Recruiters just wanna have...AI?
Implications of implementing AI in HR recruitment

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Abstract

The development and implementation of AI is rapidly growing in the Nordic countries, yet the perception and information of AI is still limited. This paper will look deeper into the managerial aspects of implementing AI as part of the recruitment system, specifically the selection process and machine learning in text mining. The data gathering of this research has been conducted via interviews with Linköping's municipality, as well as collecting secondary data from public reports and scientific articles. Afterwards, the data was then scrutinized through theoretical analysis, using frameworks from different academic researches. A set of aspects was found, which affects the implementation of AI in an organisation in Sweden. A managerial view was taken to find a deeper significance on why an understanding of these aspects is necessary when implementing AI as a part of company's recruitment processes. However, while other elements other than the ones identified in this thesis do exist, a coherent picture of the process and the affecting variables can be thoroughly explained through these specifically chosen viewpoints. The paper concludes with drawing a bigger image of the AI in recruitment and selection processes, and the implications of it to an organisation considering to implement AI as part of these processes in near future. The thesis can be seen as a recommendation to any establishment that is making the decision of adopting the usage of AI as part of recruitment.
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### Terminology

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<td>AI</td>
<td>Artificial Intelligence</td>
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<tr>
<td>ASI</td>
<td>Artificial Super Intelligence</td>
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<tr>
<td>DDS</td>
<td>Digital Data Stream</td>
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<td>EE</td>
<td>Event Engine</td>
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<td>HR</td>
<td>Human Resources</td>
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<td>HRM</td>
<td>Human Resource Management</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
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<td>LiU</td>
<td>Linköping's University</td>
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<td>LK</td>
<td>Linköping's Kommun = Linköping's municipality</td>
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<td>SME</td>
<td>Small and Medium Enterprises</td>
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An AI dictionary for professionals (adapted from Christensen, 2019)

**Algorithm** - mathematical and programming formulas and function that can solve problems through AI

**Autonomous** - when an AI construct does not need a human to function

**Black Box learning** - when the input in the system is mathematically complicated for humans, yet the output is relevant because the rules of the system are known.

**Data Mining** - the process of examining existing data in order to come up with new information

**Deep Learning** - when the AI gets a basic understanding through neural networks and applies that knowledge in new tasks.

**Machine Learning** - the process in which AI can perform intelligent functions through algorithms

**Neural Network** - designed like the human nervous system, neural networks help AI by breaking down complex problems into digestible data, so that the AI can learn.
1. Introduction

The discourse of how artificial intelligence (AI) has gotten the whole world wrapped around its finger has been present in every panel of discussion, whether if it is in the context politics, economics or business. Regardless of the tone of discussion however, whether it is about tackling climate change or imagining dystopian futuristic scenarios where millions of people lose their jobs to their machine counterparts, the areas where AI is systemically functioning are many. In the nordic countries, especially in Sweden, AI is believed to be a powerful catalyst of innovation and a key tool that brings new opportunities for business and services, as well as the development of new skills and working methods (Regeringskansliet, 2019). As the country is known to be one of the most digitally advanced countries in the world, with a strong technology-oriented population, AI has made its way into the public, private and research sector (ibid). According to Regeringskansliet (2019), AI in Sweden is greatly used not only for commercial purposes like the customization of online shopping, but also in technological innovation like robotics, self-driving vehicles, health and safety purposes, home assistants, health apps and financial fraud prevention. Being constantly influenced by technological innovations, private and public organisations are not left behind when it comes to implementing AI in their operational processes and organisational functions. One organisational function that is more likely to embrace technological innovation and transformation is Human Resource (HR) Recruitment (Reilly, 2018). Because of the continuous move of people and therefore move of talent, and the influence of internet and social media, recruiters need to constantly adapt to these trends and go one step ahead in order to attract talented human capital. One transformation that HR recruitment has undergone in last decade has been the adoption of e-recruitment methods in the whole recruitment process, from advertising job opening online and on social media, to online assessments and interviewing. As of 2018, a trend among recruiters in adopting AI softwares and solutions, in part or in the entire recruitment processes, was observed (Upadhyay & Khandelwal, 2018). Given that the war for talent is becoming more and more pervasive among organisations, recruitment professionals need to use new ways to learn more about their potential candidates and build long-lasting relationships that will prevent these candidates from sneaking to the competition instead. In this context, one reason why AI is
gaining so much attention in the recruitment world, is precisely its ability to create this closer connection with the candidates. More advanced AI can disclose even more information about candidates, revealing traits about applicants that might not be visible on a first glance by recruiters, and thus positively influencing the hiring decision. These and more reasons are creating opportunities for organisations to adopt AI in their recruitment processes. However, technological changes, especially of a magnitude of AI, do not come without causing some degree of disruption (Anderson and Tushman, 1990).

1.1 Research objective

When looking into the current research within the area of AI in recruitment, it can be observed that this area is fairly new, and not many academic papers have been written on the subject. While e-recruitment, and to some degree automation, have been previously researched, the use of AI in HRM is not. One reason for that is that the application of AI in the recruitment processes is still on the development phase in most organisations. This fairly unexplored area of AI in HRM creates an unique opportunity for research. Additionally, the nordic countries, specifically Finland and Sweden, present a unique opportunity for the study of AI, due to their strong innovation background and technological advancements. Both countries have been creating dedicated governmental programs to increase AI research funding, and oftentimes these two countries are seen competing on which one has the highest level of expertise. Nevertheless, even though AI in general has been a largely discussed topic in these countries, more information is needed on the current state of implementation, especially on the readiness of organisations to adopt AI within the recruitment processes. By using primary and secondary data, and by focusing on a single organisation, this study aims at understanding what is the current state of implementation of AI in recruitment processes, particularly in a Swedish organisational context. Additionally, we will try to uncover what could be some potential drivers and barriers in implementing AI solutions in partial or in the whole recruitment process. Finally, we would like to know, through the evaluation of results obtained so far, what could be some recommendations and learning points that organisations can use for their AI implementation strategy in HR recruitment.
1.2 Research relevance

With this thesis, we aim to present what are the main advances and hinders in the implementation of AI as part of recruitment selection process in Sweden. Additionally, this study contributes in showing the current state of application through the secondary data research and through the primary empirical data gathered from Linköping Municipality. Possible future areas for further research will be suggested, while revealing areas that are still lacking investigation. Through this thesis, the reader will be able to understand why the AI implementation as part of recruitment process can appear challenging to Swedish organisations, and simultaneously what are the drivers to use AI, and specifically, what can be the advantageous results of having AI as part of the selection process.

Academically the thesis will contribute into broadening the list of already made research within the area of AI usage in Sweden, while combining it with the primary empirical data gathered in the same topic. Additionally, specific areas like AI application in HR recruitment are still lacking deeper research, and qualitative and quantitative studies presenting data on the topic are unaccounted for. This is where this thesis present its contribution, by combining the secondary data gathered on the topic of AI (in recruitment) in Sweden, with the primary data collected through a case-study, thus delivering a coherent picture of the current state of the implementation and suggesting areas of further research.

The AI implementation in the recruitment process at Linköping’s Kommun (LK) is a process that can be used in various places and organisations. The process of implementation and technical advancement needed for the launch of the project is always dependent on the level of technical expertise of the organisation, as well as on its readiness to adopt the AI. However, in a larger scale, this process study opens up the development and the operations taken to ensure a fluid implementation of AI as a part of recruitment processes. On a practical level, this paper is directly benefiting any Swedish organisation that is in the process of either planning on implementing AI in recruitment, or has already started implementing AI as part of their HR recruitment. The thesis will make further contributions on the organisational
benefits of adding AI as part of the recruitment decision-making, and how can the AI affect the overall performance of the organisation.

1.3 Research Design and Methodology

The thesis will start with the introduction of the main concepts, stating the latest and most relevant theories on the current state, challenges and changes on the discipline of human resource management (HRM), with a focus on recruitment. Furthermore, it will continue by presenting the concepts of artificial intelligence and its possibilities in recruitment and business processes. After the reader becomes aware of the notions and theories mentioned, the paper will move on to the research section, stating the data gathering methods and reasoning for the chosen method. The findings section, which will combine the secondary data gathered with the single case study on LK, will further present the study results, which will afterwards be analyzed based on the theoretical and practical insights on the topic. The thesis will finalize its findings on the discussion section, which will then lead to the conclusion and the suggested research areas.

2. Literature review

2.1 Research strategy

After brainstorming on the topic of the thesis, the literature research began on these key thematic areas: AI, HR and recruitment, using keywords as artificial intelligence, artificial intelligence and human resources, digital human resources and e-recruitment. The goal behind this search was to learn more about each topic individually, as well as in relation to each other. Some publications were reviewed for the purpose of understanding specific processes and concepts like: HR, HR processes, recruitment stages, AI types and roles etc. Since the topic of this research is fairly new, a two-folded secondary research was carried out. On one hand, university databases, like LiU and Macquarie university online libraries, were used to search for academic publications on the aforementioned keywords. Additionally, specific scientific journals like International Journal of Selection & Assessment, Employee Relations, Computer Weekly, Business Horizons, were consulted. The publications reviewed
in these databases at this stage are dated from year 2000 to 2018, and regardless of their main focus, were reviewed and annotated in a separate excel database. On the other hand, a simultaneous online search was conducted through the world wide web, to find reports, news articles and other sorts of publications in order to build a coherent picture of the information available AI in recruitment. The lack of academic studies in our field of interest and the fact that we needed to gather data specifically on the perception of using AI in the recruitment processes, drove us to look for articles in online magazines and journals. Although available to the public, these sources were carefully selected and reviewed based on the name of the magazine, author and relevance of the topic. Some of the online sources used at this stage were the MIT Sloan, Harvard Business Review, Forbes Magazine, Wired Magazine, CFO.com and thepeoplespace.com. These sources helped create a better idea of the current thoughts and uses on the topic in discussion. Additionally, this review, which can be considered secondary data gathering, helped us build a strong practical foundation of the state of the art of AI in recruitment and other perceptual ideas and judgements. Moreover, these sources expanded our limited search into unexplored before areas like “the future of work”, “the rise of automation” and more. At the end of the initial literature review stage, 48 academic publications and 22 online articles were selected for further consideration on the topic.

2.2 Introducing HR and its challenges

Human resource management is responsible for different personnel related operations within organisations. The main tasks of HRM consists of recruitment, selection, training and development, performance management, compensation management, and workplace relations. Each of these operations have different functions and processes which assure high return on investment from the labor force working in the organisation (Alan et al., 2016). As HRM is responsible of the workplace design and competency profiling, it is necessary to assure that the right people are hired for the right positions. An organisation is only as strong as its people, and strategic planning of workforce is necessary to assure the sustainability of the organisation (ibid.).
Over the coming forty years, the working population in Europe is expected to decline due to aging population and automatization of the different industries (Alan et al., 2016). Since the markets are facing a challenging situation of losing expertise from various professional areas, it is more important than ever to find efficient solutions, while laying minimal stress on the labor force. Innovative approaches for solving the talent shortage are urgently needed, and more skillful human resource management is called for (ibid.). The business culture is changing due to rapid labor movement and globalization, and the old methods of stimulating the workforce are not delivering the same efforts as before. Moreover, organisations nowadays are expected to lead the innovation and sustainability movement, finding advanced ways to streamline production while still remaining ethical (Reilly, 2018).

Human resource strategy brings the general line to human resource management, providing a framework and guidance to the actions taken within human resources. As the competition of talented workers is getting more intense and fast-paced, the strategic side of human resource planning is more important than ever (Mathis and Jackson, 2008). Strategic human resources also calculates the long-term costs of an individual employee. As the management of the talents has considerable impact on the organisations’ success, HRM processes must be well executed and aligned with the strategic view of the whole organisation. The efforts of recruiting and managing a talent pool are optimally minimized, while the turnover of the recruiting processes often defines the return on investment (Mathis and Jackson, 2008).

Recruiting has traditionally five basic processes which assure candidate selection and fit to the specific position. These processes are recruitment planning, strategy development, candidate sourcing/attraction, selection, screening and testing, and finally evaluation and workflow tracking (Kerrin, 2003). Other variations of the different stages exist, but in order to reach the recruitment objectives, these are the five main steps needed in any recruitment process. The cost per hire is a critical measurement used in most organisations, as the effort spent per position is significant.

To understand the scale of recruitment, and the different stages of the employee acquiring, it is necessary to look at the overall process flow (Figure 1).
Human resource planning is a crucial part of HRM processes. Positions are changing continuously and organisations need to find the right talents to match to the respected positions. The emphasis is to link competencies and productivity goals, as well as to assure the highest possible productivity level (Alan et al., 2016). While the work roles might be stable, people are different, and filling in a position with most suitable combination of talents is challenging. As the positions move towards more specialization, it is harder to find a competent candidate, and traditionally, recruiting a professional to a highly specified position
takes great effort and labor hours (ibid.). Due to the difficulty of finding skilled candidates, companies can build a talent pool of all the applicants, and use the pool of applicants as resources for recruiting for future openings. Human capital management is therefore a natural part of HRM, and includes recruitment of new employees.

The selection of new employees is one of the processes that has generally been done through face-to-face interviews in order to determine the suitability of the candidates. Recruiting a suitable person involves testing the appropriate skill set needed. However, it also involves a gentle gut-feeling based on the intuition of the personality and behavior (Van Esch et al., 2019). This is partially explained by the fact that recruitment in general, is traditionally one of the processes in HR which has included the most human involvement and human intuition (Mathis and Jackson, 2008). Since finding skilled professionals is time consuming and requires a lot of efforts from human resource personnel, the recruitment operations are often being outsourced to talent acquisition companies specializing in the recruitment and selection of candidates (Kerrin, 2003).

Screening and testing are crucial stages which determine the suitability of the candidate. In modern recruiting, online testing has become a norm; the candidate is put through different assessment stages, including logical testing. Candidates who go through the testing phase and score the highest for a specific position, will be then shortlisted and invited to further interviews. The screening process is a very important and challenging stage of the recruitment, since not only it assures the selection of the best candidates with the right knowledge, but at the same time, enables the recognition of soft skills, which are hard to measure through traditional assessments (Kerrin, 2003; Van Esch et al., 2019).

The recruitment process does not end with the hiring of the applicant for the position. It continues with performance tracking and career development. To evaluate the recruitment success, a future follow up is necessary. Investing in human resources and supporting the functions of talent development, adds value to the existing work environment (Kerrin, 2003, Alan et al., 2016). As companies are looking for the maximum profits from overall human labor, many organisations are outsourcing the recruiting and screening processes, and as a
more modern trend, implementing artificial intelligence (AI) as part of the recruitment and talent management (Mathis and Jackson, 2008).

One of the major challenges for organisations is the attraction and retention of skilled employees, as commonly defined as talent management. The competition of skilled workers, as previously mentioned, is posing a challenge to companies to recruit the right talents (Alan et al., 2016). As the specialized human resources are declining, organisations must find other ways to attract professionals. Talent management also includes the development and career opportunities within the organisation, so that the acquired employees will keep investing into the organisation. Employee attraction is therefore an important part of the recruitment process, as the job posting and the application experience are crucial points for candidate to find vacancies and then apply for positions (Van Esch et al., 2019). To make talent management more difficult, it has to align with the company strategy and support the future functions and overall vision of the whole organisation (ibid.).

Figure 2. Staffing process and talent flows (Kerrin, 2003, p.10)

Talent management generates a pool of qualified applicants for different positions in an organisation, from which the organisation is able to select the skills needed (Alan et al., 2016). To strategically manage the talent flows, the organisation must be able to handle
external and internal recruiting, in which internal recruiting is the selection from the pool of employees inside the company. As the selection of the talents creates a pool of candidates for future exploitation, it is also relevant to have an efficient and effortless selection process, in order to use these skills in the future. If the selection, screening or feedback process from a job application has been a negative experience for the applicant, it is highly likely that in the future the applicant would avoid that specific company (Van Esch et al., 2019, Chapman and Webster, 2003). Therefore, the technologies used in any part of the recruitment should be user friendly, and at the same time, the tools should work for the company’s benefit through cutting costs of the human labor in recruiting (Van Esch et al., 2019). Additionally, the competition for talent has started to appear in the application processes and talent sourcing, as more and more people are recruited from abroad. Therefore the recruitment process has to be fluid and understandable, disregarding the cultural or industry-related complexities or minorities, and most importantly, it should be efficient enough to find talents among all the countries and businesses disciplines (Burgmann, 2016).

According to a McKinsey report (2016): “More than 90 percent of the world’s 247 million cross-border migrants moved voluntarily, usually for economic reasons. The remaining 10 percent are refugees and asylum seekers who have fled to another country to escape conflict and persecution.” (McKinsey and Company, 2016, introduction).

As globalization in the world is increasing and companies find talents from every part of the world, the movement of people brings also challenges to talent management and finding skilled people (Burgmann, 2016). Migrating to a new country is fairly easy nowadays, and millennials are moving globally more than the generations before (ibid.). As technology makes it easier to reach people, companies nowadays are turning into video interviews and online testing. According to J. Du Plessis (2012), around 60 percent of the software engineers that are recruited in the US, are from outside the country and mainly from developing countries, especially from India. The testing and interviewing is made through video conferencing, which makes it easy to recruit people from any part of the world (J. du Plessis and Frederick, 2012).
The globalization has also created a movement towards the internet where different products, services and even work is found through and on the internet. When job opportunities are closer than ever, the chances of finding a career outside one's home country are higher. The labor market has become global instead of local, and talents oftentimes can find a better compensated position, with a better work environment, career plan, benefits compared to the country of origin (Burgmann, 2016).

While work opportunities have moved to the internet and reaching candidates is becoming easier, studies also show that there is employee shortages in some areas. The baby boomers, the generation after World War II, is a generation with the more specialization in expert areas than before, currently filling many of the highly advanced positions (Burgmann, 2016, Wojcik, 2017). With the baby boomers retiring, the talent shortage in many organisations is becoming real. Millennials require more benefits than the generation before, leaving companies to compete for the highly talented people. An estimate of the workforce entering the market, compared to the exiting employees, forms a large gap which results in high competition of the existing workforce. A study conducted by Manpower Group indicates that between 2006-2016, 30-40 percent of employers were affected by the talent shortage (Wojcik, 2017).

Increased globalization has brought new challenges to organisations, not only on an operational level, but also in finding highly-skilled workers and most importantly retaining them (Chapman and Webster, 2003). As the competition of skilled employees is getting more intense, new technologies for faster processes are needed. At the same time, as the applicant selection is undoubtedly a routine, time consuming process, companies are using automatization in different stages of recruitment. In this way, recruiters can deal with other parts of the recruitment process, like interviewing, while AI increasingly takes care of the candidate sourcing/attraction, selection, screening and testing (Färber et al., 2003).

By using automatization and AI in recruitment, an organisation is able to screen through extensive amounts of information in short time, which considerably cuts the time needed to otherwise screen the same amount of data manually (J. du Plessis and Frederick, 2012). As the current trend is to use technology as an advantage in recruitment, companies are stepping
up to the challenge of competing for the skilled employees. However, with the use of technology comes certain risks as well. Data privacy and information rights, for example, are some of the topics which have raised concerns on a governmental and global level (Reilly, 2018).

As AI and general automatization take over the recruitment processes, it is important to discuss about another phenomenon that came prior to the aforementioned. This phenomenon is called e-recruitment. It includes a rather broad spectrum of processes, and some articles use the term web-based recruiting as well as e-recruiting. If recruitment is done through web-based tools, or at any point of the recruitment process AI is used to make decisions, the term e-recruitment is used (Kerrin, 2003). Depending on the needs of the HR function and organisation, e-recruitment can be used in any of the recruitment processes. As applicants are increasingly moving towards job posting platforms, such as Monster or LinkedIn, web-based recruitment tools are in high use and more popular than ever for to find suitable positions (Färber et al., 2003).

There are several benefits why recruitment is moving towards automatization, one distinct and immediate being the efficiency and speed that it provides (J. du Plessis and Frederick, 2012). As the increase of e-recruitment is leading applicants from the job-posting platforms directly to the company websites, the laters are attracting more visitors than before, giving the information of the position first-hand, and directly gathering the possible applicants to the talent pool (Kerrin, 2003). The fast collection of the applicant data will also encourage organisations to streamline their application processes, making it as easy and fast as possible. Technology is helping by increasing efficiency, and ultimately, first selections is already being done by AI (Kerrin, 2003; Färber et al., 2003).

2.3 Introducing Artificial Intelligence

AI can have different meanings depending on its uses and its level of intelligence. Regardless, it can be broadly defined as an intelligent system with the ability to think and learn (Jarrahi, 2018). Although AI has a wide variety of usages and stages, some core definitions and mechanics remain the same in all machine-based learning. With many
technical terms and advancements in technology, it is important to specify which categories do not fulfill the criteria of artificial intelligence.

Internet of things (IoT) is defined by a network of devices connected through the internet, that communicate through the connection to other devices and to the owner of the device (Kaplan and Haenlein, 2019). The electronic devices gather data from a device user through the technology installed in the device. Such device could be a fridge, which gathers the information of the users habits and foods. Other devices with same sort of capabilities would be, for example, an automatized home thermostat system, recording the information of users preferences and living habits through temperature changes in the premises (Kaplan and Haenlein, 2019). As data mined by AI includes all the information from IoT, the latter can be considered as an input for the machine learning made by AI, but not as an intelligent, self-learning system per se (ibid).

To open up the basic concepts of AI, we need to look at the different mechanics behind it in order to build one. As previously mentioned, devices gather user data of individuals all the time. The data collected from various sources is called big data, and contains masses of detailed information from different sources, all the way from Google searches and smart watches to grocery shopping habits (Raub, 2018; Kaplan and Haenlein, 2019). Data mining is therefore AI computing through massive amounts of big data, sorting and learning from the data in hand. In order to use the big data, algorithms must be used to simulate human behavior in a coded form. Algorithms are information to the system, commanding the AI in which way to behave. The behaviour is then trained by using these several mathematical models, in which the future prediction is made based on the past information, combining it with a set of training data to simulate this model in order for machine to learn. Once the machine can learn by itself and make new connections from the information, it can work in a human synapsis-like way, connecting abstract ideas to each other and form an independent solution from the data it has been processing. When the computer is able to come independently to a conclusion based on the training and learn from the self-made combinations of data, this learning process is defined as deep learning. The more big data the deep learning is able to go through, the more intelligent it can become and the more accurately it is able to mimic human behavior. These newly formed connections of deep
learning are called neural networks. The neural networks are a multilayered processes of simultaneous computing from all the information that the machine can process in microseconds. In the synapsis-like formation of the neural networks, the information cannot be accessed and it is impossible to know in which variants the decisions are based on. The reason for this is that the AI is connecting information from vast amount of various sources with a brain-like function (Raub, 2018; Dataiku, 2017; Chethan Kumar GN, 2018; Kaplan and Haenlein, 2019). The basic needs for having a working, simple AI thus are: big quantities of data, programmed algorithms and powerful computing power.

The most AI development comes from the US, but the nordic countries are not far behind. Finland and Sweden have well-implemented programs on a governmental level, which ensure that the development within AI is well-funded and being invested in, including the private sectors. Being relatively small countries, the resources dedicated to the development of AI in Finland and Sweden are smaller compared to the US. However, with a strong technological background and a high amount of skilled employees and organisations, the nordics play an important role in developing and pushing AI research and development forward (Vinnova, 2018). Additionally, AI is also seen as the future employee in nordics, as more services need to be automatized due to the aging and declining population.

A recent example of the application of AI in recruitment is an interviewing robot, Furhat, developed by a Stockholm based start-up, Furhat Robotics. The company developed a human-like AI robot that can be used for different operations in which the human communication is needed. One of these is the recruitment process, specifically the candidate interviewing, in which Furhat is able to make a decision without having the human bias (Engadget, 2018). As the robot simulates the human behavior, speech, vision, and decision-making, Furhat is one of the groundbreaking robots developed to be used in a recruiting or interviewing process. The robot uses different types of AI, and therefore is a more complex combination of the different types of AI which are developed as separate fields (ibid.).
2.3.1 Types of AI

Table 1. Functions of different types of AI

<table>
<thead>
<tr>
<th>Type of AI</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Learning</td>
<td>As set of rules, algorithms are coded information which the computer follows, often mimicking human behavior. A training data of wanted outcome is given to the computer. Using the training and the algorithms, the machine extracts and combines information from the new given data, coming to a solution. Simplified, the more data, algorithms and training, the more intelligence the machine can have. The machine can learn from the data and from the new solutions it makes independently. When mixing data with self-learning, it becomes deep-learning and ultimately neural networks, that represent almost human-like synapsis function (Dataiku, 2017; Kaplan and Haenlein, 2019).</td>
</tr>
<tr>
<td>Natural Language Processing</td>
<td>Speech recognition and language producing AI, which aims at fluidly mimicking human language, speech and intonations. Very complex systems, as AI is trained to hear human intonations, emotions and other subtle stress on the language. Translation is one of the NLP areas (Chethan Kumar GN, 2018; Dataiku, 2017).</td>
</tr>
<tr>
<td>Vision</td>
<td>Camera vision is enhanced with AI. The vision mimics the human vision, without human limitations. An area of AI where implants of human eye are researched, among other vision related challenges (Chethan Kumar GN, 2018).</td>
</tr>
<tr>
<td>Robotics</td>
<td>A wide area of usage, all the way from manufacturing to service and war robots. There's a high demand of service robots in current markets, especially in such areas as elderly care and assistance robots (Chethan Kumar GN, 2018; Vinnova, 2018)</td>
</tr>
<tr>
<td>Autonomous Driving</td>
<td>AI is used to independently conduct different vehicles, from cars and trucks, to drones and airplanes. Autonomous drones are also in military research (Chethan Kumar GN, 2018).</td>
</tr>
</tbody>
</table>

As AI can be used to perform in different areas of life, there are currently five different main fields specialized in the usage and development of AI. As previously explained, the deep learning behind all of the AI development is roughly the same, though specializations have their own elements of research with specific underlying processes (Jarrahi, 2018). AI being suitable for computing enormous masses of data and learning from it, it can also be
implemented to assist humans in different operations and processes. The usage of AI is not only limited to computing, but it extends to producing neural networks and autonomous vehicles, and as predictions state, it will be seen in an increasing pace in most areas of life (Chethan Kumar GN, 2018; Jarrahi, 2018).

Figure 3. Artificial Intelligence research fields (Chethan Kumar GN, 2018)

Machine Learning

In machine learning, the machine will be able to train itself through part experience and data. By doing so, it will be able to recognize different objects and patterns. In machine learning, the machine will 'remember' the past experiences and use them for future reference. At its simplest form, the AI will learn to solve problems and recognize objects, and when in highly advanced machine learning, the AI will be able to solve complex systems and train itself continuously to reach a higher stage though big data (Chethan Kumar GN, 2018). This type of AI system is the backbone of all the AI, as it uses the data mining as the base for learning and delivering solutions independently from the data given. To achieve a learning process, new data must be fed to the AI, as the data given always affects the outcome of the AI
solution. If the amount of information given to the AI is limited, there is no basis for deeper learning, and the outcome starts to repeat itself. If however, the AI is given large amounts of data and it is able to continuously mine information from a vast database, the machine will cultivate capabilities to learn deeper and deliver more complex outcomes (Raub, 2018; Chethan Kumar GN, 2018; Kaplan and Haenlein, 2019).

Figure 4. Fields of AI within Machine Learning (Chethan Kumar GN, 2018).

Natural Language Processing

Natural Language Processing (NLP) is a form of AI specifically designed to naturally use languages, especially used in producing text and speech. NLP AI will be able to understand human terms and subtle nuances in language used by humans. Thus, AI can learn to manipulate the language, being capable of fluent conversations and interaction with humans. Learning the terms and various ways of expression comes naturally to a human, but to understand metaphors and different expressions in natural conversation is still a challenging area of AI research (Chethan Kumar GN, 2018; Jarrahi, 2018).
Vision

Vision is an area where research is concentrating in teaching AI to see as a human eye, but without the human eye limitations, such as night-sight, seeing through obstacles etc. (Chethan Kumar GN, 2018). Some vision AI is developed to work as human eye, for the purpose of being used as an eye implant for humans and restore vision on visually impaired patients. In this case, the technical part of the vision would be done with a camera eye, behaving as natural part of the human. Other ways to include AI vision is in collaborative ways, such as AI collaborating and complementing human vision in smart products such as microscopes, telescopes or color vision, and complementing human vision where the limitation of humans are exposed (ibid).

Robotics

Robotics is a field mostly used in engineering and AI robots are in many cases designed to work as a part of manufacturing. Not only is robotics used in heavy duty work, but it can also be implemented as a part of hospitality branch or as human assistance robots. Another highly popular area for robotics is in the elderly care assistance, as well as service robots in various areas, where many robots are already in the testing phase and will soon be seen as a part of normal service assistance (Chethan Kumar GN, 2018). A second, less talked area of robotics usage, is in military and warfare, where highly intelligent robots have already been tested, and according to some allegations, even used in warfare (Jarrahi, 2018). Nevertheless, robotic technologies in a governmental level are also used for example in NASA and RFSA (Chethan Kumar GN, 2018).

Autonomous Driving

In autonomous vehicle designing, AI is used to drive most transportation vehicles without human interaction. Self-driving vehicles have been in testing for many years now, and in the future it is highly likely that a person will not be handling the driving manually anymore (Chethan Kumar GN, 2018). The autonomous driving is not only limited to the auto industry, as self-driving systems have been in testing for planes and helicopters as well. Amazon, for
example, has been looking into self-navigating drones as part of their delivery system (Chethan Kumar GN, 2018; Reilly, 2017).

2.3.2 Data privacy

AI brings challenges also to other areas of data usage such as privacy and security of personal information. As data mining is able to find all sorts of information from public profiles and individual’s past, such as records from Facebook, articles, shares and other means of media, it is necessary to see that this information is used in an ethical way and ethical purposes. As the AI usage is increasing, governments are under high pressure to establish rules for its usage and privacy. The latest wide-ruling privacy law undertaken in the EU parliament, which concerns the information gathered from individuals, states clear regulations of the General Data Protection Regulation, and it's known as GDPR (Kaplan and Haenlein, 2019).

The nordic countries have been investing into automation for a long time. Due to the decreasing population and technological advances in research, the scandinavian countries are finding new solutions to streamline businesses and services on a larger scale (Vinnova, 2018). As part of the European Union and after the new GDPR legislation, the nordics have been forced to find even further solutions to develop AI research, while finding solutions to keep data private and secured. On a practical level, GDPR brings hindrances to the automation development and information handling, as all the data from which a person can be identified, must be destroyed within rather short timeframes and cannot be used for data mining (Kaplan and Haenlein, 2019). Other countries, such as the US, are not forced yet to comply to such strict data settings, they have more freedom to use big data for AI, as well as time to find solutions to protect information in the future (Vinnova, 2018; Raub, 2018).

2.3.3 AI in business processes

AI systems have evolved so much that they are no longer solely used for manual, repetitive and production-related tasks. Through their exceptional self-improving capabilities, these systems are taking over knowledge-based tasks, which until lately, where thought to be human-exclusive (Jarrahi 2018). Thanks to advanced smart technologies, the authors add,
post-industrial economies are entering a second machine age in which AI is becoming the center of a fast wave of automation (Jarrahi, 2018; Brynjolfsson & McAfee, 2014). Studies like New Vantage Partners (2017) and Accenture (2017) reveal that American executives see AI as a disruptive force for business and that almost 90% of the surveyed corporate executives are heavily investing in AI R&D in the near future (Jarrahi, 2018, Guszcza, Lewis, & Evans-Greenwood, 2017).

2.4 AI in HR

Due to streamlining processes and attempt to minimizing costs, many organisations have started to outsource different HR operations (J. du Plessis and Frederick, 2012). Since recruiting of an individual employee has many stages and includes mundane processes, from human resource planning to applicant screening and interviews, artificial intelligence can bring efficiency to these processes. Some mundane operations are already efficiently being processed by using AI. However, using AI in human interactions has its own implications (Papageorgiou, 2018). As the amount of data from the applicants is time consuming to go through and sacrificing human labor hours for the completion of data research can be easily substituted with automation, many organisations are getting familiar with the automation of the recruiting processes through the use of AI (Raub, 2018).

Organisations are constantly faced with changes in the business environment. The ability to adapt and prepare for these changes will help the companies to better navigate the external environment. With some of the challenges like globalization, rapid technological innovation, organisational structure and social trends, organisations need to reconsider and adapt their operations when it comes to HR and personnel hiring in particular (Lievens et al, 2002).

In their research study, Lievens et al, (2002) identified three major trends that emerged as challenges in recruitment today: labor market shortages, technological development and applicants' perception of selection procedures. Firstly, when it comes to labour pools, the larger the pool, the better the chances for companies to select the most skilled and highest performing employees. However, studies show that the recent shortage of labor, especially in Europe, has initiated a 'war for talent' (Lievens et al, 2002; Barber, 1998; Breaugh and Starke,
2000; Highhouse and Hoffman, 2001). As a result, companies have to place additional effort in their talent attraction strategies and organisational image, as that influences top applicants in their choices to apply to open positions (ibid). Secondly, technological innovation makes its way into every part of organisational processes, with AI recently adding to multimedia and e-recruitment. According to Lievens et al, (2002) however, there are a few issues when it comes to technology in recruitment, particularly in the testing and assessment phase. Firstly, it is hard to validate a candidate knowledge and skills through online and multimedia tests, due to different factors such as variety of question and contextual factors (Lievens et al, 2002). Second, according to the authors, development and utilities costs of these algorithmic and internet-based tests should be taken into consideration and well evaluated before implemented. Finally, although the World Bank reports that in 2016, 46% of the world population had access to the internet, half of the world population is still missing from the equation (Data.worldbank.org, 2019). Because of this 'digital divide', for different regions, demographic groups or job levels, different recruitment technologies and strategies are needed to be put in place (Lievens et al, 2002). Third thematic challenge according to Lievens et al, (2002) is applicant's perceptions. Although many studies have been published around applicant's reactions to selection methods (Ryan and Ployheart, 2000) and applicant's decision-making (Anderson et al, 2001), according to Lievens et al, (2002), there is not enough longitudinal studies that research applicant's reaction to each step of the recruitment process.

As more people are starting to have access to internet and more data is available to develop complex AI, there are certain concerns regarding the introduction and usage of AI (Data.worldbank.org, 2019). While organisations are gladly introducing more technical driven solutions to customers and hi-tech gadgets become increasingly popular, so is the amount of data gathered from all the personal devices. The data streams connect the consumer products through IoT, and follow even closer the habits of the user (Pigni et al., 2016). As the data received comes from multiple sources and the amount of data has rapidly grown, organisations are facing a challenge to stream out information that is useful for the future usage. Moreover, the overwhelming amount of data received and the privacy and ethical issues that go with it, play into the difficulty of handling big data (Raub, 2018; Pigni et al., 2016).
As Pigni et Al.’s (2016) research shows, the continuous flow of real-time data that companies are receiving from their customers forms a digital phenomenon called Digital Data Stream (DDS), which requires highly advanced and powerful methods to do data mining from, and this is where many companies find difficulties to perform (Pigni et al., 2016). Not only is data gathered from IoT, but also from companies' marketing tools, such as clicks, social media, location traffic, web services, communication, general search information etc. When presented with endless amounts of data from several sources, as well as from varying measures, the data overload can be overwhelming. With the availability of technology and data, the sourcing of the important information becomes demanding and complex to mine (Saxena and Lamest, 2018). In recruitment specifically, the data-mining of hundreds and thousands of applicants brings more data than ever before, and therefore it is extremely important for companies to filter the big data in order to find job-valid information of the applicants (Pigni et al., 2016).

While companies come up with more tools and automation systems to streamline business processes, the HR function is seen as costly and therefore is often outsourced. For this reason, more innovation is necessary to cut HR costs and time. Technological innovations such as the internet and resource enterprise planning (ERP) have always served as catalysts for process innovation for companies (Davenport and Brain, 2018). Regardless of different ad-hoc innovations of AI in HR however, it is important to understand what are some AI inspired tools and softwares being test currently around the globe, and what traditional recruitment processes are they going to replace. Table 2 below gives an outlook of the transformation.
Table 2. Recruitment evolution, adapted from Thepeoplespace.com

<table>
<thead>
<tr>
<th>Recruitment stages</th>
<th>Current tools</th>
<th>Next-generation tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening and sourcing</td>
<td>Broad-based tools: Applicant tracking systems (ATS) and job boards</td>
<td>Social networks and data driven platforms: Facebook, LinkedIn, Chatbots</td>
</tr>
<tr>
<td>Applicant tracking and Interview scheduling</td>
<td>ATS and Customer Relationship Management tools, followed by traditional interview scheduling tools</td>
<td>AI candidate correspondence tracking and self-scheduling tools</td>
</tr>
<tr>
<td>Assessment</td>
<td>Skill-assessment tools are available, but evaluation is manual</td>
<td>AI-based psychometrics and behavioral assessment tools, video interviewing solutions and analytics based cultural fit assessment tools</td>
</tr>
<tr>
<td>Background checks, offer management and onboarding</td>
<td>ATS, CRM and onboarding tools that can be integrated to ATS</td>
<td>Automated background checks, automated offers, chatbots that answer basic HR questions</td>
</tr>
</tbody>
</table>

One example of changing hiring strategies comes from Google, which in the past, used to hire graduates from Ivy League universities, such as MIT and Stanford (Alsever 2017). However, after realizing that grades, university reputation and test scores where not a good predictor of job success, Google decided to change the algorithms of its AI hiring systems and look for traits like learning ability and intellectual humility (ibid). AI used in recruitment can be of any kind, from natural-language processing, image recognition to read text, recognize image and videos, as well as comparative analytics that comb through large amounts of data that can be used to predict things like employee turnover, performance and leadership (Alsever 2017). In increasing amounts, we are seeing a use of AI for its ability to connect variables such as personality, and psycho-emotional traits and job performance, while continuously learning and assessing data (Alsever 2017).
2.4.1 Current state of implementation

According to Alsever (2017) there is an increasing trend in using AI recruitment tools, considering the high number of startups fighting to benefit from the $100 billion HR assessment market. Recruitment chatbots are another way of AI use in the human resources processes (The People Space, 2017). Chatbots help recruiters by dealing with the first stages of recruitment, like asking and replying to frequently asked questions like on employee benefits or company culture, and thus allowing human recruiters to concentrate on the later stages of recruitment (ibid). Another example of using artificial intelligence in recruitment is using algorithms and other tools to scan data published by potential candidates such as Linkedin and other online profiles to target key people and present them key roles that are tailored according to their skills and experiences (Pirri, 2019).

The company “Interviewed” has developed a software which uses natural-language processing and machine learning to simulate and predict how an applicant will fit in a company (Alsever, 2017). The way it does that is by analyzing word choice and gestures that an applicant might use during an interview, and connect their potential psycho-emotional traits and skills. The creator of this software says the tool is not perfect but does make the decision-making time much shorter (ibid). The author continues by saying that while it is common to use these softwares and AI tools in the early stage of recruiting, recruiters prefer a more human approach when it comes to the latter stages of the recruitment process (Alsever, 2017).

In her article, Alsever (2017) lists a few other examples of AI software being currently used by companies in different stages of the recruitment process. Entelo is one software that scans the internet and social media profiles of candidates for the recruiters to understand how often potential candidates changed jobs during the last couple of years. The second example that Alsever mentions is Talent Sonar, a machine learning tool that writes job descriptions in a way that conforms to more gender diverse opportunities. Thirdly, HireVue uses facial and voice recognition patterns to analyze candidates in video interviews (Alsever, 2017).
When Google launched the Cloud Jobs program, many of its customers like FedEx and Johnson and Johnson started using it to enhance the communication with potential applicants in their hiring platforms as well as to increase visibility and matching probability to job seekers (Alsever 2017). In order to make this program, Google scanned millions of job vacancies and then applied machine learning models and analytics to reveal connections between these positions, particular skills and attributes, and job performance (ibid).

2.4.2 Perceptions

Boudreau states in his article for the Harvard business review, that human employees will always be essential to organisations, but organisations as we know them will change (Boudreau, 2016). They will be more diverse, more agile, and will change structure and organisation to fit these changes (ibid). The traditional perception of the rise of intelligent machines is often framed in a negative way and mostly associated with job losses (Boudreau, 2014). The fear of AI bringing total automation, which insinuates that all the jobs will be taken by machines, thus making humans, is supersized by the media and pop culture,

2.4.3 Benefits

When it comes to hiring, one well-known attribute of AI over humans is the ability to make better predictions for things like job performance, productivity and employee turnover (Boudreau, 2014; The People Space, 2017). Some believe that using AI in recruitment helps with overcoming human biases and preconceived ideas by using pattern recognition tools (The People Space, 2017). By eliminated certain human biases, AI can help human recruiters enlarger their pool of talent to extents that the latter never dared, and therefore increasing chances to finding better-skilled employees (Pirri, 2019). Another human deficiency that AI can seemingly overcome is inconsistent information processing. (Kuncel et al, 2014). The authors state that because human recruiters can be easily distracted by random bits of candidate data, machines can be more efficient in terms of unbiased and efficient information processes in the selection process (ibid)
Another strength of AI systems is the capability to integrate massive amount of data and apply predictive analytics, which then can be used to evaluate different decisions (Jarrahi, 2018). In addition, in the face of complex problems, AI can help reduce it by uncovering cause and effect relationships through predictability and statistical algorithms. This has now been taken one step further with the development of deep learning, through which machines learn by themselves from a small data sample and expand to larger data sets (ibid).

2.4.4 Limitations of AI

Kuncel et al, (2014) write that most recruiting managers believe that having a certain degree of intuition in the selection process results in better decision-making. Additionally, the authors imply that no algorithm can substitute for a veteran’s accumulated knowledge, though collaboration of human and AI, can on the other hand bring efficiency and better decisions in recruitment and talent management (Jarrahi, 2018; Kuncel et al, 2014). Both academics and practitioners are fascinated by the role of AI in bringing ultimate automation, and consequently outperforming and replacing humans in the workplace (Jarrahi, 2018).

Alsever (2017) mentions the concern and controversial reactions on using these AI tools, especially into the attraction phase, since it involves scanning data, on public and private social media, such as Facebook, that uncover gender, religion and other personal information. The companies that do this practice are called out for discriminatory recruitment practices and are often legally condemned (Alsever, 2017). Some authors believe that things like internal logic perception and subconsciousness found in humans are impossible to replicate by machines and AI (Jarrahi, 2018; Parikh, Lank, & Neubauer, 1994). In addition, it is said that AI is incapable of understanding what we humans call “common-sense”, especially if that lays outside the knowledge the AI has gathered (ibid).

3. Methodology

This methodology chapter will provide the details of the research process that was conducted during the 5 months of the undertaking of this thesis. The section will be structured as follows. Firstly, a study description including the logical argumentation towards the chosen
areas of research, choice of organisation as well as the prescriptive steps and research methods used for the collection of the empirical data, will open the section of methodology. Following that, a section containing the argumentation for the specific choice of the particular research method and how that achieves the objectives of this research study, will unfold. Thirdly, in the case description section, a background picture on the national, regional and local history and level of innovation, specifically on AI related areas, is presented. Finally, this methodology section ends with the presentation of the case study “Running the marathon of AI- the story of Linköping municipality’s recruitment” created about LK and the organisation's AI-related practices.

3.1 Study description

Upon the initial research of the topic, it was observed that the discourse on AI in general, and in recruitment in particular, is two folded: on one side there are positive perceptions, and on the other side negative perceptions. Therefore, in order to get a better understanding of the application of AI in the recruitment processes, both sides of the coin need to be examined through (a series of) interviews. At this point of the research, it is important to keep an open mind in terms of data inclusivity, meaning that both organisations that currently use AI and organisations that do not use AI, should were targeted for the interviews. Moreover, it is equally important to keep an open mind in terms of thematic inclusivity, specifically regarding the recruitment process and general effects on the rest of the organisation. After a thorough research, taking into consideration all above mentioned factors, we decided to collaborate with Linköping municipality and use this organisation as a main source for the primary empirical data. The municipality is the perfect example of an organisation that has started experimenting with easier forms of AI, such as automation, but at the same time is considering developing and evolving more complex AI processes further in the future. Therefore, the retrieving of the empirical data was based on 3 interviews and was designed as follows. Initially, an initial interview guideline for Linköping municipality was developed. Afterwards, as a second step, a follow-up interview guideline for the same organisation was designed, in order to go deeper in the recurring areas from the first interview. Finally, an interview guideline for ReachMee, the partner software development company collaborating
closely with the municipality, was created in order to retrieve more detailed data related to technical terms and topics.

*Initial Interview with Linköping Municipality*

In the beginning, as mentioned above, an initial interview guideline (see Appendix 1) was designed and the questions included were divided in four sections: **current state of application, results (significance), evaluation and future general perceptions.** This division of the interview guideline was done to aid in the collection and later organisation of the collected data and information into thematic areas. In the first section, general questions about the current state of the HR function, recruitment processes and automation/AI in the aforementioned processes, were posed as a way to begin the interview. In the second section, questions about the results and implications of using the autonomous and/AI systems in recruitment were asked. In the case of a non-AI user organisation, the same questions would be asked in the form of hypothetical questions, in order to understand the perception rather the current reality of the topic. The third section consisted of questions about the evaluation tools and strategies of the AI systems in place. When it comes to non-AI users, similar to the second section, the questions will be asked in an hypothetical form. The final section of the interview guideline included questions on beliefs, expectations and perceptions about the usage of AI in recruitment as well as in general in the future, and how would this future look for organisations, employees and the other stakeholders affected.

*Follow-up Interview with Linköping municipality*

Having had an initial 'taste' of the organisation and its efforts in implementing AI in recruitment from the first interview, a follow-up interview, as the name suggests, was essential for getting following insights around specific topics and processes (see Appendix 2). Differently from the first interview, which consisted more in learning about the current automation in the recruitment system, as well as some general perceptions about AI, the second interview focused more on how the current system could be elevated into a higher level, complex AI, and what could be some potential implications, as well some drivers and barriers of such implementation. The interview starts with technical specific questions on
data input and other technical specifications. Furthermore it continues with questions related to hiring and decision-making, implications of HR transformation and ultimately ends with questions regarding functional and organisational strategy regarding AI. This follow-up interview was a determining factor in shaping and narrowing down this research, as it brought the study closer to answering the thesis question.

*Interview with the software development company, ReachMee*

Finally, for a more detailed view on the current automated system in place at Linköping municipality, an interview with ReachMee, the software company responsible for developing the automated recruitment system, was conducted. We believe that adding the technical aspect in the pool of empirical data, adds to the story, while making the discussion more tangible and less abstract. The questions directed at ReachMee were quite technical, related to types of AI in place, system development and functionality, as well as specificities regarding HR recruitment solutions (see Appendix 3).

Overall, having built robust interview guidelines that allowed the gathering of a wide range of data, the second step was contacting the organisations for the interviews. The latters would be qualitative semi-structured interviews, focused in the areas of research, but also rather pragmatic and simplistic. The interview style was thought to be semi-formal and in the form of a discussion rather than a strict interview. This allowed more flexibility for the interviewers as well as for the participants being interviewed, especially for questions related to subjectivity, perceptions and beliefs. At the municipality of Linköping, both the initial and follow-up interviews were conducted with the same person. Patrik Reman, a recruitment specialist in the organisation, responsible for the AI and automation projects in the recruitment processes. Interviewing the same professional benefited this research in two ways; firstly, given that the recruitment specialist is the most competent person in the organisation, as well as the key driver on the topic. Additionally, it allowed us to retrieve the most accurate and relevant information on a fairly contemporary topic, Secondly, it gave us the opportunity to focus our research in specific sub-themes, without risking to broaden and overspread our research scope. Both Patrik Reman from LK and ReachMee have agreed to full disclosure of the information provided by them for this thesis.
3.2 Motivation of methodology choice

When research concentrates into finding deeper information about a phenomenon, a single-case study often produces the level of detailed information needed. A single-case study has a stronger base for producing high quality theory, as the variants can be narrowed and clear control can be established on the search (Eisenhardt, 1991). This particular form of research method is often not dependent on the outcome, because the research is narrowed to one sample, and therefore it gives a freedom for the outcome to become true, no matter the direction or hypothesis laid in beforehand. Moreover, it is difficult to make a single case from loose evidence, since the depth comes naturally, and the focus is driven into the correlations and phenomenon within one subject (Eisenhardt 1991, Reichow et al., 2018).

However, when conducting a single-case study, a risk of obtaining biased information is possible, as the data is based on only one sample. Nevertheless, as Reichow et al. (2018) conclude, even the bias can be useful when conducting the single case study, as the bias might show a different set problems in the study when the research is replicated (Reichow et al., 2018). The single-case study should however, be developed in a manner that allows the outcome to appear naturally, and without bias. Its development should be clear, transparent, and follow a methodology that questions the relevance of the variances and selection (Reichow et al., 2018). To make sure that a research of a single case is as neutral as it can be, there are few steps to take into consideration. Firstly, the selection of the participants for the research should be neutral, no intervention of the conditions should be allowed. Additionally, the participants in the single-case study should be chosen based as a presentation of a general sample. Secondly, once the case subject has been chosen, none of the procedures or research should be interrupted or leaded. As an example, the questions performed should provide a neutral base for any given answer. Thirdly, the outcome of the results should not be hidden, and the research purpose should be transparent to all the participants, as well as the data collection. The report should present all the variables, not only favorable or the data supporting the research. The information received should be unchanged, even when the test or data collection is repeated and variance might occur (Reichow et al., 2018, Eisenhardt, 1991).
After an initial communication with several organisations, Linköping municipality was chosen as the organisation to be studied in the form of a single-case study. While the option of conducting a variance study with the participation of many organisations was initially considered, it was decided that the amount of time available for this study was not enough for this type of research study. Moreover, conducting a variance study on the topic of AI in recruitment would add little insight to the academic and practical spheres, due to the possible lack of depth in the research. Therefore, given the opportunity presented by Linköping's municipality, it was decided that this study would be in the form of a single-case study, focusing on Linköping's municipality as a primary actor. Additionally, by focusing on a single case study rather than other methods, would allow us as researchers to reach a considerable level of depth on the process of applying, and implications of using AI in the recruitment processes.

In addition to the primary data collected from Linköping municipality and ReachMee, other sources of information were also used to gather a more comprehensive base of secondary data. One of the main sources of secondary data used was the 2018 Vinnova Report on "Artificial Intelligence in Swedish Business and Society - Analysis of Development and Potential". This report produced by Vinnova, the Swedish innovation agency, was commissioned by the Swedish government to produce the above-mentioned report to map and scrutinise the AI competence and application in the Swedish society and industry (Vinnova, 2018). Besides including recent data on the growth, research and needs of AI in different industries, part of the report's results are based on a cross-sectoral survey on multiple Swedish organisations which highlight information on AI applicability, drivers, barriers and strategic implications for the future (ibid). This report proved to be essential for the development of this research study, as it overcomes the risk of bias from a single-case study method by enlarging the empirical data sample used.

In addition to the Vinnova's report, Linköping municipality's technological development plan report from 2017-2019 for different sectors of the municipality, was used, showing the level of implementation of the technical advances in each area. The municipality's website shows the upcoming technological changes in the area as well as preparing Linköping citizens for
the digitization. Moreover, the organisation is also driving the AI to different areas, as the development report shows the future plan. As the report is not limited to recruitment, but rather the future development, we can use the information to analyse a future general direction.

3.3 Case Description

3.3.1 AI in Sweden

Nordic countries are known for their high level of digitization and early adaptation to technological changes. The IT infrastructure is very well developed, and standing plans of further development are made to compete on the global market. As the digitization of the nordics, specifically in Finland and Sweden, is high and the population is used to a high level of automation, it is easy for companies to implement automated processes. This provides a strong capability to develop AI competencies and applications in nordics, and specifically in Sweden. Examples of Swedish-based companies that use AI related innovation include Ericsson, IKEA, Spotify and many more (see figure 5).

Referring to the business sector, according to Sweden's Chief Digital Officer, Ms Åsa Zetterberg, deciding to implement AI will substantially increase the country's competitiveness in the global market (Regeringskansliet, 2019). Since one crucial challenge that Sweden is facing nowadays is the skill deficit, the government is committed to engage in a multi-stakeholder dialogue that involves AI in resolving this challenge by developing lifelong learning programs and other technological applications (ibid).
To get an overview of the current state of AI usage in the Swedish public sector, the Vinnova Report includes a survey conducted in 2018, where the total amount of responses from government agencies, municipalities and county councils/regions was 560. "The response rate was 60 per cent, corresponding to a total of 337 responses, of which 171 were from government agencies, 145 from municipalities and 19 from county councils where the survey was sent to both the county council director or regional director and to the health care director" (Vinnova, 2018, p. 56). Within the survey, several aspects were addressed, including perceived benefits of AI between different sectoral areas and expected benefits of AI in the organisation (ibid). The latter included topics like the implementation level of AI within the organisation, the knowledge of the AI and skills development, working strategically with AI, and forecasting the future potential with AI. Overall, the responses where measured through four variables: efficiency, quality, service and work environment. For a more detailed overview of the results, please view figure 6 below.

Figure 5. An overview of the ecosystem of companies for AI related innovation in Sweden (Vinnova, 2018, p.84)
Results from the survey question “What benefit do you think AI can provide your organisation in relation to improved service for citizens and businesses, quality, efficiency and work environment for the employees?” (Vinnova, 2018, p.57)

Regarding ethics and transparency issues, the chief digital officer of Sweden believes in the right to increase knowledge about AI and its uses (Regeringskansliet, 2019). A special focus is placed in the development of ethical algorithms that avoid discriminatory actions and are instead used only for the benefit of the public (ibid). In conclusion, the new government of Sweden sees AI as a key factor in the implementation of its digital strategy and working towards a more action-oriented sustainable digital transformation (Regeringskansliet, 2019).

3.3.2 History and innovation in Östergötland and Linköping

Being geographically positioned between Stockholm in the north and Jonkoping in the south, the region has been laying on a good physical infrastructure and transportation system (David, Charles et al. 2003). With a population of around 450,000 inhabitants, this region is the fifth largest in Sweden (Regionostergotland.se, 2019). The two biggest cities in the region, which are at the same time the most populated cities in Sweden, are Linköping and Norrköping, which combined make up 62.3% of Östergötland's total population (David, Charles et al. 2003). With an unemployment rate of 5% (only 1% lower than Sweden's average), the rest of the active labor is involved in the service (64%), manufacturing (31%) and agriculture sectors (3%) (ibid).
In addition, Cantwell and Iammarino (2001) characterize this region as one of the most dynamic industrial regions of Sweden, due to its technological activities, business climate, entrepreneurial culture and openness to external networks (ibid). Additionally, this particular area is known for its innovation and technology hub, as well as having companies driving the AI solutions within Sweden. The most prominent areas of AI usage are gathered in the field of image diagnostics, e.g. digital pathology, in which a great, globally leading research is being currently executed, in collaboration with the commune and the local university. The Östergötaland region, in collaboration with Linköping's University is also developing automation/robotisation for customer engagement. Within this area the robotics can be used both internally and externally in relation to patients and city residents, in order to develop a smoother and faster customer experience as well as better services for the commune.

3.3.3 Linköping Municipality

Linköping is particularly important for the region due to its knowledge-intense specialization in sectors like communications, aerospace and electronics (David, Charles et al. 2003). This sort of specialization is created by an innovation system that is supported by firms operating in the high-tech industry, universities, research centers, and other innovation support structures, which allow the transfer of knowledge and growth of innovation (ibid). The following are some examples of innovation supporters in Linköping. Firstly, the city focuses on developing an entrepreneurial culture and providing start-up guidance through institutions like Nyföretagarcentrum and Centre for innovation and Entrepreneurship and SMIL (David, Charles et al. 2003). Secondly, institutions like Linköping University, GROWLINK programme, East Sweden Foundation of Entrepreneurship and Technology Transfer develop and promote knowledge intensive businesses through public-private cooperation, knowledge dissemination, and technology development (ibid). Moreover, Linköping university has been a significant source of qualified labor, talented graduates and innovative start-ups and initiatives. Thirdly, since 1983, the city of Linköping has placed an increasing effort on developing knowledge intensive firms, specifically through Mjädervi Science park. While hosting 370 companies and micro-enterprises, the park works together with LiU, the municipality and other collaborators, to facilitate technology creation and diffusion, all while
fostering innovation (ibid). Fourthly, through organisations like ALMI Företagspartner and the Swedish Industrial Development Fund (IF), the city ensures constant support for product development, coordination of funds and expansion efforts for SMEs and larger companies in the area. Lastly, what makes Linköping an integral place for the development of technology-based activities in the region, is providing area-based support services and supporting local business through organisations like the city council, the east Sweden chamber of commerce and many more (ibid)

In terms of sector specialization, Linköping municipality has a strong industrial expertise in two areas. Firstly, in information-communication technology (ICT) and electronic equipment, through the historical bases of Ericsson and Siemens. Secondly, in aerospace industry, which is older and more concentrated, and comes from SAAB Aerospace (David, Charles et al. 2003). These factors have contributed in the creation of an effective system of innovation that includes both entrepreneurial initiatives, enterprise support and new knowledge diffusion (ibid).

The municipality of Linköping has a strong will to lead the innovation and communal development as part of the county's plan for digitalization of different public services e.g. school teaching, elderly care, landlord managing etc. The goal is to have an efficient and user-friendly network of digital services, to increase everyday standard of living in the municipality (Linköping, 2017). Since 2017, the municipality has piloted several digitisation projects in education, elderly care and the public sector. To support the growth of IT services, and IT development in the city, the municipality has also opened more data space for public sectors to use, as well as moved database of municipal information to electronic archives instead of papers (Linköping, 2017). Another reason for having these digitization initiatives is to bring more companies and businesses to the area. The easy accesses to any municipal information and support from Linköping to use digitalization within city services, allows the technological environment to grow even further. Linköping has also planned several digitized systems to elderly, and health care, in collaboration with the university hospital. These changes will all positively affect the standard of living in the city, as well as the attractiveness for companies as well as research (Linköping Kommun, 2019).
3.3.4 Running the marathon of AI - the story of Linköping municipality's recruitment

Introduction

“...we're not letting it (run) for it self, we always have somebody checking that nothing goes wrong. Now people working at LK are really used to this development all the time, so I think that's why they think it's good. Also, digitisation is everywhere today, from when you start school and so on, everything is going through digitisation. This is just another way to digitize, so that you don't have to come [physically] here and things like that.”

- Patrik Reman, recruitment specialist at Linköping municipality

That day for Patrik was packed with meetings, but the interesting part of it was that they all had a common topic: automation of the recruitment processes of Linköping municipality. As a recruitment specialist, Patrik is in charge of this process, serving as a point person for technical issues, as well as acting as a stakeholder manager with the software development company, ReachMee, and others. When we entered his office, he was waiting gladly, as he was eager to tell us more about the project.

3.3.5 Recruitment process at Linköping municipality

The municipality hires approximately 2500 people per year, 1000 for the permanent positions and 1500 for the part-time ones. The organisation uses a standardized recruitment process, and recently automatization, introduced in 2017, which is only used in the screening phase for the recruitment of part-time and seasonal workers. There are two reasons for that. Firstly, the intake of part-time and seasonal positions is higher than the intake of permanent positions, thus the recruitment process for the former is highly demanding in time and other resources. Secondly, usually the hiring process for the part-time positions is simpler and less complicated than the processes needed for hiring specialists or managers. For the latters, the hiring processes is a traditional one, which means that all the stages of the recruitment are performed by the recruiters in the team. However, regardless of the job position, every candidate has to apply through the official electronic platform of Linköping's municipality.
For the part-time and seasonal workers, the automated screening process consists of pre-fed qualification criteria, short-answer questions and tests. Besides the level of experience, knowledge and skills of the candidate, the pre-fed qualification criteria can include soft-skill assessment, which can be easily integrated in the algorithm in the form of questions like business and personal values. Based on the answers, the system moves the applicant to different categories which are called 'profiles' (see Appendix 6), and then does the shortlisting of the successful candidates.

3.3.6 The new automated recruitment process

A typical automated screening process at LK looks like this. The applicant applies through the official website for the desired position. If the applicant manages to go forward in the questions section, the following step will be a test. In case the applicant manages successfully the test, a second round of questions and tests will follow. During this whole process, the recruiter has an overview of all the applicants and their individual achievements and stages in the recruitment process through the automated system (see Appendix 5). After successfully completing the second round, the automated screening process is completed and the interviewing process starts. This upcoming stage is managed by a 'human' recruiter and it is the first time a person takes over the recruitment in this process (see Appendix 7).

“...it's quite simple right now. We are looking for more real AI, that can read though applications. We need to take it a step further because we have so many hires every year. Even if you can just shorten every hire with 10-15 minutes, it would be a lot for us. It's become much faster now, but we need to become even more efficient.”

- Patrik Reman, recruitment specialist at Linköping municipality

The automated system is outsourced and created by a Swedish talent solution company called ReachMee. Linköping's municipality chose this solution for their recruitment process due to its user simplicity and freedom of data input which doesn’t need constant assistance from ReachMee. Regarding GDPR and data privacy issues, Linköping municipality and ReachMee dispose of the candidates' personal data after 2 years of receiving them. When it
comes to feedback on the use of the automated screening process, the recruitment team is very positive. Recruiters are satisfied and now are demanding more automation and even more AI tools in the HR processes. Thus, the department is planning to introduce more AI, like tools that can read through the applications in the future, since the current system is helpful, but far from enough. The immediate step in the future application of AI in the recruitment process of the organisation is implementing an AI that reads through the CVs and Cover letters of the applicants, task which is currently done by recruitment personnel. The following step after that would be to connect and integrate all the AI tools together in one common system, which provides feedback and data that could increase learning opportunities for the AI, and thus increasing the future recruitment prediction and decision-making quality significantly.

3.3.7 AI testing in the recruitment system

The automated process in the recruitment system, which is currently being applied from the organisation, is only the basic step towards using AI in the recruitment processes, clarifies Patrik. Increasing the presence of AI is a long term goal not only for the HR department at LK, but for all the municipality as well. LK’s digitisation director allocates the budget and initiates digitisation projects in the department, including AI-related ones. The current status of implementation of AI in recruitment however, can be considered at a testing phase, since Patrik and his team are experimenting with different solutions and products. What the HR recruitment department is trying, in collaboration with ReachMee, is to develop a new and tailored text-mining AI that responds to the needs of Linköping municipality's recruiters and applicants. Additionally, this AI needs to have the ability to scan through and compare the applicants’ CVs and cover letters. Moreover, the AI would not only pick up key words, but would also compare data retrieved both from applications and test profile scanning, and then analyse this data in order to come up with the best hiring alternative. Regardless of the level of complexity that this tool might have, LK is very clear about its status in the initial stages of application.

“Well, the expectation is not for it to be a stand-alone AI that works for itself, but it's going to be a support for recruiters. Let's say, when they (the
recruiters) have made the first selection, then they check if the AI did the same selection as them. It's like a help system for recruiters. And then, we have to see if it can learn different education criteria from different countries, like, does it understand that this is almost the same education as the one we have in Sweden. I think that will be the hardest part”

– Patrik Reman, recruitment specialist at Linköping municipality

Using this tool as a “support system” will not only help in the trial and error and testing phase, but it will also help the AI to learn from more amounts of data. In recruitment terms, that is particularly important when it comes to reading different formats of CVs, education and experience levels, areas in which standardisation of titles and criteria is clearly lacking. In this context, a considerable challenge for Linköping municipality, as Patrik notes, is how to teach the AI to make the right choices, Another way that this AI can be used is as a self-check, as well as peer-check method in terms of making decisions about the applicants. The recruiters can use the AI to inquire if their selection matches the AI selection, and if not, what are the differences, and why are those differences there. By using the system as a support agent, the organisation makes sure, among other things, to avoid possible biases, such as gender, age, and race discrimination. In addition, as noted in the quote above, through the AI recruiters can review each-others decisions, comparing to the results of the AI. This is done in order to come to the best possible decision, but also to make sure that the machine learning AI is not taught in any wrong way. This, according to Patrik, can happen very easily, so that's why, he stresses, continuous check-ups are vital.

“That's why it's not going to be a stand-alone system, but just a support system, so we can check all the time. So when the recruiter makes a selection, and then we check: did the AI do it right or, did it do it better than the recruiter. And then we check why is there differences and how do we have to change the AI after that. If you see different companies that place the AI before the recruitment (staff), sometimes they do it very wrong: only men, 40+, or only women. Therefore we have to check it really closely in the beginning to see how it works. Maybe it doesn't work at all, and then we have to find another solution”.
“Feeding the right data to the AI is crucial for another reason” Patrik points out. In case of criteria not being met by the candidate in the selection process, the AI will need to know how to choose the candidate that is the closest to that criteria. This is currently done manually by the recruiters. Moreover, the recruitment team hopes to exploit AI's potential in order to identify future potential and employee development, by connecting the text-mining AI to the automated selection process and tests. This way, the AI can have a full view of the applicant and at the same time gather more data from more recruitment stages.

3.3.8 Evaluation

In terms of system effectiveness, the evaluation and feedback is quite positive.

“...the candidate gets more feedback than normally, because every time you get moved into different folder, you get a notification that you have gone to the next step in the process. This way, the candidate thinks that it's a person who does this; they don't know it's automation. Since there's a delay in reply when you don't meet the qualifications, it takes up to 2 days to get a “no thanks” answer. When you do meet the qualifications, it's always the same email you receive and you can see the previous messages as well [in the same chain] so it looks like a person has done this all the time, rather than automation.”

- Patrik Reman, recruitment specialist at Linköping municipality

When asked about possible failures and malfunctions, Patrik believes that the only way mistakes can happen is when the algorithm input from the personnel is wrong. This happened especially in the beginning of the implementation of the automated screening process, when HR personnel were not entirely used to handling the system. However, with continuous monitoring and feedback, as well as with a candidate reply delay of 2 days, the chances of making mistakes are very small and always decreasing.
When it comes to his perception of AI competences, Patrik thinks that, although some AI-only job interviewers are currently being tested in Sweden and worldwide, it could take up to 5 years for humans to get used to the idea that machines will interview them for their next job. According to the municipality's recruiters, candidates have a better feeling about the idea of a human interviewer.

"..I think maybe in 5 years, when it's more common. Like with video interviews that we are starting right now, but the candidate does not know it yet. But we are getting there, so more and more people will get used to it. It happens in distance as well, we do a lot of Skyping with people who live far away so, those kind of interviews could be with a robot as well. We should ask the same questions to all candidates, which we don’t do, but we should do. That’s where AI could be really useful."

- Patrik Reman, recruitment specialist at Linköping municipality

On the other hand, Patrik believes that by using an AI system as an interviewer will make the decision more objective and bias-free, by making the algorithm ask the same questions to all the candidates, regardless of their profiles or experiences. Additionally, humans tend to be distracted or judgmental during interviews, Patrik believes, thus AI can make better recruiting decisions in the end. This is the reason why implementing several control filters, like the automation process and tests, helps in making a more objective decision.

The whole recruitment process can be fully automated soon, according to Patrik. Nevertheless, the recruiter is the one who makes the final hiring decision in the end, while AI can only provide the best alternatives. The positive results are in part due to the strong evaluation and post-implementation system in place. Firstly they evaluate the hiring process with the candidate in each step of the process. Afterwards, they follow-up with the selected candidate, before and as soon as the incumbent starts, and then they follow up with their direct manager as well. In addition, after the hiring process is finalized, the new recruits are evaluated after 3 and 6 months. Secondly, they regularly follow up with the a larger team from HR, ReachMee, software developers to discuss the system. Thirdly, they often follow up with other departments in the organisation to discuss automation. The triggers for
embracing innovation and AI on this level are: the HR director, Patrik, the HR specialist himself, and the organisation as a whole in general. They all believe in digitalisation of the human resource processes and have a positive perception on automation.

When it comes to the question of implementation efficiency of the automation, and later more complex AI, Patrik sees it as a long-term investment, which, like any other long-term investment, it's expensive and has low returns in the beginning.

“Having this big recruitment for the summer, I think we can save a lot of time and also we can be faster contacting the right candidates, so that we don't lose them to other companies. So we are going to save money in many ways: we get the best candidates, because we are really fast in the selection, and then the people who are doing the selection can have more time doing interviews instead. So, maybe the total cost does not go down, but we can do longer interviews and more tests and tasks like that”.

- Patrik Reman, recruitment specialist at Linköping municipality

The opportunities for using AI in the HR function in general are numerous, and as Patrik mentions, there has already been some automation in processes like compensation and development. Managers can use automatic systems to keep track of personnel absences and leaves, which could be helpful for large teams like in the case of Linköping municipality. However, this should only be used as a purpose of assisting managers to keep track of their employees, and not to control them, Patrik clarifies. An important implication of using automation and AI that Patrik has been noticing in his department, is the transformation of the role of the recruiters, managers and the HR department in itself.

“I think recruiters, from what we are already seeing here, are more of a support for the managers when they are going to recruit. We have a long talk (with the managers) before we recruit: what are the qualifications needed for the candidate, education, previous jobs, languages. So we can have longer discussions about that as well, and to check with the whole
department: do we really need this person here or do we have to change and move people, because in 2 years things are going to change”.
- Patrik Reman, recruitment specialist at Linköping municipality

Due to more time availability, the hiring managers' roles are changing as well, drifting from task oriented, to more educational and motivational leadership oriented. They have more space to communicate with the employees and use the extra time to train and develop their capabilities further. The HR function, on the other hand, will change from a supportive function to a more strategic one. In particular when it comes to innovation and digital initiatives, the HR department aims at being not only an implementer, but a driving factor and a source of inspiration for other departments of Linköping municipality, as well as for other organisations debating whether or not to give a green light to the AI stream.

3.3.9 ReachMee e-recruitment software developer

ReachMee is a Swedish software developer specializing in the development of HR-software and automation solutions for recruitment. The company has been serving many large scale companies with their automated recruitment system and was chosen by Linköping's municipality, based on the user friendly, simple, yet efficient system ReachMee was able to customize for the organisation. As Patrik mentions, few other developers were tested as well, but the decision was soon made to use the ReachMee services, as their automation software outbid the other competitors.

ReachMee describes the automated software in discussion as Event Engine (EE), given its ability to allow the users (recruiters in this case) to set-up the criteria based on their needs, e.g. applications submitted, test questions set-up, answers to questions etc. The modifiability of the system serves well to the municipality. Different positions need different qualifications, and the flexibility of the program allows the user to make changes to any of the recruitment steps and test questions. The rules are manually set to the EE and the necessary steps and questions have to be considered carefully by the user. As Patrik stresses, it is very important for the user to understand the whole process and adjust the needed rules
accordingly, as there have been cases in which the set-up was done incorrectly and a lot of candidates were lost.

"...people can always do wrong. When we did this last year, the person who set this up moved to a different department, then went for a vacation for 2 weeks and I thought well when I come back I will have a lot of applications, but she set it up wrong, so everyone got a “no thanks”.

- Patrik Reman, recruitment specialist at Linköping municipality

Although the automation minimizes the selection biases, Patrik acknowledges the risk of losing good candidates because of it. Approximately 5% of the good candidates are lost due to insufficient or not well set up testing, and this is where AI is really needed. As the yearly amount of recruits is increasing and thus becoming challenging to manage, automation can shorten the time consumed in the selection process. Nevertheless, human error is still happening in the process, and the system is dependent on the recruiters’ actions at all final steps of the recruitment.

As previously mentioned, ReachMee software has its benefits when it comes to the user friendliness, both for the users setting-up the rules, in this case Linköping municipality, as well as the job applicants. The software does not use algorithms, and therefore can be fully adjusted to the users needs on the spot, without specific tech or programming skills. The priority for the company has been to develop a system that can serve as a simple automated platform for all the users, as the former recognizes the importance of a good applicant experience, while considering the non-tech specialized employees who will be doing the software adjustments. The training for the system usage is done in one day by ReachMee personnel. Afterwards the organisation using the software is responsible for training the rest of personnel for the system usage. However, based on the interview with Linköping municipality, the training does not take more than a few hours. As the system reduces the technological steps, the training is fairly simple which helps in cutting the costs of personnel training hours.
The ReachMee recruitment software has made the employee recruitment much faster for the municipality and the feedback on the user friendliness has been very positive. However, more needs to be done in order to reach the efficiency needed to handle over thousand applications per year, Patrik stresses. As previously mentioned, the automation still needs manual setup for each recruit, and the criteria, including the test questions, must be manually fed to the system. While most of the unqualified candidates can be rejected immediately through this automated system, the hiring process still requires a person to go in and make a manual selection and later conduct the interviews with the qualified candidates.

4. Analysis and evaluation

The case above, together with the secondary data gathered, present many interesting views on the topic of AI applications in recruitment. However, four recurring themes seem to continuously stand out from the findings of this research. Decision-making, Strategic Innovation, Control and Change have been identified as critical variables throughout the whole process of conception, implementation and evaluation of AI tools in recruitment. These 4 key thematic areas works as drivers and simultaneously as barriers on the topic of discussion. Thus, as researchers we believe that the consideration of these 4 variables and their bipolar identities is highly essential for the process of pre-implementation and strategic decision-making when it comes to adopting AI by any organisation.

Based on this reasoning, the upcoming section will be structured as following. First, a table comparing theoretical evidence and empirical evidence, gathered for this paper on the impact of each key thematic area on the discourse of using AI in recruitment, will offer a general overview of the current context. Next, each thematic area will be analyzed, both in its role as a driver and as a barrier. Lastly, the discussion section will provide an overall summary that connects all the thematic areas in more unified and consistent picture, which will create space for future recommendations for organisations interested in applying AI in their recruitment practices.
4.1 Comparison table: Theory versus Reality

Table 3. Theory vs. Reality

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<thead>
<tr>
<th></th>
<th>Theory</th>
<th>Reality</th>
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<tbody>
<tr>
<td>Decision-making, Efficiency and quality</td>
<td>Decisions based on the data fed, can lead to biased decision-making, though governmental ruling of data being used, minimizing bias (Raub, 2018). Better decisions, since can scan through masses of data from a single person, finding more information of suitability (Emmanuel, 2017). AI is capable of filtering masses of data in short time, making it extremely efficient (J. du Plessis and Frederick, 2012). AI cuts costs from the human labor, as it can sort information within seconds, as well as perform mundane work extremely quickly, making it unbeatable in any info sourcing (Chapman and Webster, 2003).</td>
<td>Better decisions, since more criteria can be fed into the system. No discrimination, as there is no person doing the decision, rather an objective tool (Patrik). AI decision-making is not trusted yet in companies, as AI still weak (Vinnova, 2018). Cuts time from the human labour, making it very cost-efficient and user-friendly. Lessens the burden of recruitment. Easy to program, takes hardly any time to set up the candidate information in (Patrik).</td>
</tr>
<tr>
<td>Strategic innovation</td>
<td>AI is not yet very advanced in creativity, thus innovation through AI is still in development. Creative tasks challenging but experiments have been done (Kaplan and Haenlein, 2019). Predicting the future direction is more accurate when using AI, as well as detecting future problems becomes easier (Moore, 2016).</td>
<td>AI is not seen as an innovative tool, the current usage is fairly limited to data mining operations (Vinnova, 20188). No information was found of the AI usage in HRM strategy.</td>
</tr>
<tr>
<td>Control, Transparency</td>
<td>Biases transform with the algorithms, therefore not necessarily transparent (Raub, 2018). AI and machine learning needs to be controlled by humans in order to arrive to the best decision and avoid biases (Kaplan &amp; Haenlein, 2019)</td>
<td>Everyone sees the results, there are no transparency issues (Patrik). AI can manage the whole recruitment process and propose the final best recruitment options. However, the recruiter makes the final hiring decision. (Patrik)</td>
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4.2 Decision-making

Understanding the subtle differences of the two types of decision-making, analytical and intuitive, is important when comparing humans to AI (Jarrahi, 2018). The author defines analytical decision-making as an approach that involves “analyzing knowledge through conscious reasoning and logical deliberation” (Jarrahi, 2018, p.3), the kind of decision-making which is based on rationality and logic, and therefore relies deeply on information and data (ibid). However, not every decision is made through analytical and laborious information processing (Dane et al., 2012). The other decision-making approach which comes from the subconscious part of thinking, is called intuitive decision-making, and is considered to be the strength of a human brain (Kahneman, 2003). Intuitive decision-making, or as Carl Jung defines it, intuitive intelligence, is an approach that is not based on rational thinking, but rather on imagination, creativity, past experiences, and thus involving deeper level of perceptions (Jarrahi, 2018; Sadler-Smith & Shefy, 2004; Bishop, 2000). This kind of decision-making is based both on holistic and abstract thinking (ibid).

As Kahneman (2003) affirms, the human intelligence in decisioning is based on a mix of statistical intuition and statistical knowledge, unlike AI which relies only on the statistical knowledge. As human decision-making has several different aspects, and the judgement is affected by several variants, such as intuition and learned behaviour, is an individual able to
use these variants smoothly together, leading to balanced decision of rationality and soft-skills (Kahneman, 2003). At the same time, we can consider that AI is not able to calculate certain attributes which come naturally to humans when making decisions, such as risk of the decision now, and in the future, and the effect of multiple possible future events which are interdependent, yet not having a direct correlation (Tversky and Kahneman, 1981, Emmanuel, 2017).

When it comes to the discussion about who's the better decision-maker, the idea of humans versus machines is becoming outdated, and more authors like Boudreau (2014), Jarrahi (2018), and Kaplan and Haenlein (2019) believe that the answer to this equation relies in the fruits of collaboration of both players. Among many examples of human-AI collaborations, the one study focusing on cancer detection is a great example of showing the interaction between the two proved to be more successful than the two approaches individually (Jarrahi 2018). In his article, Jarrahi (2018) states that while AI can be a great source of analytical and quantitative approach, tackling ambiguity and uncertainty with just rational approach is difficult and quite limited. That is why, in terms of decision making, he advocates for AI and human collaboration, where AI supplies the calculative and probabilistic approach of analytical decision-making and humans leverage that by providing the tacit, experiential and qualitative assessment of intuitive decision-making (ibid). Ultimately, the combination of fast information analysis combined with intuitive and personal judgement will result in the best approach for decision-making (Jarrahi, 2018). Additionally, as the decisions of the AI are not yet on highly advanced level in normal company usage, is AI better be seen as a human complementing system, than taking over the work of humans (ibid).

Another reason why decision-making is equally important and difficult for organisations is because of the factors like uncertainty, complexity, and equivocality (Jarrahi, 2018; Choo, 1991; Simon, 1982). Therefore, in current development, AI can be efficiently harnessed in human complementing positions, in which the data processing speed outperforms the human capacity, whole future paradoxes and creative solutions are better solved by humans (Kaplan and Haenlein, 2018). When dealing with huge amount of data, AI comes very handy for processing it, identifying multiple related variables and recognizing patterns that human might not be able to see (Alsever, 2017). Therefore, using AI algorithms in decision making
helps to reduce the lack of information that uncertainty brings and make alternative predictions to fight it (Jarrahi, 2018). Through probability, variable, and pattern recognitions, and data driven statistics, AI can make predictions about the external environment and thus aid the organisations to make strategic decisions (ibid).

Since the decisions of AI are data based, and therefore possible to program to any given usage, AI decisioning is extremely efficient. The strength of the AI lies in its efficiency to deliver solutions to rather complex questions simultaneously cutting time as well as costs (Reilly, 2017). Using AI in recruitment will free the humans to use their capacity to other tasks, as the data mining made by AI brings up more detailed information about the candidates and executes the selection decision in a matter of seconds. The ability of AI to comb through and process an extensive amount of data helps not only with efficiency matters, but increases the recruitment selection quality too (The People Space, 2017). This is what the recruitment specialist, Patrik, and the HR staff from LK, appreciate mostly from their current recruitment system: the relief from spending extra time in processes like single application scanning. In addition, the expectations are even higher with the new CV and cover letter AI, planned to be introduced in May 2019.

On a micro level, as the AI advances and learns to make better candidate selection decisions, there is a risk of it outsmarting people. AI can be used to solve future paradoxes, and to do strategic moves, as it can evolve to predict upcoming scenarios better than humans (Moore, 2016). Seeing the corrective actions and calculating future moves, AI is outperforming human with its calculative capacity and scenario mapping. Machines can browse through millions of historical events and learn the patterns and outcomes, which human could not be able to process. In this sense, AI could be used to make correct strategic moves (ibid.). Theoretically this seems quite possible and even very probable use for the AI in the near future. Problems occur when humans “blindly” trust on the machine decision.

When it comes to human resources and talent management, AI is far away from finding the potential talents, particularly when human intuition can outcall the future potential in a person, as well as the future potential needed for the company. Since machine learning can predict the future and detect problems with more accuracy than a person, it could lead to AI
making recruitments for the future needs, which people do not even recognize yet (Moore, 2016). That can be considered an ideal scenario, especially when it comes to recruiting future talents. However, the reality is further than this ideal scenario. As it was also confirmed by the recruitment specialist at Linköping municipality, for the AI to spot “talented” candidates in advance, many iterations of test results, manual data entry, checkup and feedback rounds need to be performed by the AI system together with the recruiters, before the AI manages to learn from all this amount of data, and starts making plausible recruitment decisions.

4.3 Strategic innovation

As noted in the findings, AI implementation projects are on the top of the list of innovation efforts in the region of Östergotland. As the case of Linköping municipality shows, there is a great deal of resources, human and financial, being allocated to the ideation, testing and implementation of these project. However, these projects, specifically the AI in recruitment project, are not isolated and thus not limited to a process, department or organisation innovation. This is due to the fact that the implementation of artificial intelligence in the recruitment process requires the active participation of many elements and stakeholders that are not bounded within the HR department of Linköpings municipality. These stakeholders and partners' collaboration play a crucial role in exchanging knowledge, creativity, best practices and resources, which in turn can be translated into innovation in the HR recruitment process. This kind of innovation which allows the interaction of multiple stakeholders is defined as open innovation (Hengsberger, 2019). Firstly, in order to create a purposeful and effective AI recruitment tool, the internal expertise and knowledge of the HR and recruitment staff is essential. Secondly, in order to ideate and develop artificial intelligence and other digital tools and systems, the HR department of LK needs the external technological base and knowledge of other stakeholders, such as ReachMee and Linköping university, for instance. ReachMee has previously contributed for the automatic summer-jobs recruitment software EE, and Linköping university's contribution consists, among others, in hosting the data computing processors as well as providing all sorts of data needed in making the AI more intelligent. Data is in fact, the third essential element needed to produces a highly effective and tailored recruitment AI.
The minimal condition for AI to function is to have access to data, and in an increasingly digitized society, the source and availability of the data is immense (Vinnova, 2018). However, for organisations to fully benefit from the amount of data out there, they need to set two types of strategic goals: short-term, which entails the use of current available data, and long-term, which entails making sure that the data produced is uniform and digestible (ibid). With the application of automation and AI, these goals on data accessibility will promote value creation, in the selected organisational function or process used.

Nevertheless, having access to the data is not enough for a smooth application of the AI. The organisation needs to standardise the interpretation and the outlook of the data in order to be processed by the AI system and computers (Vinnova, 2018). Regarding the knowledge required to develop these systems, it is crucial that it is a part of data science and AI nature. However, when it comes to operating these systems, it is “…adequately and resource-efficiently implement such adjustments is based on combining knowledge within AI and data science with operation specific knowledge and skills in organisational development” (Vinnova, 2018, p.29). According to the same report, it is crucial that these kinds of combinatorial competences, both data-science and operation-specific are developed.
simultaneously while implementing an AI system (ibid). This is exemplified very concretely in the case study of LK illustrated above.

The HR department of Linköping municipality has contracted the software developing company, ReachMee, to design and develop the current automated recruitment system, thus commanding partial data-science competences. However, when implementing a more complex AI in the recruitment process, for example the text mining AI, which is currently being tested, two problems emerge. Firstly, the software company, ReachMee in this case, does not provide any AI solution that can be fit into the recruitment process needs that Linköping municipality has. Secondly, the availability and integration of the data, might be problematic. In the first stages of implementation of AI, the recruitment team will need to manually input, check and integrate all the data which will need to be fed to the system. The recruitment team, and in particular Patrik, the recruitment specialist, hold all the operation-specific skills and competences to use the AI system effectively. They feed all the necessary data, including specific criteria, key words and other customisations, in order to get out the best from the AI. Without the combination of both skills, the implementation of the automatic recruitment system would not be possible. In terms of data availability, besides feeding the data manually, the organisation needs to find a broader source as well as more efficient way of finding data. Since the data input is currently limited to the received applications for open positions, and, since LK cannot have a talent pool to retrieve data from, it becomes necessary for the organisation to look for external sources of data. One reliable source to retrieve current and reliable data can be academic and research institutions, like Linköping university.

As previously mentioned, Linköping municipality has always aimed at being innovative, by fostering digitisation initiatives and other technological innovation into its processes. Looking into the recruitment process in specific, the HR department is opting for an open innovation strategy and ecosystem collaboration. Currently, with the automation of the summer job recruitment processes, the department's innovation strategy can be defined as an acquiring type of inbound innovation. The latter is a form of open innovation strategy where organisations buy the expertise and input from other organisations in the market-place (Dahlander and Gann, 2010). However, as the organisation is moving towards developing the
recruitment AI in-house and co-creating value through continuous collaboration with different sources and partners, it can be said the Linköping municipality is moving towards a more ecosystem-oriented strategy. Nevertheless, this shift is slow and will take more effort and strategic intent. One reason for that is that in Sweden, the AI used is mostly developed for the sectors of healthcare, agriculture and social services (Vinnova, 2018). The AI usage is concentrated on practical purposes, such as elderly assistance, administrative work, and education, making it a priority to develop tools and services for these sectors first, rather than micro challenges in recruitment. The future development is slowly coming to an area of administrative work, but as these challenges are often quite small scale projects which vary from one another, it is not seen as efficient to invest in small scale processes (ibid).

4.4 Control

“With artificial intelligence, we are summoning the demon.” (Raub, 2018 p.1). Controlling the AI is a question that has been pondered for a very long time. As some disastrous predictions have been made regarding AI taking over the humans through superior, ever learning intelligence, it is highly unlikely that this scenario will happen anytime soon (Jarrahi, 2018). However, some degree of control must be established on the AI usage and that has much more to do how humans use AI, rather than AI using humans. When thinking of the basic elements of AI and its usage in personal data-mining, it is obvious that limits need to be set in what data AI gets its 'hands on', and what information needs to be controlled and restrained from the AI. Moreover, the question on who gets to decide over the data and the sufficient regulations to control that the AI is fed information in an unbiased manner, is still there.

The decision-making of the AI is based on the data fed to the system and therefore it can be trained to which ever way intended. The judgement of the AI is merely repeating the existing data, mimicking human behavior and human decision-making (Reilly, 2018). As the AI does not include intuition, a machine decision-making is purely logical, and therefore leaves out the negative biases which a human might have. At other times, however, if the data carries bias, the AI will simply make a decision on that biased data, and ultimately repeat human mistakes. The problem occurs already in the human actions. As the AI relies on the data
gathered through different sources, any biases or lack of data in certain areas will affect the decision-making of the system (Raub, 2018). As AI uses the neural networks in decision-making, it is impossible to see its internal process. The neural networks work in a synopsis-like manner in which data and information runs through, and ultimately makes a decision which is impossible to understand by a human. This sort of human-like decisioning can also lead to transparency issues, if as an example, a recruitment decision would be asked to be explained for further investigation (Reilly, 2017; Jarrahi, 2018; Raub, 2018).

When AI makes a decision, it is easy to believe that the algorithms and programming have done their possible best to deliver a non-biased, overall balanced decision. This is also a reasoning for organisations to perform knowingly biased recruitment, as the decision can always be veiled into the programming of AI. Although AI has a reputation of being unbiased in a recruitment setting, promoting non-discrimination and equal chances for all the applicants, it cannot be fully controlled who gets to decide on the data and programming of AI. While equal opportunities through AI might be true in theory, there are still several biases in AI usage and development. AI is a rather new technological advancement in recruitment, and therefore it still has aspects that need to be considered when investing in it (Raub, 2018). Ultimately, equal employment opportunity is not guaranteed through adopting an ‘objective’ AI in candidate selection, as the data fed to the AI can easily be biased itself (Raub, 2018).

As mentioned, it is difficult to control AI when it comes to transparency of the recruitment. Algorithms and data used are resulting into machine decision, which is seen as a valid, unbiased decision. As Raub (2018) concludes in his research:

“...the subjective choices made both by the programmers and by the employer in previous hiring decisions are absorbed into the algorithm by way of the data that is used and the subjective labels placed on specific characteristics. Thus, when subjective labels are applied, the results are skewed along the lines of those labels and the data that is utilized. Therefore, it is possible for algorithms and artificial intelligence to inherit prior prejudice and reflect current prejudices.” (Raub, 2018, p.534).
At LK, Patrik acknowledges the difficulty of finding and feeding unbiased data to make sure the AI in recruitment does not mimic the human biases. While the legislation of AI is lagging behind, companies are fairly open to develop their AI in whichever way suits the company best (Raub, 2018). As the organisations in Sweden are not yet using AI in an advanced level, finding the data for the AI can be challenging. At the municipality of Linköping, the challenge of gathering holistic data for the AI programming has been taken into consideration: "that's a big question for us right now. How do we teach the AI to make the right choices, and where can we find the information for it" (Patrik Reman, Recruitment Specialist). Other aspects of AI control need to be considered as well: who is programming the AI and having access to the data AI is using, as well as, who will be able to use the AI, and make sure that AI is not used to mine data from people who are not related to the recruitment process? These concerns, which are often-times overlook, pose critical challenges in the implementation of AI in recruitment.

When Furhat, the Swedish interviewing robot, was introduced to the market, it was labeled as a discrimination-free tool of interviewing candidates (Engadget, 2018). While the robot is believed to not have any biases or assumptions about the candidates, the problem lies in the data that is given to the robot, not in the machine learning itself (Raub, 2018). Considering these factors when implementing AI as part of the recruitment, especially the selection process, can prevent the human biases from being transferred and incorporated in the AI decision, and ultimately making the recruitment process even more transparent than traditional recruitment.

How can the AI be controlled then, if even the decision-making can be biased and the results received might recycle the same talent pool which the company already has? Moreover, how can a company establish a solid control over the AI decisions and actions? According to a study from Kaplan and Haenlein (2019), AI needs to be controlled by people, and more creative solutions are still at this point produced by humans (Kaplan and Haenlein, 2019). When using AI in recruitment, it is necessary to oversee the AI selection and evaluate the results to ensure the best possible outcome. Keeping the AI within limitations is important, as the decision it produces in the area of recruitment concerns people’s, and organisations' wellbeing (Reilly, 2018). At Linköping municipality, the 'taming' and controlling the
intelligence of the AI in the recruitment process, is not seen as a problem. A strong belief that it can be controlled exists and possible challenging scenarios are not speculated yet. As the AI will be implemented in the near future, the testing will be done in a linear model, fixing the pain points of the system once they occur.

4.5 Change

Organisations strive for cost efficient operations and time-saving solutions and the HR function is often seen as the saving point for the organisation (Reilly, 2018). While some companies want to use AI in recruitment merely as a tool to achieve efficiency, others want to optimise the process and get better applicants and talent sourcing through AI. Thus, the benefits of AI are not limited to gaining more time and efficiency. According to Alsever (2017) many AI applications are now used to assess human and psychometric qualities, through analyzing micro-gestures, word choice and other information. The real benefit in these types of applications is the ability of AI to process this data and recognize patterns and common threads, that sometimes are invisible to even the most experienced of human recruiters (ibid). In this context, the accuracy and speed of the AI will outperform human labor in applicant selection. In other words, these types of AI can be used to overcome certain biases that are often associated with hiring and Patrik's experience at LK proved that point. He firmly believes in the AI’s objectivity, and acknowledges the intrinsic tendency of human recruiters to fall into bias traps. The AI behind the video interviewing applied in the seasonal recruitment process is a manifesto of that belief. At Linköping’s municipality, having more efficient recruitment has been a major driver for the AI implementation. While theory suggests that efficiency is the major strength of having AI driven recruitment, it is not necessarily always the case when implementing AI as part of the existing systems within a company. Investing in AI is expensive, and requires technological advances from the company and the environment (Vinnova, 2018). When already having AI in use, it might result to a very efficient recruitment, but the implementation process and the testing of AI will take time and financial resources.

This willingness to include new technological tools as advanced as AI in a typically traditional process like recruitment requires the organisation to make an effort and strive for
embracing change. Even more so, in an environment of constant technological innovation, being able to adapt sets up the rules of the game. In particular when it comes to using AI, a multifaceted adaptation is required from different actors. Adaptability requires companies to focus on business development, and managers to focus on using their leadership skills to guide employees in skills readjustment (Vinnova, 2018). Kaplan and Haenlein (2019) state that in a time when AI is transforming the business and work environment in striking ways, managers need to incrementally adopt a leadership style that exudes confidence to the employees. Leadership traits like conflict resolution, human and ethical management and open dialogue enabling are essential for a smooth transition into this transformation (ibid). Most importantly, the managers should reassure the employees that increasing the applications of AI in different business processes and functions is not done to substitute them, but on contrary to increase their efficiency and augment their results. In order to further benefit from this transformation, managers will need to become creative leaders, identify the skills, as well as design the best positions for employees so that they can thrive in this AI-human business environment (Kaplan & Haenlein, 2019). In addition, managers need to strategically identify which kind of knowledge cannot be substituted by AI, and which can (ibid).

The rise of more applications of AI will have an increasing impact in the restructuring of different departments in companies, specifically the ones that are using intensively AI-related innovations. Additionally, the impact of AI will be beared by employees as well, as they try to continuously renew their competences in order to tackle the continuously changing tasks (Vinnova, 2018). Since some functions and tasks are outsourced to AI, the employees need to develop complementary skills that go along the new AI system in place (Kaplan and Haenlein, 2019).

In the case of Linköping municipality, the HR staff was initially sceptic about introducing automation in the selection process for the summer and part-time jobs. Their immediate reaction was rejecting the idea, argumenting that it would be more complicated and it would not work. However, they immediately changed their mind as soon as they saw how much it helped get rid of the extra work of reading and assessing hundreds of applications per position.
At the same time, change is manifested not only in the recruitment employees' job description, but also in the managers role as well as the HR department as a whole. Confirming Kaplan and Haenlein's (2019) statements on change, the recruitment specialist at Linköping municipality believes that HR managers will shift their focus from operational tasks to a leadership role, motivating and cultivating their teams’ potential and skillsets. AI has been found effective to help with communication between the employees and managers. An AI software can help managers to track the performance of their teams and individuals easier than before; an AI gathers information of the employees interests and strengths, and can therefore inform the manager about the employees' motivation in different tasks or interest in career development within the organisation. As AI is able to make efficient decision in finding the correct skills to the company, it can also be used to retain the talent within. Since retaining the talents and managing the performance is not the same as a once a year salary negotiation, technology can be used to bring management closer to employees by providing long-term and real-time feedback (Buck and Morrow, 2018). Another positive effect of AI is the improvement in communication, connecting employees to managers through chatbots for example, for immediate, world-wide access to support and motivation (Buck and Morrow, 2018, Ciol, 2018).

However, what might make AI problematic in recruiting is the screening based on the previous data. If specific skills are needed, AI is able to spot these talents. However, when it comes to spotting the future potential talent without skills but rather mindset, getting the right recruit can get more complicated (ibid). Human resources can be used to evaluate the soft skills of the candidate and to make a final judgement on the selection, but to shortlist the candidates for the final selection, AI is significantly faster (Reilly, 2018). In the long run, in the area of matching skills with the job positions, AI will need further development so that it can read the underlying motivations in a candidate’s profile and see the potential, something which until now has been the task of the human intuition (Jarrahi, 2018).

By applying AI and automation in the recruitment process, the HR will become more strategic in itself, not only by employing higher quality human capital, but also by leveraging the potential of the existing employees. When rare skills are needed, companies have started
their own training programs to obtain the future skilled employees with specific expertise (Kahn, 2018). In the end, this effort will translate into higher performance, and ultimately competitive advantage for the organisation. This perceptions from Linköping municipality also goes in line with Boudreau's statement about the slow but certain transformation of organisation in face of automation and machine learning (Boudreau, 2016).

As the e-recruitment has taken a stronger position as the more effective and cost cutting solution to find new employees, some tasks and functions can changed in the recruiting process. The process’ changes affects the tasks performed as well as the nature of the tasks (Holm, 2012). While automation has been used in task managing before in such cases as automatic applicant correspondence and application database registration, AI is bringing a very different set of tasks with it (ibid). Instead of thinking AI as disrupting or over taking the whole process, it is necessary to concentrate on the benefit which can be provided through AI (Emmanuel, 2017; Jarrahi, 2018).

The transformation of the recruitment operations from manual labor to highly intelligent machine systems has its own challenges. Not only are organisations facing a different phase of technological advances, but implementing and efficiently using AI requires flexibility and adaptation from the organisation (Reilly, 2018). While implementing an AI in some of the recruitment processes might sound fairly effortless and simple, it has further implications to whole organisation, including organisational learning and talent management as some of the immediate effects. Developing, implementing and teaching AI to work in the desired process is costly, and most likely, not error free. As the human behavior is hesitant towards changes, only having the managerial intent and additional training for the personnel, is not sufficient for carrying through the change of the operating and strategic processes (ibid.).

5. Discussion and conclusion

The case illustrated above and the analysis that follows, aim at giving a contemporary overview, not only on the state of application of AI in the recruitment system in a Swedish organisation but also providing a general picture of AI competence, applicability and the state of implementation in swedish organisations in general. Noticeably, there is an increasing
willingness and affinity by swedish organisations to implement more automation and AI in different functions and processes. There are different inclinations and motivations for applying more automation in recruitment processes, and most of them vary from organisational strategy, the purpose of the intelligent system to be implemented or the readiness and technological competence of the organisation. While these motivational factors can vary, four key factors seem to be the recurring focal point of the discussion on AI implementation: decision-making, strategic innovation, control, and change. An important point that came from the LK case study, however, that these key factors act simultaneously as drivers and barriers, and for the HR management to make a decision whether implementing AI or not in recruitment, each key factor, with both the positive and negative characteristics, should be considered.

The final section of this research study will be structured as follows. Firstly, a summary of the major contributions and key learnings, particularly focusing on the four thematic areas mentioned in the analysis: decision-making, strategic innovation, control, and change, will be presented. Secondly, a section of the set of limitations faced during this research will be explained. Finally, this thesis will conclude itself with a section presenting recommendations for managers that are considering implementing AI in their processes, as well as some recommendations for future research. With this last section, we hope this study contributes to both practitioners and academics interested in the field of AI in HRM and we are eager to see what it can do for this thriving area in the future.

When it comes to decision-making and efficiency character of AI in recruitment, some might not consider it as a real breakthrough in the area. In fact, the first step towards advanced hiring processes made way before AI, e-recruitment, had already been successfully used since the late 1990's to early 2000's (Kerrin, 2003). Among other benefits, applying methods of e-recruiting strikingly raised the quality of recruitment for organisations, by increasing the accessibility of job positions to anyone, and thus enlarging the potential talent intake (J. du Plessis and Frederick 2012). However, hiring processes have started to become laborious for some organisations, when hundreds and thousands of applications are received, it becomes hard to manage, and more efficient tools are needed to solve the problem. AI has been introduced as a part of the recruitment processes, and while the dilemma of AI
producing biased decisioning, AI is still outperforming people in decision-making efficiency (Raub, 2018). According to the Vinnova (2018) report “the quality and efficiency of different tasks will increase and enable people’s work to become less routine, thus creating space for more creative work tasks for humans” (Vinnova, 2018 p.27). In the context of recruitment, AI applications support human recruiters in many trivial tasks that would otherwise would take too much time. The hiring process is accelerated, and that is very positive in terms of efficiency gains (Upadhyay & Khandelwal, 2018). In addition, by delegating these repetitive tasks to AI, recruiters can focus instead on more creative and strategic matters in their daily routines (The People Space, 2017; Upadhyay & Khandelwal, 2018). The recruiter's role is transformed and becomes more strategic. Instead of dealing with the single issues in the recruitment process, the recruiter spends more time building relationships with the new employees, as well as focuses more on talent identification and talent development (ibid). The latter task could be considered quite cost effective in one hand, as organisations are able to reach talent easier and faster.

When it comes to the control factor, introducing autonomous or even more complex AI in organisational processes, it may be considered as a large step. Looking into the recruitment and specifically the usage of AI in it, in Linköping's municipality, and Sweden in general, companies are still mostly on the implementation or development stage (Vinnova, 2018). The initial attitude towards the introduction of AI is positive, and it is seen as a non-biased method of recruitment. Legal settings of AI programming exist to hinder discriminatory set-ups. While these rulings are made to eliminate biases, discrimination is still possible and companies see AI decisioning more as an efficient, positive change as opposed to the traditional recruitment. By utilising AI or even autonomous systems, many organisations like LK, can go through numerous applications and select the most qualitative ones, extremely efficiently and with minimum human interaction. In the case of LK’s HR department, the goals for the automated process are very clear, and on the software developer's end, they had a strong expertise in developing recruitment software products. The automated recruitment tool is extremely user friendly, for both the LK recruitment team and the end user, the applicants, allowing the recruitment team to exercise full control on the process, something which is crucial in inbound-acquiring innovation according to von Zedtwitz and Gassmann (2002). As the case study reveals, the limitations of data attainment and management need to
be taken into consideration when setting up an AI. Especially if the latter is of the nature of machine learning, data management is crucial in order to produce an unbiased selection of recruits. Another quality driver that pushes toward more use of AI in recruitment, is the potential that AI has to go beyond analysis and assessment of current potential of candidates, and look beyond into the future of their careers. Existing AIs like SkillSurvey for example, can predict things like employee performance and employee turnover (Alsever, 2017). These kinds of applications reassure recruiters in making the most qualitative decisions when it comes to human capital, as well as it helps them navigate the uncertainty of the future, related to hiring and employee retaining.

Innovation-wise, when it comes to developing a more sophisticated recruitment AI, Linköping municipality has decided to forgo the option of acquiring it directly from ReachMee. For this reason, the HR department of Linköping municipality has decided to develop the AI internally, with the external input of other sources, and thus embarking on a journey towards change. This solution creates more opportunities for diverse innovation in Linköping's municipality, and also increases the chances of incorporating different kinds of strategies, including the open innovation strategy approach, which can be then used also in other sectors within the Municipality. Chesbrough and Appleyard (2007) define open strategy as a new value creating approach which adopts the benefits of open innovation coming from all the different partner and ecosystem members. Similarly, by embracing an open strategy, the HR department of Linköping municipality can collaborate with external innovators (universities, software developing companies, other municipalities) as well as internal partners within the organisation (the digitalisation team) to exchange ideas and contribute to the quality and variety improvement of AI tools in the recruitment processes, making it user friendly not only to the HR department, but also to the candidates applying for positions in the municipality.

Candidate relationship, which is considered as a branding potential by many organisations, is easily managed and nurtured by automation and AI in recruitment. Through AI, Linköping municipality can provide feedback to applicants, providing them with advice on how to improve these deficiencies, recommending positions for the future, based on the candidate's skillset, and therefore making sure the talents will not be lost in the recruitment. These are
some of the reason why AI in recruitment boosts efficiency through multi-tasking, fast and secure decision-making (Upadhyay and Khandelwal, 2018). The use of AI does not only change an organisation internally, but it can also impact the recruitment industry and therefore competition rules, by affecting revenue, profitability and talent acquisition.

**Strategy-wise**, it could be said that the HR department of Linköping municipality has embraced partly an open innovation strategy. This kind of open innovation mindset comes with a set of advantages and disadvantages. To implement AI to the city's recruitment system, will be an investment for the future, which will profit the city in the long run, but will require patience, commitment, and investment, in the beginning. The internal environment as well as the external players in the city are supporting the system implementation, and therefore, the opportunity to develop AI in-house is a great chance for the whole municipality. If successful, the AI can be even sold as a ready made system for other municipalities within Scandinavia, resulting in direct revenues for the city, and also benefit the overall AI usage in nordic countries. At Linköping's municipality, the external environment is somewhat ready to have AI as part of the municipality's recruitment processes. The city has a strong community of AI developers who hold regular AI meetings within the multiple innovation hubs in Linköping. The university is a major contributor in the scene of AI development in Sweden, and to have such a highly technological advances in the same city, helps the municipality to implement AI internally. Talents and knowledge base will be available through LiU, as well as computing power and any data support. The more organisations and institution collaborate for the improvement of AI tools in recruitment, the more effective these tools and softwares can get, and ultimately, more research and more complementary products will emerge (Chesbrough and Appleyard, 2007). Besides collaborating with players in the HR and recruitment sectors, Linköping municipality can extend the collaboration pipeline to other industries that are successfully using AI. For instance, the health and transportation sector in Linköping are already using AI, and can serve as a model for the implementation. Additionally, maintaining the cooperation with Linköping's University, which is crucial for the knowledge transfer between the AI in research and practice.

Finally, while AI has many positive qualities, and it can be used in variety of purposes like cutting the costs and increasing efficiency, it is still in its earliest developmental stage in most
of the Swedish organisations, especially in the area of recruitment. While the technological development is fast, and the future competition between skilled individuals will be even more aggressive, organisations should nevertheless not rush to the implementation of AI. Having insights like this research, especially from early adapters like Linköping municipality, organisations can learn to more about realistic expectations towards using AI as part of their recruitment. For recruiters in the future, it is essential to understand the role and the transformational power of automation and AI, as being able to master this power will determine talent flow absorption, and ultimately gain competitive advantage over competitors. The next phase for organisations, after understanding where AI stands in HR, will be to figure out a common AI strategy for the whole organisation, that transcends from being ad-hoc, to being exclusively purposeful. As the external, as well as the internal environment, are highly important factors in implementing AI successfully, it is not sufficient to merely look into the internal factors of the organisation when making the decision of AI usage. The business environment must be adaptive enough to support the technological and, most importantly organisational changes. Such questions as strategic intent, data support, access to the technology, costs of investing in computing power, talent sourcing, technical outsourcing opportunities and future development of the external environment, are some aspects that affect the implementation of AI in the recruitment process. These internal and external variables are important to look into, and some of them thoroughly investigated, before making the decision to implement AI.

5.1 Study limitations

As the thesis is conducted during a limited period of time, and follow up of the results is not possible to collect, the thesis has therefore narrowed the search to a single-case study, while secondary data is used to support the empirical research. The data for the thesis was gathered through interviews, and no first-hand AI testing was observed in practice. The thesis gathered data from the future AI users, and no interviews were conducted with current AI users. All the information has been gathered in the most unbiased way, using questions that allow a neutral outcome. As there are not many scientific or academic publications on the implementation of AI in recruitment, we are limited to using the existing, rather new and speculative information from the topic.
The thesis does not look deeper into the ethical aspects of using AI, but concentrates on the practical implications, drivers and barriers of the AI implementation within organisations. We acknowledge the ethical issues with AI usage in HR recruitment, but limit out all the ethical studies from this thesis. Detailed legal rulings of the employment discrimination act or moral controversies in the electronic recruiting, have not been researched in this paper. Therefore the thesis rules out the legal and ethical matters of AI usage from the evaluation of the implications. As the thesis acknowledges the data issues with AI, it is not looking into this topic, as it constitute a challenge in different areas. The implications of GDPR on the AI usage within recruiting are still an unstudied area, and as there are issues with the data privacy and data mining, these technological or legal issues are not investigated further in this thesis. With these limitations in mind, the thesis was built with the objective of creating a bedrock for further research studies in the future that can use this case and apply it to different types of cases with longer study timeframes.

5.2 Recommendations and Future research

The fate of work in the face of automation seems to be a hot topic within some organisations, with some researchers going as far as believing that any kind of skill one can think of is replaceable by machines (Jarrahi, 2018; MacCrory, Westerman, Alhammadi, & Brynjolfsson, 2014). The full potential of the machines is yet to be understood, and therefore the area of AI and the information around it is under constant change. As people become more accustomed to interacting with AI in different forms, more information of the implications and human-machine collaboration is needed. To change and demystify the public's perception of AI, there needs to be more active discussion on the topic. By investing in AI and programming in multiple public and private sectors, countries like Sweden and Finland can bring the topics to a more tangible level, for all stakeholders to understand and participate.

Implementing AI as a part of recruitment will affect the efficiency, profitability, talent management, organisational learning and adaptability of the company. As the AI is a part of the future scenarios, it is only a matter of time before AI is seen in several different processes
within organisations. Rather than seeing it as a choice, it is a must for a company to implement in the future, in order to compete in the changing markets and acquire talents.

While AI will transform the organisation and its way of working, it can be taken as an opportunity to find new solutions to pain points of the organisation. An organisation that is considering the implementation of AI must also understand the complexity of the process, and assure that its culture is ready for the change, before the AI is implemented. Not only has the organisation to evaluate itself, but also the business environment in which the organisation is established. Questions like the following are highly important to be posed before considering AI implementation. Does AI suit the environment and the purposes, and what is the specific case in which it will be used? Is the case valuable enough to be invested in? Is it a growing area and is the long-term contribution necessary for the case, hence the AI implementation?

Through the research done for this thesis, it was noticed that information regarding the AI implementation in Sweden, and usage of AI in general, is very limited and only few reports have been published. For future research, we recommend looking into more narrow areas of AI implementation in Sweden, concentrating to specific areas of usage e.g. AI in administrative work, service AI in municipality level, as no reports or specific information was found on how developed the AI implementation is in these areas. More research is needed for the overall recruitment AI in Sweden as well, since no information was available for the topic. While information on the AI training data biases and data acquiring do exist from other countries, extremely little information was found on the AI training data availability and data usage in Sweden specifically. With that being noted, more research is needed on the quality of the AI training data within recruitment selection process in Sweden.

For companies, organisations and public sector usage, a more detailed research of AI and machine learning in Sweden would be extremely beneficial, as the information of machine learning stages and developers are currently difficult to find. On the other aspect, the publications of individual experience of AI in recruitment is an area to look into, since most of the academic articles have the perspective from an organisational view point. A further research is needed from the area of candidate experiences in AI recruitment, and AI testing
the applicants, as these areas are still very new, and academic publications available of the topic were few. On social level, the human-machine collaboration in recruitment is an area of relevance, and further research, as the results of collaborative work have not been measured in a longer period study. As the AI is an area of constant research and development, information about it ages fast, and as the humans think at the human level, we cannot understand the reasoning of AI decisions, even when thorough research is done, or as Kaplan and Haenlein (2019) conclude: "Just as humans can never truly understand how chimpanzees think, despite the fact that they share 99% of our DNA, we will not be able to understand how an ASI system thinks" (Kaplan and Haenlein, 2019, p.24).
6. References


CIOL 2018. 'Talex' - First AI based Talent Exchange Market Place. CIOL.


Appendices

Appendix 1: Initial interview guideline for Linköping municipality

Current state
1. What is the structure and size of the HR department?
2. How is recruitment currently done in your company? (short description)
3. Which part of the recruitment process do you think needs/deserves the most amount of
time/effort/energy/focus? Why? How much time is currently being dedicated to that process?
4. How much AI do you currently use in your HR?
5. What could be, according to you, some implementation challenges of AI in your company?
6. Do you think implementing AI will change the whole/part of the HR processes in the company? If yes how?
7. Do you think implementing AI will impact other departments in the company?
8. What are the drivers of implementing AI in your organisation’s HR function?
9. Are there plans to implement automation in the recruitment processes? If yes, in which stage?
10. Have you developed the AI system internally or do you outsource this process/system?
11. Do you use the AI to perform internal and/or external hiring?
12. Can you explain or describe us how AI works? (short preview)
13. How is your company/HR department investing in creating a good candidate experience?
14. What are some of the reasons why you have not implemented AI in the recruitment processes?
15. According to you, what could be benefits and limitations of AI in the recruitment?

Results/Significance
16. According to your experience, what are some implications of autonomous recruiting methods?
17. What are some important task/processes that AI can not substitute human recruiters on?
18. What is the reaction of HR staff to it? (in terms of usage, effectiveness and perception)
19. How is the data fed to the system?
20. How do you make sure that the selection criteria fed, is relevant to the work and performance?
21. To what extent has your organisation focused on ethical and/or privacy aspects related to the use of AI in HR?
22. In your opinion, can AI neutralize any biases of the selection process?

Evaluation
23. Have the AI tools in recruitment been effective?
24. If yes, how do you measure the effectiveness?
25. Do you do any kind of strategic review/evaluation of autonomous HR with the rest of the company? (Do you follow up the AI results, review the value)
26. What are the effects of using AI on the company's talent pool/flow?
27. To what extent is the application of AI affecting your organisation's HR function and the quality of the activities it performs?

*Future and general perception of AI in HR*
28. What is your prediction for the future of recruitment and AI in HR?
29. Do you think AI is the future way, or are there factors that AI cannot perform, when recruiting employees?
30. In general, how does your company prepare for the competition in the area of recruitment in the future?

Appendix 2: Follow-up interview guideline with Linköping municipality
(Questions for Recruiting specialist, person responsible of the recruiting processes)

1. When are you implementing the AI?
2. How/Why did you choose the developer? (History of the choice of the AI software)
3. What are the expectations from AI?
4. What sort of AI are you using in CV and application reading?
5. What sort of specializations does the AI need in order to work in applicant selection?
6. How is the selection criteria fed to AI, in order to have the desired result?
7. Who feeds the data to the AI?
8. Who is responsible of the constant update of the AI?
9. How do you make sure that the data is not biased? Is the data discriminatory free?
10. How do you control the AI? (needs specification)
11. Does the machine learn from the previous data?
12. In case of criterias not being fulfilled, how do you proceed?
13. How do you keep it from not selecting anyone, in case of not AI criterias fulfilling applicants?
14. (human)Selection may find future potential but the AI is not seeing it yet. What do you do?
15. How do you deal with the trade-offs of this decision? Do you have to manually interfere in this case or can the AI give you an option B.?
16. How do you plan to develop the AI in the future?
17. Can it be made more efficient in the future? Or do you see this as a final stage? (how do you keep it in frames, 'control')
18. Can it be transferred in the other positions or operation in the future? (example managerial positions, administrative work, payroll etc)
19. What are some struggles you have faced in the testing and how are you fixing it?
20. Can you trust the decision made through AI?
21. How does it make HR job different, what are the effects?
22. Can you describe or show us the AI system?

Further questions
23. Future strategy of AI in the HRD
24. How do you think implementing AI in the future will affect employee skills and functions in your department (including yours)
25. Can you give us examples of efficiency that has been gained while implementing automation?
26. How do you see the human vs machine relationship in the future? (related to HR and decision-making)

Appendix 3: Interview guideline for ReachMee (Software developing company)

1. What sort of AI are we talking about in general? (Machine learning, neural networks, etc)
2. What can the AI do and how (through which tools) can it do that?
3. Have you developed such a product (CV and cover letter AI screening) for other customers before?
4. How do algorithms work in recruiting? Who develops them?
5. Where do you get the data to train the AI?
6. How is the data fed to fit the hiring position, is there someone from LK to oversee the process?
7. How can the hiring manager/hr personnel use the system in order to implement the desired criteria?
8. What do you do in order to make the system user friendly/ easy interface/simple for the HR personnel?
9. How important is it for that the system provides a good candidate experience. Why?
10. How important is it for you that your client gets the best possible candidate in the end of the process?
11. Do you take feedback from the users (Link.kommun) and how often, and what do you do with this feedback?
12. What has been your biggest struggle with the development of this product, why, and how did you fix it?
13. How long time it takes to make changes to the AI?
14. Can you give us a preview of the system development?
Appendix 4: Automated feedback form from LK

**When do you expect to hear from us again?**
- [ ] In 1 week
- [ ] In 2-3 weeks
- [ ] In 3-4 weeks
- [ ] More than 4 weeks

**On what device did you apply for this job?**
- [ ] Computer
- [ ] Tablet
- [ ] Mobile

**On what device would you prefer applying for a job?**
- [ ] Computer
- [ ] Tablet
- [ ] Mobile

**Did you experience any technical issues submitting your application?**
- [ ] Yes
- [ ] No

**Did you lack any essential information in the job description?**
- [ ] Yes
- [ ] No

**What is your overall impression with our application process?**
0 = not good at all, 10 = very good
0 1 2 3 4 5 6 7 8 9 10
On what device would you prefer applying for a job?

✔️ Computer  ❌ Tablet  ❌ Mobile

Did you experience any technical issues submitting your application?

❌ Yes  ✔️ No

Did you lack any essential information in the job description?

❌ Yes  ✔️ No

What is your overall impression with our application process?

0 = not good at all, 10 = very good

0 1 2 3 4 5 6 7 8 9 10

Please tell us if you have any positive feedback about the application process (optional)

(Write your answer here)

Please tell us if you have any negative feedback about the application process (optional)

(Write your answer here)

SEND
Appendix 5

Klicka på "Visa processguide" för att läsa en beskrivning om mappen.

Klicka på pennan för att redigera mappen.

Processmappar (processteg)

Här kan du lägga till kandidater manuellt.

Anpassa din lista genom att ange vilka kolumner som ska synas.

Tips!

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Appendix 6

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