Artificial Intelligence and Management
Will Artificial Intelligence replace middle-level managers?

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September 2019
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Thesis for the degree of Bachelor of Business Administration

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September 2019
Artificial Intelligence and Management: *Will Artificial Intelligence replace middle-level managers?*

Thesis for a 12 ECTS thesis a part of 180 ECTS bachelor’s degree in Business Administration, School of Social Science of the University of Iceland.

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Printing by Háskólaprent

Reykjavík, Iceland, 2019
Preface

This thesis is a final project for a Bachelor’s degree in Business Administration with an emphasis on Management at the University of Iceland. It is worth 12 of the total of 180 ECTS that is required to complete the Bachelor’s degree. It is written by Rakel Einarsdóttir in the spring of 2019 under the guidance of Inga Minelgaité.

This thesis would not exist without the invaluable support of many people, to whom I am thankful.

First of all, I would like to thank my mother, Ásdís Sigurðardóttir, for all her support with baby-sitting my child, as I was so blessed to become a mother in the middle of this challenging time in my studies. If it would not be for her, I would not have been able to complete my degree at this point. I also want to thank my dear father for patience while reviewing my paper. I also thank all my family members for their patience, attention, and support in this important period of my life.

Also, special thanks to my dear mentor, Inga Minelgaité, for accepting to guide me and for her great support. I could not have asked for a better person to guide me through this project.

I realized that I wanted to use this thesis to write about something related to management as it is my area of interest. Subsequently, there was an interest in writing about something that belonged to the future, and I began to focus on technology in connection with management. This is a topic that could enable me to gain knowledge that would be useful in the future labor market.

I opted to conduct a systematic literature review as a research method, and now after I have finished this journey, I feel that my competences in reading and analyzing scientific articles, connecting findings of empiric research to the realities of contemporary organizations and future challenges, have increased considerably. Furthermore, the other challenge I decided to accept, writing my thesis in English, proved to be a very good decision, because as a graduate in Business Administration, I feel more confident to apply my knowledge beyond the geographical boundaries of my own country. Writing this thesis has really crowned my four-year journey of study and I am thankful for all those who were with me in this important endeavor.
Abstract

The aim of this thesis is to address a gap in the literature by conducting a systematic literature review research on current knowledge of artificial intelligence within the context of future management, with special focus on findings related to middle-level managers. The thesis endeavors to identify the change middle-level managers may face and whether they will be redundant in the future. The systematic literature review included 24 text papers, that were categorized into three groups: 1) Artificial intelligence in management, 2) Artificial intelligence as a replacement for human workforce, and 3) Future of artificial intelligence. Culture differences may have affected the results since the US has contributed the largest share of the research. The most common research methodology used was secondary data analysis, where data collected in previous studies was analyzed. Based on the results of the systematic literature review, it can be stated that the future impact on middle-level managers is unclear. The results found evidence in one paper, Atkin et al. (2017), which showed that a consequence of AI in facility management, could be that middle managers will get bypassed. Still, four papers showed a future impact on managers where their hierarchical level was not specified, meaning it was unclear whether they belonged to low-, middle-, or top-level management.

Artificial intelligence in the management theme enabled a conclusion that AI technology is changing business organizations and overall managerial work. Expert systems have enabled improvements in organizational productivity, and these can be successfully used to speed up decision-making, problem-solving and improve customer service. In the artificial intelligence as a replacement of human workforce theme, it was concluded that human resource managers are most likely to be affected by the technology of AI. In relation to the future of artificial intelligence theme, it was concluded that AI technology is an important and necessary tool for organizations to consider, potentially enabling organizations to thrive in the presence of considerable competition.

Key words: Automation, Artificial Intelligence, Management, Middle-level managers.
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1 Introduction

If we look at history, the biggest changes in human history happened in line with technological developments, starting sometime between 4500 and 3300 BCE with the fundamental inventions of the wheel (Berman, 2017), including the first Industrial Revolution that used steam power and water power to mechanize production (Syam & Sharma, 2018), then to the second, that introduced electricity and saw the emergence of the telephone, automobile and plane (Sentryo, 2017), and then to the third, that witnessed the rise of electronics that brought us computers and automation (Marr, 2016). All of these changes affected how people work. For example, the use of water and steam power significantly increased the efficiency of production technology that made life easier for workers (Huginn, et al., 2019). It also had an effect on certain professions. For example, engine power replaced the muscle power of humans and animals. As a result, whole professions disappeared due to technical change, and instead of artisans, craftsmen were brought to factories (Huginn, et al., 2019).

Now we are living in exceptional times where technological transformation is expanding in practically every area of our lives. We witness the effects of unparalleled innovations of technology that simply break down our old life structures (Wahl, 2018). These are the undergoing times of the intense “Fourth Industrial Revolution”, powered by communications technology, digitization, the ‘Internet of Things’, machine learning, artificial intelligence (AI), robotics, autonomous vehicles, 3-D printing, energy storage, biotechnology, nanotechnology, material science and quantum computing (Schwab, 2016). The major change in the Fourth Industrial Revolution will be in the field of decision-making. Where previously it was in the hands of human to make decisions, now machines and algorithms are depended on to make appropriate decisions (Syam & Sharma, 2018).

Nowadays, there has been a lot of debate about jobs being exposed to or carried out as a result of technological development, including AI. They will, to some extent, be affected by increased automatization. When referring to automatization, reference is made to the use of engineers, artificial intelligence or machines, which have been programmed with certain algorithms, such as algorithms to perform precise
manipulations or work done so far by human beings (Þorsteinsson, 2017). In the year 2013 it was suggested by Oxford University that up to 47% jobs in the US labor market were at risk of automatization (Frey & Osborne, 2013). Among those deemed to be particularly at risk were the jobs of credit accountants and auditors, civil engineering technicians, credit analysts, human resource assistants, legal assistants, loan officers, marketing specialists and market research analysts, revenue agents, and tax examiners.

The above-mentioned forecasts regarding the effects of technological development on job markets are already seen in practice. For example, in the year 2015, Fukoku Mutual Life Insurance, a Japanese insurance company, replaced 34 employees with IBM’s Watson artificial intelligence system that had the job to calculate payouts to customers. The firm believed it would increase their productivity, saving them about 140m yen (£1m) after a year and 200m yen (£1.4m) the year after (McCurry, 2017). Goldman Sachs Group Inc. has reported that they expect AI to add the most significant breakthrough in US productivity by 2025. As of the second quarter, 13% of S&P 500 firms have stated that their adoption of AI has doubled their venture capital funding to more than $10 billion in the space of a year (Syam & Sharma, 2018). IT industry research firm Gartner approximates that AI and machine learning also have the possibility to immensely increase new jobs driven by these arising technologies, estimating two million new jobs by 2025 (Syam & Sharma, 2018). In Iceland, there are indications that increased automation and AI have led to a reduction in the number of jobs in the banking industry, where the number of employees has decreased by 2000 since 2007 (Baldur Arnarson, 2017). This year the Icelandic Prime Minister’s committee published a report on the Fourth Industrial Revolution (Ómar Óskarsson, 2019). This document concluded that there is a high probability that every third job in the Icelandic labor market will be subject to significant changes or that jobs will disappear completely due to automation in the coming years (Ómar Óskarsson, 2019). It concludes that industry, sales and service jobs are most likely to be automated (Huginn, et al., 2019). The majority (around 60%) of those employed in the Icelandic labor market perform jobs that are considered to be moderately likely to become automatic in the near future (Huginn, et al., 2019). This means that a large part of the tasks or the skills that belong to the job will probably be replaced by technology in the coming years (Huginn, et al., 2019). Therefore, although the job may not disappear altogether, it is likely to change enormously. For example, 90%
of the jobs (25,086 jobs) worked by technical and specialized staff are considered to be moderately likely to be automatic (Huginn, et al., 2019). These include jobs such as the work of carpenters, blacksmiths, bakers and others who require a particular specialization or education (Huginn, et al., 2019). Of those employed in the Icelandic labor market in 2017, only about 14% were in jobs where there was little likelihood of automation. These include specialist and managerial jobs within the education sector, healthcare and administration (Huginn, et al., 2019).

There are general estimations in the literature regarding the impact of automatization on the job market, but no study has yet put numbers on what effect the latest technological progress is likely to have on the future employment of middle managers (Frey & Osborne, 2013). There are some frameworks that are useful for estimating the effect of composition of job roles, however they seem not to explain fully the effect of new technology that goes beyond the computerization of routine tasks (Frey & Osborne, 2013). Middle-level managers are defined as employees who occupy the middle hierarchy and their job is to get projects finished through the work of their assistants, manage projects among people within the company, plan for future projects, have influence outside and inside the company, and adjust the team objectives in line with larger company goals (Rezvani, 2017). Kolbjørnsrud, Amico and Thomas (2015) concluded that the latest developments in AI will affect all management levels, from low- to top-level managers. They claim that there might not be a need for managers in the future, where the context in which their work is done changes rapidly and can be replaced easily with new technology. Therefore, there is a need to develop a better understanding of the effects of AI on management. Hence, the overall goal of this thesis is to review the available research in this context. Furthermore, such an analysis should advance our knowledge concerning connections between AI and management.

**Purpose:** The aim of this thesis is to address the gap in the literature by conducting a systematic literature review on current knowledge of artificial intelligence within the context of future management.

**Research questions:**

The following questions were formulated in order to focus the research.

1. What is current knowledge about the effects of AI on management?
2. What does current research predict for the future of management in relation to AI developments?

3. Does current research specify the role of middle managers in the future in relation to AI developments?

**Originality:** This study raises the issue of how AI could disrupt businesses by taking white-collar jobs and creates awareness of the need for managers to continue developing their skills by gathering AI knowledge and experience if they want to survive. Furthermore, this study creates awareness of the need for organizations who adopt AI in relation to human resource management to have proper validation processes in place, since that computer systems have shown to be biased.

**Significance:** The thesis is meant to contribute to the theory of artificial intelligence and management in the following ways:

- To increase knowledge of technological development and its opportunities and challenges within organizations.
- To enrich our understanding of AI technology.
- To enrich our understanding of how AI technology can be used within management.
- Help recognize the need for managers to gain AI knowledge so they are better prepared for the changes in the market as well as educational institutions to add AI to the curriculum in management.
- To stress the importance of AI for businesses today to be better prepared for the competition in the marketplace.

The next chapter outlines a literature review on organizations, management and managers’ role in organizations, technological development and AI, and AI and management in organizations. Then the methodology of the literature review is introduced, with the following chapter presenting the results. Finally, this thesis ends with a discussion and conclusion.
2 Review of the literature

2.1 Organizations

An organization is a social unit of people used as a tool to bring different elements of complex activity into an efficient relationship to acquire things individuals want or value — particularly, to accomplish what they planned to achieve (Jones, 2013). Examples of organizations can be an army, a police force or a bank. An organization is a reaction to and a means of giving fulfilment or the pleasure associated with some human need (Jones, 2013).

Organizations exist for the purpose of what they intend to accomplish from its resources, by setting a mission statement where they identify the resources to create unique products or services for their customers, distinguishing them in order to gain a competitive advantage (Jones & George, 2015). In order to achieve its mission efficiently, all organizations must have a management structure that establishes connections between its diverse activities and employees, and divides and allocates jobs, duties, and authority in order to perform various tasks (Jones & George, 2015). The management process involves five key activities; planning, organizing, leading, coordinating and controlling (Fayol, 1949). This is where all managers, irrespective of their capability or skill, commit in interdependent functions to reach company goals (Fayol, 1949).

![Figure 1. Fayol's five functions of management](image-url)
Furthermore, the organizational structure is needed to define how these activities are managed for achieving company goals (Jones, 2013). It also clarifies how information and authority flow between the various levels inside a corporation. For instance, in a centralized structure, all decisions are made by managers at the top level in the hierarchy, while in a decentralized structure, the power of decision-making is distributed through managers at all levels in the hierarchy (Jones, 2013). Both centralized- and decentralized authority has its strengths and weaknesses, and challenges managers to strike the right balance between the two structures (Jones, 2013). When using the term “hierarchy”, one is referring to how employees are classified by their responsibility and authority within a cooperation (Jones, 2013). Traditionally, the hierarchy resembles a pyramid – where the employees with the most authority sit at the top, and the ones with the lowest authority, are at the bottom (Jones, 2013).

There are a wide variety of different sorts of structures which an organization can choose from (see table 1), but it is essential to design it with consideration of managerial needs and satisfaction in order to achieve successful outcomes (Ghiselli & Johnson, 1970). “Because of its implications with respect to a philosophy of management, one of the most interesting dimensions of organizational structure is that which Worthy (1950) has termed flat versus tall” (Ghiselli & Johnson, 1970, pg.569). Whereas flat organizations tend to be less complex structures than the taller ones, including fewer levels within their hierarchy, high authority decentralization, greater work efficiency and offers individuals higher responsibility with the opportunities to assess and undertake tasks independently (Worthy, 1950). In contrast, tall organizations have the same number of employees, hence, more levels within their hierarchy, and therefore more managers are needed to lead them (Jones, 2013). In this case, where the tasks are divided into so many functional departments, conflicts can develop inside organizations, where each department starts operating self-sufficiently rather than working as a company unit to reach its primary goal (Ghiselli & Johnson, 1970).

Even though organizational hierarchy has received a lot of criticism, considered to be outdated and too inflexible for today’s fast changing world, some sort of hierarchy is still required in organizations as a way of achieving goals (Jones & George, 2015). Now, companies have been moving from the typical hierarchical structure to a “flatter”
structure that has usually been seen as management’s attempt to authorize workers at lower levels within the organization by allowing them to take part in the decision-making process (Kubheka, Kholopane & Mbohwa, 2013). Here, this affects managers and all employees when they perform tasks, enabling assurance of the above-mentioned processes. Since it removes layers of management, managers may vote against the changes in order to sustain the old structure and employees often require a manager to report to, which can cause chaos and struggle for power among management (Meehan, 2019).

Table 1. Classical types of organizational structures

<table>
<thead>
<tr>
<th>Structure type</th>
<th>Definition</th>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional structure</td>
<td>Places employees together in teams according to their skills and knowledge on a specific set of roles or tasks. A manager may monitor various divisions (Jones, 2013).</td>
<td>Enables specialization, and therefore more productivity among employees (Jones, 2013).</td>
<td>Can cause management problems; Lack of communications across divisions, slow process of decision-making (Jones, 2013).</td>
</tr>
<tr>
<td>Divisional structure</td>
<td>Places all divisions function self-sufficiently, managing its own tasks and stream of revenue to make specific products. The structure has three forms; Product-, Geographic- and Market structure (Jones, 2013).</td>
<td>Suitable for large organizations. Allows teams to focus on specified products with Management structure to improve the resource utilization (Jones, 2013).</td>
<td>Divisions may start competing to each other as each division focuses on its own and may lose sight of the overall organizational goal (Gillikin, 2019).</td>
</tr>
<tr>
<td>Matrix structure</td>
<td>Places employees and resources in groups (functions) by work, assignment or product. Allows for temporary project structure without disassembling the functional structure which results in employees having two</td>
<td>Suitable for large and more complex organizations. Very flexible, enables team members to take critical decisions regarding manufacturing. High utilization of</td>
<td>Increased complexity in the chain of command were workers are assigned to two managers. Expands complexity within the organization (Gleeson, 2019).</td>
</tr>
</tbody>
</table>
To sum up, organizations being complex units, where value creation and goal achievement is done through organizing processes and people. The level of complexity in organizations requires a certain organizational structure, which puts greater pressure on the role of managers, as means of ensuring new work skills are developed in order to fulfil the needs of its new structure.

### 2.2 Management and managers’ role in organizations

As it has been explained in chapter 2.1, the management process is a critical tool in order to achieve organizational objectives, as managers are employees responsible for coordination of resources and ensuring that company goals are met (Jones, 2013).

Managers direct and plan an organization’s responses to the environment they work in, along with managing the structure and culture in the company. For instance, a manager’s skills in identifying new markets for products, opening global markets, and solving technological challenges can make it much easier to achieve the goals of an organization (Jones, 2013).

However, to perform the five key functions of management efficiently (see figure 1), organizations divide their managers across different levels that are involved with different degrees of authority, skills and responsibility (Rezvani, 2017). First, they are ranked by hierarchy with each level having a different degree of authority, where the low-level managers answer to middle-level managers, and middle-level managers answer to top-level managers (Jones & George, 2015). Next, they are placed into functions (or departments) based on their specific skills or knowledge (Jones & George, 2015).
function simplifies a team of managers and employees, who operate jointly since they have comparable skills, knowledge and expertise to carry out their work (Jones & George, 2015). An example of one can be accounting, human resources-, financial-, sales-, and .... manufacturing departments (Jones, 2013) Here, it is important to note that inside every department, all three levels of managers play a part (Jones & George, 2015).

C-suite executives or top managers are members of the top management group, those who occupy the highest hierarchical level, such as CEOs or CFOs (Kolbjørnsrud et al., 2015). They are responsible for maximizing the profit of an organization’s production by investing shareholder money in appropriate resources (Jones, 2013). They themselves create organizational objectives, determine how functions should cooperate, and oversee the work of middle managers (Jones & George, 2015).

Nevertheless, as this literature review focuses on middle-level managers, it is essential to explain their role in more details. They are employees who occupy the middle hierarchical level, such as managers of smaller projects, store or office managers, shift supervisors, or departmental managers (Kolbjørnsrud et al., 2015). Their job is to get projects finished through the work of their assistants, manage projects among people within the company, plan for future projects, have influence outside and inside the company, and adjust team objectives to fulfil larger company goals (Rezvani, 2017).

They are accountable for organizing people and resources within the organization to ensure it reaches its objectives. Along with supervising employees at lower levels by helping them to figure out more efficient ways to use resources in way which lowers the cost of production or client services (Jones & George, 2015). “To increase effectiveness, middle managers evaluate whether the organization’s goals are appropriate and suggest to top managers how goals should be changed” (Jones & George, 2015, pg.14). Moreover, the middle manager is a passageway of communication within the cooperation, as they transfer a great deal of decisions from executives to workers at lower levels (Barnard, 1973). They are then placed in the seat to “sell” the decision to their employees (Cancialosi, 2016). The nature of middle management work is therefore complex and demanding (Mintzberg, 1973). Even though middle managers do not make the most significant decisions, they do make plenty of specific decisions regarding the manufacture of products and services (Jones & George, 2015). For example, they consider which low-
level managers must be selected for a specific assignment. They ask how may we get superior quality resources? In what way is best to organize employees in order for them to secure the most optimal resource utilization? (Jones & George, 2015). An effective middle manager spends time gathering new knowledge and developing skills that can make him a better resource for the company. In the case of manufacturing he could gather knowledge on new techniques or develop new marketing skills for the business and be able to make his organization more competitive (Jones & George, 2015).

Finally, front-line- or low-level managers are those who occupy the lowest hierarchical level, and are often called supervisors. They cooperate in all of an organization’s functions as they monitor the non-managerial workers who perform tasks that are needed to make products and services (Jones & George, 2015). Examples of low-level managers can be managers of smaller projects, store or office managers, shift supervisors, and departmental managers (Kolbjørnsrud et al., 2015).

![Figure 2. Levels of managers](image)

Jones and George (2015) have concluded that the relative weight of controlling, leading, planning and organizing— the primary managerial tasks — relies completely on a manager’s level within the hierarchy. The higher the hierarchical position of the manager, the more time he spends planning and organizing resources to increase the performance of the organizations. On the other hand, the lower the hierarchical level, the more time he spends controlling and leading the lower-level managers or employees (Jones & George, 2015).
To conclude, each organization’s department has all three types of managers, where top managers spend most of them time organizing and planning while middle- and low-level managers spend more time controlling and leading. The major part of a manager’s job includes the process of decision-making, where middle managers contribute as a passageway of decisions within the organization.

2.3 **Technological development and artificial intelligence**

As mentioned above, organizations today are existing in complex and fast changing environments. Constant change has become the new status quo. These changes include organizational structure, in search of the best ways to manage. However, technology and technological development have become increasingly important, not just in advancing production, but also in shaping how organizations function and are managed (Copra, 2018).

In current management literature, technology is described as “the combination of tools, machines, computers, skills, information, and knowledge that managers use to design, produce, and distribute goods and services” (Jones & George, 2015, pg.131).

The changes in this technology result in new technological forces. In the last decades, due to accelerated advances in computer hardware and software technology, the overall rate of technological change has increased dramatically, affecting most business sectors (Jones & George, 2015).

Probably the most discussed today is artificial intelligence (AI), which in general terms is defined as a field in computer science that refers to an IT system that can act, learn, comprehend and sense (Kolbjørnsrud et al., 2015). In particular, AI involves machine learning; “the machine’s ability to improve its performance without people having to explain to it exactly how to perform all the tasks to be completed” (Antonescu, 2018, pg.16).

The effect of these developments on businesses is not just due to their direct contributions but also by inspiring new innovations. The outcome can be new products in artificial vision and audio/speech recognition, natural language processing, and many other possibilities with machine and deep learning (Antonescu, 2018). In fact, Statista
company has estimated that the market global earning from AI for enterprise applications will rise to over 30,000 million dollars in the year 2025 (see figure 3) (Columbus, 2018).

But even though people have suddenly seen AI as a burning issue, it has actually been developing now for approximately 60 years (Ateniese, 2019). When AI first came to prominence, it was meant to process data and use the experience gained to make specific decisions, to moreover, think like human beings (Ateniese, 2019). At this point, the computer systems turned out to be far from fully evolved, needing more algorithmic development, cheaper production, smaller size (as they were around the size of a room) and bigger storage of data (Ateniese, 2019).

It was not until data became easier to be assembled and kept, and particular applications such as robotics were invented, that machine learning was recognized as an important part to get closer to the goal of AI (Ateniese, 2019). Instead of these machines needing to be programmed by a human all the time, they were now able to update their own parts and forecasts independently and in real time. In short, the machine was learning (Ateniese, 2019).
Many aspects of how we work or interact with each other or with businesses today have been changing by gradual development of the field of AI (Manaila, 2019). Deep learning (advanced machine learning) plays a major role in that area. For example, when using Netflix, you received personalized film recommendations. When doing online shopping you may see online adverts tailored precisely for you or communicated to you by a voice-activated assistant, and it is more than likely that deep learning was involved during your day (Ateniese, 2019). With new developments in computer hardware and software, it is now possible to create more accurate models, since hardware is more powerful and can work with larger models and calculate many more iterations (Ateniese, 2019). Models are created by passing huge amounts of data like pictures, video, text, banking information, emails and voice into specialized hardware and software (neural networks) and train models to recognize (learn) the data and be able to do accurate predictions (Ateniese, 2019). The neural networks are a class of models within the machine learning field which have revolutionized machine learning and are inspired by biological neural networks. A deep learning neural network is an artificial neural network, which has multiple interconnected layers between input and output (Manaila, 2019).

![Cousins of AI](image)

*Figure 4. Cousins of AI*

However, when it comes to organizations and their future, the application of AI is what researchers are really interested in and how it will shape the future workplace, as today
AI consists of multiple technologies that allow computers to create a sort of intelligence close to human’s with information technology applications (Farajpour & Zerehnazi, 2013). AI programs have advanced so much that today they include sensing the human language, explanation of visual information, solving complex problems, learning from experience and, finally, acting as the human mind (Frey & Osborne, 2013). As a result, AI is explicitly dedicated to the advancement of algorithms that allow automation to cognitive tasks (Frey & Osborne, 2013). All of these developments present great opportunities, but challenges as well for contemporary organizations.

One of the biggest opportunities for businesses in technology and particularly AI is the opportunity to cut labor costs. Oxford’s research estimated that 47% of jobs across the whole US labor market were at a risk from machine learning and AI fueled automation. They concluded that this will occur in various industries. However, it has been pointed out that jobs that will disappear are ones which currently minimally incorporate AI and machine learning (Frey & Osborne, 2013). Contrarily, IT industry research firm Gartner approximates that AI and machine learning also have the possibility to immensely increase new jobs driven by these arising technologies, estimating two million new jobs by the year 2025 (Syam & Sharma, 2018).

Not just front-line jobs are at risk. There are many ways how AI challenges different professions. For example, one branch of AI, expert systems, “tries to work and serve along with experts by gathering technical knowledge and information in a specific field. In other words, these systems are intelligent computer softwares which contain professional knowledge as information packs” (Farajpour & Zerehnazi, 2013, pg.124). These systems have a logical mind and by advancing their searching methods they can reach logical conclusions (Farajpour & Zerehnazi, 2013). Intelligent machines are applications and computers with AI embedded that connect multiple machines, people and processes (Kolbjørnsrud et al., 2015). Due to the use of searching methods, these systems are more precise and flexible than algorithmic programs and can easily adapt themselves to recent environments along with understanding their user’s language and the ability to contact them. These abilities have given them the appearance of an absolute expert (Farajpour & Zerehnazi, 2013).
Now AI technologies have spread over multiple fields, providing efficiency- and precision driven apps within sectors from everything from the automotive industry to finance services and healthcare (Manaila, 2019). These incredible applications can be used to make self-driving cars, can spot signs of insider trading or other financial fraud, and can be used to diagnose diseases in earlier stages, such as cancer and Alzheimer’s (Ateniese, 2019).

But even though AI offers big business opportunities, there are still some barriers and cautions that Giuseppe Ateniese, a professor at Stevens Institution Technologies, concluded in his article in the Stevens Indicator (2019). First, there are major challenges regarding security and privacy. Both Stevens research and the work of others has proved that these machines can be jeopardized, deceived and hacked. This raises concerns for organizations who think about adopting AI technology, because a leak of any data can cause serious problems (Ateniese, 2019).

Second, because machine-learning models need us, humans, to be created, they sadly reflect on our own flaws and weaknesses. Scientists have already started exposing prejudice in these systems as they learn from our images, videos and words (Ateniese, 2019). For example, AI used to make a facial recognition system has no problem identifying white human faces but has difficulty when identifying darker skin tones (Ateniese, 2019). Other examinations have shown that AI systems have a propensity to classify an individual who is making dinner as a woman, even though it is clearly a man (Ateniese, 2019).

To conclude, technological change has increased dramatically, affecting most business sectors, with AI, machine learning and deep learning giving companies new possibilities to digest and obtain new insights to develop new products and opportunities for their business with more intelligent use of their data. Furthermore, AI technology will alter how we work, eliminating some jobs and creating new ones. However, it will lead to increased revenues for AI based projects. There can, however, be challenges in the use of AI, concerning security, privacy, validation of results and possible bias in automated decisions.
2.4 Artificial intelligence and management in organizations

It is well acknowledged that the rise of AI will have a strong influence on the management of jobs and organizations in the near future, and this has led to the interest of analysts in this field. MIT Sloan Management Review’s website provides evidence that this topic has begun drawing interest and attention. Furthermore, this has been noticed to be the most read topic in journal magazines, blog posts and reports (Chopra, 2018).

In the current management literature, artificial management is the application of artificial and machines or pre-programmed logical assemblies in administrative, managerial, or organizational problem-solving, and it can be used for decision-making at the low-, middle-, and top-level of the corporate hierarchy (Shim & Rice, 1988). It indicates that computers, expert systems and robots are substituted for criteria-supported, pre-programmed and logical decision-making (Shim & Rice, 1988). Furthermore, a study by one of the key players in the management field studies, predicted that the implementation of AI will help in the efficient and systematic management of organizations, helping to better their performance, outputs and profits. Furthermore, advances in AI are expected to substantially reform the workplace, additionally to the job and manager’s research experience (Chopra, 2018).

As has been explained in chapter 2.4, top managers spend most of their time organizing and planning, while middle- and low-level managers spend more time controlling and leading. A survey on the effect of AI in management from the Accenture Institute for High Performance (AIHP) and Accenture Strategy, where 1770 managers from low-, middle- and top- levels participated, showed that AI computer systems were most likely to take over manager’s tasks, such as coordinating, controlling, collaborating and problem-solving. Instead, managers are likely to spend more time on innovation, strategy development, and on the human factor within the organization (see figure 6) (Kolbjørnsrud, et al., 2015).
Before the end of this decade, AI will enter businesses on an extreme scale. Hence, unlike earlier waves of new technology that have disrupted blue collar and service jobs on a large scale, recent advancements in AI will change all levels of management (Kolbjørnsrud et al., 2015). AI will automate scheduling, reporting and resource allocation, along with taking time-consuming and administrative tasks off managers’ shoulders (Kolbjørnsrud et al., 2015). Furthermore, AI-assisted analytics, hypothesis testing and simulation can be extremely effective for strategic decision-making and innovation throughout an enterprise (Kolbjørnsrud et al., 2015).

Although AI presents unprecedented opportunities for value creation, it also creates daunting challenges for managers and executives as they will be forced to reconsider their own roles and re-evaluate the fundamental operating principles presently guiding their organization (Kolbjørnsrud et al., 2015). Collaboration among machines and humans will increase, and the division of labor will change (Kolbjørnsrud et al., 2015). Therefore,
companies will have to reinforce their performance, training and talent acquisition strategies to place newfound emphasis on work that depends on human judgment and skills, along with experimentation and collaboration. (Kolbjørnsrud et al., 2015). As MIT Sloan professor Erik Brynjolfsson, a well-known management expert explained, the difficulty we face today is not explained as a world without a work, rather as a world with constantly changing work (Chopra, 2018). Consequently, managers will need to keep on their toes and to keep on taking advanced steps in order to continually evolve companies (Chopra, 2018).

To sum up, AI will in general change all levels of management, where key manager’s tasks such as coordinating, controlling, collaborating and problem solving are most likely to be automated. Furthermore, AI will automate scheduling, reporting and resource allocation, along with taking time-consuming and administrative tasks off managers’ shoulders, giving them more time to spend on innovation, strategy and the people within the organization. However, this challenges managers to reconsider their role in this constantly changing work environment.
3 Methodology

In this research, principles of a systematic literature review were selected, as suggested by Jesson, Matheson & Lacey (2011). The following six procedural steps were as follows: 1) Mapping the field through a scoping review, 2) Comprehensive search, 3) Quality assessment, 4) Data extraction, 5) Synthesis, and 6) Write up. “The process of systematic review and its associated procedure, meta-analysis, has been developed over the last decade and now plays a major role in evidence-based practices. Whereas systematic literature review identifies key scientific contributions to a field or question” (Tranfield, Denyer, & Smart, 2003, pg.209) and is very useful methodology in establishing (Tranfield, Denyer, & Smart, 2003).

First, a research plan was advanced comprising the research questions of interest, the keywords, and a set of exclusion and inclusion criteria. A paper that would focus on artificial intelligence “impact” on management was of interest. What aspects of this relationship have been researched? From what year and which countries has this relationship been researched? I had special interest in finding studies claiming that AI will make middle-level managers redundant in the future labor market.

After a general literature search and consideration, it was decided to use the key phrase “management”, not “middle-level management” as the narrowness of the latter term was leading to hardly any results. This validity of the consideration was inspected by conducting a ProQuest search on “artificial intelligence AND management”. The search resulted in 384 hits. Most of those were concerned with AI as a tool or implement for various types of management such as water plant management, flood management, health management, and other subjects, and were therefore not relevant.

An explicit search was conceived by use of exclusion and inclusion search criteria. The inclusion criteria were: ProQuest data base, articles, scholarly journals, English language, peer reviewed and full text, “(AB) artificial intelligence”. The keywords were linked using the Boolean operator AND with the second keyword “(AB) management”. There was no restriction on the year of publication. At this point, exclusion criteria for the search were just a language other than English. Following this, an Excel datasheet was produced that consisted of the key aspects of the field of interest. These were the year of publication, country of publication, authors, those who drew connections to AI, low-level-, middle-
level—or top-level management or other management related, were future related, those related to AI replacement of the human workforce and finally, those focusing on AI as an implement. After reading the abstracts and titles of these 384 papers, the number of articles was narrowed, focusing on those which were related to AI and management, resulting in 277 studies.

The titles, abstracts and conclusions of these 277 papers were read, and a choice was made to narrow the search furthermore so that now the selected articles in this first round of audits presented were refined according to the specifics of the research questions. Articles were included in the review if they: (i) related to artificial intelligence, (ii) drew connections between AI and management, (iii) related to AI replacing the human workforce, and/or (iii) were future related.

After the screening, 24 text papers were selected and entered in a new sheet in the Excel document for further analysis and grouped according to the aim of their research and their findings, which were then fully reviewed. The new sheet was given the name: Groups, with Excel table columns including; Name of author(s), the year of publication, country of publication, research objectives, and main findings.

Table 2. Overview of concluding text papers from “big table” that include (x) and exclude (–) on topics such as AI, low-level-, middle-level-, and top-level managers, future, AI replacement of human workforce and finally, those focusing on AI as an implement.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Article</th>
<th>Author(s)</th>
<th>AI</th>
<th>Low-level</th>
<th>Mid-level</th>
<th>Top-level</th>
<th>Future</th>
<th>AI instead of human</th>
<th>AI as a tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>Croatia</td>
<td>Ranking of current information technologies by risk and regulatory compliance officers at financial institutions</td>
<td>Britton, et al.</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>UK</td>
<td>A future for facility management</td>
<td>Atkin, et al.</td>
<td>x</td>
<td>-</td>
<td>x</td>
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<td>x</td>
<td>x</td>
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<tr>
<td>2013</td>
<td>India</td>
<td>Defining the place of expert systems in the operation of organizations</td>
<td>Farajpour &amp; Zerehnazi</td>
<td>x</td>
<td>-</td>
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<tr>
<td>2016</td>
<td>USA</td>
<td>Are You Ready for Robot Colleagues?</td>
<td>Klotz</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>-</td>
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<tr>
<td>2017</td>
<td>UK</td>
<td>Will artificial intelligence usurp white collar jobs?</td>
<td>Chelliah</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
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<tr>
<td>1988</td>
<td>USA</td>
<td>Expert Systems Applications To Managerial Accounting</td>
<td>Shim &amp; Rice</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>2018</td>
<td>UK</td>
<td>Quick takes</td>
<td>Goodson</td>
<td>x</td>
<td>-</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2018</td>
<td>UK</td>
<td>Tie me to the mast: artificial intelligence &amp; reputation risk management</td>
<td>Hirsch</td>
<td>x</td>
<td>-</td>
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</tr>
<tr>
<td>2018</td>
<td>Canada</td>
<td>Overview and Application of Artificial Intelligence concepts and some important coevolving modern issues on Management of Organization and Commerce</td>
<td>Chopra</td>
<td>x</td>
<td>-</td>
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<tr>
<td>2017</td>
<td>India</td>
<td>A review of artificial intelligence systems</td>
<td>Sreedevi, et al.</td>
<td>x</td>
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<tr>
<td>2018</td>
<td>Romania</td>
<td>Ranking of current information technologies by risk and regulatory compliance officers at financial institutions</td>
<td>Becker, et al.</td>
<td>x</td>
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<tr>
<td>2002</td>
<td>UK</td>
<td>Allying for quality excellence: Scope for expert systems in supplier quality management</td>
<td>Nwankwo, et al.</td>
<td>-</td>
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<td>x</td>
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<tr>
<td>2018</td>
<td>Romania</td>
<td>Are business leaders prepared to handle the upcoming revolution in business artificial intelligence?</td>
<td>Antonescu</td>
<td>x</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>x</td>
<td>-</td>
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</tr>
<tr>
<td>2015</td>
<td>Iran</td>
<td>Integrating RFID, web-based</td>
<td>Ko, C-H.</td>
<td>x</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Year</td>
<td>Country</td>
<td>Title</td>
<td>Authors</td>
<td>Technology, and artificial intelligence in engineering management</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
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<td>2018</td>
<td>USA</td>
<td>technology, and artificial intelligence in engineering management</td>
<td>Sion</td>
<td>x - - - x x -</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
</tr>
<tr>
<td>2001</td>
<td>USA</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>Koch, et al.</td>
<td>x - - - - x</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
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<tr>
<td>1991</td>
<td>USA</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Karen S. Jones</td>
<td>x - - - x</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
</tr>
<tr>
<td>2017</td>
<td>USA</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Calvin, et al.</td>
<td>x - - x x -</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
</tr>
<tr>
<td>2019</td>
<td>USA</td>
<td>Rebooting Work for a Digital Era</td>
<td>Kiron &amp; Spindel</td>
<td>x - - - - -</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
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<tr>
<td>1988</td>
<td>USA</td>
<td>Artificial Intelligence In Project Management</td>
<td>Foster</td>
<td>x - - - x</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
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<tr>
<td>1989</td>
<td>USA</td>
<td>It Takes A Champion</td>
<td>Carr, et al.</td>
<td>x - x x x</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
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<td>2014</td>
<td>India</td>
<td>The Role of Artificial Intelligence in the Development of Accounting Systems: A Review</td>
<td>Moudud-Ul-Huq</td>
<td>x - - - x</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
<td>Artificial Intelligence In Project Management</td>
</tr>
<tr>
<td>2017</td>
<td>India</td>
<td>Applications of Data Mining in Banking Sector</td>
<td>Miyan</td>
<td>x - - - -</td>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Decentralized Network Management Using Distributed Artificial Intelligence</td>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Acculturation and allied contributing factors that further advance cross-cultural</td>
<td>Rebooting Work for a Digital Era</td>
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<tr>
<td>1988</td>
<td>USA</td>
<td>Tomorrows organizations</td>
<td>Gerber</td>
<td>X</td>
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<td>-</td>
<td>-</td>
<td>x</td>
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</table>
4 Results

The 24 articles cover different aspects of artificial intelligence and management. The US has the largest part of the research scene, with 42% of studies focusing on an American situation. The UK has the second largest share with 21%, and the rest is quite diverse geographically, including the following countries: India (17%), Romania (8%), Croatia (4%), Canada (4%) and Iran (4%). The most common research methodology used was secondary data analysis, where data collected in previous studies was analyzed. Other occurring methodologies were experiments, literature reviews, qualitative research based on interviews, and quantitative based on surveys.

Table 3. General overview of the presenting 24 articles that include titles, author(s), location and research method

<table>
<thead>
<tr>
<th>Paper</th>
<th>Author(s)</th>
<th>Location</th>
<th>Research method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomorrows organization</td>
<td>Gerber</td>
<td>USA</td>
<td>Literature review</td>
</tr>
<tr>
<td>It Takes A Champion</td>
<td>Carr, et al.</td>
<td>USA</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Artificial Intelligence In Project Management</td>
<td>Foster</td>
<td>USA</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Decentralized Network Management Using</td>
<td>Koch, et al.</td>
<td>USA</td>
<td>Secondary data analysis</td>
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<tr>
<td>Distributed Artificial Intelligence</td>
<td></td>
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<tr>
<td>Acculturation and allied contributing factors</td>
<td>Calvin, et al.</td>
<td>USA</td>
<td>Secondary data analysis</td>
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<tr>
<td>that further advance cross-cultural</td>
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</tr>
<tr>
<td>Expert Systems Applications To Managerial</td>
<td>Shim and Rice</td>
<td>USA</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Accounting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Author(s)</td>
<td>Country</td>
<td>Research Method</td>
</tr>
<tr>
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</tr>
<tr>
<td>The Role of Artificial Intelligence in Information Retrieval</td>
<td>Karen S. Jones</td>
<td>USA</td>
<td>Secondary data analysis and expert opinion</td>
</tr>
<tr>
<td>How artificial intelligence is transforming the economy. will cognitively enhanced machines decrease and eliminate tasks from human workers through automation?</td>
<td>Sion and Gratiela</td>
<td>USA</td>
<td>Secondary data analysis and expert opinion</td>
</tr>
<tr>
<td>Rebooting Work for a Digital Era</td>
<td>Kiron and Spindel</td>
<td>USA</td>
<td>Qualitative - Interviews</td>
</tr>
<tr>
<td>Are You Ready for Robot Colleagues?</td>
<td>Klotz</td>
<td>USA</td>
<td>Qualitative - Interview</td>
</tr>
<tr>
<td>Tie me to the mast: artificial intelligence &amp; reputation risk management</td>
<td>Hirsch, et al.</td>
<td>UK</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>A future for facility management</td>
<td>Atkin, et al.</td>
<td>UK</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Will artificial intelligence usurp white collar jobs?</td>
<td>Chelliah</td>
<td>UK</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Allying for quality excellence: Scope for expert systems in supplier quality management</td>
<td>Nwankwo, et al.</td>
<td>UK</td>
<td>Quantitative (survey)</td>
</tr>
<tr>
<td>Quick takes</td>
<td>Goodson</td>
<td>UK</td>
<td>Quantitative (survey)</td>
</tr>
<tr>
<td>The Role of Artificial Intelligence in the Development of Accounting Systems: A Review</td>
<td>Moudud-UI-Hug</td>
<td>India</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Defining the place of expert systems in the operation of organizations</td>
<td>Farajpour and Zerehnazi</td>
<td>India</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>A review of artificial intelligence systems</td>
<td>Screedevi, et al.</td>
<td>India</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Applications of Data Mining in Banking Sector</td>
<td>Miyan</td>
<td>India</td>
<td>Survey and secondary data analysis</td>
</tr>
<tr>
<td>Are business leaders prepared to handle the upcoming revolution in</td>
<td>Antonescu</td>
<td>Romania</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Business artificial intelligence?</td>
<td>Becker, et al.</td>
<td>Romania</td>
<td>Survey and secondary data analysis</td>
</tr>
<tr>
<td>----------------------------------</td>
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<tr>
<td>Ranking of current information technologies by risk and regulatory compliance officers at financial institutions</td>
<td>Britton, et al.</td>
<td>Croatia</td>
<td>Qualitative - Interview</td>
</tr>
<tr>
<td>An investigation into the significant impacts of automation in asset management</td>
<td>Chopra</td>
<td>Canada</td>
<td>Secondary data analysis</td>
</tr>
<tr>
<td>Overview and Application of Artificial Intelligence concepts and some important coevolving modern issues on Management of Organization and Commerce</td>
<td>Ko and C-H</td>
<td>Iran</td>
<td>Experiment</td>
</tr>
<tr>
<td>Integrating RFID, web-based technology, and artificial intelligence in engineering management</td>
<td></td>
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</tr>
</tbody>
</table>

### 4.1 Artificial intelligence in management

This group introduces the research of 12 articles that drew connections between AI and management, and are presented in Table 4 below, together with research objectives, methods of research and the main findings of each article.

<table>
<thead>
<tr>
<th>Table 4. Articles on artificial intelligence in management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author(s)</td>
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<tr>
<td>------------</td>
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<tr>
<td>Foster</td>
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<tr>
<td>Author</td>
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<tr>
<td>Gerber</td>
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<tr>
<td>Carr, et al.</td>
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<tr>
<td>Karen S. Jones</td>
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<td>Koch, et al.</td>
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<td>Farajpour and Zerehnazi</td>
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</tbody>
</table>
Ko and C-H 2015

To enhance managerial efficiency through the integration of RFID, web-based technologies, and artificial intelligence.

Experiment

Calvin, et al. 2017

To place into context various skill and practice intelligences that are combined into cross-cultural management and international management.

Secondary data analysis

Miyan 2017

To give a general overview of data mining (DM), primary data mining techniques and mentioning the main fields for which the data mining can be applied.

Survey + Secondary data analysis

Hirsch 2018

To examine how this rapidly growing field of analytics might be used in the area of reputation risk management.

Secondary data analysis

and financial management. Integration of RFID, web-based systems, and AI can be effectively applied in a practical environment. The proposed method can improve managerial efficiency, data transfer, data quality, and service process time.

The field would benefit from the addition of new knowledge for business organizations to consider as transformative tools and processes for assessing cross-cultural management.

DM that uses machine learning and other technologies can help to improve decision-making and customer experience. It can be applied to the banking system and architectural design, with its main components for the solution, customer segmentation, banking profitability factor, marketing, risk management and customer relations management and fraud detection.

There were at least two areas in which AI could be applied to reputation risk management; the use of machine learning to analyze employee emails in real time to detect early signs of aberrant behavior and the use of algorithmic game theory to stress test business
decisions to determine whether they contained perverse incentives leading to potential fraud.

Business managers will need to improve their skills to gain a deeper understanding of the technologies that are driving their business. AI will enable the businesses they lead become more competitive, upgrade their customer service, improve productivity and help in decision making. Inexperienced organizations that have not invested in AI could affect their ability to remain competitive.

IBM's efforts to modernize its performance management system are part of an ongoing process. They will continue to refine the measurement and expectations of skills growth in IBM as it becomes clear that they need to become a fabulous re-skilling-at-scale machine and hold themselves accountable to that.

Various conclusions were found in relation to the use of AI in management. Hirsch (2018) showed there were at least two areas, reputation risk management and information management, in which AI could be applied to reputation risk management, while Jones (1991) suggests there is an important place for the specific application of AI when
constraints can be placed on the informational management tasks involved. Expert system (ES) was noted in two articles and in both instances was ES considered as an effective future tool for organizations to adopt, one that could help in decision-making processes and problem-solving, hence overcoming limitations such as a long duration and high implementation cost (Foster, 1988; Fajpour & Zerehnazi). The research of Foster (1988) showed that ES appears to have future applications in the project management area. Farajpour and Zerehnazi (2013) concluded that adopting ES gives companies an advantage in the areas of management, such as strategic planning, total quality management, production management and financial management. Miyan (2017) concluded that data mining, which uses machine learning and other various techniques, can help to improve decision-making and the customer experience. It can be applied to the banking system and architectural design, with its main components being the solution, customer relation management, customer segmentation, banking profitability factor, marketing, risk management and fraud detection. Ko and C-H (2015) showed that the integration of AI, RFID and web-based systems can improve managerial efficiency, data transfer, data quality, and service process time. Calvin, et al. (2017) concluded that cross-cultural management would benefit from the addition of new knowledge for transformative tools and processes in the field. Koch et al. (2001) concluded that there are still a number of improvements and additional proposes before the network management field can use Autonomous Agents. Even though the research by Kiron and Spindel (2019) had considerable limitations, the findings of the paper are interesting and beneficial, as they explain how IBM's efforts to modernize its performance management system are part of an ongoing process, where continuing refinement of the measurement and expectations of skills growth is in focus. Antonescu (2018) discussed how AI will enable businesses to become more competitive, upgrade their customer service, improve productivity, help in decision-making and affect organizations that have not invested in AI and their ability to remain competitive. Therefore, business managers will need to improve their skills in order to gain a deeper understanding of the technologies that are driving their business. Gerber (1988) also showed that AI will become a necessary part of running a business in the next generation, where a component of AI, the neural network, will be needed in the future as a tool for planning, execution, and review. However, Carr
et al. (1989) concluded that it will require champions to implement the change of the then emerging application of AI to organizations.

To sum up, this category of articles suggests the unavoidable presence of AI in future organizations and that it will effect various areas of managerial work, such as total quality management, production management, financial management, risk-management, customer relation management, customer segmentation, banking profitability factor, marketing, risk management and fraud detection. Furthermore, it is suggested that AI can be useful in addressing some of the biggest management challenges e.g. cross-cultural management. It is also suggested that managers need to acquire skills and competences in order to tap into new emerging environments where AI will be present.

Interesting findings in this group include the fact that AI technologies have spread to multiple fields of management. Nevertheless, there is more knowledge needed in some areas before it is possible to implement AI programs in the fields of network management and cross-cultural management. However, 58% of the articles studies were from the US. Other studies in this field are quite varied in location: Iran, India, Romania and the UK. These papers report on studies that were conducted in the years 1988 to 2019. Interestingly, the majority of articles are based on research involving secondary data, suggesting a need for methodological diversity. None of these articles place particular emphasis on middle-top or lower-level management. However, Carr, et al. (1989) stated that the champion of the implementation of AI must have the capacity to operate with staff from all levels of the company, from supervisors to C-suite executives, to ensure that training, use and support are successful.

4.2 Artificial intelligence as a replacement of human workforce

This group of nine articles introduce research regarding AI as a replacement for the human workforce. A special focus was on the potential future impact to middle-level managers, which included an endeavor to identify the change middle-level managers may face and whether they will be redundant in the future.

Table 5. Artificial intelligence as a replacement for the human workforce
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Research objectives</th>
<th>Method</th>
<th>Main findings</th>
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</thead>
<tbody>
<tr>
<td>Shim and Rice</td>
<td>1988</td>
<td>To review new system programs of Artificial Intelligence and expert systems that are designed to solve business-related problems.</td>
<td>Secondary data analysis</td>
<td>ES will become computerized foremen for industry; accounting, inventory management systems, sales management, financial management. Many managerial functions will be carried out by ES. Human managers will learn to interact with artificial managers. Knowledge management such as offered by ES is an enabler and could serve as a key to the development of an integrated supplier quality strategy. However, a point needs to be made that ES will not replace human experts but support their decisions.</td>
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<tr>
<td>Nwankwo, et al.</td>
<td>2002</td>
<td>To identify the role of quality in evaluating and selecting suppliers; how it assesses the level of adoption (and potential relevance) of ES technology in developing an effective supplier quality strategy.</td>
<td>Quantitative - survey</td>
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<tr>
<td>Moudud-Ul-Hug</td>
<td>2014</td>
<td>To demonstrate how AI is helping in the development of accounting systems and comparative organizational analysis of the impact of expert systems on organizational issues.</td>
<td>Secondary data analysis</td>
<td>AI is automating the field of accounting where AI techs such as knowledge-based systems, neural networks, data mining and expert systems are found to be effective tools that have been found to be successful in many other areas of business. Robots will have capabilities as idea generators for new product development, as consultants and counsellors, and they may take over many HR roles.</td>
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<tr>
<td>Klotz</td>
<td>2016</td>
<td>To review how artificial intelligence is advancing, and how it is likely to impact the workplace and even managerial creativity.</td>
<td>Qualitative - Interview</td>
<td></td>
</tr>
<tr>
<td>Author(s)</td>
<td>Year</td>
<td>Research Question</td>
<td>Methodology</td>
<td>Findings</td>
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<td>Britton, et al.</td>
<td>2017</td>
<td>To investigate automation within the asset management sector</td>
<td>Qualitative Interviews</td>
<td>In the asset management sector; current entry level occupations with systematic, repetitive tasks in a fixed domain will be automated. Placing a greater demand for analytical abilities in junior recruits as the cognitive understanding of what data represents is a weakness of artificial intelligence (AI), thus strengthening augmentation between employees and technology.</td>
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<tr>
<td>Atkin, et al.</td>
<td>2017</td>
<td>To discuss the current debates in facility management to understand where the research community is working and where the sector and discipline might be heading.</td>
<td>Secondary data analysis</td>
<td>AI can present top management with supported recommendations upon which to base a decision. Because of AI, middle managers - a group that includes facility/asset managers - could be bypassed, as mission-critical decisions are reached in a fraction of the time it normally takes. Reveals susceptibility of white-collar jobs to AI; HR practitioners need to anticipate the impact of AI on their workplaces. HR departments may themselves be undergoing change as AI takes over some of the functions performed by people previously such as HR systems reporting or assistance with</td>
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<tr>
<td>Chelliah</td>
<td>2017</td>
<td>To highlight the risks faced by white-collar workers resulting from advances in artificial intelligence (AI).</td>
<td>Secondary data analysis and expert opinion</td>
<td></td>
</tr>
</tbody>
</table>
Goodson 2018

To highlight the key point and action steps in the feature articles in the issue of Strategy and Leadership.

Organizations will need to reinvent HR into "HAIR" to fully achieve the potential of AI, Human Resources needs to become Human AI Resources (HAIR).

Quantitative - Survey

Sion and Gratiela 2018

To determine whether cognitively enhanced machines will decrease and eliminate tasks from human workers through automation.

Secondary data analysis

Automation of tasks assumed unaccomplishable by machine. Numerous jobs require employees to operate jointly with machines, transferring tasks from personnel to machines and back. Innovative goods may provide a growing degree of automation or the manner they are designed for production should be altered to enable automated mass customization.

Artificial intelligence as a replacement for the human workforce was noted in seven papers. Research by Atkin et al. (2017) showed that a consequence of AI in facility management was that middle managers could get bypassed. Moudud-Ul-Hug (2014) concluded that AI is automating the field of accounting, where AI techs, such as knowledge-based systems, neural networks, data mining and expert systems, are found to be effective tools that have been successful in many other areas of business. He added that though AI is very useful for accounting it lacks human creativity, since it does not have common sense it is limited in the use of preceding data and may be unable to benefit from very broad context of experiences. Shim and Rice (1988) explained how many managerial functions will be conducted by ES in accounting, such as tutoring, problem-solving, knowledge sharing, and decision making, with human managers learning to interact with artificial managers. Klotz (2016) suggests that robots will appear as consultants and counsellors and can take over many roles in human resource
management. Chelliah (2017) concluded the susceptibility of white-collar jobs to AI and that HR practitioners would need to anticipate the impact of AI on their workplace for that reason that AI will gain control over some of the functions previously performed by people in HR systems or via assistance with recruitment and selection. Goodson (2018) concluded that to fully achieve the potential of AI, HR needs to become Human AI Resources (HAIR). Britton et al. (2017) showed that in the asset management sector, the current entry level occupations with systematic, repetitive tasks in a fixed domain, would be automated. Placing a greater demand for analytical abilities in junior recruits as the cognitive understanding of what data represents is a weakness of AI, thus strengthening augmentation between employees and technology. However, Nwankwo, et al (2002) present adverse findings in research results; he concluded that ES will not replace human experts but support their decisions in knowledge management. Meanwhile, Sion and Gratiela (2018) showed that automation of tasks are assumed to be unachievable by machines, especially in the many cases where jobs require employees to operate jointly with machines, transferring tasks from personnel to machines and back.

In conclusion, this section suggests that in future terms, HR managers are most likely to be affected by the technology of AI, with three of the seven papers finding evidence of automation in relation to HR, considering AI both as a tool or as a replacement for the human workforce. A future impact on middle-level managers was noted in one paper; Atkin et al. (2017) shows evidence for a reduced need for middle managers in facility management. Still, four papers showed that a future impact on managers where their hierarchical level was not stated, meaning it was unclear whether they belonged to low-, middle-, or top-level management (Shim & Rice, 1988; Klotz, 2016; Chelliah, 2017; Goodson, 2018). The UK and US dominated the research scene; 44% of the articles deal with a British situation and 33% with an American. Other studies were found from Croatia and India. These papers were all studied in the years 1988 to 2018.

4.3 Future of artificial intelligence

Papers in this section presents recent future predictions in relation to AI and are presented in Table 6 below, together with research objectives, methods of research and the main findings of each article.
### Table 6. Articles on Future of Artificial Intelligence

<table>
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<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Research objectives</th>
<th>Method</th>
<th>Main findings</th>
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<tbody>
<tr>
<td>Sreedevi, et al.</td>
<td>2017</td>
<td>To review the different types of Artificial Intelligence Systems and highlight some of the popular Industrial AIS in use today.</td>
<td>Secondary data analysis</td>
<td>Companies like Google, Apple, Microsoft, IBM etc. signify the role of AIS in the near future. It is predicted that the penetration of AIS will be much higher by 2030. Though replacing humans is looked as a downside, AIS has a lot of potential and the future is a world of highly Intelligent Systems.</td>
</tr>
<tr>
<td>Becker, et al.</td>
<td>2018</td>
<td>To provide new insights on the relevance of new information technologies for the risk and regulatory compliance management of financial institutions in Germany.</td>
<td>Survey and secondary data analysis</td>
<td>AI, big data and cybersecurity technologies are on top of the agenda of financial institutions in Germany. Moreover, most participants are convinced that AI solutions will widely be implemented and used in the risk and regulatory compliance environment by the end of 2022. Some attempts have been made in combining AI and management, leading to an entirely new and evolving field - Application of AI in management. New advances are being made in developing neural networks, quantum computation, and simulation techniques; and therefore, new important achievements are expected in the near future in these important fields.</td>
</tr>
<tr>
<td>Chopra</td>
<td>2018</td>
<td>To review the concepts and applications of AI and important coevolving modern issues on management of organizations and jobs.</td>
<td>Secondary data analysis</td>
<td></td>
</tr>
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</table>

Companies like Google, Apple, Microsoft, IBM etc., signify the role of AIS in near future. It is predicted that the penetration of AIS will be much higher by 2030. However, replacing
humans is looked as a downside (Sreedevi et al, 2017). Becker et al. (2018) are convinced that artificial intelligence solutions will become widely implemented and used in risk and regulatory compliance management by the end of 2022. Chopra (2018) concluded that there are new important achievements expected in the near future in the field of AI in management where new advances are being made in developing neural networks, quantum computation, and simulation techniques.

Interesting findings in this category include the fact that AI in management is an important and necessary field for organizations to consider, especially if they want to be able to compete with companies such as Google, Apple, Microsoft, IBM etc. Studies in this field are from a wide range of nations: Canada, India and Romania, and all were published in 2017 and 2018. In addition, none of these articles place particular emphasis in AI effects on low-, middle-, or top-level management.
5 Discussion and conclusion

The aim of this thesis was to review available research on artificial intelligence and management, and in this way contribute to filling a gap in the academic literature by mapping existing knowledge in this field.

A variety of concepts related to artificial intelligence in management have been analyzed and discussed, e.g. organization, management, technological development and artificial intelligence, and artificial intelligence in management. The results of the literature review facilitated a conclusion that organizations and forms of managing organizations are changing. As a result, the classical definitions of managerial functions, as well as levels of managers (top, middle, low), become less clear in certain settings. Adapting and adjusting becomes a very important skill for managers in today’s organizations.

The systematic literature review resulted in 24 articles that covered various aspects of artificial intelligence and management. These studies were then categorized according to the following themes: (1) Artificial intelligence in management, (2) Artificial intelligence as a replacement for human workforce, and (3) Future of Artificial intelligence.

The artificial intelligence in management theme found that AI technology is changing business organizations and overall managerial work. Expert systems have enabled improvements in organizational productivity as these can be successfully used to speed up decision-making, problem-solving and improve customer service. This is in line with the literature review which suggested that AI, machine learning and deep learning gives companies new possibilities to digest and get new insights to develop new products and opportunities for their business, with more intelligent use of their data.

Artificial intelligence as a replacement of the human workforce theme found that in the future HR managers are most likely to be affected by the technology of AI, with three of seven papers reporting evidence of automation in relation to HR (Klotz, 2016; Chelliah, 2017; Goodson, 2018). AI was considered both as a tool and a replacement for the human workforce. This is in line with the literature review which suggested that HR managers were among many other jobs at risk of automatization. This theme also concluded that computer systems have been shown to be biased, which stresses the need to have proper validation processes in place.
The future of artificial intelligence theme uncovered that AI technology is an important and necessary tool for organizations to consider, as the future challenging competition will thrive on it. The technology will continue to grow, as it is predicted that the penetration of AIS will be much higher by 2030 (Sreedevi et al, 2017). This is in line with literature review which suggested that the world business revenue from AI applications will continue to increase.

However, culture differences may have affected the result since the US had the largest share: 42% of the research scene and the UK the second largest: 21%, while the rest of the studies dealt with Asian and European countries. The most common research methodology used was secondary data analysis, where data collected in previous studies was analyzed. Other occurring methodologies were - on experiment, literature review, qualitative research based on interviews, and quantitative based on survey. This indicates an urgent need for more diversity in research methods and in real-life settings, e.g. organizations.

This research aimed to answer three research questions. First, was regarding our current knowledge about the effects of AI on management. Based on a literature review and results of a systematic literature review, it can be stated that AI is an unavoidable presence in future organizations and that it will effect various areas of managerial work, such as accounting, asset management, facility management, financial management, fraud detection, information management, inventory management, marketing, knowledge management, human resource management, reputation risk management, sales management, total quality management, performance management, production management, network management and project management. Furthermore, it is suggested, that AI can be useful in addressing some of the biggest management challenges, e.g. cross-cultural management. It is also suggested, that managers will need to acquire new skills and competences, in order to tap into emerging environments where AI will be present.

Second, what does current research predict for the future of management in relation to AI developments? Based on the results of this thesis, it is evident that AI technology will carry out many managerial functions, such as tutoring, problem-solving, knowledge sharing, and decision-making. Furthermore, there is also some evidence that AI can
improve managerial efficiency, particularly in strategic planning, data transfer, data quality and service process time. AI will help in the efficient and systematic management of organizations for bettering their performance, outputs and profits. Nevertheless, it is critical for companies who desire to adopt AI that they consider that it will require champions to implement the change of the emerging application, because if they do not succeed their implementation can be costly – AI is considered to have high implement- and duration costs.

Third, does current research specify the role of middle managers in the future in relation to AI developments? Based on the literature review and results of systematic literature review, it is apparent that the future impact on middle-level managers is unclear. The results found evidence in one paper, Atkin et al. (2017), which showed that a consequence of AI in facility management was that middle managers could get bypassed. Still, four papers showed a future impact on managers without specifying their hierarchical level, meaning it was unclear whether they belonged to low-, middle-, or top-level management (Shim & Rice, 1988; Klotz, 2016; Chelliah, 2017; Goodson, 2018). This indicates that there is a research gap concerning for middle-level managers, since very little research defines the level of management within each sector, and thus more theses on this topic could be developed in the future.
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