MASTER THESIS

Chatbots and the employee selection process: what lies ahead?

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To my Mom, always with me

To my Dad, wherever you are

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This year has not been easy. I remember again when I wanted to let it go, a little bit for uncertainty, a little bit for fear. But then, thanks to my motivation and my never giving up, I fixed a purpose. Now, I am understanding what all this means to me, and finally, I realized that I have done the right choice.

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Secondly, I would like to thank Dr. Jeroen Meijerink, that despite the summer break accepted the collaboration like Supervisor with the Professor Bondarouk and me for my Master Thesis.

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A thought goes to my aunt Maria Rosa and my neighbor Lucia, that left us after a serious illness.

However, a big hug to all

Sincerely, your Stefano

Abstract

Purpose

In several decades, the use of Chatbots and IT has increased in exponential way. This led to a competitive advantage for organizations and acquisition of talents, within a continuous evolution of Human-Robots communication. Since the HRM functions can and cannot be outsourced to computer programs, this study aims to analyze the literature to understand the use of Chatbots in the selection process, and what HRM functions can be outsourced or not to Chatbots. For this reason, we have proposed the research question as follows: "*Which of the selection processes are (im)possible to outsource to a chatbot?".* To answer the proposal research question, studies from three decades have been used, from 1988 to 2021.

Methods

The current Master thesis has been developed through a literature review, using bibliographic studies from Google Scholar. Since the current study aimed to understand both theoretical concepts of HRM functions and the use of Chatbots, different criteria have been considered to choose the useful articles to conduct this Master thesis.

Results

In order to understand the results, the application of Chatbots in the selection process has its advantages and disadvantages. For example, a Chatbot can be time and cost saving, and can accelerate the processes within efficiency. On contra, the application of Chatbots can result disruptive in wrong hands and lead to unemployment and loss in Human touch.

However, the results have shown the HRM functions that can be outsourced or not to Chatbots as Cognitive, Creativity and Emotional process. A detailed description will be provided in the next chapters.

Conclusion

We can conclude saying that the application of Chatbots in the selection process can have its benefits. Novel experiments and directions have been taken to apply Chatbots in each fields, in order to gain an organizational competitive advantage, and to make a technological globalization. Not ever the Chatbots are efficient, because of the lack in certain functions that cannot be outsourced at the moment. Practical implication will be described in the next chapters. However, this study has reported the main important HRM functions that have been analyzed accurately, describing in detail what can be

outsourced to Chatbots and what cannot. In addition, this study aimed to understand the latest state of art of knowledge in using Chatbots in the selection process under the lens of the HRM functions.

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1. Which of the selection processes are (im)possible to outsource to a chatbot?

Nowadays in a dynamic and complex environment the Artificial Intelligence (AI) is the new technology for the global market. For this reason, I will talk about the new technological developments. Known as Chatbots, these programs can communicate with humans easily using natural language, through software, machines, systems, and computers. AI allows systems to understand their environment, relate to what they perceive and solve problems, and act toward a specific goal. The computer receives the data, already prepared, or collected via sensors, such as a video camera, processes it and responds. AI systems can adapt their behavior by analyzing the effects of previous actions and working independently.

Dimitriadis, (2020) highlighted that human communication with a chatbot is a state of mind, divided in psychological layers. The first impression for humans is called Anthropomorphism, since the interaction is wrong perceived by humans, attributing to a Chatbot human characteristics that do not exist. The interaction between Humans and Chatbots can be via text to voice messages, where there is an exchange of questions and answers, information, which will all be recorded by chatbots in such a way as to allow an initial screening, (Dimitriadis, 2020).

During the years, the development of these technologies gives a Human identity to the Chatbots. In fact, according to Brandtzaeg and Følstad, (2017), the evolution thanks to the mobile Internet has allowed the use of online chat, satisfying a large part of the world population. A chatbot can appear as an imaginary user, but it has cognitive skills and specific analysis. Thanks to the application of artificial intelligence, in fact, a Chatbot can interpret the signals, it receives and responds consistently to each query. The use of Chatbots is so extensive that it has been introduced in many businesses such as information, entertainment, social platforms, and customer services. It has been shown that Human-Chatbot interaction is much smoother and more constant, unlike Human-Human interaction, which is much shorter, rude, and complicated. Using simple language, humans are much more involved because paradoxically the commitment to entertainment is minimal (Brandtzaeg & Følstad, 2017). As aforementioned, the using of Chatbots is more easily applied in the educational process. This type of approach, according to Dimitriadis, (2020), is fundamental for economic and demographic factors, to find more educational solutions and minimize costs. The application of Chatbots gives opportunities of improvements for education and not only. In the last few years, this technology has transformed people's lives, communities and societies and it has radically changed the working way, covering many fields, helping the HR practices and activities (Dimitriadis, 2020).

In addition, AI is used for the recruitment of talents, selection process and for other many services. Wilfred, (2018) said that the benefits of AI are many. The main benefits are found in the time optimization, decrease of errors and less human-human relationship that can be disruptive. Also, this technology can produce accurate results, finding issues into large dataset (Wilfred, 2018). The author argued that applying AI in recruitment can automate repetitive tasks, collecting fundamental information and interviews. It is a good way to analyze and find abilities, talents, and characteristics to fight the various human biases interference. Thanks to the capabilities of Natural Language Processing (NLP) and powerful algorithms of Machine Learning, it can be possible to process a large amounts of information and data, checking what are the right candidates' position related to the professional profiles. The recruitment process, according to Wilfred, (2018), is developed since organizations and enterprises have evolved at a technological level. In fact, Chatbots are used to recruit workers, reducing hiring costs and large hiring teams. But it is fundamental that the use of these technologies must be done in an appropriate way, otherwise it will be quite destructive for both organizations and candidates.

The paper written by Nawaz and Gomes, (2019) highlighted that the digital technologies influence the HR organizations and the way in which these technologies lead to organizational effectiveness. Also, they can help to establish strategies for talent acquisition, monitoring the recruitment processes and paying attention to workforce and planning.

Looking at the HR functions, AI is severally improved especially in employees' satisfaction, performance management and retention. Since the Chatbots have been considered a concept of AI, the application of these computer programs has transformed the processes and the organizational purposes. For this reason, AI has enabled the Chatbots in conversating with users and job applicants through words, emotions, and effectiveness, using the NLP (Nawaz & Gomes, 2019). Surely, the standardized Chatbots are not able in performing the hard skills.

Nawaz and Gomes, (2019) argued that all this is made possible thanks to the right data, which represents the candidate at 360 degrees, since the Chatbots can give accurate results through an excellent job, showing as aforementioned the candidates' skills, past experiences, and qualifications to achieve the best position. Another way to take key information is the "Question and Answer" method (FAQ) on the company website, where the recruiters drive the applicants to communicate, optimizing time and resources (Nawaz & Gomes, 2019).

According to the authors, it is essential to show a different approach in the recruitment and selection process, making the candidate's experience different from past experiences with other competitors, as a negative experience may penalize the process itself. For this reason, many organizations use the technology process to improve their position on the global market and to obtain the best talents to

achieve a competitive advantage.

An increase in technology will have an influence in the future. Due to the technological environment, the employers and recruiters are more able to recruit people because the candidates are educated to this volatile context, also leading to a strengthening of the organizational brand that attracts talent pools. It is surprising to know that Chatbots, despite new solutions, new implications for the application processes and cognitive technologies, can apply extraordinary methods to collect data about candidates in the smart way possible (Nawaz & Gomes, 2019).

The purpose of this Master thesis was to analyze the literature, to make a literature study to review the existing studies and state of the art knowledge about working within Chatbots in the selection process. During the years, the HR function has evolved in the exponential way. However, the automation of processes is not applied by wire or by sign, because the Chatbots can help in foster the HR functions, but cannot replace humans. Hence, there are factors that can be or cannot be outsourced from Humans to Chatbots.

The HR departments can encounter several challenges in collecting information and selecting job applicants (AbdElminaam et al., 2021). In this regard, to speak about the selection process, the concept of online or E-recruitment plays a key role. This viewpoint is not interchangeably concept, but a step-by-step concept. Since the selection process is the following step of the recruitment process, nowadays the innovative technologies are fundamental in acquisition of talents and their retainment (Allal-Chérif, Aránega, and Sánchez, 2021). The HR Chatbots use interviews to perform the selection process of Job applicants. The Chatbots also are enabled of sophisticated algorithms job applicants' suitable skills for the next job application. AbdElminaam et al., (2021) argued that the application of Chatbots in the selection process leads to the extraction of relevant information for the job-fit; reduces the time of interviews and decreases the unconscious biases, human error, and judgements; and finally, can understand if the application by job applicants is reliable and valid.

Due to this relevant topic, and to uncertainty, there are different studies and opinions on the impact and effectiveness in applying the Chatbots in the selection process. We try to address the research goal through an exploratory analysis of the literature.

For this reason, the proposal research question is as follows:

"Which of the selection processes are (im)possible to outsource to a chatbot?". More insights can be given, drawing between different viewpoints. Some people believe that the application of these computer programs, as an evolution of technology, is useful for the future. Others consider the technology advancement as a cause of complications and destructiveness in the modern world, because the Chatbots do not own the Human factors. Different topics and statements will be faced in the next paragraphs.

2. Chatbots and the employees' selection process: First introduction, or setting the stage

The classic definition of Chatbot is due to a computer program designed to simulate a conversation with human users, especially through Internet platforms.

Going into more detail, several authors have a different way in seeing chatbots. For example, Daniel, Cabot, Deruelle and Derras, (2019, p. 2-3) define a Chatbot as *"An application embedding a recognition engine to extract intentions from user inputs, and an execution component performing complex event processing represented as a set of actions"*. This type of definition is given according to an engineering weighing method. Although in many articles the authors focus on the methodology and not on the definition, others focus on the definition and different methods of Chatbots' application. On the other hand, the interaction is defined as psychological between the Chatbot and the user. Indeed, Ho, Hancock, and Miner, (2018, p. 714) have argued that "*Disclosers know that chatbot is a computer program that cannot understand them on this deeper level. The chatbot's responses may be seen as pre-programmed and inauthentic, preventing disclosers from feeling truly understood*". About the study we are doing, we will see Chatbots' challenges, opportunities, and implications for the HR and selection process.

During the decades, the phenomenon of AI and information technology in the HR management field has improved a lot, because companies are trying to extend their processes and business operations across the world.

Nawaz and Gomez, (2019) emphasize that digital technology forces HR processes to identify talents, leaders, personality traits and some training needed to develop candidates' skills and abilities. This new AI can lead the selection process and recruitment to an effective communication between recruiter and candidate.

According to van Esch, Black and Ferolia (2019), different industries and sectors use Chatbots to improve speed in delivering outcomes for the selection, verification, application, and recruitment of candidates. From the candidates' side, individuals use and adopt new technologies to take benefits, considering AI a novel situation. For this reason, many industries use Innovative technologies to attract talents. But it is important the figure of the organization. The type of approach towards candidates, and several factors such as job requirement, job security and application process play a key role for the organizational transparency and trust (van Esch Black & Ferolia, 2019). In the last few years, with an increase in online users and virtual profiles, hiring managers are selecting and recruiting applicants through social platforms. Since info are protected by laws to guarantee the maximum privacy, the employers use these info to make better the selection process (Black & Johnson, 2012). The authors

argued that technologies had a relevant impact on HR departments and their processes and decisions. Information, taken through Chatbots, shows the candidates' behavior and interactions without focusing on career development. Also, new technology enables to predict the dimension of candidates' intelligence, special interests, hobbies, to see the compatibility between the applicant required and the applicant proposed. According to Geetha and Bhanu (2018), AI is used by HR in eight steps:

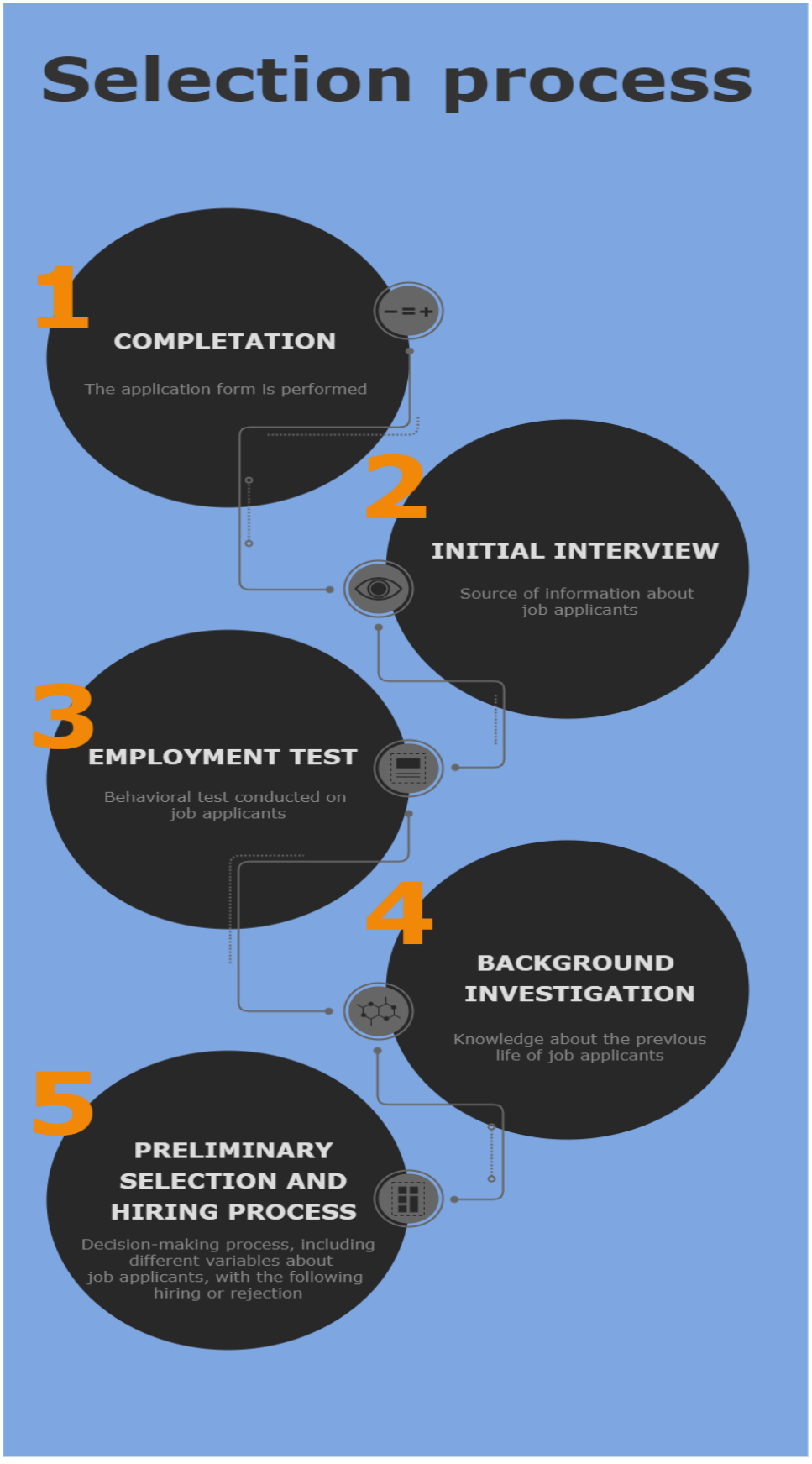
- Screening candidates, where chatbots help applicants to answer different questions to collect info.
- Candidate engagement, where artificial intelligence uses processes and automated emails through instant messaging systems to entertain the applicants.
- Re-engagement, where using the new technology is enabled to establish the engagement opportunities and positions.
- Post-officer acceptance, where after the application process is asked to candidates the acceptance for the workplace.
- New hire on-boarding, that enables new applicants to use an online orientation program.
- Career development, because the applicants need to be motivated, also using offered online training programs.
- Employee relations, because the employees accept only having many queries. AI can manage the employees regarding this type of tool through chatbots and emails.
- Scheduling, to register events or meetings, where AI creates book meetings and schedules.

The application of Chatbots is important in the HR field for many processes, especially because it is time saving, maps the talents, hires with quality, reduces costs, and takes applicants with superior quality. The selection process is a later stage of recruitment (Kamran, Dawood, & Hilal, 2015). It is a process not only to choose new members into the organization, but to attract qualified applicants. The focus in the selection process is relative to methods that can select skills in terms of contribution to organizational outcomes and increasing value.

The selection processes, according to Kamran, Dawood and Hilal, (2015), follow a standard pattern as initial screening, background investigations and physical/medical examination that enable the continuation of the processes themselves. This info is crucially to give a decision-makers a final choice.

As aforementioned, the selection process as HRM practice is the following step after the initial recruitment, where are identified the possible qualified candidates that will be hired (Shih, Huang & Shyur, 2005). This process, according to Petrovic-Lazarevic, (2001), can give valid and reliable information about applicants. Usually, the procedure requires different steps:

Figure 1: Selection process steps



Shih, Huang and Shyur, (2005) have argued that the validity and reliability of interviews and tests are fundamental because the candidates that own the right skills, the right behavior and ethic mind, can lead to organization success, avoiding issues and creating value.

Looking at the traditional hiring and selection process, the decision-makers select using a clinical or statistical approach, where they select referring to themselves values, beliefs, emotions, past experiences. For this reason, both selection and hiring processes are fundamental to select candidates. However, the decision-makers tend to include a lot of variables to make the better decision, considering the real impact of it (Petrovic-Lazarevic, 2001).

According to Bolander and Sandberg, (2013), choosing the right employees, the organizations achieve an advantage in future situations. The authors considered two principal approaches on employee selection:

- The psychometric approach that considers each job a sum of great skills and tasks, independently from the candidates' behavior. Skills and behavior can be measured separately, to identify what are the attributes and tasks that fit with the job requirements.
- The social process approach that highlights the validity and reliability of the tests. In this case the tests that do not have high validity and reliability can be considered favorable to establish a psychological contract between candidates and organizations.

These two types of approach are used also to explain the selection process in practice, where the decision- making process is characterized by an initial agreement and an initial disagreement. Then, each form is defined by a deliberation from the selector that decide (Bolander & Sandberg, 2013).

Referring to the social process approach, Petrovic-Lazarevic (2001) also said that some selectors make decisions based on his/her ideas. For this reason, practitioners and academics believe that HRM practices and especially the decision-making process into the selection of candidates can be affected by a minimal subjective judgement resulting disruptive for the process itself (Petrovic-Lazarevic, 2001).

Coming back to the HR management that uses chatbots to carry out its practices and functions, Johansson & Herranen (2019) emphasize that this strategic choice is due to technological advancements and increased number of job applicants that impact on HR departments. Usually, HR departments use ranking systems to gain time and to not involve HR practitioners and selectors in more effort. With the introduction of AI, the Chatbots' online interviews can find, through recorded videos, personality traits, analyze body's language, voice, and facial expressions (Chapman & Webster 2003; Johansson & Herranen, 2019).

The application of Chatbots has its advantages and disadvantages. For example, the first benefits

show that Chatbots can work 24/7, easy access to necessary information and give fast feedback (Egorov, Lebedeva, Prokhorova, Tsapina & Shkunova, 2019). There are different opinions across the world, because each country and each market offer different services, including obviously AI. According to Egorov et al., (2019), the use of Chatbots in HR practices and functions are significantly limited by the "Human factors", because the implementation of Innovative technology cannot

- Create a comfortable condition for the interaction and interviews for applicants.
- Give answers to non-standard and illogical questions from the applicants.
- Correlate habits of a candidate towards the new corporate culture of the new organization.
- Read the true meaning of what applicants say, "Between the lines".
- Diagnose the needs, interests, potentials, and other traits/attributes of the applicants.

Table 1: Advantages and disadvantages of Chatbots' application

Advantages	Disadvantages
Speed in performing tasks	Wrong use leads to mass destruction
Ease of use in stressful context	AI wrong responses to Human command
Easy responses to difficult works	Human job disruption
Multitasking approach	Increased unemployment
High ratio of success	Limited creativity
Lower level of errors	Loss in Human Touch
Increased efficiency	Lazy young generation
Time and cost savings	Expensive investment
Easy management of large number of people	Technological dependency

Once discussed the processes carried out by HRM and Chatbots, and to the steps of the decision-making process for the HRM and the steps used by the chatbots to select, we can note that there are not many differences in the processes but in the contents of the processes. Due to the research question that we proposed, we can analyze the contents that have led to the following proposed research question:

"Which of the selection processes are (im)possible to outsource to a chatbot?".

To answer the research question, we can consider three main concepts that have been chosen to develop the current study.

2.1 The Cognitive Process

Starting from the HRM, the decision-making process is one of the fundamental cognitive processes of human beings (Wang & Ruhe, 2007, p.74). It is used to determine rational, intuitive, and heuristic selections in nowadays complex environments. Since the decision-making process is a mental process, the only way is to stop and think for a few seconds.

According to Newell and Shanks (2014), unconscious biases can control the mind and behavior. These biases influence and can distort other processes, playing a key role in the decision-making process. Sometimes, variables as criterion or events in the environmental contingencies/relationships between cues and criterion, the weighting and integration of information and making a judgement, can lead to a wrong decision.

For example, diversity can become a resource for the organization, it can be valued only if the selector is not affected by biases. One of the principal and possible causes are the stereotypes, that means a rigid valuation of an individual (Newell & Shanks, 2014).

Black and van Esch, (2020) argued that other biases can affect the cognitive process and the decision-making process:

- Confirmatory bias, that can be the same for the selection process, where the selector obtains information from candidates that confirm the initial judgement (Windschitl, Scherer, Smith & Rose, 2013).

- Similarity bias, where the selector unconsciously helps candidates like him, independently from the final decision (Sacco, Scheu, Ryan & Schmitt, 2003).

The substantial difference is that while the human cognitive process can be distorted by external agents, a cognitive process for Chatbots can be bias reduced.

2.2 The Creative process

Most developers of computer programs tried to outsource the creativity. The creativity has been defined as a social construct, most properly the implementation of useful and innovative ideas derived from individuals and teams, through brainstorming outcomes (Amabile, 1988). Indeed, Boden, (1998) said that the creativity is a result of human intelligence, highlighting two types of creativity: Psychological and historical. While the psychological creativity has been considered the main and fundamental concept, the historical creativity comes from experience, being a particular component of the human

beings.

In addition, Boden, (1998) has classified the creativity in three main categories:

- Combinational, that considers novel ideas regarding familiar circumstances. This type of creativity acts through analogies, where ideas are developed by structural judgements and similar concepts, directed to solve issues. It can be said that the judgments are bias reduced, to help the problem-solving process.

- Exploratory, that goes over the structured analogies. In this case, the results of the exploratory creativity are unexcepted, producing new ideas to transform.

- Transformational, that allows the creation and implementation of novel ideas that are not threated before. It is important to develop new technologies and the advancement of innovation.

Boden, (1998) highlighted that the exploratory and transformational creativity are narrowly linked, useful to break out the structured and stuck ideas.

However, these concepts can be discussed. Hence, Boden, (1998) highlighted that Chatbots could own the historical creativity because of judgements from experience, formulating novel ideas but not creative. The main reason is that creativity is limited to the application of algorithms that cover a little bit values and beliefs of human beings. Since the transformational creativity requires a good level of self-criticism, it seems that algorithms can compare and explore structured information to produce novel ideas, without values. The valuation of results is important to be creative, where the self-criticism allows to transform novel ideas in concrete useful structures that arise the added value. It seems that it is difficult to outsource the self-criticism from HR functions to Chatbots, since it depends on what is transferred on used algorithms.

However, Allal-Chérif, Aránega, and Sánchez, (2021) argued that the gamification can be a creative way to discover talents between job applicants. The gamification is the use of algorithms applied to Chatbots to replicate the work environment, to entertain the job applicants and to avoid the monotony of classic job interviews.

2.3 Emotional process

The emotional process, within the perception of interaction between humans and robots, plays a key role in establishing the added value for both subjects. Martinez-Miranda and Aldea, (2005) emphasized that humans' emotions and intelligence are fundamental in the decision-making process, more properly within their reaction to people's behavior. Since the AI often is used in problem solving fields, the application of Chatbots and different agents that work with communication, collaboration, and achievement, leads to an organizational success.

However, the emotions are crucial in determining the humans' behavior (Damasio, 1994, as cited in

Martinez-Miranda & Aldea, 2005). The emotions have been classified in primary emotions as enjoyment, love, fear, sadness, disgust, and surprise, while the emotions in the working environment could be affected by external agents. For example, the sociability and social skills nowadays are determinant in work. In addition, the emotional competence has been presented as the model in which personal and professional competencies work together, (Goleman, 1999, as cited in Martinez-Miranda & Aldea, 2005). In this case, the personality traits could affect positively or negatively the humans' professional profile. These have been classified as self-confidence, self-awareness, self-control, adaptability, consciousness, creativity, empathy, optimism, leadership, and team capabilities. This is the main characteristics that an organization tries to find for the organizational achievement and success.

AI has been introduced in the organizations to create an added value. If we consider the importance of the humans' emotions within programs and robots, a crucial statement can be done. The nature of emotions can affect in big extent the outcomes in each field. When an algorithm is written and outsourced to the computer programs, it is important to distinguish and choose the right components. On one hand, emotions that help to stimulate a good interaction with humans can result in positive responses of job applicants. On the other hand, negative emotions as stress, anxiety and fear could result disruptive for the humans' perceptions and interactions.

Thus, several developments regarding the humans' emotions and Innovative technologies led to a technological advancements. Indeed, emotional components have been outsourced to Intelligent systems to copy the human behavior in HR processes, through three basic aspects:

- Cognition, where algorithms use the developer's knowledge as experience and creativity.
- Social characteristics, where algorithms referring to assigned tasks, shows different personality traits and emotional state of the developer.
- Personality, where algorithms have a specific role for each field in which it works.

All this can work for humans and optimize the processes. The last important point refers to the outsourcing. The term outsourcing is translated in automation of Chatbots. The Chatbots can be automated by the transfer of particular aspects from the engineers that develop the algorithms. These algorithms that must be developed needs of different characteristics according to the application field (Martinez-Miranda & Aldea, 2005). However, the automation is still limited to these algorithms, that do not enable the Chatbots in going over the boundaries.

Technological innovation is constantly growing, and despite conflicting opinions, could only improve everyday life.

3. Literature Review Methodology

Once decided the content of the study, relevant literature on AI, Chatbots, HRM functions, recruitment process, selection process, decision-making process, creativity, emotional process, and cognitive process has been found. The source used to find these articles was Google Scholar, making an accurate research for each argument considered. The importance of Google Scholar enables students, professors, and researchers in accessing to relevant studies, bibliographic documents, because is a good source of information. In addition, using Google Scholar is possible to submit own works to share. The studies used to develop the current Master thesis follow the period of three decades from 1988 to 2021.

After the scan of more than 1000 articles, and 76 articles selected, in the end 24 articles have been chosen. Since more articles were a review of other studies, we have got the most useful and relevant, especially for conceptual theories and the way in which they were clearly explained. For both conceptual and empirical articles, it was provided a descriptive explanation, reporting authors, countries, methodologies, and the main information, shown in the spreadsheet. The full description of the articles can be found in the appendix A.

All the 1000 articles have been scanned to get a choice. The selection of 76 articles has been made checking the abstract and reading the full articles where necessary, considering theoretical frameworks behind the HR functions and their possible outsource to Chatbots, the application fields of Chatbots, internet platforms, recruitment process AI-Chatbot-related and conceptual theories, selection process, decision-making process, creativity Chatbot-related and conceptual theories, cognitive process Chatbot-related and conceptual theories, emotional process Chatbot-related and conceptual theories,

All the chosen articles have been written in English, including the nature of them as literature review, conceptual article, or empirical article. To choose the 24 final articles, different criteria have been considered. As aforementioned, the importance of theoretical frameworks has played a key role. Not all articles were detailed, but more general. Indeed, the inclusion criteria adopted refer to the importance of conceptual theories that could be connected to develop the current study, research questions, empirical evidence (where provided), and application fields. Some article has been considered only for different definitions.

The search terms or keywords used to find information were AI, Chatbots, Selection process, Job application, Innovation, Innovative technologies, Emotional intelligence, Creative chatbots, Cognitive chatbots, Job applicant selection, machine learning, natural language, unconscious bias, HR chatbots.

As aforementioned, the inclusion criteria refer to important sources of information regarding the keywords, both for the relevance of theoretical frameworks to understand the theories behind, and the practical results, to have a comparison between different viewpoints, different studies, and authors.

Instead, the exclusion criteria refer to general studies and superficial results, where authors did not cover in complete way the necessary information to develop this Master thesis.

The figure 2 shows the literature search process.

Figure 2. Literature search process

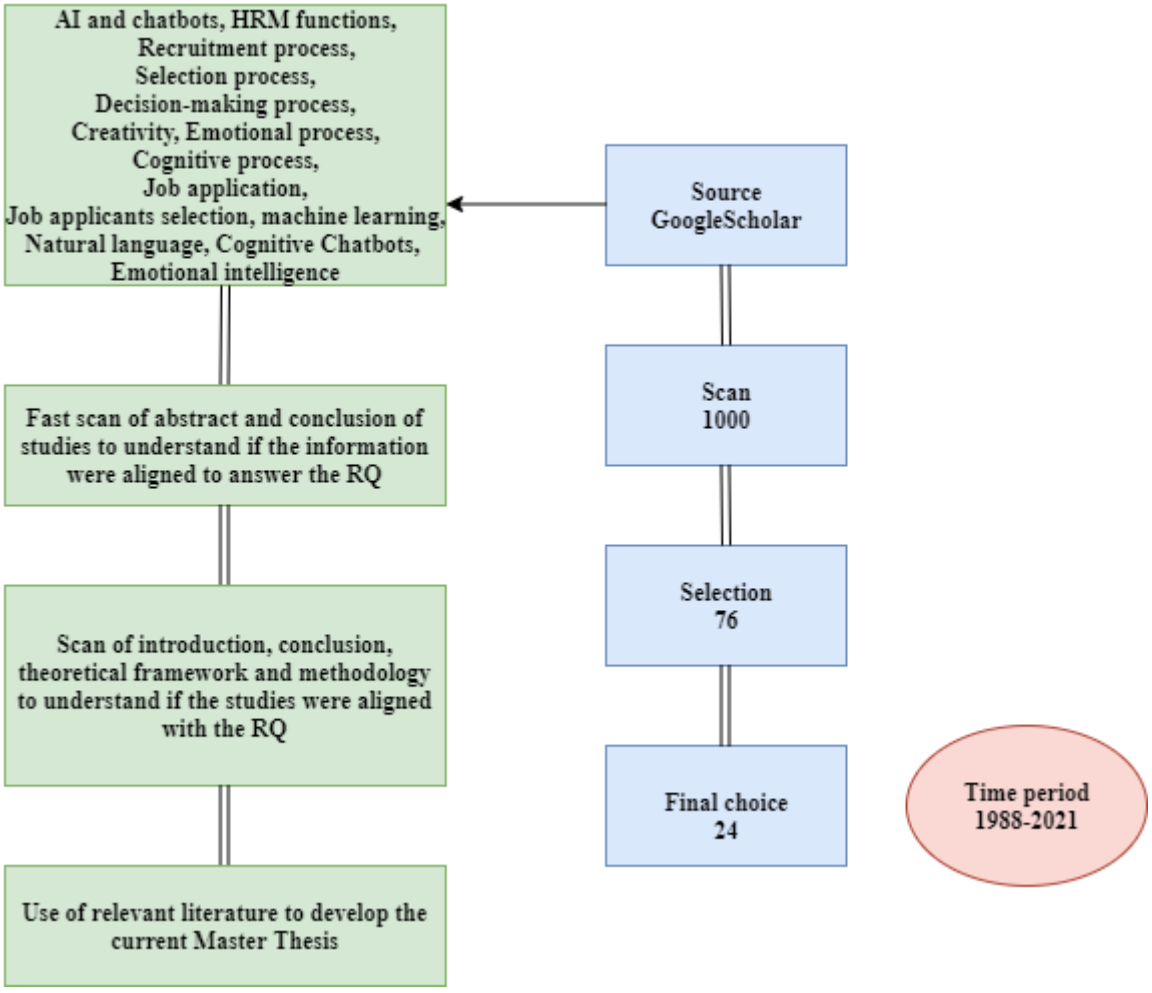


Table 2. Selection criteria

Method	Authors and Articles
Mixed Method	*AdElminaam et al., (2021) (HMR functions Chatbots-related)* *Allal-Chèrif, Aranèga, and Sanchez (2021) (HR Functions Chatbots-*

	related) *Black and Johnson (2012) (HRM Social network selection-related)* *Black and van Esch (2020) (HRM-related but not Chatbots)* *Boden (1998) (Creativity Chatbots-related)* *Daniel et al., (2019) (Engineering Chatbot-related)* *Dimitriadis (2020); (Human-Chatbot-related)* *Egorov et al., (2019) (HRM AI-Chatbpts-related)* *Geetha and Bhanu (2018) (HRM AI-related)* *Kamran et al., (2015) (HRM-related but not Chatbots)* *Martınez-Miranda and Aldea (2005) (Emotional process Chatbots-related)* *Newell and Shanks (2014) (Decision-making process-related but not Chatbots)* *Petrovic-Lazarevic (2001) (Selection process-related but not Chatbots)* *Wang and Ruhe (2007) (Decision-making process-related but not Chatbots)* *Wilfred (2018) (Recruitment process AI-related)*
Qualitative	*Amabile (1988) (Creativity and innovation-related but not Chatbots)* *Bolander and Sandberg (2013) (Decision-making process-related but not Chatbots)* *Brandtzaeg and Følstad (2017) (Chatbots-related)* *Chapman and Webster (2003) (HRM Technologies-related)* *Johansson and Herranen (2019) (HRM AI-Chatbots-related)*

Quantitative	*Ho et al., (2018); (Psychology Chatbots-related)* *Nawaz and Gomes (2019) (HRM Chatbots-related)* *Shih et al., (2005) (HRM-related but not Chatbots)* *Van Esch et al., (2019) (HRM Chatbots-related)*

From the articles, different publications can be seen: 1 from 1988, 1 from 1998, 1 from 2001, 1 from 2003, 2 from 2005, 1 from 2007, 1 from 2012, 1 from 2013, 1 from 2014, 1 from 2015, 1 from 2017, 3 from 2018, 5 from 2019, 2 from 2020, 2 from 2021.

3.1 Data analysis

The current study aims to understand what the HRM functions can be outsourced or not to Chatbots. To answer our proposal research question, a full description of an exploratory analysis has been provided. The spreadsheet can be found in the appendix A where are reported:

- The full reference of the article

- The research question/research goal

- The definition of the main concepts as for example decision-making process, Chatbot, Creativity; AI

- The country where the study has been performed

- The concepts and theories used in the study

- The methodology used in the study, for example qualitative method as interview, or quantitative as population/employee sampling, scales of agreement

- Findings from studies

The construction of this Master thesis using the literature review has been thought with my Colleagues Giorgia and Martina. While them used different methods (Qualitative and Quantitative approach), we chose to use the literature review because it is possible to cover 3 different arguments together. Instead, the use of Qualitative and Quantitative method implies the treatment of one variable.

4. Findings

If we look at the contents of the process, we can see the processes that can be outsourced or not from HRM to the Chatbots.

As aforementioned, the cognitive process is the starting point of the decision-making process, it is used to determine rational, intuitive, and heuristic selections in nowadays complex environments. Since the decision-making process is a mental process, the only way is to stop and think for a few seconds (Wang & Ruhe, 2007, p.74). Referring to the selection process, and according to Allal-Chérif, Aránega, and Sánchez, (2021), the data analysis made from Chatbots is unconscious bias reduced, since the classic interviews are counterproductive for the job applicants, all related to unnecessary managers' answers on job applicants' CV, pre-judgements, fighting relationships, personal interests and discrimination. Despite the large amount of data, and the various screening about required job-fit skills, the Chatbots are able to select the candidates' skills and talents that are in line with the firm's requirements.

In addition, Allal-Chérif, Aránega, and Sánchez, (2021) argued that an important way to be creative is the gamification. The first application of gaming refers to the training of new workers to adapt them in the work environment. Then, this method has been applied in the recruitment and the selection process. More properly, the application of serious games in the selection process enables the discovery of talents that can lead to an added value for the organization, and the job applicants that own the right skills to be select and hired. However, the author highlighted that the gamification and the application of serious games can be detrimental in certain situations. The concept of "Game" for more people means the lost in credibility and seriousness, because "The workplace is not a game".

A Chatbot, to be effective, has to be created to achieve the purpose. The use of Chatbots helps the HR department in foster the processes as the recruitment and especially the selection process of job applicants. The collection of fundamental information is necessary to identify job applicants' personal skills to contribute to the organization's competitive advantage (AbdElminaam et al., 2021). Some important criteria are used to test the realness of the job application. The Chatbots interviews are useful to discover real or fake candidates' application. The reliability and validity of job applicants' interviews can be tested through the emotional process. Since the Chatbots can lack in responding with emotions, they are enabled in capturing the job applicants' humors, behaviors, and emotions, to understand if the application is real or fake (AbdElminaam et al., 2021). The authors highlighted two main steps as the pre-screening where are provided empty questionnaires to job applicants; and then the interviews, where the job applicants answer the questions, using facial expressions. This process is a creative way to

analyze the job applicants, in addition to the gamification, recognizing the emotions through interviews and the emotional process, being an accurate method of decision-making process to select, hire, or reject the job applicants (AbdElminaam et al., 2021; Allal-Chérif, Aránega, & Sánchez, 2021).

5. Discussion

This study has been developed to understand what processes can be outsourced from HR functions to Chatbots. The purpose of this Master thesis was to analyze the literature, to make a literature study to review the existing studies and state of the art knowledge about working within Chatbots in the selection process, analyzing different articles taken from Google Scholar, identifying the most important concepts that led to answer the proposal research question. It has been necessary to clarify what processes of HR regarding the selection process, the mechanisms as cognitive process, decision-making process and emotional process are. Since Chatbots has been defined as "The use of computer program to communicate with people through software, videos and voice", the processes became more efficient and quicker, being also cost and time savings machines.

Different viewpoints highlighted that the application of Chatbots towards people must be done carefully. The main issue refers to the first interaction between humans and robots, and the importance of a good first impression. According to Dimitriadis, (2020), the interaction with Chatbots is seen under the psychological lens, where humans can have a wrong or fake perception of this AI that could lead to negative outcomes.

It is known that AI in the last decade played a key role in determining firms' competitive advantage and talent acquisition. Indeed, Nawaz and Gomez, (2019) said that AI is used to identify the best talents through a good interaction that can lead to the organizational success. In addition, Esch, Black and Ferolia (2019) highlighted that "*Different industries and sectors use AI to improve speed in delivering outcomes for the selection, verification, application, and recruitment of candidates*".

During the years, the evolution IT and AI has raised the opportunity of new horizons, especially with the use of internet platforms. Since the application of Chatbots on internet have boosted the request of job positions, these technological advancements can easily manage many people, and the hiring managers select people through internet platforms, receiving the accurate information about job applicants (Black & Johnson, 2012; Brandtzaeg & Følstad, 2017).

However, Petrovic-Lazarevic, (2001) have argued that the selection process follows different step as Application form, Initial interview, Employment test, Background investigation, the Preliminary selection, and Hiring decision. Indeed, according to Bolander and Sandberg, (2013), it seems that firms hire job applicant using the psychometric and social approach, where selectors try to find the best

applicants' skills and talents, establishing a psychological contract for both.

Thus, the application of Chatbots has its pro and contra. According to Egorov et al., (2019), some pros refer to the speed in performing tasks with a large number of information, cost and time savings, increased efficiency, and lower level of errors. On contrary, the use of Chatbots could be disruptive for people when is applied by wrong persons. In addition, the humans can lose the human touch, perceiving the interaction with chatbots as inappropriate.

As aforementioned in the findings, we tried to understand what HR functions during the years have been outsourced to Chatbots, what the new algorithms are, and what HR functions are difficult to apply in Chatbots.

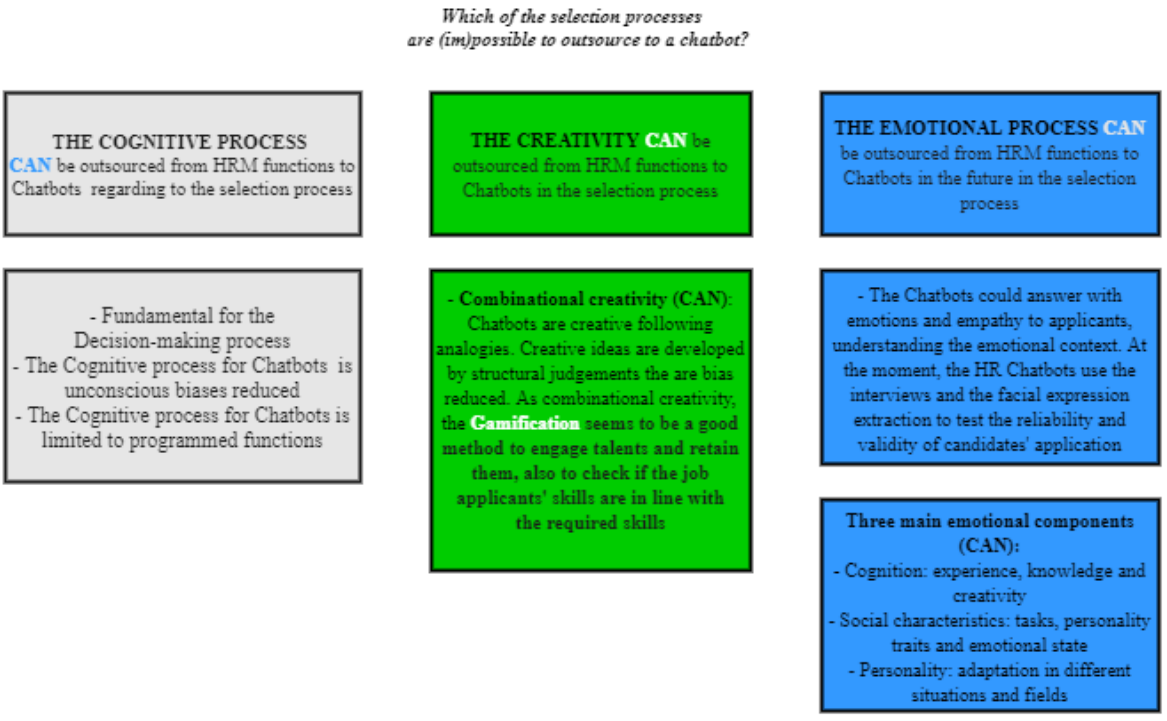
Wang and Ruhe, (2007, p.74) have defined the decision-making process "*One of the fundamental cognitive processes of human beings, used to determine rational, intuitive, and heuristic selections in nowadays complex environments*". In this regard, the unconscious biases can negatively affect the selectors' decisions. More properly, the confirmatory bias and the similarity bias are biases that influence the first judgement in the selection process, leading to a rigid evaluation of an individual (Nawaz & Gomez, 2019; Black & van Esch, 2020). The main difference refers to the Human cognitive process and the cognitive process. While the cognitive process can be outsourced from human beings to Chatbots with a lower level of unconscious biases, the Human cognitive process can be affected by external agents, that causes issues. Despite the big amount of data to analyze, nowadays the Chatbots are able to know, to interact and to select the right candidates.

Another process that could be outsourced to chatbots is the creativity. Allal-Chérif, Aránega, and Sánchez, (2021) said that the gamification could be a creative method to engage talents and retain them. Since the creativity is a social construct that states the implementation of useful and novel ideas, it can be classified in three main categories as combinational, exploratory, and transformational (Amabile, 1988; Boden, 1998). While the algorithms that are applied follow values and beliefs of the developer, they are provided of combinational (i.e. gamification can be a way). It means that the production of novel ideas results in non-creative ideas. In addition, Boden, (1998), said that is difficult to outsource a self-criticism. For this reason, particular algorithms cannot have transformational creativity, the fundamental process to implement novel ideas. In addition

In the end, the emotional process has been considered fundamental. Martinez-Miranda and Aldea, (2005) said that "*Humans' emotions and intelligence are fundamental in the decision-making process, more properly within their reaction to people's behavior*". Indeed, humans' emotions, personality traits and behaviors can affect the position into the working field. The authors identified different emotions as self-confidence, self-awareness, self-control, adaptability, consciousness, creativity, empathy, optimism, leadership, and team capabilities. When these emotional components could be outsourced to Chatbots, it

has to be done using three basic aspects as cognition, personality and social characteristics given by developers. However, it is important to outsource the right components for each field of application, because the wrong attribution can lead to disruptive technological environment. In addition, AbdElminaam et al., (2021) added that the emotional process is a way to understand the people humors, personality and social carachteristcs.

Figure 3. Findings



6. Implications

Implications for further research refer to a large number of studies developed during the years. The chosen period from 1988 to 2021 shows that more concepts and empirical evidence are given, but not more in detail. The articles used to face the current study do not hold more assumption together but are limited to explain the concepts separately.

In addition, the idea of a review was born to link all the variables, trying to explain what a group of HR functions can be outsourced to Chatbots, and considering the conceptual frameworks behind them. This

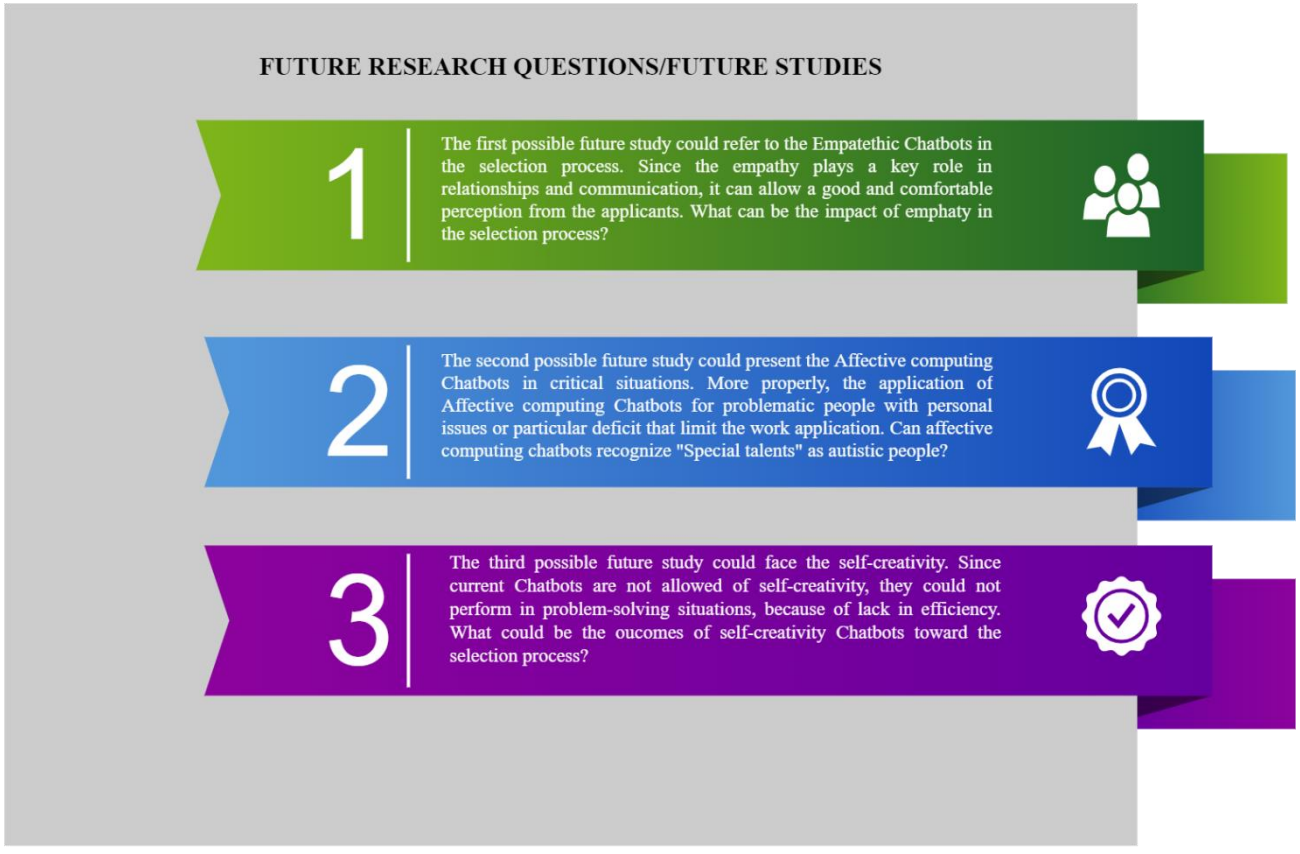
can be a starting opportunity to develop following studies, also to understand the real impact of Chatbots in the selection process, what processes can be improved and what new processes can be outsourced.

Looking at the practical implications, we can say that the obtained results have given different responses. The studies have highlighted that the application of Chatbots in the selection process could improve the efficiency and boost the organizational success, acquiring the best talents in the world.

Hence, practical implications refer to the first impression given to people, because they could not perceive the human touch. It is important to guarantee a pleasant experience, creating a sort of loyalty.

One recommendation to the HR practitioners is to implement the right processes through algorithms that enable subsequent processes. Since the Intelligent algorithms own limited cognition and personality traits of developers, it is recommended to outsource new processes that lead to transformational creativity, ever without biases. The importance of creativity plays a key role because in this rapid and volatile environment the innovation is fundamental for the organizational success.

Figure 4. Future research questions/future studies



7. Conclusion

The principal purpose of this study was to identify what HR processes can be outsourced to Computer programs, considering the selection process as the mainly process. We developed this Master thesis by proposing the following research question:

"*Which of the selection processes are (im)possible to outsource to a chatbot?"*

To develop and achieve the goal, a consistent number of articles have been checked and used to get useful information. Since the application of AI in this complex and volatile environment have helped to achieve a firm's competitive advantage, added value and talents' acquisition, not ever the processes outsourced from HR departments to Intelligent algorithms known as Chatbots are efficient at all. Starting from the Human cognitive process, it can be affected by external agents. For this reason, during the selection process the Chatbots choose through a standard values and beliefs written on the algorithms, but lower unbiased. This Cognitive process can help in efficiency and immediate work tasks but is limited for outsourced qualities of the developers. In the same way the outsourcing of creativity and emotional process. However, the improvement of processes during the years enables the growing in all fields, because the implementation of Chatbots in the HR departments is increasing significantly.

In this study we have provided a lot of information, unifying different results and conceptual components to allow future studies about this argument. Using Google Scholar, the choice of particular articles has been done because of the needs of clear information, explanations, and empirical evidence and. Since more studies were a mixed articles as literature reviews and other methodologies, limited empirical evidence have been found. This means that the studies on this field are not unified but generalized in different conceptual models, because more key words were difficult to find in each article.

Providing this Master thesis, our hope is that we can contribute to new useful studies about the application of Chatbots in the selection process. We have demonstrated what the theoretical concepts, advantages, and disadvantages of Intelligent algorithms' application. Future research can use the current article to develop a directed study to a real impact of Empathetic Chatbots in the selection process and the future new applications useful to improve the technological innovation in everyday life.

References

- AbdElminaam, D. S., ElMasry, N., Talaat, Y., Adel, M., Hisham, A., Atef, K., ... & Akram, M. (2021, May). HR-Chat bot: Designing and Building Effective Interview Chat-bots for Fake CV Detection. In *2021 International Mobile, Intelligent, and Ubiquitous Computing Conference (MIUCC)* (pp. 403-408). IEEE. https://ieeexplore-ieee-org.ezproxy2.utwente.nl/stamp/stamp.jsp?arnumber=9447638&casa_token=_3gBM4E3utQAAAAA:1Tfe2f0cQ1Ll3axpSvwh9-x2CIaf778tngz2Uk4r0wmuA-RsGZr3ZaTo3-iR6jPwxjzbXEQJsQ *
- Allal-Chérif, O., Aránega, A. Y., & Sánchez, R. C. (2021). Intelligent recruitment: How to identify, select, and retain talents from around the world using artificial intelligence. *Technological Forecasting and Social Change*, *169*, 120822. https://doi.org/10.1016/j.techfore.2021.120822 *
- Amabile, T. M. (1988). A model of creativity and innovation in organizations. *Research in organizational behavior*, *10*(1), 123-167. *

  https://web.mitedu.ezproxy2.utwente.nl/curhan/www/docs/Articles/15341_Readings/Group_Performance/Amabile_A_Model_of_CreativityOrg.Beh_v10_pp123-167.pdf *
- Black, J. S., & van Esch, P. (2020). AI-enabled recruiting: What is it and how should a manager use it?. *Business Horizons*, *63*(2), 215-226. https://doi.org/10.1016/j.bushor.2019.12.001 *
- Black, S. L., & Johnson, A. F. (2012). Employers' use of social networking sites in the selection process. *The Journal of Social Media in Society*, *1*(1). https://www.thejsms.org/index.php/TSMRI/article/view/2 *
- Boden, M. A. (1998). Creativity and artificial intelligence. *Artificial intelligence*, *103*(1-2), 347-356. https://doi.org/10.1016/S0004-3702(98)00055-1 *
- Bolander, P., & Sandberg, J. (2013). How employee selection decisions are made in practice. *Organization Studies*, *34*(3), 285-311. https://doi-org.ezproxy2.utwente.nl/10.1177/0170840612464757 *

- Brandtzaeg, P. B., & Følstad, A. (2017). Why people use chatbots. In *International conference on internet science*, 377-392. Springer, Cham. https://link-springer-com.ezproxy2.utwente.nl/chapter/10.1007/978-3-319-70284-1_30 *

- Chapman, D. S., & Webster, J. (2003). The use of technologies in the recruiting, screening, and selection processes for job candidates. *International journal of selection and assessment*, *11*(2-3), 113-120. https://doi-org.ezproxy2.utwente.nl/10.1111/1468-2389.00234 *

- Daniel, G., Cabot, J., Deruelle, L., & Derras, M. (2019, June). Multi-platform chatbot modeling and deployment with the Jarvis framework. In *International Conference on Advanced Information Systems Engineering* (pp. 177-193). Springer, Cham. https://link springer-com.ezproxy2.utwente.nl/chapter/10.1007/978-3-030-21290-2_12 *

- Dimitriadis, G. (2020). Evolution in Education: Chatbots. *Homo Virtualis*, *3*(1), 47-54. https://doi.org/10.12681/homvir.23456 *

- Egorov, E. E., Lebedeva, T. E., Prokhorova, M. P., Tsapina, T. N., & Shkunova, A. A. (2019, December). Opportunities and Prospects of Using Chatbots in HR. In *Institute of Scientific Communications Conference* (pp. 782-791). Springer, Cham. https://link-springer-com.ezproxy2.utwente.nl/chapter/10.1007/978-3-030-47945-9_83 *

- Geetha, R., & Bhanu, S. R. D. (2018). Recruitment through artificial intelligence: a conceptual study. *International Journal of Mechanical Engineering and Technology*, *9*(7), 63-70. https://d1wqtxts1xzle7.cloudfront.net/57190371/IJMET_09_07_007.pdf?1534314312=&response-content-disposition=inline%3B+filename%3DRECRUITMENT_THROUGH_ARTIFICIAL_INTELLIGE.pdf&Expires=1612379978&Signature=gP0kY467z9u40tKHNZNG3wWjW3E~NgfyRPSRLbKtpHRJaONMTbA9QNswhpoBMEgJZMWANvlReybsxtEM2eiBRmfwb2R1qZzWG2JlooyxZAo-~ZJOUmRGFwslyrn06HSwjGFbg9NaC0Q65W3o8SMt~VuAB2vmEUFVpnCnOejOEzilKKfIILh1EhnhyWCAnpMDVnNwODYy8LPxv9xgfrvq3~QYx3MIBJUjNCtk1YYUTYFbwapJAjE00VWEd9kgibKO-yJYM8y83rEVzyQSnx~hr3Cex1~3rJh6fXYpXQiNsME38mCfberCn11YehP~uXXcBxBT4R9hWGGX7gRTAR62Aw &Key-Pair-

Id=APKAJLOHF5GGSLRBV4ZA *

- Ho, A., Hancock, J., & Miner, A. S. (2018). Psychological, relational, and emotional effects of self-disclosure after conversations with a chatbot. *Journal of Communication*, *68*(4), 712-733. https://academic.oup.com/joc/article/68/4/712/5025583?login=true *

- Johansson, J., & Herranen, S. (2019). The application of Artificial Intelligence (AI) in Human Resource Management: Current state of AI and its impact on the traditional recruitment process. https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1322478&dswid=4213 *

- Kamran, A., Dawood, J., & Hilal, S. B. (2015). Analysis of the recruitment and selection process. In *Proceedings of the Ninth International Conference on Management Science and Engineering Management* (pp. 1357-1375). Springer, Berlin, Heidelberg. https://link springer-com.ezproxy2.utwente.nl/chapter/10.1007/978-3-662-47241-5_114 *

- Martınez-Miranda, J., & Aldea, A. (2005). Emotions in human and artificial intelligence. *Computers in Human Behavior*, *21*(2), 323-341. https://doi.org/10.1016/j.chb.2004.02.010 *

- Nawaz, N. & Gomes, A. M., (2019). International Journal of Advanced Computer Science and Applications, 10(9), 1-5. https://thesai.org/Downloads/Volume10No9/Paper_1-Artificial_Intelligence_Chatbots_are_New_Recruiters.pdf *

- Newell, B. R., & Shanks, D. R. (2014). Unconscious influences on decision making: A critical review. *Behavioral and brain sciences*, *37*(1), 1-19. https://discovery.ucl.ac.uk/id/eprint/1419217/ *

- Petrovic-Lazarevic, S. (2001). Personnel selection fuzzy model. *International Transactions in Operational Research*, *8*(1), 89-105. https://doi-org.ezproxy2.utwente.nl/10.1111/1475-3995.00008 *

- Shih, H. S., Huang, L. C., & Shyur, H. J. (2005). Recruitment and selection processes through an effective GDSS. *Computers & Mathematics with Applications*, *50*(10-12), 1543-1558. https://doi.org/10.1016/j.camwa.2005.08.026 *

- Van Esch, P., Black, J. S., & Ferolie, J. (2019). Marketing AI recruitment: The next phase in job application and selection. *Computers in Human Behavior*, *90*, 215-222. https://doi.org/10.1016/j.chb.2018.09.009 *

- Wang, Y., & Ruhe, G. (2007). The cognitive process of decision making. *International Journal of Cognitive Informatics and Natural Intelligence (IJCINI)*, *1*(2), 73-85. https://pdfs.semanticscholar.org/7d63/1e6580dbd4dc92a3e12f29fb3f2a50651537.pdf *

- Wilfred, D. (2018).AI in Recruitment. *NHRD Network Journal*, *11*(2), 15–18. https://doi.org/10.1177/0974173920180204

Appendix A

Selected articles and Overview

References	Research question/Research goal	Definitions	Country	Main concepts and theories used in the research	Method used	Findings
AbdElminaam, D. S., ElMasry, N., Talaat, Y., Adel, M., Hisham, A., Atef, K., ... & Akram, M. (2021, May). HR-Chat bot: Designing and Building Effective Interview Chat-bots for Fake CV Detection. In *2021 International Mobile, Intelligent, and Ubiquitous Computing Conference (MIUCC)* (pp. 403-408). IEEE	The main idea of this paper is to help HR employees in collecting information about applicants to a specific job through identifying applicant's personal skills and through writing their CV in an organized manner and filtering or rearranging job applicants throw a chatbot interview that can discover fake CV skills and find applicant's personal skills.	Chatbots nowadays are common in our daily use like cortana, Siri or Alexa in addition to virtual personal assistance there is another type of smart application that can improve our user experience and makes our lives easier and better. Chatbot is an AI concept that interacts with humans through voice or text chatting. The	-	This HR chatbot system could highly minimize the time and the amount of human processing on job applicants, filtering all applicants to see who is suitable to carry on to the next step of job applying .Also , it helps the job applicants to connect with multiple companies throw just one interview. The major contributions of	The System will use a chat-Bot to extract these features with the help of facial gesture recognition techniques.The system will use different machine learning and deep learning techniques for extracting the HR skills. The system will also include different tests that can discriminate between applicants according to the job desired skills to ensure that the right person is in the right place	Detection of job personal skills is essential to achieve a high level of communication and harmony between company's employees.By helping HR employee's taking a better decision on who's suitable for the job is important to achieve companies aims and goals.Chatbots could highly

	The main idea of the system is to help HR interviewers, Job Applicants, and HR employees collecting information about applicants to a specific job. The system will help to build an easy link between HR employees and their job applicants through identifying applicant's skills and through writing their CV in an organized manner.	chatbot communicates on behalf of the companies in order to simplify online communication. Chatbots are typically used in dialogue systems for various practical purposes including customer services and information acquisition. Chatbots with the help of facial expression recognition techniques could help accessing better results for detection throw conversation. Facial expressions are the facial changes in light of an individual's interior passionate states, expectations, or social interchanges. This HR chatbot system could		this paper are as follows: 1) The construction of a chatbot that can assess job applicants and extract applicants' skills by interview. 2) Applying Facial extraction techniques that can get applicant's expression during the interview to achieve a better decision. 3) Minimize the time of interviewing that HR takes on deciding the right man while decreasing Human error and judging 4) Verifying to the HR employees that applicant's skills are real or fake.	Our system is based on three essential stages and they are input & preprocessing stage, processing stage, and finally the output stage. In our facial emotion recognition we are using IBug-300 as our dataset that cover a wide range of different subjects, poses, illumination, occlusions, among other things, The given annotations tend to have a number of limitations,It contains 300 Image with multiple dimensions. **Questions and Answers data set** By contacting and communicating with the HR department in Misr international university (MIU) we constructed a data set of multiple situations wise questions and some pre-processing were added to construct the questions and answers flow that is needed to give	help facilitate our communications and helps reaching some important decisions with the help of some outer algorithms and techniques a more accurate decision could be reached like facial emotion extraction or speech emotion extraction .As in this case with the usage of the snatchbot platform and construction of a questions and answers dataset and usage of Facial emotion technique SVM reaching an accuracy of 78% and combining all there results together to form a report that could help HR employees

		highly minimize the time and the amount of human processing on job applicants, filtering all applicants to see who is suitable to carry on to the next step of job applying .			a certain score for each question multiple-choice questions where added just to direct the applicant to the right flow of answering.	achieve a better decision on selecting the right man for the right job
• **Allal-Chérif, O., Aránega, A. Y., & Sánchez, R. C. (2021). Intelligent recruitment: How to identify, select, and retain talents from around the world using artificial intelligence. *Technological Forecasting and Social Change, 169,* 120822.**	This research analyzes how digital technologies contribute to improving the successive stages of the recruitment process: identifying, selecting, and retaining talented people. The research therefore provides a complete overview of available technologies, a critical analysis of their advantages and limitations, perspectives on their evolution, and managerial recommendations concerning their	E-recruitment is an emerging and polymorphous phenomenon that starts with identification of candidates on social networks, continues through gamification of recruitment and job interviews with chatbots, and ends by matching a candidate and a job using artificial intelligence. These technologies are particularly useful for social businesses looking to recruit not only skilled people, but above all employees who	-	The methodology is based on grounded theory, participant observation, and qualitative data collection. A multiple case study is designed to analyze, compare, and combine several technologies dedicated to recruitment: (1) a social network with LinkedIn, (2) a MOOC with Udacity, (3) a serious game called *Reveal* from L'Or´eal, (4) a chatbot called *Ari* from TextRecruit, and (5) a massive	Social networks facilitate recruitment through four different mechanisms: 1) the connector role, which allows quick and direct contact between job-searchers and recruiters. 2) the development of the employer brand, which contributes to the company's reputation, visibility, and attractiveness and promotes contact 3) transparency in relationships, which contributes to building trust and encouraging richer and more humane exchanges, far from the formality of job interviews. 4) specifying the	Implemented technologies foster contact between recruiters and talent and optimize a process that is faster, more systematic, more specific, and more objective. New features help social businesses reach previously inaccessible targets and achieve better results in terms of attractiveness, integration, and retention. They can carry out their social

	use. The second part of this article offers a review of the literature dedicated to different forms of e-recruitment, associated practices, and impacts on the performance of the process. The third part is devoted to the research methodology, based on grounded theory, and a multiple case study using a constructivist approach. The fourth part explores five typical and emblematic cases of e-recruitment via different technologies: (1) a social network with LinkedIn, (2) a MOOC with Udacity, (3) a serious game called *Reveal* from L'Or´eal, (4) a chatbot with *Ari* from TextRecruit,	have behaviors and values that match their mission. Innovating has become essential to identify, select, and retain the best talents from around the world during an economic context of recession and intense competitiveness (Sahay, 2014). Young talents are hyperconnected and accessible in virtual spaces that recruiters struggle to invest in. Digital technologies also make it possible to reach out to individuals who are passive but are open to proposals to change jobs. The Internet significantly facilitates recruitment simultaneously for recruiters and those being recruited (Carrillat et al.,		data analysis matching system with Randstad.tech.	proposed job data, which leads to a gradual ranking of applicants according to idiosyncratic and objective criteria.	missions and maintain their financial balance with optimized human resources at a reduced cost. Implemented technologies foster contact between recruiters and talent and optimize a process that is faster, more systematic, more specific, and more objective. New features help social businesses reach previously inaccessible targets and achieve better results in terms of attractiveness, integration, and retention. They can carry out their social missions and maintain their financial balance with optimized human resources at a reduced cost.

	and (5) a big data analysis matching system with Randstad.tech. The fifth part of the article offers a discussion and perspectives about these cases. A conclusion then summarizes the main findings of the research and provides managerial recommendations. This article aims to explore the emerging phenomenon of e-recruitment and the extent to which it can improve the identification, selection, and retention of talents to enable social businesses to achieve their goals.	2014). Social networks, whether professional or traditional, are a major source of potential talent who are accessible to recruit very easily and at a low cost. Social networks are creating an increased pressure on recruiters to work faster and absorb much larger and more diversified streams of information to find the right candidates for their jobs. Recruitment via social networks makes it possible to contact passive candidates who are not actively job searching but who may be open to opportunities for professional mobility (Sivertzen et al., 2013). The efforts of recruiters become essential because they must convince				

		those people who are already satisfied with their situation to take the risk of leaving it to work elsewhere. The recruiters can attract these potential employees with different forms of remuneration, but it is above all the environment and working conditions, values, and culture of the company, as well as the vision and the personality of the leaders, that will be decisive. Potential employees are sensitive to these more personal and open relationships. Serious games not only involve the left brain—rational, logical, analytical, and sequential—but also the right brain—intuitive, creative, proactive, and relational.				
1. **Amabile, T. M. (1988). A**	In this paper the	Creativity is	-	A model of	This study is a	Individuals or

model of creativity and innovation in organizations. *Research in organizational behavior, 10*(1), 123-167.	author examined what are the factors that influence the creativity and the innovation into the organization. The author proposed the following research question "What influences creativity and innovations in work organizations? What is it about persons and their work environments that makes a difference?". In addition, have been described what are the skills and the intrinsic motivation that allow the people's creativity, also highlighting what organizational environment factors inhibit the creativity and innovation.	defined as "A social construct, most properly the implementation of useful and innovative ideas derived from individuals and teams, through brainstorming outcomes". Organizational innovation is the successful implementation of creative ideas within an organization". Other have defined the creativity as "The emergence in action of novel relational product, growing out the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other" (Rogers, 1954). Kanter, (1983) defines innovation as "The process of		individual creativity: Domain relevant skills, include factual knowledge, technical skills, and special talents in the domain. Creativity-relevant skills include a cognitive style favorable to be problem solver, within the application of heuristics and energy to explore new boundaries. Intrinsic task motivation, where motivational factors and personal quality could enhance or inhibit the creativity. Environmental factors: Various organizational Characteristics that influence creativity, as	descriptive research that uses qualitative data from 3 different sources as 120 R&D scientists from 20 different corporation; 16 marketing and development employees; 25 marketing and sales employees.	teams creativity can be influenced, more properly regarding individual skills in task domain, skills in creative thinking, and intrinsic motivation. In addition, the creativity can be influenced from the organizational environment and its components, as constraints and lower level of transparency and communication .

		bringing any news; problem-solving idea into use… Innovation is the generation, acceptance, and implementation of new ideas, processes, products, or services". Excellent candidates do not have the time to look for work, but they may feel flattered that people think of them and make them interesting offers.		wrong reward, wrong communication between organizational layers and non-efficient corporate climate. Constraint as reduced freedom in choices from employees, in managing tasks and the work. Organizational disinterest, within non-perceived organizational support, trust, and interest. Poor project management, where managers do not communicate adequately the organizational purpose, the tasks, leading to organizational fragmentation. Evaluation, non-sufficient responses from managers about		

				work, inadequate and non—constructive feedback and criticism. Resources, non-sufficient resources as materials, money, facilities, funds, equipments. Status Quo, disinterest from managers and high management in changing critical situation, without being taking risk. Competition, interpersonal and intergroup competition is useful to stimulate the creativity and develop the tasks and work. A model of organizational innovation: Motivation to innovate, a sort of support from management in showing interest		

				toward innovation, also stimulating employees in being creative, as corporate vision. Resources in task domain, the area used appositively to innovate. It includes people with relevant knowledge, relevant skills, and relevant creative ideas. This area generally can be found in R&D departments. Skills in innovation management, where management in both lower and higher organizational layers cares about the balance between freedom and constraint to promote the individual creativity.		
2. Black, J. S., & van Esch,	The authors have highlighted the	The paper reports that Humans own	-	-	This paper uses a descriptive research	Today, companies are at

P. (2020). AI-enabled recruiting: What is it and how should a manager use it?. *Business Horizons, 63*(2), 215-226.	development of human capital in becoming "Starring role" from "Supporting cast". In addition, the purpose of this study is to explain the role of AI applied in the recruitment, highlighting the steps of the digital recruiting, and some differences between the digital recruiting and the traditional recruiting.	cognitive biases that can distort the choices in the screening process, without reliability and validity on the judgements (Judge, Cable, & Higgins, 2000). Also, have been presented the Confirmatory Bias as positive and negative judgement and confirmation in the initial choice (Windschitl, Scherer, Smith & Rose, 2013). In addition, the Similarity bias, defined as favorable position of recruiters toward the candidates for similar characteristics, without caring on future applicants' job performance (Sacco, Scheu, Ryan & Schmitt, 2003).			approach using different data from previous studies.	the beginning of what we term Digital Recruiting 3.0. At the heart of this transformation is the use of artificial intelligence (AI) in recruiting activities. Computers can now perform tasks and make decisions that normally require human intelligence. Some key potential advantages include the ability to more effectively identify, attract, screen, assess, interview, and coordinate with job candidates. These advantages come from AI's ability to process information and make decisions at volumes

						and speeds that far exceed human capacity and the availability of AI-enabled recruiting tools and systems that overcome common cognitive biases that hurt the reliability and validity of human judgment in recruiting activities.
3. Black, S. L., & Johnson, A. F. (2012). Employers' use of social networking sites in the selection process. . ***The Journal of Social Media in Society, 1*****(1).**	Therefore, the primary purposes of this paper are to (a) foster research on these issues, (b) discuss factors that may create biases with use of SNWS data, and (c) propose fair information policies that will enable organizations to collect information from SNWS while ensuring better human resource	Boyd and Ellison (2008) define social networking sites via three necessary criteria by stating that users must: "(1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse	-	-	We present an overview of social networking sites, briefly discuss applicable existing literature, offer relevant theory and propositions, discuss potential impacts on stakeholders, suggest guidelines for practitioners, and conclude with future research directions.	The study additionally indicates that employers are using both search engines and SNWS in the pre-screening process. Framingham (2008) showed that approximately 20% of managers are using SNWS, and Taylor (2007) indicated

	practices. The outcomes of this study should raise awareness of the use of online information in hiring decisions and provide a basis for future research.	their list of connections and those made by others within the system" (Boyd & Ellison, 2008).				that the number is closer to 25%. Suggesting an upward trend, Zeidner's (2007) study showed that 40% of employers are likely to use SNWS as a resource in the near future. Each study indicates that a significant number of hiring managers are using the Internet as a resource to select job applicants. Additionally, the rapid growth of SNWS and the familiarity of these resources in society will likely contribute to increased usage.
Boden, M. A. (1998). Creativity and artificial intelligence. *Artificial intelligence, 103*(1-2), 347-	-	Creativity is a fundamental feature of human intelligence, and a challenge for AI. AI techniques can be used to	-	The ability to produce novelties of the former kind may be called P-creativity (P for psychological),	-	Some H-creative ideas have already been generated by AI-programs, though usually by merely exploratory (or

356.		create new ideas in three ways: by producing novel combinations of familiar ideas; by exploring the potential of conceptual spaces; and by making transformations that enable the generation of previously impossible ideas.		the latter H-creativity (H for historical). P-creativity is the more fundamental notion, of which H-creativity is a special case. There are three main types of creativity, involving different ways of generating the novel Ideas in AI application. 1) Combinational creativity is studied in AI by research on (for instance) jokes and analogy. For all combinational tasks other than "free association", the nature and structure of the associative linkage is important too. Ideally, every product of the combinational program should		combinational) procedures. Transformational AI-originality is only just beginning. Valuation, thus far, is mostly implicit in the generative procedures used by the program, or interactively imposed by a human being. Only a few AI-models can critically judge their own original ideas, And hardly any can combine evaluation with transformation.

				be at least minimally apt, and the originality of the various combinations should be assessable by the AI-system. 2) The exploratory and transformational types of creativity can also be modelled by AI-systems. For conceptual spaces, and ways of exploring and modifying them, can be described by computational concepts. In general, providing a program with a representation of an interesting conceptual space, and with appropriate exploratory processes, requires considerable		

				domain-expertise on the part of the programmer-or at least on the part of someone with whom he cooperates. A main reason why most current AI-models of creativity attempt only exploration, not transformation, is that if the space is transformed then the resulting structures may not have any interest or value.		
5. Bolander, P., & Sandberg, J. (2013). How employee selection decisions are made in practice. *Organization Studies, 34*(3),285-311.	The authors have presented an ethnomethodological-discourse analytical real-time study of how selection decisions are made in situ. In addition, they have identified two basic forms of selection decision-making: one characterized by initial agreement,	In the following study, the authors have built some definitions about the selection and decision-making from previous study: 1) By choosing the right employees, organizations improve their abilities to realize strategic objectives and manage future challenges	Swede n	The *psycho-metric approach* assumes that every job consists of a number of discrete tasks, that individuals possess stable attributes and that job and person can be measured independently (McCourt, 1999). It aims to develop and test selection tools (Herriot &	We conducted an in-depth real-time study of the selection of IT professionals in two medium-sized IT businesses, herein called IT Consultant and IT Bank. IT Consultant was the Swedish subsidiary of a global technology consulting group, while IT Bank supplied all IT solutions to its group. In both organizations, job applications were	the results from this study suggest that selection decision making is defined by ongoing practical deliberation in which selectors interactively make sense of and make decisions about candidates and orient towards

	and one characterized by initial disagreement. In the end, have been analysed eight real-time selection decision meetings in two IT businesses in order to explore how the selection decisions occur in practice. The author investigated *how* selection decision making takes place in practice by adopting a combined ethnomethodological-discourse analytical approach and pursuing the question: *what discursive processes and considerations are selectors engaged in when making decisions about whether a candidate should be offered a job*?	(Barber, 1998; Compton, Morrissey, & Nankervis, 2009; Gatewood, Feild, & Barrick, 2010; Sears, 2003). 2) Employee selection is considered key for organizations, existing research has usually paid little attention to how selection decision making takes place in real-life situations (Collinson, Knights, & Collinson, 1990; Highhouse, 1997; Iles & Salaman, 1995; Zysberg & Nevo, 2004)		Anderson, 1997; Iles, 1999) that enable selectors to identify, step by step, the candidate whose attributes objectively best match the job and organizational requirements. the *social process approach* claims that selection tools that do not have a high proven validity and reliability can be judged favourably due to their usability in establishing a psychological contract between candidate and organization (Anderson, 1992; de Wolff, 1993; Herriot, 1992; Lockyer & Scholarios, 2004; Schuler, 1993).	examined first by HR specialists who short-listed promising candidates. The chosen candidates were then interviewed once, twice or three times by selectors (HR specialists, managers and colleagues).	making their constructions of the candidates and the selection decisions meaningfully consistent with each other. Importantly, this practical deliberation varies depending on whether the selection decision is characterized by initial agreement or initial disagreement. The results also challenge the assumption that selection tools can be used to identify and objectively measure candidates' attributes and, based on that, decide which of the candidates best match the job requirements.
6. Brandtzaeg, P. B., &	The authors performed a study	Chatbots represent a potential shift in	US	As a theoretical basis for	To explore why people use chatbots and reach a	The majority of chatbot users

Følstad, A. (2017). Why people use chatbots. In *International conference on internet science*, 377-392. Springer, Cham.	addressing the following research question: RQ: *Why do people use chatbots?* The study contributes new knowledge regarding individuals' motivations for using chatbots based on an online questionnaire completed by US chatbot users. This study provides needed insight into the motivational factors related to use of conversational interfaces.	how people interact with data and services online. Chatbots are machine agents that serve as natural language user interfaces for data and service providers. Currently, chatbots are typically designed and developed for mobile messaging applications. Chatbots may serve a number of purposes, such as customer service, social and emo-tional support, information, entertainment, and ties the user to other people or machines. Users' interactions with chatbots often mimic interactions between humans, but there are differences. In a study comparing human–human		understanding people's motivation for using chatbots, we ap-ply the well-established uses and gratifications theory (U&G). U&G explains why and how people use specific media to fulfill specific needs; the specific use of a medium depends on the expected and experienced gratification it will provide. The theory assumes that the user is goal-driven in his or her selection and use of a particular medium based on social and psychological needs or gratifications. "uses and gratifications" refer to the motivation for use of a specific	sufficiently broad sample of chatbot users, a questionnaire was used. The questionnaire included 17 questions regarding chatbot use, including motivations for and experiences with chatbots, and respondents' demographics (age, gender, and state of residence). recruiting participants for this study was challenging, as we had to not only identify relevant participants but also filter out non-relevant participants. We decided to target chatbot users in the US as the technology companies that pri-oritize chatbots—Google, Facebook, Kik, and Slack—are all focused on the US market. We also decided to target a relatively young user group (those aged 16–55 years). Data were collected in April 2017 by Survata, an independent US-based research company. Data obtained from	seek quick and consistent feedback when searching for information or assistance. This finding might reflect the use of chatbots in the customer service domain. finding may also reflect a general trend for users to gravitate toward immediate communication channels. The broad adoption of private messaging platforms such as Facebook Messenger, WhatsApp, and Snapchat reflects users' interest in more instrumental or goal-directed communication with fewer interruptions compared to regular commu-nication on Facebook and

		interactions to human–chat-bot interactions, Hill et al. found that human–chatbot interactions tend to last longer than human–human interactions between strangers and involve shorter messages, less complicated vocabulary, and more profanity.		medium and the satisfaction people gain from use.	responses to the preset questions were analyzed through descriptive statistics using the SPSS 24 statistical package. Qualitative data regarding participants' open answers underwent content analysis based on the coding categories established through an initial thematic analysis.	Twitter. The typical chatbot user's need for information may require more immediacy and interactivity than the information needs associated with other media. This hypothesis is in line with recent research identifying young social media users' need for instant gratification.
7.Chapman, D. S., & Webster, J. (2003). The use of technologies in the recruiting, screening, and selection processes for job candidates. *International journal of selection and assessment, 11*(2-3), 113-120.	The main goal for this research was to provide a descriptive snapshot of the types of technologies currently being used in recruitment and selection in North America. Further to this goal, we wanted to examine the extent of technology use across the	Only recently have we seen an increased interest in the use of information technologies (IT) in Human Resource (HR) practices such as personnel screening and selection. Advances in technologies have had a profound impact on the business practices of many	North America	There are several factors that have been reported to contribute to the increased use of technologies for screening and selection: 1) The first relates to potential cost savings. 2) A second reported factor is linked to the increased globalization of	This study consisted of a web-based survey administered to a broad subset of HR managers who were members of the Society for Human Resource Management (SHRM). Before conducting the survey, we conducted in-depth interviews with six senior HR personnel from some of the world's largest and most influential companies. These	Technology use in recruiting and selection in North America reveals that while technology use is becoming more prevalent in organizations. Organizations that reported projecting the image of being a dynamic culture that values an aggressive, growth-oriented

	various stages of recruiting and selection including: (a) advertising positions, (b) receiving applications, (c) initial screening, and (d) final selection. In addition, we wanted to determine the extent to which HR departments used these technologies for staffing: (a) low-level or entry-level positions, (b) mid-level positions, and (c) high-level positions. In addition to determining what technologies are being used, there is another objective of examining why HR managers were adopting these technologies.	organizational functions including financial systems, sales, marketing, and production.		the economy and labor market. To succeed in a competitive global marketplace, businesses are looking for the best and brightest employees, regardless of their geographical setting. 3) Another promise of increased use of IT in screening and selection has been the potential to reduce adverse impact for protected groups. 4) These rating biases and errors represent the potential for individuals responsible for screening and selection to consciously or unconsciously discriminate against protected	interviews allowed us to discover the types of technologies used in leading companies and to identify critical issues related to technologies. In February 2001, we designed the web-based survey to assess HR professionals' use of technologies with job candidates. The survey collected a wide variety of data from HR professionals representing 125 organizations. These professionals were sampled from members of the Society for Human Resource Management (SHRM) who had indicated that they were at the corporate level (as opposed to branch or regional level) and listed 'Employment/Recruitment' as their primary function.	approach reported being more likely to adopt emergingHR technologies while organizations that reported being more people-oriented have been more cautious. HR managers have pinned many hopes on technology from increasing efficiency, and reducing costs to increasing applicant pools and standardizing their entire selection systems. Each of the companies we interviewed reported that there were challenges associated with using technology-based

				groups or at least make poor decisions about applicant suitability. 5) A final reason proposed for adopting various technologies in recruiting and selection processes is to improve the efficiency of the hiring system by automating processes such as resume screening.		practices in HR.
3. Daniel, G., Cabot, J., Deruelle, L., & Derras, M. (2019, June). Multi-platform chatbot modeling and deployment with the Jarvis framework. In *International Conference on Advanced Information Systems Engineering* (pp.	This work aims to tackle both issues by raising the level of abstraction at what chatbots are defined, and can be summarized by the following design research question: Can we improve the development of chatbot applications by abstracting out the platforms complexity and deployment configurations in	Instant messaging platforms have been widely adopted as one of the main technology to communicate and exchange information. Nowadays, most of them provide built-in support for integrating chatbot applications, which are automated conversational	-	Pereira and D´ıaz have recently reported that chatbot applications cannot be reduced to raw language processing capabilities, and additional dimensions such as complex system engineering, service integration, and testing have to be	Our case study is a simple example of a multi-platform chatbot aiming to assist newcomers in the definition of issues on the Github platform, a reported concern in the open-source community. Our approach applies Model Driven Engineering (MDE) principles to the chatbot building domain. As such, chatbot models become the primary artifacts that drive all software	Jarvis decouples the chatbot modeling part from the platform-specific aspects, increasing the reusability of the conversational flows and facilitating the deployment of chatbot-enabled applications over a variety of chatbot service providers.

177-193). Springer, Cham.	order to allow designers to focus on the logic of the designed chatbot?	agents capable of interacting with users of the platform. Chatbots have proven useful in various contexts to automate tasks and improve the user experience, such as automated customer services, education, and e-commerce. Intentions are named entities that can be matched by the recognition engine. Actions are used to represent simple responses such as sending a message back to the user, as well as advanced features required by complex chatbots like database querying or external service calling.		taken into account when designing such applications. Indeed, the conversational component of the application is usually the front-end of a larger system that involves data storage and service execution as part of the chatbot reaction to the user intent. Thus, we define a chatbot as an application embedding a recognition engine to extract intentions from user inputs, and an execution component performing complex event processing represented as a set of actions.	(chatbot) engineering activities. In the following we show how this chatbot is defined with the help of the Jarvis modeling language. The Jarvis Modeling Language packages decouple the different dimensions of a chatbot definition, facilitating the reuse of each dimension across several chatbots. In the following we introduce the Jarvis Modeling Language, a chatbot Domain Specific Language (DSL) that provides primitives to design the user intentions, execution logic, and deployment platform of the chatbot under construction.	
4. Dimitriadis, G. (2020). Evolution in Education:	This paper examines how Chatbots have evolved over	**C**hatbots are programs that are able to interact with users using	-	-	The author faced a systematic literature review of previous studies.	Adopting Chatbots in the educational process offers

Chatbots. *Homo Virtualis, 3*(1), 47-54.	the years, what the advantages and disadvantages of using them are and tries to explain the rise taking place nowadays. Subsequently, it explores the potential of applying this technology in educational settings. Finally, it investigates the possibility of using them as virtual teaching assistants relieving teachers from the burden of repetitive tasks and helping them focus more on providing quality education to their students.	natural language. They are virtual assistants who are capable of engaging in computer-to-human dialogue either by typing text or by using voice. The development of Chatbots has been rapid ever since as it made easier for users to communicate with computers by making greater use of their natural language. They have become an integral part of life as large companies have developed numerous Chatbots, offering a variety of solutions in the business sector, customer support, information retrieval systems, entertainment as well as in science for research purposes (Colace				many benefits. Voice Chatbots enable the learner to focus more on their learning object by communicating directly with them as opposed to the traditional way of using a computer that requires navigating through various menus using the mouse. Adopting Chatbots in the educational process offers many benefits. Voice Chatbots enable the learner to focus more on their learning object by communicating directly with them as opposed to the traditional way of using a computer that

		et al., 2018). Human communication with a Chatbot has particular psychological dimensions. This creates an environment where the human being perceives this interaction in the wrong way, imparting human characteristics to the Chatbot that do not really exist. This attribution of human characteristics to non-human beings, objects, physical or not phenomena, is a natural tendency of man called Anthropomorphism (Anthropomorphism, n.d.). Koletsi describes Artificial Intelligence as one of the radical technologies of today along with				requires navigating through various menus using the mouse. They create a sense of pleasure and satisfaction; while at the same time encourage students to express themselves. They can collect some useful data such as feelings, moods and they have the ability to react to unforeseen situations such as increased student anxiety (Di Blas et al., 2019). in cases where large scale lectures are held such as in university courses or when massive open online courses (MOOCs) are offered, interactive and

		the augmented and virtual reality and blockchain environments that have transformed our lives, our communities and our societies (2019). The use of Technology in Education is becoming imperative nowadays and this among other things is because of demographic and economic factors.				personalized support can be achieved by recruiting Chatbots while at the same time minimal financial resources and use of elementary organizational structures are consumed and required respectively (Hone & El Said, 20 16).
5. Egorov, E. E., Lebedeva, T. E., Prokhorova, M. P., Tsapina, T. N., & Shkunova, A. A. (2019, December). Opportunities and Prospects of Using Chatbots in HR. In	The article describes functions, opportunities, and prospects of using chatbots in HR. The purpose of this article is a description of the existing practice of using chatbots to automate personnel management processes of companies, as well	The use of artificial intelligence and chatbots allows to improve only part of management functions (Uldrich 2018b). Most management decisions are taken taking into account human and if these systems allow to minimize such risk by a little, and	-	-	Possibilities of using chatbots in HR was carried out using the methods of systematization and structuring of publications of Russian and foreign researchers of this issue. On analysis of the practice in HR in solving specific personnel problems of companies, authors of the article relied on information content of leading companies	Deloitte predicts that by 2023 up to 40% of HR-solutions will use artificial intelligence and chatbots, which become the leading direction of optimization of modern management processes (Bersin et al. 2017). Modern chatbots

Institute of Scientific Communications Conference **(pp. 782-791). Springer, Cham.**	as an analysis of the future development of this tool.	it will increase the efficiency of a company (Denisov and Kardash 2018).			and corporations, presented in the public domain on the Internet (The official site of HR in Russian 2018; Osadchuk 2018; Ting 2018). In addition to these methods, for the preparation of this work was used the sociological method—on-line survey of specialists of Russian HR-services about possibilities and difficulties of using chatbots to solve standard human resources tasks.	in the service of HR not only analyze the data presented in the CV but also are able to conduct an initial interview with the candidate, as well as a ranking of candidates who have passed the such an interview. recruiters have a proper professional part of their work—to organize face-to-face acquaintance of the best candidates with the enterprise and to agree on mutual expectations. At the same time, the use of chatbots capabilities in HR is significantly limited by the "human factor", which is

						still very important in the selection of personnel. While the Russian market does not offer chatbots capable of fully: 1) Create comfortable conditions for interaction at the interview; 2) Give answers to non-standard and illogical questions of applicants; 3) Correlate habits and/or expectations of a person with the already formed corporate culture of the future employer; 4) Read the true meaning of what the applicants said “between the lines”; 5) Diagnose the needs, interests, potential and other characteristics of the applicant

						(Egorov and Lebedeva 2015).
6. Geetha, R., & Bhanu, S. R. D. (2018). Recruitment through artificial intelligence: a conceptual study. *International Journal of Mechanical Engineering and Technology*, *9*(7), 63-70.	The major objective of this paper is to study how Artificial Intelligence influences the recruitment strategy. The study also throws light on the techniques used by companies in AI while recruiting, to observe how artificial intelligence is used currently in recruiting process, and to understand the importance of artificial intelligence in recruitment.	The Encyclopedia Britannica states, "artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings." Intelligent beings are those that can adapt to changing circumstances. According to Dictionary 1: "Artificial Intelligence is an ability of computer or other machine to perform activities that are normally thought to require intelligence. The advancement in the branch of computer science concerned with development of machines	-	The cognitive modeling approach is a field of cognitive science. As it is an interdisciplinary field to build cognitive modeling approach for AI technology. To test workings of human mind the cognitive science tries to construct precise and testable theories between the two AI and Experimental techniques. Only when the test is programmed with some way of human thinking then the test will result in machine think like human. And this leads to think about actual working nature of	This study is entirely done based upon secondary sources of information like conceptual papers, various peer reviewed journal articles, books and websites are used to further explore the concept. This is a conceptual paper developed on the basis of reviews from literature. The literature supports to understand the concept of Artificial Intelligence and its flow in recruitment strategy. Secondary sources such as Websites, Journals, Reports, Publication of professionals and books are referred for drafting the entire paper. The search engine Google helped the researcher to find more related blogs which were exclusively focusing on Artificial intelligence, its importance and how	Now, recruitment industry is taking up growth by implementing smart way to recruit i.e., recruiting through artificial intelligence. And numerous industries are focusing on the changes taking place in recruitment process. AI technology has tremendous impact on recruitment activity as it enables the recruiter to align all some unstructured candidate bio-data, construct profile into uniformity, identify and match skill sets required for the industry. AI is:

		having this ability". According to Dictionary 2: "The subfield of computer science concerned with the concepts and methods of symbolic inference by computer and symbolic knowledge representation for use in making inferences. AI can be seen as an attempt to model aspects of human thought on computers. It is also sometimes defined as trying to solve by computer any problem that a human can solve faster. Now, HR managers implement Artificial Intelligence technology to recruit, retain and		human brain. To check whether machines act rationally there is a need of the laws of Thought Approach. The Greek Philosopher Aristotle provided patterns of argument that always gave correct conclusions. And the law of thought tries to administer the function of brain and that lead to the ground logic behavior. System mechanism that act rationally. Artificial Intelligence is the intelligent agent approach. A rational Agent approach is something which tries to perceive and acts. A formula for rational agent is Agent =	does it relates to the business world. Recruitment done using AI was the key term used for the overall paper.	1) Time saving: AI saves time by keeping the records as such which leads not to do the repeated event. 2) Mapping of Talents: AI assist HR in acquiring best talent required for the organization. 3) Cost saving: The task of acquiring right aspirant to the organization takes place with qualitative manner and outsourcing recruitment agency is reduced. 4) Hire with Quality: AI tool works in a way that it uses huge data for recruitment and does an unbiased screening and selection takes place. 5) Query redressing:

		inspire the proficient manpower which leads to success and growth for both the employer and employee. AI in recruiting has a major role in talent acquisition (Madeline Laurano Co-Founder & Chief Research Office). Artificial intelligence is all about fast thinking with lot of knowledge, think as human, logical reasoning, etc., as it is a part of computer science leading to efficiency in problem solving by giving solutions. Father of AI, John McCarthy described AI as, "Artificial Intelligence is the science and engineering of		Architecture + Program. Agent means a mechanical agent i.e., a computer or a machine. And also the machine can decide what has to be done or what not to be.		Employees get updated information and get immediate responses for their queries. 6) Unbiased recruitment: Hiring of candidates takes places with machines and no involvement of human. 7) Quality aspirants: AI packages helps to screen and select quality aspirants. It helps to identify candidates' skills, competency and trait that match the job applied for.

		making intelligent machines, especially intelligent computer programs". Artificial Intelligence works as similar as human intelligence like to learn, to adapt, to identify and to correct. According to Edwin B. Flippo, "Recruitment is the process of searching the candidates for employment and stimulating them to apply for jobs in the organization" Recruitment process is identification of different sources of personnel requirement to organization.				
7. Ho, A., Hancock, J., & Miner, A. S. (2018). Psychological,	This study advances current understanding of disclosure and whether its impact is altered by	Disclosing personal information to another person has beneficial emotional,	-	1) According to the theoretical model of perceived understanding (Reis, Lemay, &	In this study, we examined the effects of partner identity (chatbot vs. human) on disclosure outcomes to determine which of the	We found that chatbots and humans were equally effective at creating

relational, and emotional effects of self-disclosure after conversations with a chatbot. ***Journal of Communication, 68*****(4), 712-733.**	technology, providing support for media equivalency as a primary mechanism for the consequences of disclosing to a chatbot. Authors experiment examined downstream effects after emotional versus factual disclosures in conversations with a supposed chatbot or person. The effects of emotional disclosure were equivalent whether participants thought they were disclosing to a chatbot or to a person. As chatbots, or computer programs that can simulate human-human conversation, begin to take part in intimate	relational, and psychological outcomes. When disclosers believe they are interacting with a computer instead of another person, such as a chatbot that can simulate human-to-human conversation, outcomes may be undermined, enhanced, or equivalent		Finkenauer, 2017), feeling truly understood, or that the partner "'gets' [disclosers] in some fundamental way," brings emotional, relational, and psychological benefits. According to this model, the positive effects of feeling understood are mediated by the extent to which disclosers perceive that they are understood. In other words, disclosers need to believe the partner understands them before the positive impact of feeling understood can take place. In the case of a chatbot, disclosers know that a chatbot is a computer	three hypotheses is best supported. In an experiment, participants were told they would have an online chat conversation with either a chatbot or a person. We employed a standard method within human-computer interaction, termed a Wizard of Oz1 (WoZ) method (Dahlbäck, Jönsson, & Ahrenberg, 1993). The closest equivalent to our procedure is the expressive writing procedure, in which college students emotionally or factually disclose in writing and psychological outcomes are assessed (Smyth, 1998). This effect size is r = .35 (Smyth, 1998). A power analysis with a significance level of .05, powered at 80% (see Cohen, 1992), required at least 23 participants per condition to find an effect, for a total of 92 participants after exclusions.	emotional, relational, and psychological benefits. Consistent with previous research, effects were stronger after emotional disclosure compared to factual disclosure, and we found that this occurred regardless of the partner's perceived identity. We also found that the processes involved in producing these outcomes (perceived understanding, disclosure intimacy, and cognitive reappraisal) were equivalent in strength and affected outcomes similarly, regardless of the

	conversations, an important question is raised: what are the downstream psychological effects of disclosure when the partner is a computer and not another person?			program that cannot understand them on this deeper level. The chatbot's responses may be seen as pre-programmed and inauthentic, preventing disclosers from feeling truly understood. 2) A perspective we call the disclosure processing framework emphasizes the advantages that non-human partners may provide compared to human partners. This framework suggests that people will disclose more to chatbots and subsequently experience more positive outcomes. Computerized	Participants were recruited from university research participation websites and flyers posted around a university campus. A total of 128 participants took part in the study (68.75% women; M age = 22), and received either course credit or financial compensation.	perceived partner. This provides support for the CASA framework and its Equivalence Hypothesis, that people psychologically engage with chatbots as they do with people, resulting in similar disclosure processes and outcomes.

				agents reduce impression management and increase disclosure intimacy compared to human partners in situations in which fears of negative evaluation may be prominent (e.g., when asked potentially embarrassing questions; Kang & Gratch, 2010; Lucas et al., 2014). According to Pennebaker's (1993) cognitive processing model, a key component of the link between cognitive changes and beneficial outcomes is the process by which disclosing what was formerly undisclosed eliminates		

				negative affect and processing and induces reappraisal. 3) The Computers as Social Actors (CASA) framework predicts a third possibility. According to this framework, people instinctively perceive, react to, and interact with computers as they do with other people, without consciously intending to do so (Reeves & Nass, 1996). This framework suggests that disclosure processes and outcomes will be similar, regardless of whether the partner is a person or a chatbot. Across		

				many different types of social situations, people also behave and interact with computers in ways that are common in human-human interactions, applying social norms derived from experiences with other people to interactions with computers.		
8. Johansson, J., & Herranen, S. (2019). The application of Artificial Intelligence (AI) in Human Resource Management: Current state of AI and its impact on the traditional	The purpose of this thesis is to research the implications that technological advancements, in particular Artificial Intelligence (AI), have for the recruitment process. It aims to investigate where AI can be implemented in the traditional recruitment process and possibly make the process more effective, as well as what the	In today's globalized world, the traditional ways of how business is conducted are being challenged. There are no longer only local firms as competitors, but organizations have to compete constantly on a global level as new technology is making the world smaller (Erixon, 2018). Due to the	Swede n	1) For the purpose of this study, HRM will be defined as the process of acquiring and maintaining new skills, capabilities and competences in an organization through its workforce by the means of different management techniques. The role that HRM have within an organization	There are different methods one can apply when conducting research, many may seem good but not all is fitting to each research purpose. Some of the most common methods for a qualitative study, as this thesis is, include observations, focus groups or interviews (Gill, Stewart, Treasure & Chadwick, 2008). The questions were determined based on three different aspects. The first aspect was based on general questions of the	1) Some of the interviewees argued that by having human to human interactions as it is in recruitment nowadays, it is easier to communicate without misunderstandings. It also makes it possible to discuss ideas, both between recruiters but also between recruiter and job applicant.

recruitment process.	implications would be of having AI within recruitment. This thesis aims to explore the aspect of one of the newer technologies: Artificial Intelligence (AI). Application of AI to HRM was one of the most 7 remarkable trends among recruitment professionals in 2018. This thesis will expand current research by applying AI into Breaugh's (2008) recruitment model to fill the gap on how AI can impact traditional recruitment and possibly increase effectiveness. Two research questions have been developed to help narrate the study. These will guide the route of the research together with the	importance HR has for the organization, the recruitment process of how these resources are obtained is the key to success (Kok & Uhlaner, 2001). The recruitment process used to be longer, take a large amount of time and imply a large amount of paperwork for the recruiters, however this has already slowly started to change with online recruitment becoming common (O'Donovan, 2019). Recruitment is defined as the practice of finding the right candidates which make up a candidate pool which fits an open job vacancy that a company have (Stoilkovska,		have changed severely during many years and are no longer just used as a way to manage an organization's internal costs of labor (Becker & Gerhart, 1996). 2) The research conducted within recruitment as a part of HRM has increased in the later decades and there is now more available research on how recruitment actually impact applicant behaviors and employee behavior (Taylor & Collins, 2000). This is further supported by Newell (2005) who states that it is very important to have competent personnel in organizations, which is fulfilled with an effective	interviewed professionals and the other two aspects was based on aspects identified from the literature review. The two aspects include questions relating to application of AI in HRM and questions relating to challenges and benefits of AI in recruitment. There was no delimitation locally to Jönköping or Sweden, as implementing AI within HRM is a rather new subject. This implies that there is limited amount of companies, especially within Sweden, who actually implement AI in recruitment.	2) Another point that six out of eight professionals agreed on is that traditional recruitment is an already tested measure. 3) All agreed that the current recruitment process is very time consuming, both for candidates and the recruiter. It makes applicants go through lengthy and complicated processes which makes candidates wait for a long time to even get through the process. 4) Two of the professionals also mentioned that one of the major problems in traditional recruitment is to find the right candidate among those who are

	problem and purpose of the thesis. They are as follows: ***RQ:* 1.** *What is the current state of AI in the traditional recruitment process?* ***RQ*: 2.** *What impact can AI make on the traditional recruitment process?*	IIieva & Gjakovski, 2015). Tecuci (2012) mentions that AI as a field is wide and a multidisciplinary domain, which can be exploited not only in computing disciplines but also in linguistics and philosophy. AI can take many different forms, such as robots, bots or software (Tecuci, 2012). A definition by Schemerhorn (2001) is that HRM is how you are able to gain and develop a workforce which is talented, to help the company achieves its goals, as well as its mission, vision and different objectives at hand. HRM practices include recruiting new employees, managing employees, hiring		recruitment and selection process. If the wrong person is hired, the organization can suffer from several economical losses instead (Newell, 2005; Muir 1988). 3) Selection is the second process which is undergone when hiring new employees. It usually takes place after the organization have been doing initial recruitment where they establish a pool of possible qualified applicants, and now have to select the right applicant for the job (Newell, 2005; Stoilkovska et al. 2015). To evaluate the right selection method		not actively seeking for a job, as focus usually lies in finding new talent. 5) Overall, many of the interviewees agreed that even though AI is an interesting new technology, it has a long way to go before it could be perfectly implemented strategically. 6) The pre-screening for four of the professionals was said to most often take place through social media channels such as LinkedIn or Facebook. The rest of the professionals said that the screening was conducted on applications sent in directly on a job posting. In terms of pre-

		employees and developments (Wall & Wood, 2005)		for an applicant there are three methods, usually applied as follows: reliability, validity and usefulness. In validity, applicants can be scored on a scale with job performance on y axis and team-working score on the x axis according to “false negatives” or “false positives” - either people were thought to be bad, but they were good, or people were thought to be good but ended up performing badly (Newell, 2005). The final selection decision is usually taken by one person in the end, most often a recruiter with experience		selection, it was discussed that AI helps give an organization all the necessary information to select candidates that seems the most fit.

				within the job who can take adequate decisions on who would fit the job. 4) Furthermore, according to Ved et al. (2016) there is five different main areas of implementation of AI which are firstly interpretation of language, secondly machine perceptions, thirdly problem solving, fourth robotics and lastly games. These implementation areas are also further supported by Tecuci (2012) who have knowledge acquisition, natural language and robotics as some key areas for AI. 5) Job interviews conducted as a video interview		

				have become a popular recruiting tool among companies. An application for video interviews that utilize AI has been developed by HireVue. In this application AI is able to interpret and analyze applicant's body language, facial expressions or tone of voice. The application compares the interviewed applicants to the top talent employees in the company and finally suggest the best applicants to recruiters (HireVue, 2018).		

9. Kamran, A., Dawood, J., & Hilal, S. B. (2015). Analysis of the recruitment and selection process. In *Proceedings of the Ninth International Conference on Management Science and Engineering Management* (pp. 1357-1375). Springer, Berlin, Heidelberg.	The purpose of the research was to identify the problems relating to the recruitment and selection methods and sources used in different ways by organizations. This research is based on the major problems faced by the HR department of an organization in regards to the recruitment and selection methods or sources and these are stated below: (1) Do the HR personnel's pay due attention to the recruitment and selection methods or do they follow their own way of doing it? (2) Analyze the outcome of the traditional and modern way of recruitment and selection methods. The recruitment and selection of the person intended for	Human resource management is a unique term for the old version or Personnel management or we can say that to deal with the staff or manpower this new term has been evaluated.	Englan d	The strategic needs of the organization are specifically designed and the implementations of it are to be taken by the departments by itself and there is a major role of the HR section to provide the basic needs of the in self departments. Recruitment is the process of discovering potential candidates for actual or anticipated organizational vacancies. Selection is a later stage of recruitment. It involves choosing not only new members of the organization but also ensuring that the selection process can manage to attract competent and qualified	The research method used is the methods used to conduct the research are interview which is the qualitative method of the research and questionnaire which is the quantitative method of conducting the research. And the audiences for the research are the HR personnel and employees from English Heritage and National Trust. Interviews were held and questionnaires were given out to management and staff in the organizations, which were found out to be very useful for the research and the outcome of the analysis and findings. While we conducting the research, we used both primary and secondary data. The questionnaire and its analysis is discussed and shown the analysis and discussion. There were 10 questions asked to the respondents and the rate of return, analysis and answers have been included	One of the internal challenges faced by the HR department is the relationship between the staff and management. The union and the management have to run good terms for either of them to be secure. The diverse workforce or people from different cultures and understanding are also an external problem or challenge faced by the HR department which has to resolve within its limits so no one gets disturbed. This is also one of the external challenge faced by HR, the trained workforce is not normally hired

	the job or not? (3) Do the standards and requirements of the recruitment and selection sources or methods turns out to be feasible or not?			applicants suited to the job. The focus in the selection process is on: (1) Selection methods and skills in terms of contribution to the reliability of decisions made; (2) The criteria defined and applied (explicitly and implicitly) by decision-makers		up in low levels other than the high levels with a substantial amount of experience. The unskilled or untrained workforce also becomes a challenge for the HR to tackle with, which is presumed to be taken up by the line manager to fulfil.
10. Martınez-Miranda, J., & Aldea, A. (2005). Emotions in human and artificial intelligence. *Computers in Human Behavior*, *21*(2), 323-341.	This paper presents the research that has been carried out into the incorporation of emotions to intelligent systems, how a computer can show affections and how to create intelligent agents that show emotions to other agents that communicate with them in the same environment.	Intelligence and emotions differentiate humans from animals. Emotion is part of a persons behaviour and certain feelings can affect his/her performance, emotions can even prevent a person from producing an intelligent outcome. Emotions play an important role in	-	**Primary emotions:** despite the disagreement about the primary emotions, Goleman (1995) classified them into eight families, and argued that all the emotions belong to one of these families. The families of emotions are: Anger, sadness, anxiety, surprise,	This paper presents a review of recent research that shows the importance of the emotions in human intelligence.	Only recently, intelligent systems that show emotions have started to emerge. Research on the artificial generation of emotions has been described, however, a lot of work needs to be done to develop an artificial system that simulates the exact relation

		human decision-making process, and thus they should be embedded within the reasoning process when we try to model human reactions, particularly when these reactions may affect other peoples behaviour. Human being is emotional and emotions thus influence our everyday behaviour and as a consequence emotions affect our work		disgust, love. **Emotions in the work environment:** Sociability is part of a person_s personality, which is closely linked to the emotional intelligence and is analysed to measure the EQ of a person. Social skills are nowadays considered as most jobs require working in a team. Goleman (1999) proposed an emotional competence frame that contains all the important features that affect a person_s professional life. They are divided into personal and social competencies as self- awareness, trustworthiness,		between emotions and human behaviour. Work on affective computing was reviewed in this paper as well as some new approaches on the development of emotional agents. The main applications of the research in this area are human–computer interaction, games, entertainment and human decision-making simulation.

				adaptability, self-motivation, self-control. **Virtual actors:** Goleman (1999) proposed an emotional competence frame that contains all the important features that affect a person_s professional life. They are divided into personal and social competencies.		
11. Nawaz, N. & Gomes, A. M., (2019). International Journal of Advanced Computer Science and Applications, 10(9), 1-5.	The paper is to examine the artificial intelligent (AI) on recruitment effectiveness. Also, the study is to aim to know artificial intelligence impact on the recruitment process. Therefore, the study was observed to understand the opportunities, risks	Artificial intelligence is now enhancing tools in recruitment practices in Indian and MNC companies. The artificial intelligence integrating all the functions of the process that lead to the human resource professionals screen		Artificial intelligence tools such as chatbots communicate effectively and screen the application is quick, will reduce the burden for human resource professionals. Another piece of work on artificial intelligence chatbots screen the applicant	The study made in CMMI (Capability-maturity model integration) software companies of Bangalore, collected data through a structured questionnaire from 100 human resource professionals. The present study was conducted by using a convenient sample method. It identified construct from literature by using the constructs	The recruiters stated that using artificial intelligence useful in finding new talent. Even applicant comfortable of finding the right job through artificial intelligence. The artificial intelligence is providing two sharp edge

	and utilization of artificial intelligence in the recruitment process.	the top-scoring applicant without having much time.		CV's and will reduce the routine work of the recruiters. The artificial intelligence also escalates screening candidate, the establishment a relationship, unbiased decisions and schedules, moreover, can be engaged applicant via the web, social media communications and mobile platforms will work as front end communication with the candidate. Artificial intelligence using the process of recruitment that leads to the speed and accuracy in applicant data[10], but the in recruitment process artificial	developed questionnaire by using the five-point scale of Likert from range to strongly acceptable (5) to strongly unacceptable (1). To establish quality constructs, the survey (questionnaire) pre-tested with five experts from the field, three from the industry and two from academic reviewed and provided their inputs, the inputs are reflected in the questionnaire. Finally, a questionnaire prepared for circulation among the human resource professionals. The questionnaire was circulated from March 2018 to October 2019 across the recruiters in Bangalore city having accreditation of CMMI Institute for CMMI level. After identification of companies, the well communicated the participants and	information for recruiter and applicant. This mechanism will establish a productive system of recruitment. Artificial intelligence utilization in the recruitment process, the respondents stated that it is possible to make the speed of recruitment and also it will gain time and cost-effective. The artificial intelligence of using in the recruitment process, the recruiters will get the right applicant for the right job for the correct position, this will enhance the quality of the applicants in the pool of talent. This strategic

				intelligence will replace human efforts in searching right talent for the right job to give right position in the organization.	circulated questionnaire link. The researchers received 126 responses, after proper examination of each questionnaire inputs, found that only 100 questionnaires correctly filled, that were all considered for analysis purpose.	approach launches the employer reputation in the market.
12. Newell, B. R., & Shanks, D. R. (2014). Unconscious influences on decision making: A critical review. *Behavioral and brain sciences*, *37*(1),1-19.	To what extent do we know our own minds when making decisions? This article presents a novel framework for evaluating these claims and reviews evidence from three major bodies of research in which unconscious factors have been studied: multiple-cue judgment, deliberation without attention, and decisions under uncertainty.	The unconscious has of course played a major role in the history of psychology, certainly predating Freud's extensive development of the concept.	-	The framework is based on the *lens model* (Brunswik 1952). 1) The idea that an event or criterion in the environment that is not consciously perceived by the decision maker nonetheless influences behavior. 2) The idea here is that there are properties of the stimulus environment. 3) A lack of awareness of the cues relied upon to make a judgment or decision.	The authors faced a systematic review from previous studies.	Inadequate procedures for assessing awareness, failures to consider artifactual explanations of "landmark" results, and a tendency to uncritically accept conclusions that fit with our intuitions have all contributed to unconscious influences

				4) A lack of awareness of one's utilization of cues.		
13. Petrovic-Lazarevic, S. (2001). Personnel selection fuzzy model. *International Transactions in Operational Research*, *8*(1), 89-105.	The paper presents a two-level personnel selection fuzzy model: short list and hiring decision. The model is an attempt to minimize subjective judgment in the process of distinguishing between an appropriate employee and an inappropriate employee for a job vacancy.	Human resource management (HRM) is a process of managing people through recruitment and personnel selection, performance appraisal, reward systems, training and development (Pullin and Fastenau, 1998). The traditional hiring selection procedure uses a clinical or statistical methods approach. In the clinical approach decision-makers select upon their understanding of the job specifications and the individuals who have been successful in the preliminary	-	A common belief among business academics and practitioners is that HRM should be based on justice principles, particularly in hiring. 1) The justice principle is understood as the process of decision-making to be carried out with the minimal influence of subjective judgments. The hiring procedure is the first contact of a future employee with an organization. 2) The multi-hierarchical approach usually implies the analytic hierarchy	The model is an attempt to minimize subjective judgment in the process of distinguishing between an appropriate employee and an inappropriate employee for a job vacancy. The model comprises an analytic hierarchy process of three levels. The lowest level relates to the preliminary selection or shortlist procedure. Modifying multi-objective models of decision-making, the main decision elements are assumed as linguistic fuzzy variables. The problem is considered broad, since the worth values of the variables are calculated as expected values of the fuzzy variables. The second level relates to the hiring decision or	The justice principle argues that the personnel-selection decision process should be carried out with minimal influence of subjective judgment. In order to avoid individual value judgment in the selection process's stages of preliminary selection and hiring decision it is proposed to implement the personnel selection fuzzy model (PSFM). The proposed PSFM uses the AHP as a basis for selecting the appropriate candidate for an employment

		selection. Job specifications include skill requirements, effort, responsibility, and job conditions. The procedure usually has personal biases and stereotypes `covered up by what appear to be rational basis for acceptance or rejection'. The selection process following the recruiting process should provide reliable and valid information about job applicants. The procedure to obtain such information usually involves several steps: completion of application form, initial interview, employment test, background investigation,		procedure (AHP). The AHP is a process for identifying, understanding, and assessing the interactions of variables in the chosen decision. It is based on the principle of constructing hierarchies, setting priorities, and logical consistency (Saaty, 1995). The AHP is structures on several levels, of which level one comprises the expected utility. The lowest level comprises alternatives that would contribute to the expected utility `through their impact on the intermediate criteria' in the intermediate level. Since the	selection of a ®nal candidate for an employment opportunity. The selector assesses his/her own expectations of the short-listed job applicants. The expectations are treated by a probabilistic/possibilistic approach. The top level is the expected utility of hiring the successful candidate.	opportunity. Being based on standard statistical procedure common to HRM, but highlighting additional important criteria for selection, it is relevant of eliminating bias. The model is based on a computer program that can be easily adapted to any specified personnel selection problem. PSFM could be further developed towards inclusion of other aspects of managing people through the application of neuro-fuzzy logic to a wide cross-section of HRM processes.

		preliminary selection, hiring decision.		criteria are achievable only at the expense of alternatives that underpin each criterion, there is a need to establish a hierarchy of importance among alternatives so as to satisfy as many criteria as possible in the order specified. Labib, Williams and O'Connor (1998) suggest that in the personnel selection process one should: - Break down a complex decision process into component criteria; - Arrange these criteria or variables into a hierarchic order; - Assign numerical values to subjective judgments on the		

				relative importance of each variable; - Synthesize the judgments to determine the overall priorities of the variables. Cheng, Young and Hwang (1999) developed a method for evaluating systems by AHP based on linguistic variable weight. The model was applied in military systems. They believe that AHP is to a certain extent applicable to present simple decision processes. However, if the decision process is a complex system with an unbalanced scale of judgment, `the subjective judgment, selection and		

				preference of decision-makers influence the AHP method'. Using the fuzzy decision models, it is necessary to consider decision problems mainly through two approaches: (1) The solution search procedure that starts from the top-level solution to the lower level solutions. This is known as Stakelberg strategy (Wen and Bialas, 1986); (2) AHP solution search procedure for which the decision-makers at the lower level optimize their objective function, taking a goal or preference of the upper level into consideration (Lai, 1996).		

14. Shih, H. S., Huang, L. C., & Shyur, H. J. (2005). Recruitment and selection processes through an effective GDSS. *Computers & Mathematics with Applications, 50*(10-12), 1543-1558.	This study proposes a group decision support system (GDSS), with multiple criteria to assist in recruitment and selection (R&S) processes of human resources. A two-phase decision-making procedure is first suggested; various techniques involving multiple criteria and group participation are then defined corresponding to each step in the procedure.	Recruitment and selection (R&S) processes are important practices for human resources management (HRM) and are crucial in affecting organizational success. A human resource information system (HRIS), is a system exploited to acquire, store, manipulate, analyse, retrieve, and distribute relevant information regarding an organization's human resources. a decision support system (DSS), once established, can do the work. The DSS is a computer-based information system that combines models and data in an attempt to solve	Souther n Taiwan	Due to the complexity of GDSSs with various information technologies and activities, many pioneers try to classify the developing systems into adequate categories. 1) Communication being the first concern of GDSSs, DeSanctis and Gallupe initially propose three levels of systems based on an information exchange perspective for decision making. Level 1 attempts to reduce communication barriers through information infrastructure, Level 2 tries to overcome process	To characterize our GDSS, we designate a GDSS engine and other common subsystems, such as databases, model base, and user's interfaces. The user's interfaces allow communication bi-directionally between the system and its users, including general members and the chairman via the GDSS engine. The engine acts as a control center for the system, and it connects previous components allowing communication, collaboration, and decision making. It helps plan the agenda, acquire and store information and knowledge, stream the processes, and direct decision activities for the integrated R&S process on the system. The system is established on networked-based PCs in the MICROSOFT WINDOWS	The established system shows the competency of a much more effective and efficient analytic tool than traditional ones. In addition, the suggested prototype has been checked through an example by the human resources department of a chemical company in southern Taiwan. The recent survey shows that recruitment and selection are the top priorities for HRM. Our proposed system is valuable for implementing the selection process. Besides the illustrated exampie, the system is suitable for different job

		unstructured problems with extensive user involvement through a friendly user's interface. The GDSS is an interactive, computer-based system, or computer-supported cooperative work system, which offers solutions to unstructured problems through tile brainstorming of concerned decision makers (DMs) working together as a group. Decision quality is an essential element in making decisions.		difficulties by adding decision techniques, and Level 3 aims at enhancing the control of timing, content, or message patterns exchanged by participants through an active regulated decision process. From the viewpoint of decision analysis, numerous techniques, in the areas of multieriter i a / a t t r i b u t e decision making, multiobjeetive decision making, and group decision making, can help DMs make a better choice. These techniques are naturally incorporated into GDSSs to facilitate an efficient decision. 2) A decision	environment. 1) In the first phase, the chairman of the group logs onto the system initially and selects a sufficient amount of members or experts from different function areas of the company. After all members have logged on, a general discussion will be conducted in the chat room to define the R~:S requirements. 2) In the second phase, a series of R&S activities will be conducted interactively. After the human resources department establishes an applicants ~ database, screening and evaluation activities will be served through background investigations, tests, and interviews, respectively. Using the example of recruiting on-line managers, the relevant selection tests are suggested as: knowledge tests, skill tests, and interviews.	requirements. In addition, the concept of the system is showing the promise of adopting many other HRM pract.ices.

				with high quality not only will be regarded as a prime choice but definitely also facilitates the ease of its execution at a later time. Now that we are concerned with the problem-solving procedure, decision quality must be considered throughout the procedure. Conceptually, MCDM techniques can help DMs distinguish the kernel of a complicated problem by identifying different criteria on a categorized basis, thus achieving a multi-dimensional decision. GDM techniques,		

				especially in the category of group participation, try to control the conflicts among group members and obtain multiple sources of knowledge and experience . Moreover, these techniques are designed to increase the creative productivity of group actions, facilitate group decisions, help stimulate the generation of critical ideas, give guidance to the aggregation of individual judgments, and leave DMs with a sense of satisfaction		
15. Van Esch, P., Black, J. S., & Ferolie, J. (2019). Marketing AI	The purpose of this paper is to find that attitudes towards organizations that use AI in the recruitment	AI is any intelligent agent (e.g., device) that distinguishes between different	-	1) Web-based e-recruitment platforms utilizing AI can be more effective in assuring	We employed a cross-sectional design in which participants (n=532) were recruited through an online survey platform (Hauser	The marketing and use of AI is an emerging trend in the e-recruitment process. Even

recruitment: The next phase in job application and selection. *Computers in Human Behavior, 90,* 215-222.	process, significantly influences the likelihood that potential candidates will complete the application process. The	environments and can take a course of action(s) to increase the success of achieving predetermined objectives (Oana, Cosmin, & Valentin, 2017). For job application and selection, AI can utilize behavioral and physiological characteristics (e.g., biometrics) as a part of the overall decision-making process. Human resources (HR) practitioners are marketing to potential job candidates the increasing use of technology-enhanced macros for accuracy, cost reduction, and time saving capability (McDonald, Fisher, & Connelly, 2017). Russell and		objectivity and reducing costs for both applicant and employer (Konradt, Warszta, & Ellwart, 2013; Viswesvaran, 2003). The AI recruitment process needs to be a two-way channel of communication and information. For the applicant, the information needs to include, as a minimum, the benefits, conditions, job requirements, policies, processes, regulations, and rules (Wang & NOE, 2010). For organizations, communication from potential candidates needs to include attitudes, career highlights,	& Schwarz, 2016; Smith, Roster, Golden, & Albaum, 2016). Participants received $0.15 for successfully completing the survey, a reasonable rate of pay compared to similar survey tasks. All participants were considered "talent", as talent is an encompassing characteristic that concerns all potential, current and future employees (e.g. not restricted to only a few individuals), regardless if some have more talent than others.	though its current applicability is in the initial phase of the applicant selection process, job applicant anxiety towards the use of AI is secondary to an applicants' attitude towards the hiring organization. Integrating candidate experiences of e-recruitment technologies could significantly bolster AI recruitment technology and its value cocreation component. Not surprisingly, the marketing and use of AI in the human resource management (HRM) field has the potential to

		Norvig (1995) defined AI as "anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors" (p. 31), whilst Hayes-Roth (1995) attempted to broaden the definition by suggesting that AI provides "reasoning to interpret perceptions, solve problems, draw inferences and determine actions" (p. 329).		educational achievements, expectations, motivational behaviors, and their physical capabilities to complete specific job requirements (Stone & Lukaszewski, 2009). 2) When candidates apply for jobs that utilize AI, they will be more attentive and possibly distracted by its novelty aspect (Venkatesh, Thong, & Xu, 2016). This is because technology has brought both ambiguity and novelty into the e-recruitment process. Moreover, there is limited, if any, research on the use of AI technology and		cause ethical, legal, privacy, moral, and vilification concerns for potential candidates. This is primarily due to the AI component having the ability to consider a candidate's physical attributes as part of the overall decision-making process. This has the potential to cause significant levels of anxiety, and due to AI recruitment being in its infancy, candidates may not be aware of AI's full capability within the decision process. Because AI is in its infancy in recruitment processes,

				the job application process (Pardamean, 2014). Organizations through their marketing, commit extensive financial and technological resources to attract and recruit high-caliber candidates (Eveleth, Baker-Eveleth, & Stone, 2015). The role of AI recruitment is an important aspect in the process, yet little research has explored how the use of AI influences candidates' recruitment experiences or their attitudes and intentions towards the organization. 3) In the war for talent, many organizations have started to		candidates may not be aware of AI's full capability within the entirety of the decision process. In fact, the presence of anxiety may cause organizations to consider how best to reduce uncertainty and anxiety. Positive job applicant responses to their experiences with AI recruitment processes could lead to a higher acceptance rate of job offers and a more positive attitude towards the hiring organization.

				market and use different technological platforms to communicate with and attract talent as part of their e-recruitment strategies (Van Esch & Mente, 2018). This brand image is a critical component of the recruitment process, as one of the key factors that prevents applicants from applying for a job is, in fact, their attitudes towards the brand image and the organization itself (Matthews, Son, & Watchravesringkan, 2014). Candidate expectations play a substantial role in recruitment outcomes. Therefore, organizations		

				must consider candidate pre-use technology perceptions when implementing e-recruitment strategies involving the latest technological advances (e.g., AI). 4) In today's stressful and fast-paced work environment, feelings of anxiety can become a serious problem. One of the main sources of anxiety comes from the employment interview which is the most common selection tool used by organizations' (Wanberg, 2012). Anxiety in the applicant has some serious implications on their likelihood to apply for the job.		

				High levels of anxiety often lead to a low job interview score. Social anxiety is extremely relevant to job interviews, because it affects listening skills, nonverbal communication skills, and verbal communication skills.		
16. Wang, Y., & Ruhe, G. (2007). The cognitive process of decision making. *International Journal of Cognitive Informatics and Natural Intelligence (IJCINI), 1*(2), 73-85.	This article presents a fundamental cognitive decision making process and its mathematical model, which is described as a sequence of Cartesian-product based selections.	Decision making is a process that chooses a preferred option or a course of actions from among a set of alternatives on the basis of given criteria or strategies (Wang, Wang, Patel, & Patel, 2004; Wilson & Keil, 2001). Decision making is one of the 37 fundamental cognitive processes modeled in the layered	-	The outcomes of a decision making process are determined by the decision-making strategies selected by decision makers when a set of alternative decisions has been identified. The taxonomy of strategies and corresponding criteria for decision making can be classified into four categories	This article adopts the philosophy of the *axiom of choice* (Lipschutz, 1967). The three essences for decision making recognized in this article are the *decision goals*, a set of *alternative choices*, and a set of *selection criteria* or strategies. According to this theory, decision makers are the engine or executive of a decision making process. If the three essences of decision making are defined, a decision making	This article has developed an axiomatic and rigorous model for the cognitive decision-making process, which explains the nature and course in human and machine-based decision-making on the basis of recent research results in cognitive informatics. One of the interesting findings of this work is that the

		reference model of the brain (LRMB) (Wang et al., 2004; Wang, 2007b). Decision making is the process of constructing the choice criteria (or functions) and strategies and use them to select a decision from a set of possible alternatives.		known as *intuitive, empirical, heuristic,* and *rational.* The first two categories of decision-making, *intuitive* and *empirical*, are in line with human intuitive cognitive psychology and there is no specific rational model for explaining those decision criteria. The rational decision-making strategies can be described by two subcategories: the *static* and *dynamic* strategies and criteria. The *heuristic* decision-making strategies are frequently used by human beings as a decision maker. Rational and	process may be rigorously carried out by either a human decision maker or by an intelligent system. This is a cognitive foundation for implementing expert systems and decision supporting systems (Ruhe, 2003; Ruhe & An, 2004; Wang et al., 2004; Wang, 2007a).	most fundamental decision that is recurrently used in any complex decision system and everyday life is a Cartesian product of a set of alternatives and a set of selection criteria. The larger both the sets, the more ideal the decisions generated. Another interesting finding of this work is that, although the cognitive complexities of new decision problems are always extremely high, they become dramatically simpler when a rational or formal solution is figured out.

				complex decision making strategies can be classified into the static and dynamic categories. Most existing decision-making strategies are static because the changes of environments of decision makers are independent of the decision makers' activities. The *dynamic strategies and criteria* of decision-making are those that all alternatives and criteria are dependent on both the environment and the effect of the historical decisions made by the decision maker.		
17. Wilfred, D. (2018).	-	AI is any device or machine that perceives its	-	In the field of recruiting, AI is designed so as to	-	The benefits of AI are many. The most basic

AI in Recruitment. *NHRD Network Journal,* *11*(2), 15–18.		environment and takes actions that maximize its chances of success at meeting some goal. The AI field draws upon computer science, mathematics, psychology, linguistics, philosophy, neuroscience, artificial psychology and many others.		automate some part of the recruiting workflow, especially repetitive, high-volume tasks namely the sourcing, screening, assessments of the resumes and scheduling the interviews. Implementing AI in the sourcing helps in standardizing the process so as to be able to assess a candidates' skills and abilities more objectively without letting the inherent human biases. AI can also be used in powering up chatbots that engage with applicants as soon as they apply to a company. Applicants who get immediate responses		benefit of AI is that it replicates decisions and actions of humans without the shortcomings inherent to humans, such as fatigue, emotions, biases and limited time. At a glance, there is enough evidence that AI has the potential in the field of recruitment, in accelerating the process of hiring, removing tedious, manual tasks from the staffs, profile and thus, making them more productive.

				from potential employers are more likely to form a relationship with the company. These chatbots use technologies like Natural Language Processing to examine candidate data and ask relevant questions to the candidates using popular messaging apps. Candidate-relationship management software use AI to enhance an organizationals applicant-tracking system as well as to build relationships with their candidates. It uses data mining algorithms to track the interactions between the		

				employers and potential candidates to zero in on the best candidates to engage with. Tasks like sending follow-up emails, contacting candidates when relevant job profiles are available, to notifying the staff when a candidate is actively job hunting, can easily be automated through AI.		