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Intelligent Software Tools for Recruiting

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ABSTRACT

In this paper, we outline how recruiting and talent acquisition gained importance within HRM field, then give a brief introduction to the newest tools used by the professionals for recruiting and lastly, describe the Artificial Intelligence-based tools that have started playing an increasingly important role. We also provide further research suggestions for using artificial intelligence-based tools to make recruiting more efficient and cost-effective.

Keywords: Human Resource Management, Talent Acquisition Software, AI, Machine learning

INTRODUCTION

As companies become specialized in their offerings, they need employees with specialized skills to remain competitive. Recruiting and talent acquisition is gaining prominence within the Human Resource Management (HRM) field, especially for filling high-tech positions due to the high demand for such roles (Hunckler, 2018 and Bolden-Barrett, 2018). This trend has led to an increased usage of software tools and new technologies such as artificial intelligence to achieve better efficiency in overall HR operations as well as in recruiting. In this paper, we outline how recruiting and talent acquisition gained importance within HRM field, then give a brief introduction to the newest tools used by the professionals for recruiting and lastly, describe the Artificial Intelligence-based tools that have started playing an increasingly important role. We also provide further research suggestions for using artificial intelligence-based tools to make recruiting more efficient and cost-effective.

The Increased Importance of Recruiting and Talent Acquisition Function Within HRM

HRM is concerned with the selection, development, and retention of the employees and is critically linked to the organizational effectiveness and success (Kramar, 2014 and Saridakis, Lai, & Cooper, 2017). The proliferation of personal computers and later internet technologies caused a tremendous rise in the knowledge economy-based companies. The knowledge economy is defined as the economy where products and services are based on knowledge-intensive activities rather than physical inputs or natural resources. (Powell & Snellman, 2004). In the knowledge economy, human capital is a critical factor for every organization to achieve sustainable competitive advantage. Hence selection of competent employees is the most important function of human resource managers (Heidary Dahooie, Beheshti Jazan Abadi, Vanaki, & Firoozfar, 2018). The high-tech industry companies realized that a significant amount of their competitive advantage depends upon their employees' talent and the company may be at a disadvantage if these employees were to leave and join a competitor. The companies realizing the value in the employee selection and retention of good employees started treating their employees (human talent) as a strategic asset that can positively influence organizational outcomes. Hence the traditional human resources management approach became geared towards managing human talent, or "Talent Management".

The term "Talent Management" (TM) originated from a study conducted by McKinsey Group of 200 top executives of 77 large organizations ("A Primer on Talent Management," 2017). TM can be considered as a collection of four activities – recruitment management, learning management, performance management, and incentive management, as well as the data collection around these activities. (Schweyer, 2010). TM has been linked to the success (or failure) of the organization; hence, it is a critical aspect of executive and managerial attention. Though TM functions do not specifically single out recruiting and talent acquisition as essential functions, they emphasize the need for tools for strategic recruiting. Strategic Talent Management (STM) is defined as "activities and processes that involve the systematic identification of key positions which differentially contribute to the organization's sustainable competitive advantage, the development of a talent pool of high potential and high performing incumbents to fill these roles, and the development of a differentiated human resource architecture to facilitate filling these positions with competent incumbents and to ensure their continued commitment to the organization" (Collings & Mellahi, 2009). There have been a significant investment and technological development in the talent

management area, including cloud technology and software-as-a-service. (Zickar & Austin, 2018).

It is easier to recognize the importance of talent acquisition function within talent management systems if the qualifying question is phrased as “what does it cost to replace the skilled worker with a new hire?” (Schweyer, 2010). The recruiters and talent acquisition professionals are responsible for new hiring; hence, they have the mandate to minimize the cost of the new hire. With the rise of the gig economy (a labor market characterized by the prevalence of short-term contracts or freelance work as opposed to permanent jobs), the employee-employer relationship changed drastically. Employees expect to spend much less time working for one employer, and they do not buy into the employment for life concept (Smith, 2018 and Pichault & McKeown, 2019). This change is making recruiting a continuous function. The recruiters and talent acquisition professionals are expected to continuously build a pipeline of candidates and be ready to start hiring as soon as someone leaves the company. At the same time, the low unemployment rates for high-tech industries such as Information Technology (Loten, 2019) drives up the need for qualified people. Because of the high competition for qualified people and the continuous demand for such workers, talent acquisition and recruiting are becoming important pieces of the overall talent management system.

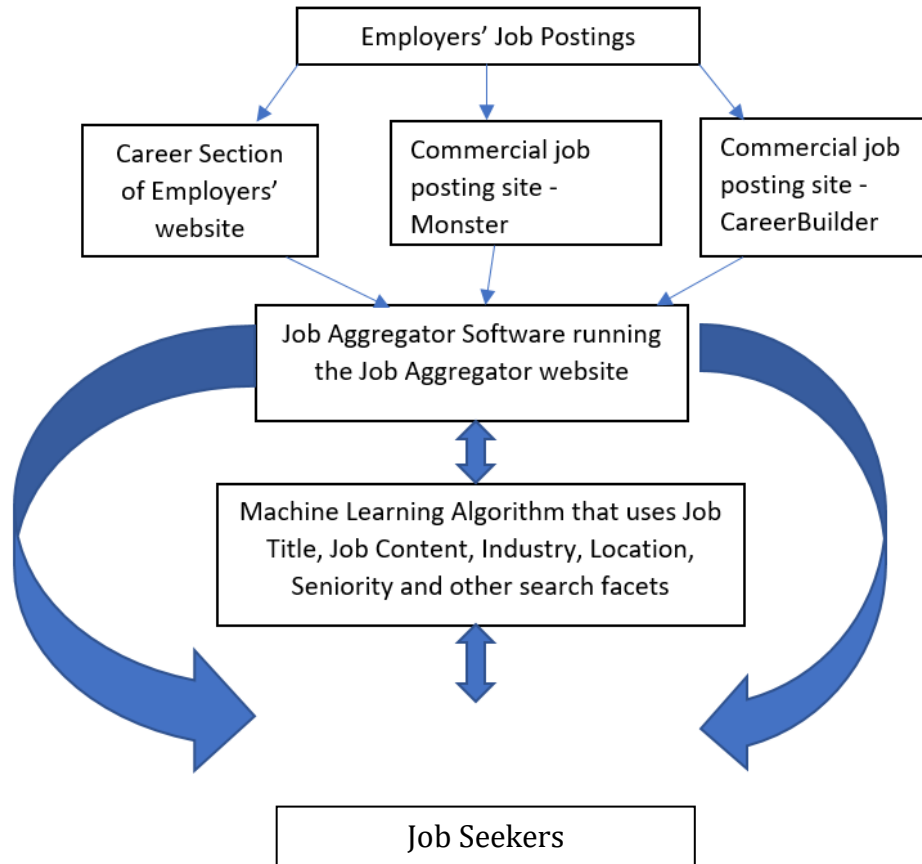
TYPES OF RECRUITMENT SOFTWARE TOOLS

Software tools entered the HR field with computerization and automation in the 1980s to improve efficiency and accuracy (Bondarouk & Ruël, 2009). Information Technology has wholly infused within the HR department, making tools (ERP, SaaS, cloud-based, etc.) available to HR professionals. In this section, we review the role of technology related to Talent Acquisition and Recruiting. As the investment and development of Talent Management tools increased, a significant portion of these efforts was allocated to the talent acquisition / recruiting tool development. A whole new industry catering to recruiters and recruiting function was developed. In particular, the push for technology-based recruiting and talent acquisition is impacted by four dynamic factors - (a) changes in the employment conditions during period of economic growth when number of open jobs surpasses the number qualified applicants available, (b) changes in the corporate business practices that force outsourcing or automation of activities that are considered non-core to the business, (c) changes and advancements in the communication, software and hardware technology, and (d) changes and advancements in the data collection and data analysis methodologies to accurately predict a fit between a prospective employee and the organization. (Reynolds & Weiner, 2009).

The software tools available to recruiters and talent acquisition professionals can be assigned to one of the following three categories:

1. **Job aggregator software:** This software tool scans jobs posted on various websites and brings them to one website. The goal of these job aggregator software is to find and list available jobs on their site, and by doing so, attract a sufficiently large number of potential applicants who may then apply for those open jobs. Sophisticated versions of this type of software are used by renowned companies such as Indeed, Google, LinkedIn to create popular job aggregator websites. These popular job aggregator websites generate a lot of visitors and offer other services such as visitor data and related analytics to the talent acquisition professionals.

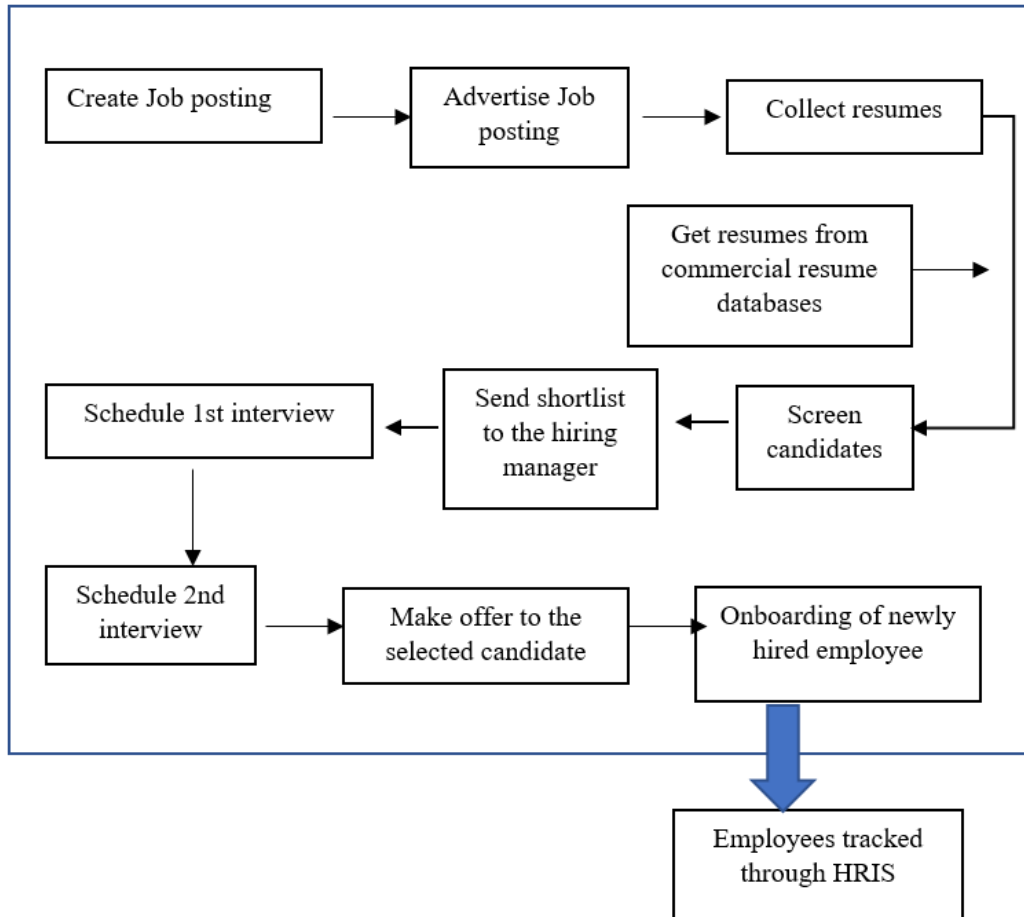
Recruiters use job aggregator websites to post their jobs directly on them during times of high traffic. Sometimes, they write their job postings in such a way that the targeted job aggregator website would notice the job posting and bring to the site. The data analytics provided by these job aggregator websites is extremely valuable for recruiters who are trying to fill highly technical roles when few candidates are available to fill those roles. The job aggregator software functions more like a search engine by collecting job postings from across the internet and organizing them into one searchable feed with relevant filters for job seekers. Figure 1 below shows, using “Google for Jobs” as an example, how a job aggregator software pulls job postings from different places around the Internet, including career sites, employer job listings, and other niche job posting.

Fig. 1. Job aggregator site, Google for Jobs

2. Candidate assessment software: Candidate assessment is the process by which an employer evaluates individuals when considering them for an open position. The goal of candidate assessment software is to assess the candidates using preset criteria and measures and pick the best from the set of candidates. When recruiters are not technically savvy to evaluate the candidates' strengths in niche areas or technologies, they rely on this type of software. Such tools are also used for aptitude testing and personality evaluation. The software typically contains multiple sets of questions in various domains to conduct skills testing of candidates in multiple areas. Usually, the employer selects only one such software to work with since the results vary from one to another. The software can conduct tests online through the Internet, also, it can be implemented on the organization's internal server. The software tracks

the time taken by the candidate to complete the assessment, tabulates the results, and may have other analytics capabilities as well. Examples of this software include TestDome, eSkill, etc.

3. Applicant tracking software (ATS) tools: ATS Tools help recruiters handle the recruitment needs of the company and keep track of candidates. ATS tools are typically a part of a larger Human Resources Information Systems (HRIS) (Derous & Fruyt, 2016). Examples of ATS tools include Ceipal TalentHire, Jobvite, Bullhorn, etc. A typical ATS has a user-friendly interface through which recruiters can perform the following tasks: (1) create and advertise open jobs, (2) collect resumes, (3) create a shortlist of candidates, (4) schedule interviews of shortlisted candidates, (5) manage interview process and (6) make offer to and facilitate the onboarding process of selected candidate. Most of the ATS tools allow customization of each of these tasks in the hiring process and provide easy integration with emails and other business productivity tools, bringing efficiency to recruiters' workload. The ATSS allow both recruiters and hiring managers to look at the same data, such as the number of candidates applying, the status of candidates in the pool, etc., which improves collaboration in the organizations. ATSS also help companies stay compliant with the Equal Employment Opportunity Commission regulations by putting all candidates resumes in one place. Because of these advantages, ATS tools have become very important for recruiters and talent acquisition professionals. Figure 2 below shows a typical ATS and its components:

Fig. 2. Applicant Tracking System

ARTIFICIAL INTELLIGENCE IN HR SOFTWARE TOOLS

The HR operation could be complex, tedious and prone to human errors and bias. Artificial Intelligence (AI) deals with the simulation of human behavior in computers (“Definition of Artificial Intelligence,” 2018.) Traditionally, AI technology has been deployed as an aid for human workers to handle complex and tedious jobs in many fields. Within the last decade, the Artificial Intelligence (AI) field has grown tremendously and has been applied to many complex business problems including those in the HRM fields. Application of fundamental AI ideas such as expert systems, machine learning, natural language processing, and pattern recognition has increased the efficiency of software tools used for all HRM processes - selection, development, and retention of the employees. In this section,

we describe the AI concepts briefly first and then specifically the incorporation of AI in recruiting and employee selection.

Key concepts of Artificial Intelligence:

Expert Systems

An expert system (ES) is an application of artificial intelligence as a knowledge-based system that employs knowledge about its application domain and uses inferencing (reasoning) procedure to solve problems that would otherwise require human competence or expertise.

The main component of an expert system is the database of expert knowledge pertinent to a narrow domain, coded into a “knowledge base.” The other two critical parts of an expert system are an inference engine, typically built using “if – then – else” rules and a user interface that allows non-expert users to query the knowledge base. The major shortcoming of an expert system is that it will fail when it faces a scenario that is not programmed into its knowledge base.

Machine Learning

Machine Learning (ML) uses computers to simulate human learning and allows software systems to identify and acquire knowledge from the real world, and then improve the performance of some tasks based on this new knowledge. The ML algorithms can be classified based on the method used for learning and drawing inferences from the data: supervised learning, semi-supervised learning, and reinforcement learning (Portugal, Alencar, & Cowan, 2018).

Natural Language Processing (NLP)

Natural Language Processing (NLP) is the ability of a computer program to understand human language as it is spoken and it is emerging as an important AI implementation, which is used in everyday gadgets such as Apple Siri, Amazon Alexa, etc. By utilizing NLP, developers can organize and structure knowledge to perform tasks such as automatic summarization, translation, named entity recognition, relationship extraction, sentiment analysis, speech recognition, and topic segmentation.

Incorporation of AI in recruiting and selection

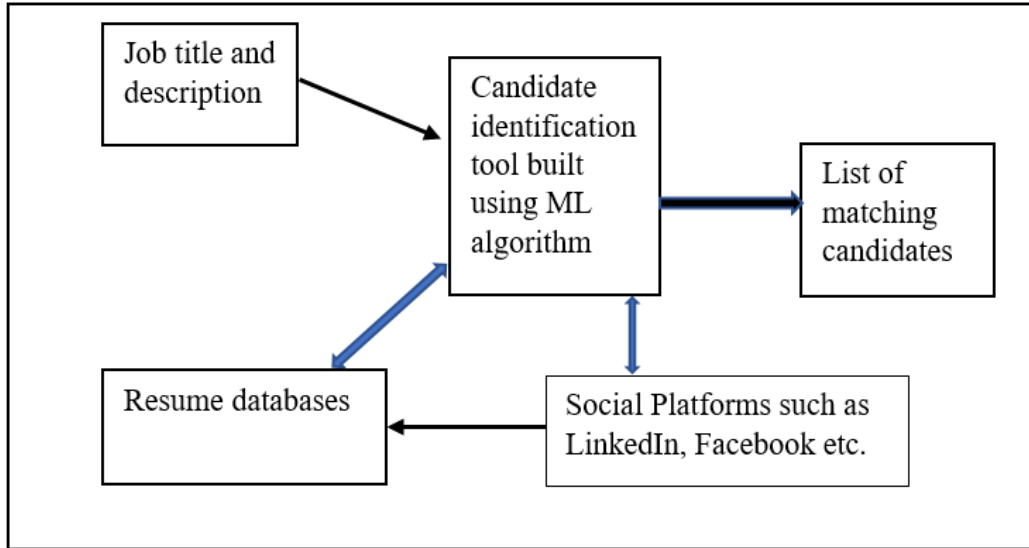
Recent advances in machine learning coupled with computing power and data storage capacity have led to the development of new HR software tools targeted to recruiters and talent acquisition professionals for (1) candidate identification, (2)

drive up candidate engagement and (3) candidate selection. (“List of 30+ Useful AI Tools for Recruitment - TalentSum,” 2018 and Sennaar, 2017).

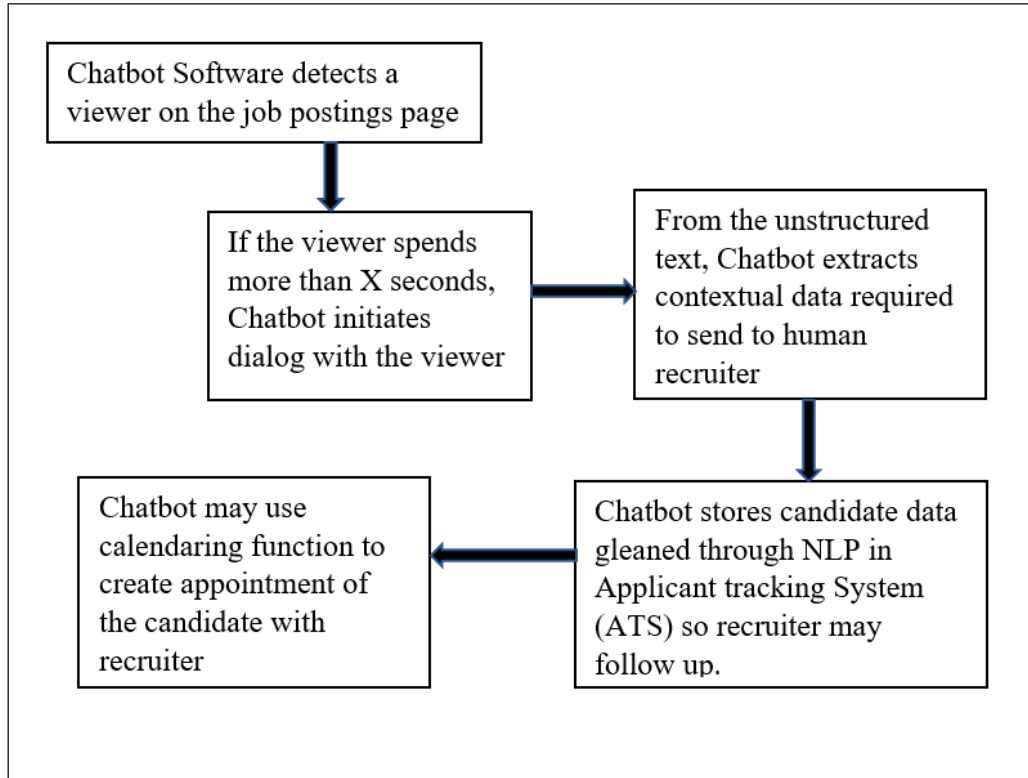
1. AI-based tools for candidate identification: These tools typically use supervised learning algorithms. Supervised learning happens when algorithms are provided with training data and correct answers. The task of the ML algorithm is to learn based on the training data and to apply the knowledge that was gained using real data.

Supervised machine learning algorithms are described as the general learning function $Y = f(X)$, where the AI-based tool makes predictions in the future (Y) given new examples of input variables (X), that is, the HR data related to ideal matches of jobs to candidates available for training the algorithm. The function f is unknown, and the AI-based tool needs to learn it from data using machine learning algorithms. The top 10 machine learning algorithms used by data scientists are (1) Linear Regression (2) Logistic Regression (3) Linear Discriminant Analysis (4) Classification and Regression Trees (decision trees) (5) Naive Bayes (6) K-Nearest Neighbors (KNN Algorithm) (7) Learning Vector Quantization (8) Support Vector Machines (9) Bagging and Random Forest (10) Boosting and AdaBoost. No one algorithm works best for every supervised learning application. (Le, 2018).

More specifically, the AI-based candidate identification tools use a newly created job posting and go through the company’s resume databases (which may contain thousands of resumes) and bring matching candidates to recruiter’s attention. More advanced tools provide further capabilities of visiting the social platforms such as LinkedIn, Facebook, etc. on a pre-determined frequency and adding profiles of people that match with the certain keywords defined by the recruiters into the ATS. Both types of tools use similar contextual search and matching algorithms to sift through thousands of resumes. Figure 3 below shows the workflow:

Fig. 3. A typical workflow of a candidate identification tool

2. AI-based tools to drive up candidate engagement: These tools use Natural Language Processing (NLP) to exhibit human-like intelligence in addition to machine learning to drive up candidate engagement. In recruiting field, Chatbots are used as AI-based candidate engagement boosting tool. Chatbots are used by organizations to interact with the candidates when they are reviewing the job postings. Chatbots also follow up with candidates after they have submitted their resume/application by sending them pre-formatted messages at a pre-determined frequency. Some chatbots are equipped with calendars/scheduling software to schedule interviews between recruiters and candidates. Recruiters/talent acquisition professionals usually implement chatbot tools in their employee selection process to reduce their workload. Fig 4. Below shows the typical chatbot workflow:

Fig. 4. A typical workflow of a candidate engagement tool

3. AI-based tools for candidate selection: These tools use Pattern Recognition and Analysis in addition to machine learning. These tools conduct, and record video interviews of candidates and use the video for further analysis. The tool breaks down the video interviews into smaller segments either by the question asked or time interval. For each segment, the data about candidates' facial expressions, voice, and tone is measured and compared with other candidates or other successful employees performing a similar role. The candidates are given a ranking based on the match. For example, a candidate interviewing for customer service role may be ranked at 37% on an interview question that probes him/her regarding handling an irritated customer, which may not be an acceptable ranking for this role.

Overall, the AI-based tools automate tasks in employee selection, development, and retention which, if performed manually, will take several hours of the recruiter's time and may introduce human errors. By automating these repetitive tasks and

bringing natural language processing features, the tools also aid in preventing recruiter burn-out. The major benefit to the organizations is the cost savings by implementing these tools.

FURTHER RESEARCH IMPLICATIONS

Even though several AI-based software tools are available to the recruiters, the cost of hiring, the time it takes to hire the right candidates, and the risks of wrong hiring continue to increase. The high-tech sector faces these challenges more acutely. We argue that more sophisticated AI tools should be used in the recruiting and talent acquisition field on a broader scale to bring competitiveness and efficiency so that HR professionals can focus on tasks that require human interaction, empathy, and intuition. There are many areas within the recruitment and selection processes that can be positively impacted using artificial intelligence such as (1) creating matching criteria to match candidates to requirements, (2) generating ideal personality profile of the candidate to be hired and (3) compiling a ranked list of candidates. Further research needs to be done to analyze whether the AI-based tools may replace the recruiters and talent acquisition professionals altogether. Further research may also be needed to validate if factors such as company size or industry type play a role in the implementation of AI-based tools.

CONCLUSION

Software tools used in human resource management have evolved with the advances in computing and information technology and changes in the priorities in the HRM field. The talent management aspect requires a focus on an efficient, cost-effective, and forward-thinking approach for talent acquisition. While using the latest internet technology and social media software tools, the recruiters and talent acquisition professionals must find ways to incorporate the human touch and core human values such as intuition and adaptability (“Recruitment goes virtual,” 2013). Because of the strategic role that employee selection plays in organizations, there is a strong drive to develop new tools and expand traditional ideas embedded in the HRM field by taking into consideration the insights from other disciplines. Artificial Intelligence theories have been applied to the HRM field to develop new tools that increase the efficiency of the employee selection process. New AI-powered tools help HR professionals identify and reach prospective applicants quickly and screen them faster, thereby reducing the time of recruiting cycle, which is an advantage for both the organization as well as the potential candidate. AI-powered tools use social media sites and links extensively and efficiently for

candidate identification. The organizations benefit indirectly in their public relations efforts because these AI-powered tools can strategically create an image of the organization in front of the prospective candidates in the local job market (Deros & Fruyt, 2016). Though much work needs to be done to explore additional areas in employee recruitment and selection process where AI-based tools may be implemented, it is clear that they help improve organizational efficiency.

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