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The Effect of Industry 4.0 and Artificial Intelligence on Human Resource Management

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Abstract

In today's market conditions, the importance of competition is obvious. Organizations must direct the right resources to the right investment to increase their competitive power and stay in the market. In this respect, the Human Resource Management (HRM) unit has also entered the digitalization phase. The digitalization phase in Human Resources (HR) has made significant progress, particularly in the recruitment process, with the help of Artificial Intelligence (AI). During this phase that creates a loss of value for the organization, searching for candidates among hundreds or even thousands of applications, selecting the most suitable one for the job, and placing the suitable ones in open positions within the institution; As a result of the evaluations made with artificial intelligence technology, it can be carried out without loss of cost and time. Thus, the AI approach ensures that interviews are managed quickly and with less cost in the recruitment process. Furthermore, AI enables the efficient fulfillment of various activities of the HRM unit, such as training, orientation, and career planning. The present study attempts to explain the impact of Industry 4.0 and AI on human resource management processes as a result of a literature review. This study, examined the role of Industry 4.0 and artificial intelligence in human resources management by making a literature review.

Keywords: Human Resource Management (HRM), Artificial Intelligence (AI) , Industry 4.0, Recruitment Process.

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İnsan Kaynakları Yönetiminde Endüstri 4.0 ve Yapay Zekâ'nın Etkisi

Özet

Günümüz piyasa koşullarında rekabetin önemi ortadadır. Kuruluşlar, rekabet gücünü arttırmak ve pazarda kalabilmek için doğru kaynağı doğru yatırıma yönlendirmek zorundadırlar. Bu bağlamda, İnsan Kaynakları Yönetimi (İKY) birimi de dijitalleşme evresine girmiş bulunmaktadır. İnsan kaynaklarında (İK) dijitalleşme evresi, yapay zekâ yardımı ile özellikle işe alım sürecinde önemli aşamalar kaydetmiştir. Kurum için değer kaybı yaratan bu evrede, yüzlerce hatta binlerce başvuru arasından adayların aranması, işe en uygun olanın seçilmesi ve uygun olanların kurum içinde açık pozisyonlara yerleştirilmesi; yapay zeka teknolojisi ile yapılan değerlendirmeler sonucunda maliyet ve zaman kaybı olmadan gerçekleştirilebilmektedir. Böylece, yapay zekâ yaklaşımı, işe alım sürecinde mülakatların hızlı ve daha az maliyetle yönetilmesi sağlamaktadır. Ayrıca, yapay zekâ İKY biriminin eğitim, oryantasyon, kariyer planlama gibi çeşitli faaliyetlerinin de verimli bir şekilde yerine getirilmesini sağlamıştır. Bu çalışma, Endüstri 4.0 ve yapay zekânın insan kaynakları yönetimindeki rolünü literatür araştırması yaparak incelemiştir.

Anahtar Kelimeler: *İnsan Kaynakları Yönetimi (İKY), Yapay Zekâ, Endüstri 4.0, İşe Alım Süreci.*

1. Introduction

Human beigns are in constant development. New needs emerge with each passing day in this continuous development process. Information, information management, and technology develop in line with these needs. Nowadays, many institutions can survive, grow faster, and carry out their business efficiently by keeping up with changes in technological needs.

Human resource management, one of the main resources through which the institution's employees shape their skills, competencies, behaviors, and attitudes toward achieving organizational goals, takes place among the most critical organizational structures of the institution (Öğüt et al., 2004; Saridakis et al., 2017). Hence, when corporate managers design their practices in human resource management, they aim to be open to innovation, learn and develop the information management capacity among employees within the organization. Therefore, human resources practices are essential in knowledge-based economies (Kulkarni and Che, 2019; Ertaş, 2023). The main purpose of HRM is to maximize organizational performance by improving the human element's knowledge, abilities and skills, attitude, behavior, contribution and performance in line with organizational goals in enterprises (Özçelik et al., 2021). Because the quality of the existing human resources and their dynamic usage determine an organization's survival (Tripathi and Singh, 2017).

The fact that the increasing need of institutions for smart automation technologies has become widespread in recent years and the use of artificial intelligence together with Industry 4.0 in the human resources unit of enterprises and companies have allowed them to regulate their managerial and operational processes, increase efficiency, and reduce costs (Tewari and Pant, 2020). The present study will attempt to explain the concepts of Industry 4.0 and artificial intelligence and reveal the impacts of Industry 4.0 and artificial intelligence on human resource management.

The literature review on the impacts of Industry 4.0 and artificial intelligence on human resource management addressed the current studies. Table 1 summarizes these studies. In this literature review, numerous studies demonstrating that Industry 4.0 and artificial intelligence will have great significance in the field of HR in the future and can fulfill the functions through which most HR applications can be made have been encountered.

Table 1. Studies examined in the literature review**.**

Date of Publication	**Author (s)**	**Summary of the Study**
2023	Murugesan et al.	The authors of the study examined the contributions of artificial intelligence to HR digitalization and its applications in Industry 4.0. The findings demonstrated that hierarchical organization investigation represented the basis of sustainable development. Well-being and safety improvement were regarded as essential elements under AI application in HR**.**
2023	Seyidzadə	In the study, the author conducted a survey to determine the importance of digital transformation in terms of the functions of HRM in enterprises and research and examine innovations in this field. The study concluded that digital transformation in enterprises had positive impacts, particularly in human resources management.
2023	Anayat	The research in question made contributions to the field of AI in HRM and provided an in-depth theoretical analysis of the domain. The analysis revealed that AI technologies, including ML, natural language processing (NLP), machine vision and recommendation systems, were employed in HRM functions for particular uses. Moreover, the research determined that the basic applications of AI in HRM were in the automated induction process, skill development and training, screening and hiring process, queries and feedback, decision-making, employee involvement, and performance appraisal.
2023	Akça	The present research examined the role of artificial intelligence applications in talent management. It was found that artificial intelligence applications contributed significantly to the organization and employees in terms of finding and recruiting talent, data collecting and analyzing, increasing productivity in the workplace, reducing the workload of employees, and decreasing the increasing costs.
2023	Uğurlu and Doğan	In the study, the researchers elaborated on the field of digital HRM and conceptually discussed digital HRM transformation and the effects of digital advancements on the recruitment function. They reported that the most important outcomes of digitalization in the field of HRM were web-based human resources technologies, intranet portals, and online platforms. The researcher stressed that

		this situation brought and would continue to bring different applications and perspectives to the classical way of doing business and methods.
2023	Yılmaz and Yılmaz	In the study conducted, the researchers investigated the effects of Industry 4.0 on HRM. By explaining various concepts regarding Industry 4.0 and HRM, they analyzed the effects of HRM 4.0 on HRM functions and concluded that human resources management and practices were highly impacted by digital transformation.
2023	İbrahimağaoğlu	The researcher addressed studies conducted in the last three years on electronic human resources management, which emerged along with the need for organizations to store and process human resources data in the digital environment. In this study, the researcher revealed the definition, purpose, types, importance, development, stages, advantages, and disadvantages of electronic human resources management.
2023	Pereira et al.	The researchers investigated the impacts of artificial intelligence applications on HRM activities and organizational performance of the organization, particularly in the health sector. As a result of their study, they revealed the financial and organizational contributions of using artificial intelligence applications in the health sector to the organization.
2023	Chowdhury et al.	The current study aimed to develop AI applications in HRM. In this regard, the researchers did a comprehensive literature review covering international business, information management, general management, operational management, and human resources management to provide a comprehensive understanding of corporate resources. As a result of the review, it was found that organizations' adoption of artificial intelligence applications and their benefiting from these applications could not be realized only with technical resources, but the necessary studies must be performed to ensure that the working personnel have adequate awareness.
2022	Rahman et al.	In the present study, a blockchain-based performance evaluation system was developed to control the performance of an organization's employees. It was stated that this system would be reliable, secure, and anonymous.
2022	Gong et al.	In their study, the researchers designed a salary estimation module with the objective of strengthening HRM via information management by employing AI technology. The aforesaid module optimized abilities based on a back-propagation neural network (BPNN) according to applicants' CVs and industry knowledge. As a result of the study, the researchers established an AI based human resources management system (HRMS) and an intelligent HRMS and increased the efficiency of HRM.

2022	Suseno et al.	In their study, the researchers investigated the effects of high-performance work systems on the links between change readiness for AI adoption, beliefs of HR managers, and AI apprehension. In line with the research results, the beliefs and levels of worry around AI of HR managers were considerably impacted by their organizations' level of readiness for AI implementation. The researchers discovered that individuals who had positive beliefs were more likely to be open to embracing AI, whereas individuals feeling more significant concerns about it were prepared at a lower level for its implementation. They combined HR managers' beliefs, AI anxiety, and perceptions of implementing high-performance work systems within the company with the objective of presenting an insight into HR managers' readiness for AI adoption.
2022	Toprak et al.	In the study, the researchers investigated the usage of AI in HRM. Furthermore, they revealed the advantages and disadvantages of AI in HRM activities with the developing applications of AI and presented the impact of artificial intelligence on human resources management as a conceptual discussion.
2022	Oruçoğlu	The researcher studied the effect of Industry 4.0 and digitalization on HRM functions. As a result of the study conducted, the researcher found that Industry 4.0 affected all functions in the field of human resources and the most impacted functions were recruitment, employee training and employee empowerment, performance appraisal, industrial relations, job analysis and design, career development, job evaluation and remuneration, human resources planning, human resources information system, occupational health and safety, and HR metrics.
2022	Karaboğa and Karaboğa	In their study, the researchers presented a bibliometric analysis of studies on digitalization and digital technologies in the domain of HRM with a qualitative approach. The analysis results demonstrated that studies were clustered in three primary research areas: "HR Analytics," "e-HRM Approach," and "Industry 4.0, Smart HR Practices and Performance Relationship." Furthermore, the researchers indicated that the use and development of digital technologies in the domain of HRM was a new subject and the interest and studies in this domain would increase in the following years.
2022	Pan et al.	In the present research, the authors investigated the relationship between the behavioral limits imposed by AI adopting enterprises and the facilitators of such companies in the recruitment process. The study used the integration of the technology, organization, and environment (TOE) model with transaction cost theory with the objective of better comprehending numerous limitations and possible opportunities. The research findings demonstrated that firms' perceived

		complexity toward AI restricted AI adoption, whereas regulatory support and technology competence promoted AI adoption.
2022	Van Noordt et al.	In their study, the researchers determined that whereas AI was generally utilized for the purpose of improving public service delivery and internal management, there were still limitations to its usage in policy decision-making.
2022	Pal et al.	In the current research, the authors employed machine learning methods to categorize resumes, assist in skill extraction, and display various abilities under relevant job profile categories. The resume classification tool will enhance the effectiveness and usability of e-recruitment. The method in question will assist companies and, therefore, provide effort savings throughout the hiring process.
2022	Ming	The present research analyzed the effects of machine learning in applying human resource management, which is expanding and has considerable potential for enhancing HRM systems' performance and efficiency.
2021	Kumari and Hemalatha	The current research aimed to examine different AI technologies utilized in HRM practices and employees' perceptions of the said technologies. The study was performed in Chennai by employing the sociological survey approach, with participants comprising HR experts and employees in the IT sector. The researchers did not reveal a favorable impression of the AI system's attitude toward AI technologies among employees. They presented a review of the obstacles preventing the implementation of the AI system in HRM procedures. The research ensured a better understanding of the significance attached by enterprises to including AI technology in HRM practices, e.g., recruitment, planning and decision-making, training and development, work-life balance, and performance analysis.
2021	Zhu and Usman	The present study employed ML technology with the objective of managing and analyzing HR data in modern businesses. ML technology functioned as the HR system, decreased the business volume of HR, and enhanced the effectiveness and management level of HR.
2021	Qamar et al.	This research performed a comprehensive literature evaluation of AI in HRM. The study generated a one-of-a-kind AI-HRM concept map explaining how it was possible to utilize AI for the purpose of better comprehending the decision-making processes in HRM. Furthermore, the researchers presented a deeper knowledge of the ethical difficulties related to AI's applications in HRM. They suggested an indicative preliminary framework to integrate ethical practices and techniques in order to assist with the transition toward ethical AI.
2021	Wei and Jin	This study combined an optimized GM model and a backpropagation neural network model with the objective of enhancing the HRM system.

2021	Vrontis et al.	This study examined the impacts of AI, robotics, and other advanced technologies on HRM. The results demonstrate various opportunities for HRM but also significant challenges at technological and ethical levels.
2021	Tiwari et al.	This study investigated the relationship between AI and HR functions and the different functions carried out by the HR department. The results acquired through analysis indicated a positive connection between different factors, such as ease of use and innovation, which means that AI affects both factors.
2020	Nawaz	The present study aimed to provide an understanding of the usage of AI in HRM. The study reviewed 23 pertinent articles in the Scopus online database published between 1991-2020. In line with the research results, nine different HRM activities could benefit from AI technology application, ensuring that enterprises improve their effectiveness and efficiency levels with the objective of meeting their customers' needs better.
2020	Tewari and Pant	This research reviewed the studies of a number of famous experts with the aim of revealing how AI alters the domain of HRM.
2020	Jawad	This study suggested a website-based HRMS for the purpose of managing employee activity information, including registration, salary, and promotion. The HRMS comprised two sections: website design and database. Experimental findings demonstrated that high efficiency and performance in employee information storage and management were provided by the HRMS designed.
2020	Samarasinghe and Medis	This research reviewed the studies of a number of famous experts with the aim of revealing how AI alters the domain of HRM.
2020	Parsehyan	The present research investigated HR 4.0 in terms of technological compliance. It was indicated that significant benefits would be obtained in case of using AI in the recruitment, screening, interviewing, and training processes in organizations. The researcher also explained that the competitive power and transparency of organizations using AI in human resource management processes would be preserved.
2020	Bayarçelik	In this study, the author performed a literature review on the impacts of digital transformation on human resource management. As a result of the literature review, it was explained that artificial intelligence would automate the talent development process by transforming the operations of HR processes. Furthermore, it was stated that artificial intelligence accelerated the current processes and contributed to increasing productivity by evaluating the data of the organization's employees.

2020	Şendoğdu	This study researched how human resource management was impacted by Industry 4.0 developments. The study also explained the place of robotic resources in our life and the need for the concept of robotic resource management.
2020	Uğur and Güner	In the present research, the author explained the digital applications implemented in HR processes and the problems encountered when implementing these applications. It was reported that the digital applications used in HR processes facilitated the work of employees in the relevant processes and increased their speed.
2020	Qin et al.	The research in question introduced a Recurrent Neural Network (RNN)-based applicant-job matching framework by utilizing the word-level semantic representation, perception ability, and experience of job applicants. The aforesaid method was capable of decreasing dependence on manual labor and enhancing employability.
2019	Tambe et al.	This study demonstrated that AI deployments in HRM issues, e.g., staffing and selection, are becoming increasingly widespread and have dramatically decreased the cost and time of realizing the said functions.
2019	Alkan	In the current study, the author defined machine learning and the sub-concepts of machine learning, such as supervised learning, unsupervised learning, semi-supervised learning, reinforcement learning, and intensive learning, by assuming that the frequency of using ML management would increase during the change in the industry.
2019	Aksu and Sürgevil	This study explained the concept of digital competence by conducting a literature review. The research indicated the competencies sought the most by organizations in the technological age as digital literacy, information analysis, susceptibility to self-change, problem-solving skills, and digital emotional intelligence.
2019	Şekeroğlu and Özer	The present study performed a literature review and explained the impacts of AI and technology on HRM. It was revealed that using artificial intelligence in organizations contributed to finding the right candidate, particularly in recruitment processes, and establishing a system free from prejudices.
2019	Çiftçioğlu et al.	This research explained the relationship between Industry 4.0 and HRM. Additionally, it also explained the obstacles that would be encountered in the face of the transformations that innovations brought by developing technology with Industry 4.0 could bring to business life.

2019	Yawalkar	The said study explained the role of artificial intelligence in human resource management and the advantages and disadvantages that might occur if artificial intelligence was used in human resource management.
2019	Necula and Strîmbei	In the current study, an architecture was developed for enriching data semantically using semantic web technology and data science for talent training. The experimental findings demonstrated that the classification impact of the suggested architecture was higher compared to the common regression analysis, Random Forest (RF), and Support Vector Machine (SVM), and the suggested architecture could efficiently mark the resume data and utilize the semantic web for the purpose of extracting data information from the resume.
2019	Rykun	The present research found that a number of the main HRM areas that have already been transformed by AI involve labor-intensive and time-consuming duties in recruiting, e.g., reading numerous CVs and sorting them out, determining the most suitable candidates in a time fraction, and revealing the most appropriate training type for employees.
2018	Onik et al.	The present research suggested a Blockchain-based recruitment management system and HRMS algorithm. The obtained results indicated that the suggested system had definite advantages over the existing recruitment systems.
2018	Jarrahi	This study stated that AI revolutionized organizational decision-making and altered management approaches. It is possible to observe the tangible impacts of AI in corporate processes and key competencies, including knowledge management and consumer outcomes, e.g., service quality perceptions and satisfaction.
2018	Thite et al.	In the present research, the authors reported that electronic transition was experiencing two main obstacles in the perspectives of business and technology leaders. The first is the ability of HR to help business leaders with adopting a digital mindset and a digital way of organizing, managing, and leading change. The second is the ability of HR to transform the entire employee experience by transforming HR systems, processes, and the HR organization through new digital platforms, applications, and the way of providing HR services.

2. Material and Method

2.1. Industry 4.0

The term Industry 4.0, also named the Fourth Industrial Revolution, is defined as the business world in which people and machines are connected to each other by real-time data and which is fed through a digitized value chain (Samarasinghe and Medis, 2020). Industry 4.0 aims at systems

generating data with a high level of automation by creating a business environment in which the labor market will be replaced by machines that can think like humans. With Industry 4.0, human and machine activities are connected to a range of technologies, which are displayed in Figure 1.

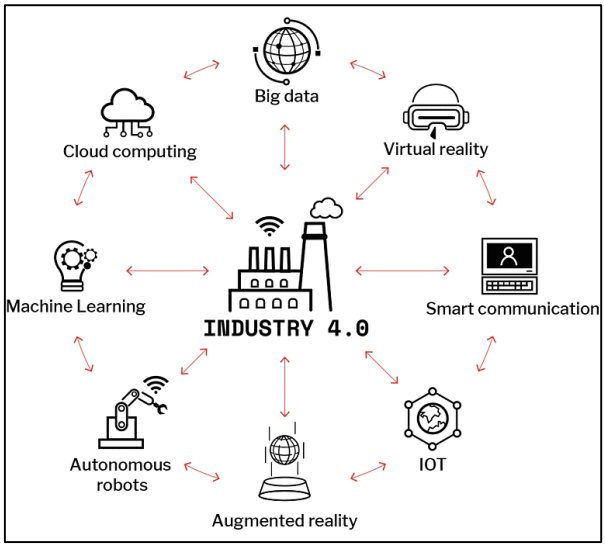

Figure 1. Industry 4.0 technology (Booth,2019).

2.2. Artificial Intelligence

McCarthy et al. introduced the concept of AI for the first time in 1956. Nevertheless, studies on AI were started by the English mathematician and computer scientist Alan Turing in 1950 (Kılıç Kırılmaz and Ateş, 2021; Soleimani, Intezari, and Taskin, 2021). However, despite the considerable contributions of the first scientists (Kılıç Kırılmaz and Ateş, 2021), the basic idea of artificial intelligence dates back to 1890 (James, 1890).

AI is, in general, imitating the working style of the human brain by transferring it to the computer environment. Complex relations are analyzed very easily owing to the ability of AI to learn, generalize, discover, and derive new information. In this respect, human beings exceed the limits of the power of human intelligence through AI technologies. Artificial intelligence applications that are increasing nowadays are utilized effectively in various fields, such as finance (Şengüler & İnel, 2022; Arda & Küçükkocaoğlu, 2021), health (Ullah et al., 2021; Batur & Diri, 2018), safety (Batur Dinler & Batur Şahin, 2021; Batur Şahin, 2021) voice processing (Korkmaz & Boyacı, 2022; Batur Dinler & Aydın, 2020), natural language processing (Lauriola et al., 2022; Ning 2022), production (Çiçek

et al., 2022; Dikel & Öz 2022), and human resource management (Ming, 2022; Vrontis et al., 2021; Wei & Jin, 2021).

As seen in Figure 2, AI basically comprises two main components. Therefore, it is also necessary to know the concepts of deep learning (DL) and machine learning (ML) to ensure a better understanding of the concept AI.

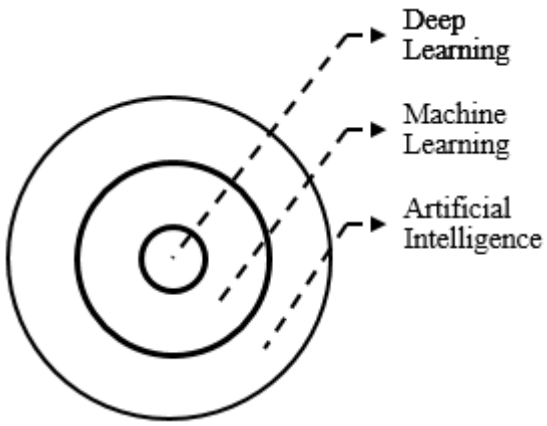

Figure 2. Component of AI.

2.2.1. Machine Learning

Machine Learning (ML), defined as pattern recognition and numerical learning, is one of the sub-branches of artificial intelligence. ML represents a system that can learn and ensures the structural development and studies of algorithms with the ability to predict using data. The said algorithms work by developing a model in order to create data-based predictions and decision mechanisms in accordance with the information from the model data inputs, instead of following and applying standard program commands without any interpretation (Gardner and Dorling, 1198; Batur Dinler and Aydın, 2020).

To briefly explain the concepts of machine learning;

- Supervised learning: It is acquiring data from systems that interact with each other and organizing these data in a certain order.
- Unsupervised learning: It is investigating in groups the data belonging to systems whose interaction with each other has not been determined and categorized yet.
- Semi-supervised learning: It is a combination of supervised and unsupervised learning. In other words, it is a learning method using both labeled small data and unlabeled big data.

- Reinforced learning: It is evaluating the information obtained as a result of the system's operation as true or false by the instructor.

2.2.2. Deep Learning

Deep learning (DL) is a model developed in 2006 based on the AI method and frequently used in the field of sound and image processing nowadays. It has a multi-layer structure in architectural terms, and due to this structure, it is able to host a lot of hidden information. With deep learning, the model automatically learns and summarizes the relevant information as the data pass through the network. The term "deep" denotes the number of layers in the network (i.e., the network's depth increases with an increase in the number of layers) (Eker et al, 2021).

When the difference between ML and DL technologies is compared, it is seen that machine learning performs a process in a single layer, while deep learning performs processes in multiple layers simultaneously. According to the system's size and complexity, DL tries to reach a single process result using multiple machine learning algorithms simultaneously and interpreting the results of these algorithms. For example, we need to separate the pictures of two planets, Mars and Earth. In machine learning, we should introduce the experience that human beings have acquired to the present day to the machine with parameters. The properties of these planets, tried to be introduced, are introduced to the system with a hypothesis sentence. We need to enter many parameters into our system, e.g., if there is water, it is probably the Earth; if its color is orange, it is probably Mars. However, DL can learn the difference between these parameters on its own. Hence, DL can learn on its own. If we introduce only the pictures of the Earth and Mars to the deep learning system, the system creates its own rules, reveals the difference between these pictures and recognizes distinctive elements, such as color and shape. Thus, the system can perform its operations by creating its own distinctive competencies without needing basic human skills.

3. Results and Discussion

The increasing number of Y-generation employees in working life and the entry of generation Z into working life, along with Industry 4.0, have accelerated digital business solutions in human resources. This transformation experienced has made digitalization indispensable in human resources and thus has caused institutions to move their human resources processes to digital platforms. For example, Vodafone Turkey was deemed worthy of special awards by the Great Place to Work Institute in the categories of "Digital Transformation in Human Resources" and "Diversity" with digitalization

in development programs and advancements in the field of education. It is observed that Vodafone Red Academy Learning Center has reached a target audience of approximately 29,000 people since 2015 by employing novel learning technologies with 3300 Vodafone, 7500 dealers, and 18,000 sub-dealer employees. It continuously supports the development of its employees with digital technologies through many applications such as the orientation program DiscoveRed, Leadership and Talent Development Programs, Specialization and Functional Development, and Strategic Development Programs. The "Over Sea (DenizAşırı)" program, which was implemented for the first time in Turkey in the field of online internship, is another example. With the said program developed by Deniz bank, it won the "Most Innovative Human Resources Technologies" award in 2017, showing the importance of digitalization (Çiftçioğlu et al., 2019). This demonstrates that digitalization has great importance in human resources on a global scale.

Artificial intelligence, which has started to show its presence in almost every sector, also takes a very significant place in human resource management. Artificial intelligence applications in human resources reduce the workload of administrative staff in the institution and can select the right candidates for the right position and duty. Moreover, they can suggest suitable training for employees to acquire skills, and with these analyses and reports provided by artificial intelligence, it helps the human resources unit to create a correct career plan for the institution's employee. Additionally, it helps to reduce the possibility of errors that may occur, prevent failures in the workflow of other units, and provide more efficient participation of employees (Yawalkar, 2019).

3.1. The Impacts of Industry 4.0 on Human Resource Management

In Industry 4.0, institutions should redesign human resources practices, such as performance evaluation, remuneration, staffing and training practices to encourage innovation and learning in their organizational structure. In this respect, to respond effectively to rapid technological developments, it should be ensured that new production capabilities are created, enabling firms to expand and renew their resource bases.

3.1.1. Performance Evolation

In Industry 4.0, the performance evaluation system must facilitate learning and innovation. Therefore, the institution should concentrate on the career development of employees, the behavior-based approach, and the result-based method. For employees' motivation, they must be informed

regularly about their performance. Furthermore, the presence of quantitative matrices that evaluate performance is very important for evaluating performance more objectively. For an ideal evaluation process, the performance criteria of the institution should be standardized, the expectations of the institution from its employees should be determined and shared with employees. It is characterized as measuring the actual performance, comparing the actual performance with the standardized performance criteria, evaluating and discussing this situation with employees, and initiating corrective actions when required.

3.1.2. Remuneration

The payroll system is one of the areas in which digitalization in human resource management is manifested in remuneration. Considering the calculation system of payrolls, we see that they are calculated with legal parameters. If this calculation is performed using a program, these operations can be performed faster, with less cost and fewer errors. Even in institutions with the number of employees reaching thousands, remuneration can be performed easily using such programs. Using these systems, called digital remuneration, the mentioned calculations, in which mistakes to be made while calculating social rights, advance payments, enforcement, and other deductions cause considerable costs, are made perfectly. These systems can submit employees' requests, such as advance payments, for the approval of their managers through the system. Additionally, payrolls approved in digital archives can be archived. The significance of the corporate portal increases with the spread of digitalization in human resource management. The TofaşGo project developed by the Tofaş company, a pioneer in many fields in Turkey, is among the best examples we can give in this regard. In this project, the Tofaş company developed a corporate mobile and web platform gathering its employees under a single roof. With the above-mentioned Industry 4.0 project, Tofaş can access many HRM processes, such as annual leave requests and monitoring of employees, payrolls, management of employee fund requests, monitoring of time management reports, monitoring of vacancies in companies within the Koç group, and monitoring of applications for these positions, via this application (Ogoo Digital, 2017).

3.1.3. Staffing

Institutions have to enhance their recruitment processes since placing an incorrect candidate in a position and a mistake he/she will make in this position can cause considerable costs for the institution. Therefore, institutions should focus on determining the innovative behaviors of candidates

and their openness to innovation using psychometric tests in the candidate selection process. Thus, the institution establishes its staffing system on solid foundations. Creativity, flexible thinking, active imagination, intellectual curiosity, and openness to new experience are other issues that institutions should consider and test in candidate interviews. The employees included in the staff by the institution by taking into account these parameters will adapt more easily to the innovations coming with Industry 4.0 (Çiftçioğlu et al. 2019).

The use of artificial intelligence with Industry 4.0 is among the most important developments in the staffing process. Using artificial intelligence applications in these processes ensures that these processes are carried out faster and with less cost. One of the most striking examples used nowadays is the Mya Artificial Intelligence Recruitment Assistant. In the applications made in institutions using the Mya Artificial Intelligence Recruitment Assistant, it is observed that the staff working in the recruitment process saves 75% of their working time. Furthermore, it was seen that the satisfaction rate of candidates in the job interviews with Mya was found as 9.8 out of 10. L'Oréal, a global cosmetics company, uses the Mya artificial intelligence recruitment assistant in the recruitment process. Artificial intelligence, which performs the recruitment process for various positions, has been successfully implemented in the US, England, and France since September 2018. Using this artificial intelligence application, L'Oréal has caught the chance to evaluate more than 1 million applications per year, increasing the probability of finding suitable candidates. Niilesh Bhoite, the Head of Human Resources & Digital at L'Oréal, expressed their satisfaction with the positive impacts of the artificial intelligence application in the recruitment process in the following way, "As L'Oréal, we have observed that, in the job interviews with 10,000 people, the artificial intelligence system communicates more efficiently with 92% of the candidates and reaches a 100% satisfaction rate. We have received very positive feedback from the applicants about how easy the system is and that they feel really special." payroll system is one of the areas in which digitalization in human resource management is manifested in remuneration. Considering the calculation system of payrolls, we see that they are calculated with legal parameters. If this calculation is performed using a program, these operations can be performed faster, with less cost and fewer errors. Even in institutions with the number of employees reaching thousands, remuneration can be performed easily using such programs. Using these systems, called digital remuneration, the mentioned calculations, in which mistakes to be made while calculating social rights, advance payments, enforcement, and other.

3.1.4. Training Programs

Institutions must design training programs aimed at improving innovative skills, continuous learning, and development for Industry 4.0. It is recommended to organize training programs aiming at multiple assignments for the personnel working within institutions. It is suggested that the training program organized should be of a nature developing the competencies of employees rather than being directly related to their job. These training programs should be long-term and continuous, not short-term. Furthermore, it is suggested that the personnel working within institutions should be supported by mentoring and on-the-job coaching practices from the moment they first start to work to help them improve their teamwork and problem-solving competencies (Çiftçioğlu et al. 2019).

3.1.5. Management by Objectives

It is seen that management by objectives has gained popularity among numerous assessment approaches. This approach is described as "a performance evaluation that aims to achieve the previously determined goals and involves mutual goal setting and evaluation." In this program, managers and employees determine the methods of mutual discussion and declaring ideas and reaching goals by consensus. Additionally, since there is constant feedback in this program, it allows managers and employees to monitor activities and take regulatory actions accordingly. Hence, it is indicated that the management by objectives approach is a performance evaluation approach compatible with Industry 4.0.

3.2. The Impacts of Artificial Intelligence on Human Resource Management

AI plays a role in different HR applications ranging from acquiring abilities in human resource management to evaluating the performance of people in the workplace.

3.2.1. During the Recruitment Period

The recruitment process, one of the main processes of human resources, is a process that may cause very considerable costs even for a medium-sized institution. The mismanagement of this process or experiencing troubles in the process can have significant effects that will impact the company's future strategic plans.

The cost and time losses caused by the exams and interviews for the institution to identify the suitable candidates for the relevant position among the hundreds of applications made for an employee candidate planned to be taken for any position and select the employee candidate with the competencies for this position among these applications are considerable. In this case, artificial intelligence appears to be an effective tool for HR. The process of finding employee candidates, which should be done in the first step of recruitment, is not carried out in the form of one-to-one applications but rather through intermediary websites or the institution's own web address nowadays. The CVs uploaded by candidates to these websites to find a job constitute a database to be used in selecting the right candidate for the institution. AI based tools take the candidate's CV and job description as input. ML algorithms are defined as the general learning function Y = f (X), in which the AI based tool predicts in the future "Y" considering novel examples of input variables "X", i.e., the HR data concerning the best matches of jobs to candidates available for the algorithm's training. The function f is not known, and it must be learned by the AI based tool from data by utilizing ML algorithms. To express it in a more specific way, AI based candidate identification tools utilize a newly established job posting and screen the resume databases of the firm (which can comprise a high number of resumes) and present suitable candidates to the attention of the recruiter. More developed tools offer possibilities for visiting social platforms, e.g., Facebook, LinkedIn, etc., at a frequency specified in advance and adding profiles of individuals matching with the particular keywords identified by recruiters into the applicant tracking software. Both tool types utilize similar contextual search and matching algorithms for the purpose of scrutinizing numerous resumes (Kulkarni and Che, 2019). The workflow is displayed in Figure 3 below:

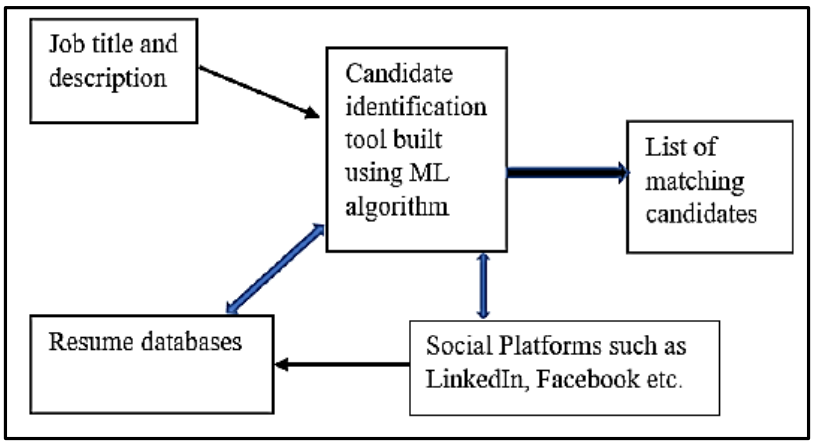

Figure 3. The typical workflow diagram of an AI based candidate identification tool (Kulkarni and Che, 2019: 11).

However, it is very difficult and time-consuming for the institution to find the right employee candidate from this database with its own efforts. This is exactly where artificial intelligence filtering features come into play. Owing to this feature of artificial intelligence, the institution eliminates most candidates, and in this case, it prevents the loss of time and cost for other steps.

The interviews and exams conducted before contacting the HR unit and creating any workload for this unit display another effect of artificial intelligence on this process. Mya chatbots can be given as an example of this. This chatbot, created by Mya systems, an enterprise and innovation company, conducts an online interview with candidates applying for a job, and when this interview ends, it scores the candidate in the Mya application system and uploads this report to the system. As a result of this report uploaded, if the candidate has been able to impress Mya, Mya ensures that this candidate meets with the human resources recruitment unit to initiate the other steps of the process. Moreover, it ensures that the necessary information is transferred to the employee candidate during the recruitment steps. Mya, one of the most used software by human resources units of medium- and large-scale institutions, provides 70% time savings to the institution during the recruitment process (Medium, 2018).

3.2.2. In the Educational Process uring the Recruitment Period

Orientation training is extremely important for the hired employee to adapt to the workplace and adopt the corporate culture and policy. The impact of artificial intelligence in this area is observed with virtual assistants. Virtual assistants can provide consultancy to employees during the orientation process and analyze the results of tests measuring the effectiveness of the training received by employees during the orientation program using various analysis techniques. As a result of these analyses, the strengths or weaknesses in the employee's performance can be determined and presented to the human resources unit in the form of a report. Virtual assistants conduct the activity analysis of the training received by the newly recruited employee in the orientation program. Virtual assistants perform these analyses by asking questions about the training received, the educator in this training, the educational environment, and the used materials to the employee. Thus, the satisfaction survey about the training carried out by the human resources unit after each training organization is performed automatically. Thus, a more systematic data analysis is performed, unnecessary costs are reduced, and time losses are also reduced in the training process. In this case, the personnel working in the human resources unit can allocate more time to employees' issues, such as remuneration, family

problems, social activities, communication, talent management, etc., and, thus, the bond of belonging and loyalty of the employee to the institution will increase.

3.2.3. Employee Commitment

Many IT companies check all e-mail correspondence and internal communication portal correspondence of its employees before a certain date, examine the sentences established by its employees and words and emojis used, warn the human resources unit about employee commitment, make suggestions specific to the relevant person to increase his/her commitment and can present a report.

4. Conclusions and Recommendations

With the development of technology, every product or service in the human environment undergoes change. Organizations that can keep up with the said change can survive, whereas others lose their market shares one by one. It is a fact that must be known that organizations that want to survive should also include their employees as well as customers, products, and services in their list of importance. A correctly positioned and structured human resources unit can select and train the best employee who can be beneficial to the organization. However, the opposite situation can lead the organization to a disaster.

The present study investigated the effects of Industry 4.0 and artificial intelligence technologies on HRM. Considering the literature review, it was found that Industry 4.0 provides positive effects such as time and cost savings, unbiased evaluation, reduction of workload, increased productivity, analyzing and collecting data in organizations' functions of human resources management, such as selection and placement, orientation and integration, wage management, performance management, career management, training and development management. Industry 4.0 and artificial intelligence technologies have taken their place among the most important tools that can help integrate artificial intelligence into human resources activities in an organization and find suitable employee candidates, especially when we consider the increasing human population. Hence, it was revealed that manual processes of most organizations were transformed into chatbots, machine learning, deep learning, robot, automation, expert systems, and autonomous systems and this transformation was slow and new and would become increasingly popular and develop further. On the other hand, the systematic literature review stressed that the need for human capital would decrease and new business areas would emerge. Additionally, the fact that organizational culture and employees find the use of

Industry 4.0 and artificial intelligence technologies complex and their prejudiced approach to using these technologies were evaluated as a negative effect. It is thought that this information acquired by reviewing 45 current articles will contribute to the literature.

Although the known effects of Industry 4.0 and artificial intelligence on people and processes are limited at the present moment, it is clearly foreseen that this technology will become widespread and accelerate in the future. In this regard, it is thought that it will lead to a great change, transformation, and development in the information, information management, information processing system, and information technology to be used in the field of human resources management, and the importance of the e-HRM concept will increase and become widespread. It can be argued that these technologies, whose boundaries we still cannot solve, may form the basis of the concept of unmanned human resources in the future.

Authors Contribution

Both authors contributed equally to the study

Conflict of Interest Statement

There is no conflict of interest between the authors.

Research and Publication Ethics Statement

Research and publication ethics were complied with in this study.

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