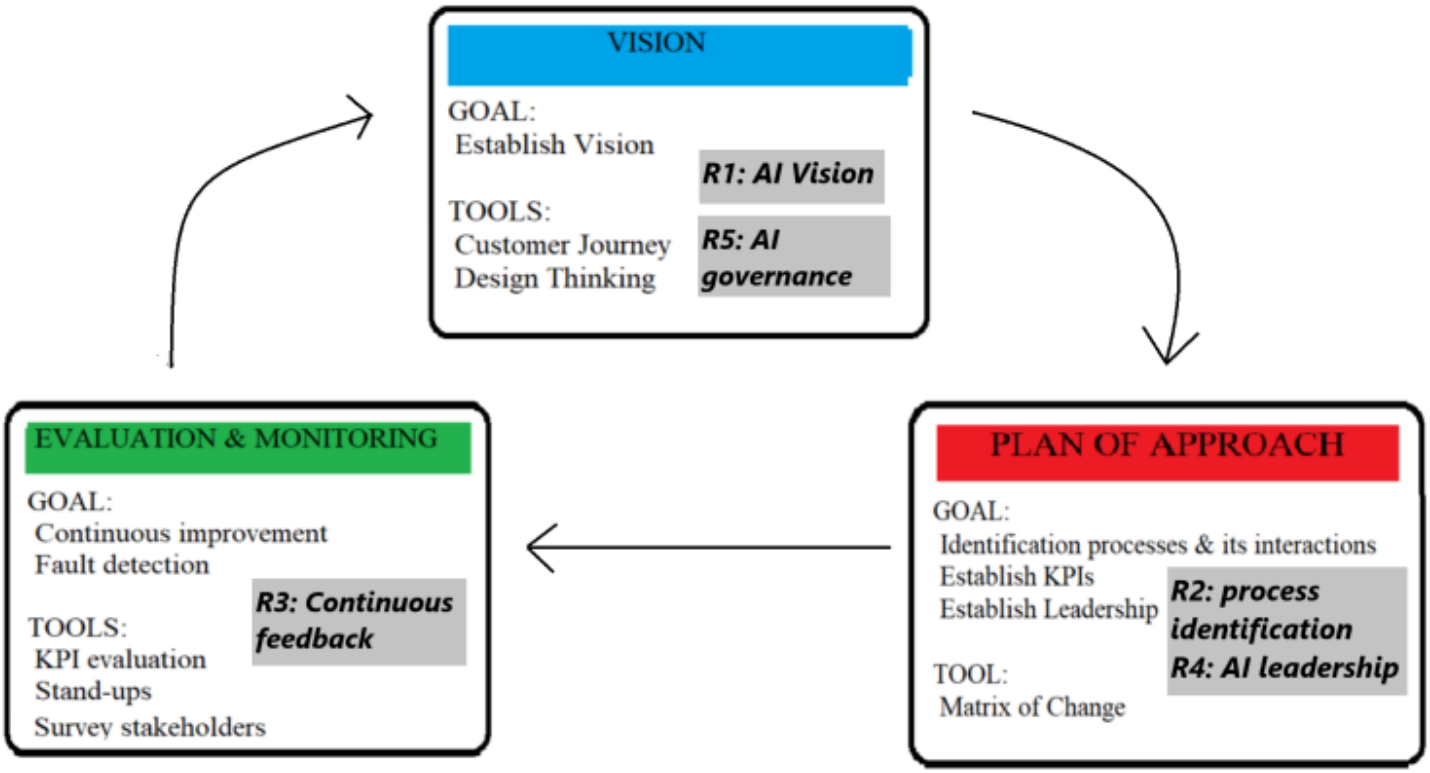

Figure 5.1. Cycle of Change for AI, pre-validation

The CoC for AI has three cyclical components, this starts with Vision, then Plan of Approach and lastly Evaluation & Monitoring before coming back to Vision. A cyclical approach has been chosen to encourage continuous improvement and continuous feedback, as specified in R5. Each component specifies the goal the change agents have to reach, and which tools are recommended to reach this goal. This design choice was made so the teams have an end-goal in mind when working on a component and can make use of the tools they are most comfortable with within the organization. Each component will be introduced more in-depth in the next sections.

5.4.1. Step 1: Vision

The first component is 'Vision' and has been adopted to meet R1 and R5, which requires for the method to have a clearly defined vision and define the AI governance framework. This has been chosen as the first step, because establishing a vision before starting a project and making a plan of approach is essential. Tools recommended for establishing the vision include customer journey and design thinking. These are two tools mentioned by the interviewees during the qualitative research that can help with problem identification and goal establishment, which can be translated into a vision. After every cycle of the CoC for AI, the change agents return to the component vision. This can help keeping the team goal oriented and adapt (if necessary) by altering the vision based on new insights.

The following AI oriented topics are advised to be discussed during the ‘Vision’ process:

- Definition of AI Vision.
- Definition of AI governance framework.
- Definition of AI structure.
- Design an organizational structure which is supportive for AI.
- Definition and assessment of processes clearly in need of AI (‘low hanging fruits’).

5.4.2. Step 2: Plan of Approach

After the vision has been established, the change agents move on to the Plan of Approach stage. Within this stage, the goal of the change agents is to identify the existing processes and their target processes, combined with their interactions. This can be done by filling in the Matrix of Change that also satisfies R2. Besides this, KPIs that help reach and monitor the identified goals should be identified and established, which satisfies R3. Furthermore, leadership should be established that take ownership of reaching the target practices and are made accountable for monitoring KPIs, this satisfies R4.

The following AI oriented topics are advised to be discussed during the Plan Of Approach process:

- Identification of requirements for building an integrated AI system.
- Design a recruitment plan for attracting AI talent and design trainings or workshops to increase AI capabilities among current staff.
- Establishment of (change) leadership with top management support and appoint a change leader for each process.
- Definition of an agreed upon solid AI planning.
- Clear communication of the business case.
- Definition of clear metrics together with stakeholders to enable metric accountability.
- Initiation and maintenance of foundational data capabilities to build an integrated AI system.

5.4.3. Step 3: Evaluation & Monitoring

After the ‘Vision’ component and the ‘Plan of Approach’ component have been completed, the Plan of Approach will be executed and the AI transition will start. The leadership will decide on a recurring moment to evaluate and monitor the progress of the AI transition, a tool like a project dashboard can be used to assist this process. The goal of this component is to continually improve the current way of working and detect faults early on in the process. This can be done by evaluating the KPIs, doing recurring meetings (stand-ups) and conduct surveys amongst stakeholders, which satisfies R3. After this process has been conducted, the change agents will take the insights gathered from the evaluation and monitoring session back to the Vision component to decide to follow up with the current vision or adapt.

6 Validating the CoC for AI

In this chapter, the validation approach of the method validation is explained in Section 6.1. Furthermore, the results of the expert validation session of the pre-validation CoC for AI is given in Section 6.2. The insights from the expert session is assessed and applied to the CoC for AI to create the post-validation method in Section 6.3. The post-validation method is assessed one more time with an expert session and the final version of the CoC for AI is presented in Section 6.4. Lastly, in Section 6.5. the researchers has made final adjustments to the CoC for AI method and demonstrated its use with an AI transition case.

6.1. Validation Approach

After the requirements have been set and the pre-validation method has been designed, it is time to validate the method. In this stage, the effectiveness to contribute to stakeholder goals and requirements of the designed artifact in the problem context have to be justified. This has been done by conducting an expert feedback session. Before the expert participated in the expert feedback session, for ethical and informational purposes, the researcher sent an expert session information sheet containing the evaluation criteria & questions (A.5.) and an informed consent form (A.6.). These documents contain information on the purpose of the research, its ethical implications and asks the expert to formally verify he/she understands and agrees with participating in the research.
During the information session, the researcher gave a presentation to introduce the method. After a discussion and brainstorm session about AI, change management and the CoC for AI, the expert filled in the evaluation criteria form and gave answers to the evaluation questions. The evaluation is based on a selection of three factors for information systems evaluation as mentioned by Prat et al. (2014): understandability, completeness and usefulness.
The insights collected from the validation method are used to improve the designed artifact and to stimulate academic discussion on the artifact. After the improvements gathered from the validation method have been implemented, a final summative evaluation round of the final version of the artifact is conducted by presenting the applied changes to the method to the expert. A discussion follows, the insights gathered from this discussion are evaluated (possibly implemented) and can be used for recommendations for future research on the artifact.

6.2. Evaluation Results

Within this section, details about the evaluation criteria will be further introduced and the outcome of the evaluation are presented. The questions the evaluation criteria are based on can be found in appendix Section A.5.

6.2.1. Understandability

To assess the understandability of the method, two closed questions on a 5-point Likert scale and one open question have been answered. With the understandability criterion, the researcher aims to assess if the given names, concept, visuals and the method in general are understandable. Furthermore, the researcher asks for feedback from the expert on what could be done to improve the understandability of the method.
The expert felt neutral on both of the two closed questions on understandability, meaning there is room for improvement to make the method more understandable. The expert gives as feedback that the components should be numbered, to emphasize that the first step is to assess

the Vision (1), then Plan of Approach (2) and then Evaluation & Monitoring (3). Furthermore, the expert noted that the component 'Vision' should be renamed 'AI Vision'. This is because just the term 'Vision' is very broad and the term 'AI Vision' makes the focus within the component more specific on AI. The expert also felt that, especially with AI, it is important to first test the AI application in one department and then in other departments. So the expert mentioned that each department requires its own AI vision with its own timeline and each department that implements AI applications later, can learn from the departments that have already implemented AI applications.

6.2.2. Completeness

To assess the completeness of the method, one closed question on a 5-point Likert scale and one open question have been answered. With the completeness criterion, the researcher assesses if the CoC for AI method covers all necessary steps accurately, is not missing any components or perhaps has redundant steps.
The expert agreed with the identified steps of the method, noting that the researcher should not add new components or leave components out. The expert did mention that the researcher should keep in mind that 'Vision' component has a longer time interval than the other two components, and that it is not necessary to keep returning to the 'Vision' component after the 'Evaluation & Monitoring' component has been completed. The expert advised to add an extra arrow that goes from the 'Evaluation & Monitoring' component back to the 'Plan of Approach' component. Because, according to the expert, it is not necessary to keep going back to reassessing the vision after the evaluation & monitoring phase is done. The expert noted that
the loop the additional arrow between 'Plan of Approach' and "Evaluation & Monitoring' creates will have smaller time intervals, which will most likely help with monitoring the progress of the AI transition.

6.2.3. Usefulness

To assess the usefulness of the method, one closed question on a 5-point Likert scale and one open question have been answered. With the usefulness criterion, the researcher examines if the CoC for AI method addresses the problems faced with managing an AI transition and adds value to the organization in that aspect.
The expert agreed that the method addresses the problems faced with managing an AI transition. The expert mentions that the method gives insight, overview and commitment within the organization to follow the changes of the transition of the processes within the organization.

6.3. CoC for AI – post-validation

After assessing the outcome of the expert valuation session, the post-evaluation method of the CoC for AI has been created and is presented in Figure 6.1. below. The following three changes have occurred to improve the CoC for AI. The first change is that the 'Vision' component has been renamed to 'AI Vision'. This change has been adopted to emphasize that the CoC for AI focusses on AI implementation. Furthermore, this change helps to narrow the scope of the vision, making it easier to make targeted changes. The second change is that every component is numbered now, starting with (1) for 'AI Vision', (2) for 'Plan of Approach' and (3) for 'Evaluation & Monitoring'. These changes have been adopted to

emphasize that the CoC for AI starts at the component ‘AI Vision’, and progresses to the other components from that starting point. The third change that has been implemented is that an extra arrow has been added that goes from component (3) ‘Evaluation & Monitoring’ to component (2) ‘Plan of Approach’. This change has been made to create a shorter feedback loop between these two components. Another reason this change has been made is to prevent that after every evaluation & monitoring session the AI Vision will change. Having a solid AI Vision that does not change every cycle can help with creating stability in establishing the AI transition. However, it is still important to evaluate if the current AI Vision is still viable in component 3. Only if the decision is made that the AI Vision is unviable, the change agent can return to component 1 and reassess the AI Vision.

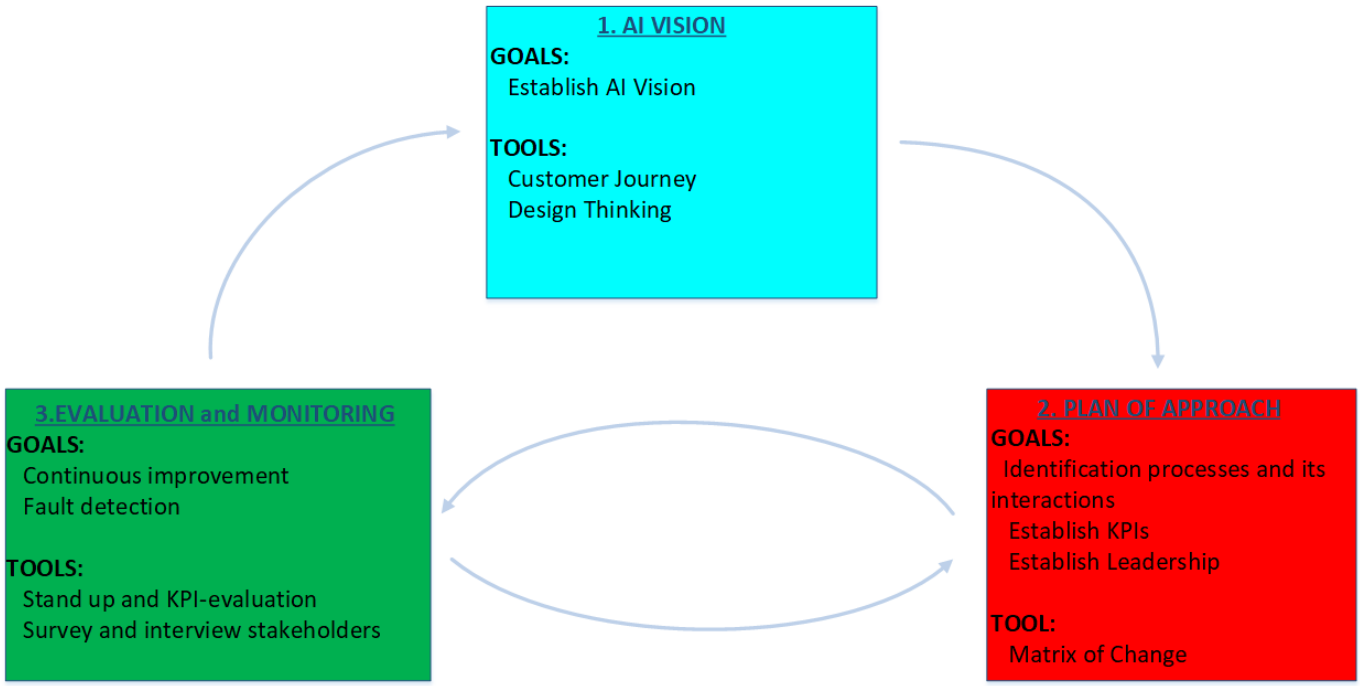

Figure 6.1. CoC for AI

6.4. Final evaluation results

For the final assessment, another expert session is conducted with the post-validation CoC for AI. This post-validation expert session is conducted with the same expert as the pre-validation expert session. Furthermore, the same evaluation tool as for the pre-validation expert session is used, which are the evaluation criteria and questions found Section A.5. The expert agreed with the improvements made to the CoC for AI. The expert mentioned that the method is more understandable, complete and useful in general. The expert did not have any feedback to improve the method. This means that the CoC for AI found in Figure 6.1. is the final version of the method for this research.

6.5. Final Adjustments

After the final assessment had been conducted with the expert session, the researcher had chosen to reassess the CoC for AI to increase its clarity and makes its relations to the original MoC more clear. A change made within the 'AI Vision' component is that two *goals* have been added which are 'identify existing practices and 'identify target practices. These goals correspond to step one of the MoC, which is specified under *tools*. This choice has been made because identifying existing and target practices helps with clarifying the transition happening between processes when implementing the AI vision. Furthermore, the goal 'define AI governance framework' has been added explicitly to clearly satisfy R5 'AI Governance' and assure that the AI vision gets executed ethically. A change made within the 'Plan of Approach' component is that under *goals* the 'identification processes & its interaction' is removed and replaced with 'conduct steps 2, 3 and 4 of MoC'. This choice has been made to clarify that this component follows up on MoC step 1 from the AI Vision component and clarifies that the complete MoC is filled in within this component. Furthermore the choice has been made to clarify that a goal within this component is to interpret the MoC and that the tool to do this is the full MoC. A small change made within the 'Evaluation & Monitoring' component is made to rename the tool 'stand up' to 'feedback session', this is to improve clarity. Another change made is adding assertions along the lines which connect the components to clarify the interactions between the components and improve interpretability. From the component 'AI Vision' to the component 'Plan of Approach' the word *Implementation* implies that the AI vision is implemented in the plan of approach. From the component 'Plan of Approach' to the component 'Evaluation & Monitoring' the word *Execution* implies that after (aspects of) the plan of approach is executed an evaluation and monitoring session will take place. From the component 'Evaluation & Monitoring' to the component 'Plan of Approach' the word *Feedback* implies feedback to the execution of the plan of approach is given. The loop between *Execution* and *Feedback* also represents a small

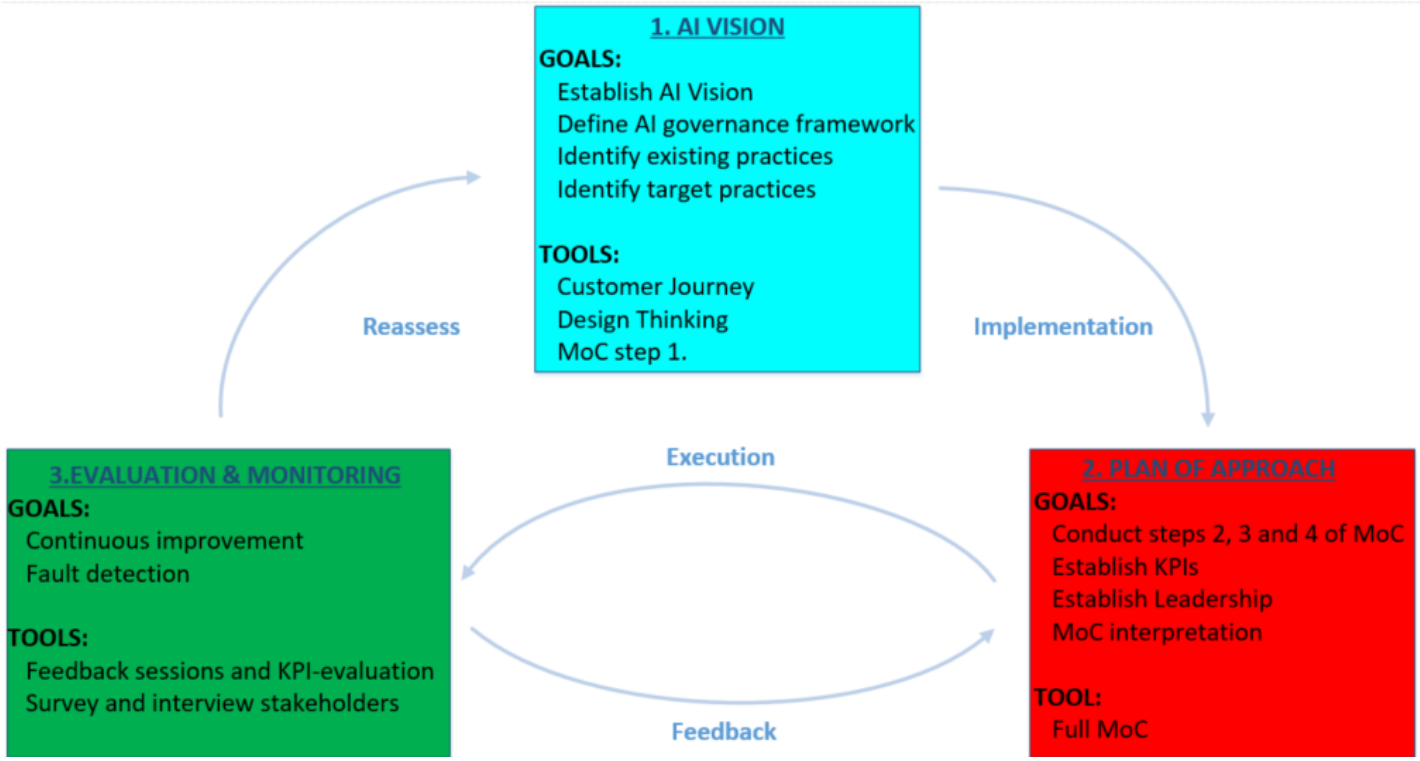

Figure 6.2 Final version Cycle of Change for AI

feedback loop between the two components. From the component 'Evaluation & Monitoring' to the component 'AI Vision' the word *Reassess* closes the big feedback loop and reassess the AI vision *if* it is deemed necessary by the team during the evaluation and monitoring session.

6.5.1. Human-Centered Intelligent System adoption case

The use of the final version of the CoC for AI is demonstrated by conducting a theoretical case with the CoC for AI based on a real life case on the implementation of an AI application which is made by Klein-Koerkamp (2019). In the case by Klein-Koerkamp (2019), an AI application in the form of a clinical decision support system (CDSS) gets implemented. An application of a CDSS within healthcare is making predictions with ML based on large datasets to detect diseases and predict the development of diseases. In the case, a CDSS gets applied to support the physicians' decision-making process on whether or not to administer antibiotics based on the probability on sepsis for premature born babies identified by the CDSS. This asks for a change in the existing practices wherein a physician conducts the decision making process of administering drugs to premature born babies without a CDSS, to a target practice where a CDSS supports the physicians' decision making process. To aid with the transition, the CoC for AI can be used as a tool to implement the CDSS in the existing work processes.

Component 1. AI Vision

Establish AI Vision

The AI vision in this case is already clear, so the customer journey and the design thinking tools do not have to be used. The AI vision is as follows: implement a CDSS tool which analyzes a large medical dataset to predict the probability on sepsis for premature born babies and supports the physicians' decision-making process on administering antibiotics (Klein-Koerkamp, 2019).

Define AI governance framework

For the definition of the AI governance framework, the regulations of the Dutch data protection laws are taken into account because this case takes place in the Netherlands. Furthermore, the Governance Model for AI in Healthcare (GMAIH) found in Section A.7. by Reddy et al. (2020) is used. The GMAIH model has four main components of fairness, transparency, trustworthiness and accountability. Because this case is only for illustrative purposes, only one recommendation from the 'fairness' component (design of AI models ensuring procedural and distributive justice) and one recommendation from the 'trustworthiness' component (educate clinicians and patients about AI) is implemented in the MoC.

Identify existing practice(s)

The existing practices and its constituent process identified are summarized in Table 6.1.

Table 6.1 Identified existing practice(s) and its constituent processes

Existing practice	**Constituent processes**
Antibiotics administering decision making by physician without CDSS	1. Physician inspects an infection
	2. Physician takes a blood culture

	3. Physician examines blood culture for bacteria in laboratory
	4. Blood culture is examined by Gram staining when it contains bacteria
	5. Decision is made based on physician's examination

Identify target practice(s)

The target practices and its constituent process identified are summarized in Table 6.2.

Table 6.2 Identified target practices and its constituent process

Target practices	**Constituent processes**
CDSS assisted Antibiotics administering decision making by physician.	1. Physician inspects an infection
	2. Physician takes a blood culture
	3. Physician examines blood culture for bacteria in laboratory
	4. Blood culture is examined by Gram staining when it contains bacteria
	5. Decision is made based on the combination of the physician's examination and the CDSS system
Design of AI models ensuring procedural and distributive justice	Create an AI fairness protocol Create data collection and utilization strategy
Educate clinicians and patients about AI	Organize workshop to educate clinicians Inform the parents of the patients of the use of the CDSS

Component 2. Plan of Approach

Implement AI vision

In this stage, the aspects found within the AI Vision component will be evaluated. Based on this evaluation the MoC is filled in for this case, KPIs for the target practice are identified and leadership is established.

Fill in full MoC

The MoC is filled in based on the aspects identified in the AI Vision component.

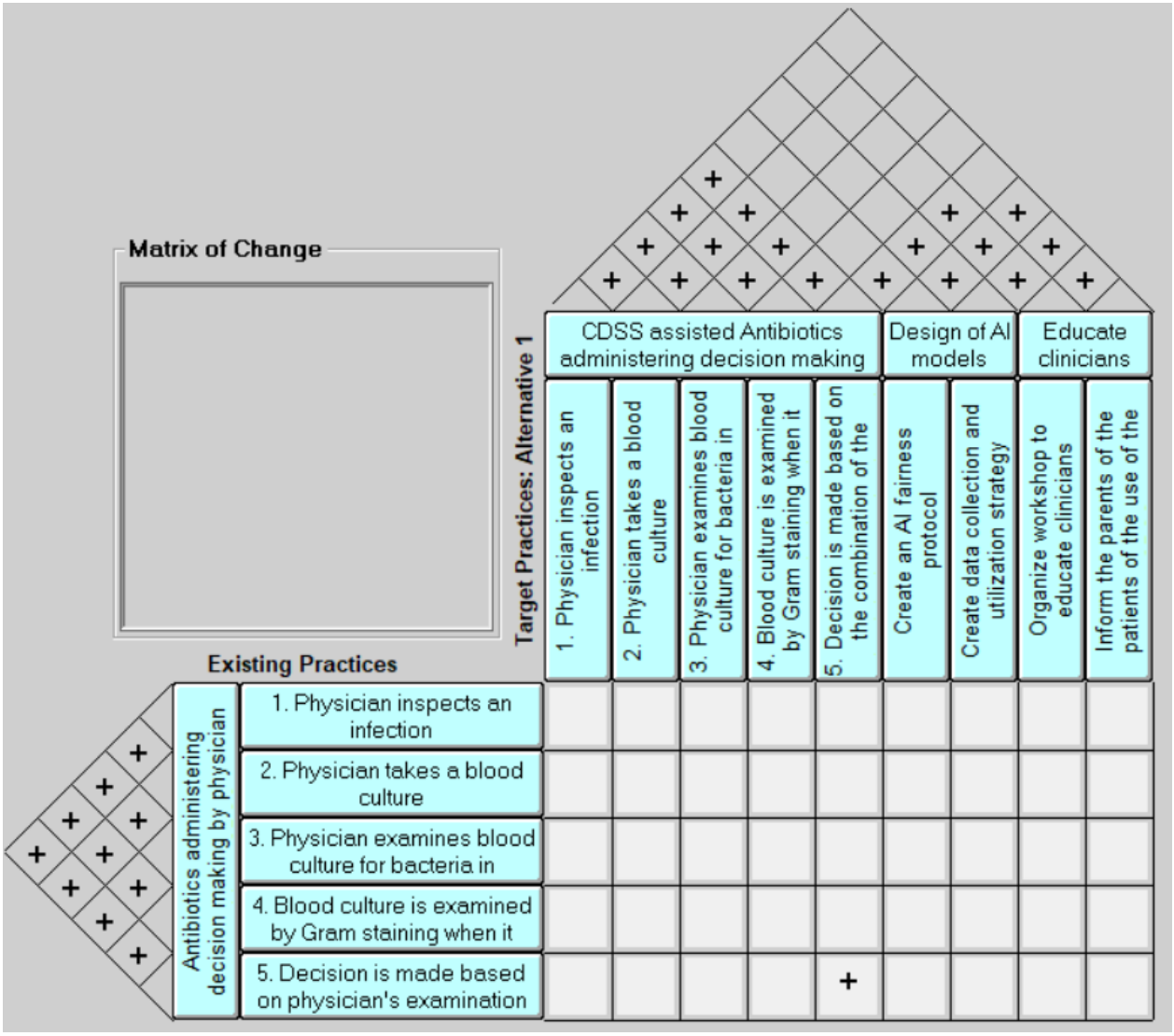

Figure 6.3 CoC for AI (theoretic CDSS case)

Interpret MoC

The MoC displays only complementary interactions between the existing processes and the target processes. This is because every step within the existing an target practices depends on the previous steps and they do not interfere with each other. The 'design of AI models ensuring procedural and distributive justice' and educate clinicians and patients about AI' also contain mostly complementary practices. In the transition matrix nearly all interactions are neutral because four of the five processes stay the same. The only process that changes is that the decision making process of administering antibiotics is assisted by a CDSS tool in the target process. This transition is identified as a complementary practice, because the physician is not hindered by the new CDSS tool, he or she only needs to be educated to work with the new tool and is not dependent on the tool.

Establish KPIs

Four KPIs are identified.

The first KPI is *process time decision making*, this KPI can be evaluated to assess if the process time of decision making gets longer or shorter when making use of the CDSS tool.

The second KPI is *amount of times physician consults the CDSS during the decision making process*. This KPI helps to assess if the CDSS tool gets used at all during this critical decision making process. The third KPI is *percentage of false negatives registered by the CDSS*, this can be assessed to find out how reliable the CDSS tool is. The fourth KPI is *amount of clinicians that attended the AI workshop*.

Establish leadership
In this case, the leaders established responsible for the transition are the physician and a hospital manager.

Component 3. Evaluation & Monitoring

Execute plan of approach
After the plan of approach is executed, the plan of approach and the AI Vision get evaluated and monitored. During the evaluation and monitoring session, the identified KPIs are evaluated and feedback is given on the current way of working by a selection of stakeholders. The stakeholders identified are the physician, ethicist, management hospital, CDSS developer, IT department hospital, physician and regulatory entities (Klein-Koerkamp, 2019). The CDSS implementation challenges referred to in this section are taken from the study by Klein-Koerkamp (2019) and Wijnhoven (2021).

Find improvement in the current plan of approach
The current plan of approach should get extended to reflect a bigger scope with the inclusion of more stakeholders. The plan of approach should include processes, KPIs and representative change leaders of every stakeholder identified by Klein-Koerkamp (2019) mentioned in the previous paragraph. However, these are not mentioned in depth in the study by Klein-Koerkamp (2019) and is beyond the scope of this example.

Detect faults in the current plan of approach
A number of challenges have been summarized by the study of Wijnhoven (2021), a notable challenge is the issue of maintaining good data quality. This means that the data policies, architecture and infrastructure should be improved. Furthermore, the employees that work with the dataset should attend a data management workshop to improve their skills and improve their technological readiness level.

Provide feedback for plan of approach
The current plan of approach will be discontinued because it does not account for enough factors of the system surrounding the change.

Reassess AI Vision if necessary
In this particular case, the change agent should go back to the AI vision component and reassess the vision with the inclusion of more stakeholders.

7 Conclusion and Discussion

This chapter sums up the research, starting by answering the research questions in Section 7.1. Furthermore, this chapter discusses the contributions and implications of the research results for researchers (Section 7.1.1.) and practitioners (Section 7.1.2.). In Section 7.2. the validity, limitations and reliability of the research are addressed. In Section 7.3. recommendations for future research are given.

7.1. Research Contribution

This research started with the motivation to provide a holistic change management method to implement AI in business processes. This motivation stemmed from the increased interest and application of AI in business processes in practice, combined with little academic research on a practical change management tool which aids change agents managing an AI transition in business processes. The aim of this research is to give a solid contribution and good starting point for future research on this topic. This has been done by answering one general research question, two knowledge questions and one design question. The knowledge questions were fundamental in understanding the current stage of knowledge on the research topic in both academics and practice. This knowledge was essential to answer the research & design question and solving the design problem. Below, each research question is discussed and the answer to each research question is given.

KQ 1. Which practices or methods to conduct an Artificial Intelligence transition in a business process are mentioned in the literature?

The KQ 1. is answered by conducting a systematic literature review to find out which practices or methods to implement an Artificial Intelligence transition in a business process are mentioned in the literature. *Nine* practices used to conduct an AI transition in business processes have been found. The *first* practice identified is to build an integrated AI system, this means that the new AI application should be well integrated with the current business processes. The *second* practice identified is to define AI governance, this helps cultivate consistent quality data practices and helps cultivate a company culture that works well together with AI. The *third* practice identified is to design an organizational structure which is supportive for AI, meaning identifying business processes where AI can aid humans and adjusting these processes to create a human-AI symbiosis. The *fourth* practice identified is to define metrics clearly, this enables metric accountability and effectively track the performance of the implemented AI application. The *fifth* practice identified is to define processes clearly, this helps in identifying if AI provides improvements for the current processes and helps to make a targeted changes if the choice is made to implement AI. The *sixth* practice identified is to define solid AI planning and vision, this provides the basis for an AI strategy, defines key business objectives and enables the creation of a business case for AI implementation. The *seventh* practice identified is to establish an AI leader, this AI leaders is responsible for communicating and executing (aspects of) the AI strategy, which helps stimulate the openness for AI adoption within the company culture. The *eighth* practice identified is to initiate and maintain foundational data capabilities, which refers to managing and structuring data maintaining data capabilities. The *ninth* practice identified is to recruit AI talent and train AI capabilities current staff.

KQ 2. Which practices or methods to conduct an Artificial Intelligence transition in a business process are used in practice?

The KQ 2. is answered by conducting a semi-structured interview analysis to find out which practices or methods to implement an Artificial Intelligence transition in a business process are used in practice. The semi-structured interview analysis identified the importance of having an AI vision and a clear AI business case before executing an AI transition. Furthermore, *three* management techniques to conduct an AI transition in a business process and *seven* requirements to execute an AI vision are identified. The management techniques identified are the Agile methodology, DevOps and design thinking. DevOps and Agile are characterized by continual improvement, short feedback cycles, flexible response to change and cross-functional teamwork – focussing on *executing* the AI vision. While design thinking is characterized by emphasizing with the end user(s) and understanding the customer (or stakeholder) journey – focussing on *understanding* the (potential) need for AI. The *first* requirements to execute an AI vision is leadership, meaning the AI transition should be supported by a business sponsor. The *second* requirement is investment, the AI transition needs to be backed with monetary investment and support from top management. The *third* requirement is education, implying that the employees need to be educated in working with the new AI application. The *fourth* requirement is talent, to execute the AI vision the organization needs to hire or educate talent that know how to work with AI applications. The *fifth* requirement is compliance, the organization needs to have practices in place that ensure privacy, transparency and protection standards in relation to data and AI are upheld. The *sixth* requirement is KPIs, they are necessary to enable continuous improvement and fault detection in the AI implementation process. The *seventh* requirement is culture, to successfully implement AI a human-AI symbiosis needs to be forged to create a AI-accepting culture. All in all, it is essential to have the right leadership, investment strategy, education, talent, compliance and the KPIs that match these requirements to create a AI accepting culture with human-AI symbiosis.

DQ: *How can the Matrix of Change be (re)designed to be a viable Artificial Intelligence transition method?*

The DQ has been answered by using the insights gathered from the literature review and the semi-structured interview analysis. Based on those insights, five requirements for creating a viable AI transition method which makes the MoC a more viable AI transition method have been identified. The first requirement identified is ‘Vision’, according to the research a (AI) vision should be defined clearly before implementation. The second requirement is ‘Process Identification’, which states that business processes and their interrelations should be defined clearly. The third requirement is ‘Continuous Feedback’, which states that the artifact should support feedback cycles used to improve and monitor the business processes. The fourth requirement is ‘AI leadership’, which states that change leaders need to be established that are responsible for the processes that are to implement AI applications. The fifth requirement is ‘AI Governance’, which upholds the data standards and reduces algorithmic bias.

RQ: How to create a holistic change management method for Artificial Intelligence implementation in business processes?

Based on the requirements identified to redesign the MoC found by answering the DQ, a pre-validation method of the CoC for AI has been made, which is presented in Fig. 5.1. This in turn got assessed and improved by conducting an expert feedback session and making final adjustments. This resulted into the creation of the final version of the CoC for AI (Fig. 6.2.)
The final version of the CoC for AI presents a holistic change management method for Artificial Intelligence implementation in business processes. This method contains three components, one big feedback loop and one small feedback loop. The first component is 'AI Vision', which is followed by the second component 'Plan of Approach' which leads to the third component 'Evaluation & Monitoring'. Components 1 to 3 create a big closed loop which start at component 1. In component 1 the *AI vision* is identified, which is implemented into component 2, the *plan of approach*. The execution of the *plan of approach* gets *evaluated and monitored* in component 3. Based on the *evaluation and monitoring* outcome, the *AI vision* gets reassessed and the big loop continues. The small feedback loop is between the 'Plan of Approach' component and the 'Evaluation & Monitoring' component. When (parts of) the *plan of approach* get executed, an evaluation and monitoring session will follow. The feedback gathered from this session will be fed back into the execution of the *plan of approach* and the change agents decides if improvements need to be made to the current *plan of approach*.
The combination of the answers to the two KQs and the DQ have provided the answer to the RQ. This has led to a number of theoretical and practical contributions which will be discussed in Section 7.1.1. and Section 7.1.2. respectively.

7.1.1. Theoretical contributions

As mentioned in the Section 4.1., little academic research has been done till now on the change management process of implementing AI in business processes and practical methods of AI implementation have not been identified in the literature. This research has uncovered this by conducting a literature review on the topic. Furthermore, the literature review has uncovered nine practices used to implement an AI transition in business processes mentioned in literature, as summarized in Table 4.1. The practices identified can be used as directions for new research or can be used for argumentation purposes in new research.
Besides having conducted the a systematic literature on the topic of AI implementation in business processes, this research also conducted a semi-structured interview on the topic. The semi-structured interview has uncovered varying interesting insights practitioners come across when implementation AI in business processes, summarized in Table 4.3. and Table 4.4. This includes the management techniques practitioners use to implement AI applications in business processes, the importance of having an AI vision and the requirements to correctly execute the AI vision.
Furthermore, this research has identified design requirements for a method that aids in the AI transition of business processes, as summarized in Table 5.1. This research has investigated the requirements necessary for creating such a method, therefore furthering the theoretic knowledge of method creation for this topic. These requirements have been used to conduct the first effort in research for creating a method specifically meant for guiding the business process AI transition, called the CoC for AI. This method has been validated in an expert

feedback session and by conducting a theoretical case, which can be found in Figure 6.2. of Chapter 7. The CoC for AI is an effort to create a holistic method for AI implementation in business processes, and gives a basis for discussion and improvement on AI implementation methods. Besides this, the method designed, and the design process conducted to create this method give insight into the specific problems encountered when implementing AI in business processes. Furthermore, it offers a set of factors and tools to handle these problems, giving a solid basis for further research.

7.1.2. Practical contributions

This research has uncovered a number of aspects that are useful for change agents dealing with an AI transition in business. First of all, this research has identified and summarized what best practices and methods to implement an AI transition in a business process are mentioned in academic literature in Table 4.1. This summary of AI transition practices identified can be used by practitioners that want to conduct an AI transition as talking points for strategizing and decision making. Second of all, the research has summarized the best practices and methods practitioners use for AI implementation in business processes in Table 4.4. These insights, combined with the insights from the practices identified in the systematic literature review, can give practitioners a broad overview of aspects to take into account when conducting an AI transition. This can be of great value of making leadership conscious of the techniques and practices currently available for conducting an AI transition. The third and most notable aspect that will be useful for practitioners, is the final version of the CoC for AI method. The CoC for AI aims to provide a holistic approach of applying AI into business processes. This is an useful tool for change agents to guide the change management process of implementing AI in business processes.

7.2. Validity, reliability and limitations

In this section, the quality of this research is examined by assessing its construct validity and reliability. Furthermore, the limitations of this study will be discussed.

7.2.1. Validity

For assessing the validity of the study, the construct validity of the study is investigated. This means that the extent to which the researcher has used correct operational measures for the concept which has been studied is assessed (Yin, 2009). The researcher has made the design choice of triangulation to increase the validity of the research. Triangulation is a research strategy making use of multiple methods and data sources to increase validity by getting information from multiple sources (Carter, Bryant-Lukosius, DiCenso, Blythe, & Neville, 2014).

The researcher has done this by conducting a systematic literature review, a qualitative study in the form of semi-structured interviews, and an expert feedback session. The systematic literature review made sure the bias has been minimized and consistency maximized by having exclusion- and inclusion criteria for systematically searching for scientific research. However, this also increases the chance that some concepts or research has been overlooked because it did not match with the exclusion- and inclusion criteria or is not present on the chosen literature database. To combat this, the snowballing technique has been applied, but there will always be a chance relevant research has been overlooked during the systematic literature review process.

Besides consulting existing academic studies, the researcher has made use of human sources of information in the semi-structured interviews and expert opinion. This means that the research might be influenced by subjective judgment of experts. To reduce this bias, the researcher has conducted the interviews with experts in the field from different organizations and varying levels of experience in the field. This helps to get a more broader perspective on the subject. However, the amount of interviews conducted was four, and the target amount of interviews was five or more. So because of the low amount of interviews conducted, some bias towards certain perspective may have been included in the research. Another source of bias may have occurred in the expert opinion session, because only one expert has participated in the expert session. This mean that there is an increased chance that the opinions of both the researcher and this one expert may have influenced the outcome of this study.

7.2.2. Reliability

The reliability of the study assesses whether the research process would yield the same results when another researcher repeats the steps (Yin, 2009). Several design choices taken by the researcher have contributed to safeguard the study's reliability. Starting with the design choice of following the Design Science method by Wieringa (2014). This method follows a set amount of steps conducted within the research process which can easily be reproduced by other researchers. Furthermore, the researcher has elaborated on the steps taken to conduct the systematic literature review, which can be reproduced. Besides this, the researcher has created a reproducible protocol for the semi-structured interviews (Section A.2.) and a reproducible evaluation sheet for the expert validation session (Section A.5.). The outcome of the interview and expert evaluation session can be different when reproduced, but this only adds to the body of research of the topic and does not nullify any of the research already done on the topic in this study.

7.2.3. Limitations

The research has had a couple of limiting factors, starting off with a couple of factors the researcher did not have any control over. This research took place during the COVID-19 pandemic, which made it impossible to meet AI experts face-to-face and resulted into having to do every interview and expert session online. This may have influenced the data collection process compared to conducting the meetings face-to-face. Another limiting factor is the limited network of the researcher, limited amount of AI implementation experts currently in the field, and a limited amount of experts willing to do an interview. Without this limiting factor, a lot more data and knowledge on the AI transition topic could have been gathered. Another limitation is the fact that the validation process of this research has only one expert to conduct the expert evaluation. This was due to time constraints and other limiting factors. A better option would have been to conduct the validation with at least two expert panels, each containing at least two experts. This would have increased room for discussion and would have provided more feedback. Besides this, an option would have been to conduct an AI transition case study, applying the CoC for AI in practice. This would have given the researcher the opportunity to identify how practitioners would interact with the method in practice, giving interesting insights for improvement of the method.

7.3. Future research

The field of academic literature on AI implementation in business processes is relatively limited, even though AI in business is a widely discussed topic. The systematic literature review in this paper has already proven that there are still a lot of research opportunities available in the field of change management of an AI transition in business. Besides this, there are also research opportunities in the field of AI transition method design.

The first opportunity for future research is to extend on this research by further validating and improving on the CoC for AI – or creating a completely different method based on insights of this research. This study has given a very solid basis for further research on AI transition method design by conducting a systematic literature review, qualitative interview study and method design with expert opinion. Validation of this method could be done for example by applying the CoC for AI in a real organization and learn from its interactions in practice. A method suitable for this could be a Technical Action Research, as mentioned by Wieringa (2014). Another way to extend on this study, is by conducting the semi-structured interview of this study with more interview respondents. This can give more insights into the practices and methods used for AI transition in business.

A second research opportunity could be to apply the CoC for AI in a change management situation where no AI transition takes place. This could be done to assess if the CoC for AI can be of used in other business situations than just the implementation of AI applications in business processes. For example a reorganization that asks the organization to work with a new software solution that changes a lot of business processes.

A third research opportunity is to do research on how to define an AI Vision, and what tools help to define and operationalize this vision. This will be a great asset for improving the first step of the CoC for AI. On the same note, research can be done on step 2 and 3 of the CoC for AI. This research could focus on defining requirements for creating a plan of approach for AI transition in business. This could be extended by doing research on what metrics or KPIs should be defined for progress evaluation and monitoring in an AI transition. Another interesting research avenue within the plan of approach component of the CoC for AI, would be on leadership within an AI transition. Including identifying capabilities, leadership style or knowledge the leader is required to have to lead a successful AI transition in business.

A third research opportunity can be based off of the practices identified during the systematic literature review in in Table 4.1. A researcher could dedicate a whole research on doing a deep dive on one of the practices identified. Research avenues include a study or method on identifying the requirements of building an integrated AI system of a business. A study which defines what factors are necessary for an organization to be supportive of AI adoption, including a study which offers a method to help in creating AI acceptance within a company.

A fourth research opportunity is to assess the management methods the practitioners currently use for managing an AI transition, as found in Table 4.4. Research could be done on the effectivity of using the Agile methodology, Design thinking, and DevOps for managing an AI transition in a business.

8 References

Agrawal, A., Gans, J., & Goldfarb, A. (2018). *Prediction machines: the simple economics of artificial intelligence*: Harvard Business Press.

Alsheibani, M., Cheung, Mazoon. (2020). *Winning AI Strategy: Six-Steps to Create Value from Artificial Intelligence*. Paper presented at the AMCIS.

Alsheibani, S., Cheung, Y., & Messom, C. (2019). *Factors Inhibiting the Adoption of Artificial Intelligence at organizational-level: A Preliminary Investigation.* Paper presented at the AMCIS.

Attaran, M., & Deb, P. (2018). Machine Learning: The New 'Big Thing' for Competitive Advantage. *5*, 277-305. doi:10.1504/IJKEDM.2018.10015621

Awalegaonkar, B., Douglass, Reilly. (2019). AI: BUILT TO SCALE From experimental to exponential. *Accenture*.

Babbie, E. R. (2013). *The practice of social research*. Belmont, Calif.: Wadsworth Cengage Learning.

Black, J. S., & van Esch, P. (2020). AI-enabled recruiting: What is it and how should a manager use it? *Business Horizons, 63*(2), 215-226. doi:https://doi.org/10.1016/j.bushor.2019.12.001

Brynjolfsson, E., & Mcafee, A. (2017). Artificial intelligence, for real. *Harvard business review*.

Brynjolfsson, E., Van Alstyne, M., & Aa, R. (1997). The matrix of change. *Sloan Management Reviews, 38*.

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., & Neville, A. J. (2014). The use of triangulation in qualitative research. *Oncol Nurs Forum, 41*(5), 545-547. doi:10.1188/14.onf.545-547

Chan, L.-K., & Wu, M.-L. (2002). Quality function deployment: A literature review. *European Journal of Operational Research, 143*(3), 463-497. doi:https://doi.org/10.1016/S0377-2217(02)00178-9

Commission, E. (2019). The assessment list for trustworthy Artificial Intelligence (ALTAI) for self assessment.

Davenport, T. H. (1993). *Process innovation: reengineering work through information technology*: Harvard Business Press.

Deloitte. (2017). Bullish on the business value of cognitive - Leaders in cognitive and AI weigh in on what's working and what's next. *The 2017 Deloitte State of Cognitive Survey*.

Desouza, K. C., Dawson, G. S., & Chenok, D. (2020). Designing, developing, and deploying artificial intelligence systems: Lessons from and for the public sector. *Business Horizons, 63*(2), 205-213. doi:https://doi.org/10.1016/j.bushor.2019.11.004

Dignum, V. (2019). *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*: Springer Nature.

Fitts, P. M. (1951). Human engineering for an effective air-navigation and traffic-control system. *National Research Council, Committee on Aviation Psychology*.

Floridi, L. (2013). *The ethics of information*: Oxford University Press.

Floridi, L., & Sanders, J. W. (2004). On the Morality of Artificial Agents. *Minds and Machines, 14*, 349-379. doi:https://link.springer.com/article/10.1023%2FB%3AMIND.0000035461.63578.9d

François-Lavet, V., Henderson, P., Islam, R., Bellemare, M. G., & Pineau, J. (2018). An introduction to deep reinforcement learning. *Foundations and Trends in Machine Learning, Vol. 11*(No. 3-4). doi:https://doi.org/10.1561/2200000071

Gallivan, M., Hofman, J., & Orlikowski, W. (1994). *Implementing Radical Change: Gradual Versus Rapid Pace.* Paper presented at the ICIS.

Gartner. (2020). 2 Megatrends Dominate the Gartner Hype Cycle for Artificial Intelligence, 2020. Retrieved from https://www.gartner.com/smarterwithgartner/2-megatrends-dominate-the-gartner-hype-cycle-for-artificial-intelligence-2020/

Grønsund, T., & Aanestad, M. (2020). Augmenting the algorithm: Emerging human-in-the-loop work configurations. *The Journal of Strategic Information Systems, 29*(2), 101614-undefined. doi:10.1016/j.jsis.2020.101614

Grover, P., Kar, A. K., & Dwivedi, Y. K. (2020). Understanding artificial intelligence adoption in operations management: insights from the review of academic literature and social media discussions. *Annals of Operations Research*, 1-37.

Grover, V. (1995). The implementation of business process reengineering. *Journal of Management Information Systems*, *12*(1), 109.

Jarrahi, M. H. (2018). Artificial intelligence and the future of work: Human-AI symbiosis in organizational decision making. *Business Horizons, 61*(4), 577-586. doi:https://doi.org/10.1016/j.bushor.2018.03.007

Kakatkar, C., Bilgram, V., & Füller, J. (2020). Innovation analytics: Leveraging artificial intelligence in the innovation process. *Business Horizons, 63*(2), 171-181. doi:https://doi.org/10.1016/j.bushor.2019.10.006

Kitchenham, B. (2004). Procedures for performing systematic reviews. *Keele, UK, Keele University*, *33*(2004), 1-26.

Klein-Koerkamp, R. M. (2019). The road from analytical CDSS invention to implementation in healthcare. Source: http://purl.utwente.nl/essays/77341

Lunenburg, F. C. (2010). Managing change: The role of the change agent. *International journal of management, business, and administration, 13*(1), 1-6.

March, S. T., & Smith, G. F. (1995). Design and natural science research on information technology. *Decision Support Systems, 15*(4), 251-266. doi:https://doi.org/10.1016/0167-9236(94)00041-2

Microsoft. (2021). Responsible and trusted AI. Retrieved from https://docs.microsoft.com/en-us/azure/cloud-adoption-framework/innovate/best-practices/trusted-ai

Oates, B. J. (2005). *Researching information systems and computing*: Sage.

Paschen, U., Pitt, C., & Kietzmann, J. (2020). Artificial intelligence: Building blocks and an innovation typology. *Business Horizons, 63*(2), 147-155. doi:https://doi.org/10.1016/j.bushor.2019.10.004

Plastino, E., & Purdy, M. (2018). Game changing value from Artificial Intelligence: eight strategies. *Strategy & Leadership*.

Prat, N., Comyn-Wattiau, I., & Akoka, J. (2014). *Artifact Evaluation in Information Systems Design-Science Research - a Holistic View*. Paper presented at the PACIS.

Reddy, S., Allan, S., Coghlan, S., & Cooper, P. (2020). A governance model for the application of AI in health care. *J Am Med Inform Assoc*, *27*(3), 491-497. doi:10.1093/jamia/ocz192

Sullivan. (1986). Quality function deployment. *Quality Progress*, *19*, pp. 39-50.

Talabis, M. R. M., McPherson, R., Miyamoto, I., Martin, J. L., & Kaye, D. (2015). Chapter 1 - Analytics Defined. In M. R. M. Talabis, R. McPherson, I. Miyamoto, J. L. Martin, & D. Kaye (Eds.), *Information Security Analytics* (pp. 1-12). Boston: Syngress.

Wieringa, R. J. (2014). *Design science methodology for information systems and software engineering*. London: Springer.

Wijnhoven, F. (2021). Challenges of Adopting Human-Centered Intelligent Systems: An Organizational Learning Approach *Human Centred Intelligent Systems* (pp. 13-25): Springer.

Wooldridge, M. J., & Jennings, N. R. (1995). Intelligent agents: Theory and practice. *The knowledge engineering review*, *10*(2), 115-152.
Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5): sage.

Appendix

A.1. Description systematic literature approach

Research goal:
Answer the knowledge questions "*Which best practices and methods to implement an Artificial Intelligence transition in a business process are mentioned in the literature?"*

Scientific database: Scopus

Search engine for grey literature: Google Scholar

First Action: find relevant literature with search key as found below on Scopus

Keywords: Search key: ("Artificial Intelligence") AND ("Business") AND ("transition" OR "transformation")

Inclusion and exclusion criteria:

Inclue	Exclude
Papers about the topic in English	Papers only discussing AI from a non-business perspective
Papers about AI and its application to business	Papers that only conceptualize AI
Papers about AI transition	Papers outside the topic of AI
Papers about AI transformation	Papers that aren't in English

Second Action: Scan peer-reviewed articles from critically acclaimed journals via BrowZine as found in the table below. A range between four and seven years old has been chosen to assure the literature is current.

Journal	Search from year … onwards
European Journal of Information Systems	2015
Information Systems Journal	2015
Information Systems Research	2017
Journal of the AIS	2016
Journal of Information Technology	2015
Journal of Management Information Systems	2015
Journal of Strategic Information Systems	2014
Management Information Systems Quarterly	2017
New Horizons	2019

Third Action: Snowball relevant articles from the articles that have been selected.

A.2. Interview Protocol

Introduction and goal of the study

Hello, first of all, thank you for participating in this research. My name is Steffan Hakkers, a masters student of Business Administration – Digital Business track at the University of Twente in the Netherlands. This research is part of my graduation thesis that focuses on investigating the requirements necessary to create a holistic change management method for Artificial Intelligent (AI) implementation in business processes. This semi-structured interview helps to reach this goal. With the semi-structured interview I hope to get insight into what practices and methods get used to perform an Artificial Intelligence transition in business processes in practice.

Ask consent to start recording

[If the interviewee has allowed recording, start interview here]

Ask if the information sheet has been understood, ask for verbal consent on the content of the information sheet.

1. Please introduce yourself. What is your expertise, experience and role in the organization?

2. What is the definition of Artificial Intelligence (AI) according to you ?

3. How much experience do you have with managing an AI transition (how many projects/ years)?
    a) In what kind of industry did you implement AI application during this time?
    b) Can you describe an example of a business process you augmented with AI?

4. What management techniques (if any) have you used to manage this AI transition in the organization?
    a) Would you describe this management technique as holistic (does this management technique take into account the whole business system of the organization)?

5. What KPIs did you use to manage this transition?

6. What were the biggest challenges managing this transition?
    a) Is there anything you would do different looking back?

7. What were the lessons (best practices) you learned from managing this transition?

8. Do you have any remaining insights on the future or the current state of AI or AI transition management you would like to share? (anything interesting for future research)

Thank you very much for your participation and contributing to my research. Do not hesitate to contact me if you have any questions about your participation or about my research.

A.3. Information sheet semi-structured interview

Information sheet Semi-structured interview on AI implementation in business

Purpose of the research
The goal of this research is to investigate the requirements necessary to create a holistic change management method for Artificial Intelligent (AI) implementation in business processes. This semi-structured interview helps to reach this goal. With the semi-structured interview the researcher hopes to get insight into what practices and methods get used to perform an Artificial Intelligence transition in business processes in practice.

Benefits and risks of participating
There is no risk in participating in this research: the personal information of the interviewee will be kept private, the vocal recordings of the interview will be kept private and will be destroyed after the research has been completed, the interview gets conducted online, and the questions asked in this interview will not cause psychological stress, inconvenience or discomfort beyond the normal experience of everyday life of the interviewee. Furthermore, this research has been reviewed and approved by the BMS Ethics Committee of the University of Twente.
Besides furthering research on the topic of AI implementation in business, the interviewee will get no benefits from this interview.

Procedures for withdrawal from the study
In the case the interviewee would like to withdraw from the study, the interviewee shall send an email to the researcher with the request to withdraw from the study. When this is done, the researcher will fulfil the interviewee's request of withdrawal.

Privacy and personal data
For this research, no personal data of the interviewee will be collected or processed, besides the interviewee's job role. The interviewee has the right to request access to the data and has the right to rectify or erase any personal data (if any) contained in the research.
The data used in the research will be kept secured on the BMS server hosted by the University of Twente. Personal information of the interviewee will be safeguarded and anonymized. Sound-recordings of the interview will be destroyed after the research is completed

Contact details researcher
Researcher: Steffan Hakkers Email: s.hakkers@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant
If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-bms@utwente.nl

A.4. Informed consent form semi-structured interview

Informed consent form semi-structured interview on AI implementation in business

Consent Form for the research "*Creating a holistic method for Artificial Intelligence implementation in business processes*"

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information dated 16/04/2021, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves an audio-recorded semi-structure interview which will be transcribed (with personal info anonymized) , the audio recording will be destroyed after the research has been completed.	○	○
Use of the information in the study		
I understand that information I provide will be used as input for the researcher's master thesis Digital Business at the University of Twente.	○	○
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the researcher.	○	○
I agree that things I said during the interview can be quoted in research outputs	○	○
I agree to be audio recorded.	○	○

Signatures

_____ _____ _____

Name of participant [printed] Signature Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____ _____ _____

Researcher name [printed] Signature Date

Study contact details for further information:

Name: ***Steffan Hakkers*** ***Email: s.hakkers@student.utwente.nl***

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-bms@utwente.nl

A.5. Expert session information sheet and evaluation criteria & questions

Purpose of the research

My name is Steffan Hakkers, a masters student of Business Administration – Digital Business track at the University of Twente in the Netherlands. This research is a part of my graduation thesis that focuses on designing a method used for implementing Artificial Intelligence (AI) applications in business processes. I have designed a holistic method for implementing AI applications in business processes based on the insights collected from the scientific literature and from interviews conducted with AI practitioners. The holistic AI implementation method provides guidelines for companies that want to implement AI applications in their business processes. In a focus session, I would like to present the holistic AI method I came up with and would like to collect your feedback for the sake of improving and validating the method. All necessary materials to familiarize with the designed AI implementation method such as background information, the presentation and questionnaires will be provided to you in advance.

This expert session is expected to take about 60 minutes, and will be audio-recorded for analysis purposes. During this session, I will use an interactive presentation to present the method and discuss questions related to components of the designed method,. The questions have been formulated based on the following evaluation criteria**:** understandability, completeness and usefulness. All questions that will be discussed in this session are found on the next page of this document.

Procedures for withdrawal from the study

In the case the interviewee would like to withdraw from the study, the interviewee shall send an email to the researcher with the request to withdraw from the study. When this is done, the researcher will fulfil the interviewee's request of withdrawal.

Privacy and personal data

For this research, no personal data of the participant will be collected or processed, besides the participant's job role. The participant has the right to request access to the data and has the right to rectify or erase any personal data (if any) contained in the research.

The data used in the research will be destroyed after the research is done. Personal information of the participant will be safeguarded and anonymized. Sound-recordings of the interview will be destroyed after the research is completed.

Thank you for taking the time to participate in this focus session and help me with this research

If you have read and agree with the information stated above, please sign your consent below or give your consent orally *on record*.

Participant	**Researcher**
Name:	Name:
Date:	Date:
Signature:	Signature:

Contact details researcher

Researcher: Steffan Hakkers Email: s.hakkers@student.utwente.nl

Date creation of this information sheet: 21-06-2021

Evaluation criteria and questions

1. Understandability

Do you understand the method?

Are the given names, concepts and visuals of the method straightforward and easy to understand?

Open question: *What could be improved to improve understandability of the method?*

2. Completeness

Do you agree with the identified steps of the method?

Open Question: *What could be improved, added or deleted in the method to make it more complete?*

3. Usefulness

To what extent does the method address the problems faced when managing an AI transition?

Open Question: *Do you think that the Matrix of Change for AI could add value to your organization for an AI transition? Why/why not?*

4. General opinion and open discussion

Open Question: *Do you have any general opinions or feedback on the method I can use to improve it?*

Edit: The name 'Matrix of Change for AI' has been change to 'Cycle of Change for AI'

A.6. Informed consent form expert session on AI implementation in business

Informed consent form expert session on AI implementation in business

Consent Form for the research "*Creating a holistic method for Artificial Intelligence implementation in business processes*"

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information sheet dated *21/06/2021*, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves an audio-recorded expert session which will be transcribed (with personal info anonymized) , the audio recording will be destroyed after the research has been completed.	○	○
Use of the information in the study		
I understand that information I provide will be used as input for the researcher's master thesis Digital Business at the University of Twente.	○	○
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the researcher.	○	○
I agree that things I said during the expert session can be quoted in research outputs	○	○
I agree to be audio recorded.	○	○

Signatures

_____	_____	_____
Name of participant [printed]	Signature	Date

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____	_____	_____
Researcher name [printed]	Signature	Date

Study contact details for further information:

Name: ***Steffan Hakkers*** ***Email: s.hakkers@student.utwente.nl***

Date creation informed consent form: 21-06-2021

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-bms@utwente.nl

A.7. The Governance Model for Artificial Intelligence (AI) in Health Care

This image is adapted from Reddy et al. (2020)