



Artificial Intelligence in Human Resources Management: A Review and Research Agenda

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Abstract

Background: *Researchers and practitioners both exhibit a growing interest in the application of Artificial Intelligence in Human Resources Management. However, research shows that there remains a substantial gap between the promise of AI and its practical application in organizations. Previous research has identified some of the challenges facing the application of Artificial Intelligence in Human Resources Management. Among these challenges is the varied nature of Human Resources functions. To address this, we adopt the Human Resource Life Cycle, which is composed of 6 dimensions that closely mirror the Human Resource functions that exist in many organizations: 1) Strategic Planning, 2) Recruitment and Deployment, 3) Training and Development, 4) Performance Management, 5) Compensation Management, and 6) Human Relations Management.*

Method: *Through a scoping literature review, we have identified 85 articles on the topic and classified them based on the 6 dimensions of the Human Resource Life Cycle.*

Results: *Our scoping review found that Artificial Intelligence has already been studied in relation to all 6 dimensions of the Human Resource Life Cycle. In addition, a seventh dimension was identified and integrated into the existing Human Resource Life Cycle framework: Legal and Ethical Issues. Based on the scoping review, a research agenda is presented to provide guidance for future research in the field of Artificial Intelligence in Human Resources Management.*

Conclusion: *All 6 dimensions of the Human Resource Life Cycle, along with the seventh dimension – Legal and Ethical Issues – are already present in the literature. Future research could focus on the impact of AI on connections between dimensions, as well as the impact on HR-specific outcomes. Practitioners must recognize the limitations related to the application of AI in Human Resources Management, even though AI should still be viewed as a solution to many challenges facing Human Resources Management in organizations.*

Keywords: Human Resources Management, Artificial Intelligence, Human Resource Life Cycle, Scoping Review, Research Agenda.

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Introduction

The greatest competitive advantage to an organization in uncertain times is insight into its employees (DiClaudio, 2019). Around the world, organizations are actively seeking new analytical tools and emerging practices to improve their decision-making capabilities, in order to develop new sources of business value: artificial intelligence (AI) is one of these new tools (Baldegger et al., 2020; Johnson et al., 2021). AI refers to technologies that allow computers to replicate human abilities, including learning, adapting, interacting, reasoning, and optimizing (Chedrawi & Haddad, 2022). In fact, AI is expected to occupy an increasingly important role in organizations and in society at large in the near future (Nguyen et al., 2022), possibly even being the solution to major societal problems such as corporate social responsibility (Pai & Chandra, 2022) and sustainability (Bracarense et al., 2022). Gikopoulos (2019) notes that AI already surrounds us, from self-driving cars to customer-service chatbots. AI has already begun to transform the labour market, with humans using – or being replaced by – AI in various circumstances (Wibowo et al., 2022). Within organizations, AI is already used in a wide range of disciplines and for a wide variety of functions, including finance, marketing, operations, human resources management, and beyond. In a recent study, Nguyen et al. (2022) identified five research opportunities related to AI in business: 1) AI and Organizations, 2) AI and Markets, 3) AI and Groups, 4) AI and Individuals, and 5) AI Development. Nguyen et al. (2022) also highlight the relative lack of academic research on AI at the individual and organizational level, despite the growing interest of AI amongst practitioners of a myriad of disciplines. One such discipline is Human Resources Management (HRM).

While the stereotypical view of HRM might consider it to be more people-oriented than data-oriented, Davenport (2019) claims that HRM has in fact become the most analytics-driven function in organizations today. Because of this increase reliance on data analytics, HRM should be a prime candidate for the application of AI. In fact, AI is already being used in many organizations to perform HRM functions, from making hiring decisions (Tambe et al., 2019), to training employees (Vrontis et al., 2021), to monitoring employee performance (Bales & Stone, 2020). The Society of Human Resource Management has identified AI as one of the key drivers of HRM in the future (Johnson et al., 2021). This has resulted in an increased interest in AI in HRM from practitioners, which has been mirrored by an increased number of researchers who are turning their attention towards the topic (Vrontis et al., 2021). Interestingly, these researchers do not originate solely from within the discipline of HRM, but also from other disciplines, such as Information Systems (IS), management, and other fields, showing that the topic is interdisciplinary in nature. Additionally, research into AI in HRM responds to the research opportunities identified by Nguyen et al. (2022) through HRM's focus on organizations and individuals. Nevertheless, despite the increased interest into AI in HRM by practitioners and researchers, there remain a significant number of areas to explore (Vrontis et al., 2021).

As a practical discipline, HRM is composed of such functions as recruitment, training, performance management, and compensation. Together, these functions form the HR Life Cycle (Jia et al., 2018). Recent research in the field of Strategic Human Resource Management (SHRM) has increasingly focused on the interrelationships and synergies between different HR functions. One of the main assumptions of this research is that the effectiveness of one HR function depends on other HR functions (Boon et al., 2019). By extension, research into AI in HRM should consider the interrelations between the various HR functions, in order to leverage the synergies identified by researchers in SHRM. In doing so, research into AI in HRM can become part of the broader research into SHRM. The HR Life Cycle therefore provides a foundation upon which future research in AI in HRM can be conducted. In order to guide researchers, this paper aims to fill the gap in the literature by answering the following research questions:

RQ1. How has the existing literature on AI in HRM addressed the HR functions in organizations?

RQ2. How can a better understanding of the HR functions in organizations guide future research into AI in HRM?

In order to answer the research questions of this study, a scoping literature review was conducted. Scoping reviews differ from other types of reviews – such as narrative and descriptive reviews – by focusing on the breadth of the literature rather than its depth, with a view to be as comprehensive as possible (Paré et al., 2015). A scoping review is appropriate for answering these research questions because it is necessary to assess the literature discussing all of the HR functions in organizations, rather than conducting an in-depth evaluation of the literature discussing a single HR function.

By answering these research questions, this study contributes to the IS and HRM literature in three ways. First, a scoping review was conducted on the topic of AI in HRM, in order to provide an indication of the size and nature of the available literature. On the IS side, this scoping review contributes to the literature by drawing attention to specific challenges and limitations related to the application of AI in HRM. On the HRM side, the scoping review contributes to the literature by highlighting the technological capabilities of AI that might be of interest to HRM. As a result of this scoping review, 85 relevant articles were identified, which in turn were classified based on the 6 dimensions of the HR Life Cycle (i.e., *Strategic Planning, Recruitment and Deployment, Training and Development, Performance Management, Compensation Management, and Human Relations Management*) (Jia et al., 2018). As part of the process of classifying the articles based on the dimensions of the HR Life Cycle, a seventh dimension – *Legal and Ethical Issues* – was identified. Due to the importance of legal and ethical considerations to the HR profession, this seventh dimension was integrated into the existing HR Life Cycle framework. A future research agenda is presented based on the results of the scoping review. In this agenda, potential research questions related to the use of AI in each of the dimensions of the HR Life Cycle are proposed.

The remainder of this paper is structured as follows. First, the background on the topic, which led to the research questions above, is presented. Then, the methodology of the study is described, followed by the results of the study, including an overview of the existing literature related to the use of AI in each of the dimensions of the HR Life Cycle. Finally, the findings of the study are used to develop the aforementioned future research agenda, and the implications for research and for practice are discussed, including specific implications for the Asia-Pacific Region.

Background

The term “artificial intelligence” was originally defined in 1950s as “making a machine behave in ways that would be called intelligent if a human were so behaving” (McCarthy et al., 2006; Pillai & Sivathanu, 2020). Since that time, the concept of AI has evolved to encompass various technologies which makes the term unclear and difficult to define (Ågerfalk et al., 2021; Nguyen et al., 2022). Significant research into AI began in the 1960s and 1970s, but the lack of computational power limited the practical outcomes (Benbya et al., 2021). Expert systems emerged as the first practical application of AI in the 1980s and 1990s, while research into machine learning and neural networks in the early 2000s has led to a proliferation of business applications for AI (Benbya et al., 2021).

In fact, the contemporary debate suggests that AI is actually a broader category of technologies (Ågerfalk et al., 2021; Benbya et al., 2021). Benbya et al. (2021) provide examples of practical applications, which range from analyses on big data (e.g. machine

learning) to self-driving cars (e.g. deep learning) to automating factory tasks (e.g. robots). Machine learning (ML) in particular has received considerable interest from researchers and practitioners, as ML has been shown to be superior than human intelligence in situations where decisions must be made quickly based on large volumes of data (Asatiani et al., 2021). ML also enables AI to play an active role in knowledge creation (Nguyen et al., 2022). However, ML operates differently than human cognition, oftentimes resulting in accusations of inscrutability (Asatiani et al., 2021). Nevertheless, despite challenges such as inscrutability, the promise of AI has been embraced by many organizations and disciplines, including HRM (Tambe et al., 2019).

The increasing interest amongst both practitioners and researchers in the application of AI in HRM (Vrontis et al., 2021) provides support to Davenport's (2019) claim that HRM has become the most analytics-driven function in organizations. Certain capabilities of AI in particular are of interest to HR practitioners, namely AI's capability to process high volumes of data (Vrontis et al., 2021), along with its capability to use machine learning to learn from past data to predict future outcomes (Benbya et al., 2021; Tambe et al., 2019). For example, an organization seeking to recruit high-quality talent might look at the top performers in the organization – their background, education, previous experience, etc. – and attempt to predict which job candidates will become top performers. While this exercise could be done manually, an AI can process the data much quicker. In addition, as candidates are hired and their performance is evaluated, the AI can learn which candidates have indeed become top performers and refine its predictions for the future accordingly.

In their paper, Tambe et al. (2019) develop a four-phase life cycle for AI-supported HRM, namely: 1) operations, 2) data generation, 3) machine learning, and 4) decision-making. The first phase, operations, consists of the various HR functions performed by the organization, such as recruitment, performance management, etc. The second phase, data generation, consists of extracting the data produced by the various HR functions. This might include data from job applications, training programs, performance evaluations, compensation, etc. The third phase, machine learning, consists of using the data generated to train the AI, developing an algorithm that can be used to make predictions about future outcomes. The final phase, decision-making, consists of deriving insights from the algorithm to make decisions related to HR functions. These decisions are then used as part of the organization's HR functions, which in turn begins the cycle again (Tambe et al., 2019). As each cycle generates more data, the machine learning process refines the algorithm, allowing new and improved insights to be derived.

However, there remains a substantial gap between the promise of AI and the practical application of AI in organizations (Tambe et al., 2019). Tambe et al. (2019) identified four challenges related to the adoption of AI in HRM:

1. Many HR phenomena are more complex than in other business disciplines. For example, the characteristics of a "good employee" are difficult to quantify and may vary from one organization to another. This makes it difficult to generalize from one organization or situation to another.
2. Many HR outcomes result in small (or non-existent) data sets. In order to be effectively employed, certain AI technologies – such as those based on machine learning – require large data sets to train the model, but many HR functions do not generate the volume of data that would be required. For example, dismissals are relatively rare events, so it is unlikely that an organization can collect enough data points to be used for machine learning purposes. This challenge is even greater in smaller organizations, where there are even fewer employees to generate the required data points.
3. Many HR outcomes must comply with legal and ethical guidelines, which add constraints on the capability of AI to make decisions. For example, each jurisdiction – country, state, province, etc. – has its own set of employment laws governing how

organizations manage their employees; the use of AI cannot violate any applicable laws. In addition, organizations that operate in multiple jurisdictions must take into consideration multiple sets of laws, which are not always compatible with each other, further complicating the task of generalizing from one situation to another.

4. Many HR decisions affect employees, either individually or as a group, such that the inscrutable nature of AI decision-making can often cause dissatisfaction with the outcome. For example, employees have a reasonable expectation that decisions will be made fairly and objectively, but that they will not be treated merely as numbers or variables in an equation. Furthermore, there are societal norms about what factors should and should not be taken into consideration when making decisions about employees (Tambe et al., 2019); employees must feel that the decision-making process does not violate these norms.

In identifying the four challenges, Tambe et al. (2019) draw attention to the fact that the application of AI in HRM is more than just the deployment of a technology: it is also necessary to consider how the technology responds to the needs and context of HRM. As a cautionary tale, Tambe et al. (2019) relate the case of Amazon, which discovered that its hiring algorithm was biased against female applicants because it had identified a causal relationship between sex and job performance based on the data that was used to train the AI. Even when the sex of applicants was excluded from the algorithm, the AI excluded applicants based on other attributes associated with women candidates, such as educational background. From a purely technological perspective, the AI deployed by Amazon might have been considered successful, but from a practical HRM perspective the AI must be considered a failure because it did not comply with the necessary legal and ethical guidelines.

Additionally, the application of AI in HRM faces challenges derived from the varied nature of HR functions – recruitment, selection, onboarding, training, performance management, compensation management, etc. – all of which have their own needs (Tambe et al., 2019). While each of these HR functions can be considered individually, in practice they do not exist in a vacuum: they are all part of the HR Life Cycle (Tambe et al., 2019; Jia et al., 2018). Following Jia et al. (2018), this study adopts the HR Life Cycle, which consists of 6 dimensions that closely mirror the HR functions that exist in many organizations. The 6 dimensions are:

1. *Strategic Planning*, which includes activities related to establishing the HR strategy and vision for the organization, determining present and future personnel needs, as well as providing direction to the other HR functions.
2. *Recruitment and Deployment*, which includes activities related to attracting and selecting external candidates, onboarding new hires, and identifying internal candidates for promotions and transfers.
3. *Training and Development*, which includes activities related to improving the knowledge, skills, and abilities of employees for their current job (i.e. training), as well as preparing them for future jobs (i.e. development).
4. *Performance Management*, which includes the monitoring of employees as they complete their tasks, as well as the evaluation of their performance on the job.
5. *Compensation Management*, which includes motivating employees to achieve the organization's goals, rewarding employees for their performance, and retaining employees.
6. *Human Relations Management*, which includes managing the employer-employee relationship, ensuring compliance with applicable employment legislation and organizational policies, and managing the employer-union relationship (i.e. in unionized environments).

As shown in Figure 1, these 6 dimensions form a cycle, with the outputs from one forming the inputs for the next. To illustrate the HR Life Cycle in practice, consider the following. An organization begins with its *Strategic Planning* at the organizational level – operations, finance,

marketing, etc. – and the HR strategy must be developed to respond to the organization's needs. Once the *Strategic Planning* is done, employees must be recruited or deployed to achieve the organization's goals. Employees will not always be fully prepared for their role in the organization, so *Training and Development* activities are required. Once the employees are doing their jobs, their performance can be monitored and evaluated. *Compensation Management* can then be used to reward performance, to motivate, and to retain employees. Other issues can be addressed through *Human Relations Management*, such as employee engagement, the labour relations climate, legal compliance, etc. Finally, all of the data generated throughout this Life Cycle then becomes part of the *Strategic Planning* process for the next cycle.

While numerous papers have addressed one or more of the 6 dimensions of the HR Life Cycle, only a few have addressed the concept of the HR Life Cycle itself (e.g., Jia et al., 2018; Tambe et al., 2019). In order to guide future research towards a holistic view of AI in HRM, a scoping review of the literature is needed (Paré et al., 2015) along with a research agenda touching on each of these dimensions to illuminate potential research questions that could be answered to further develop the research on the topic. A recent conference paper began this work by presenting the preliminary findings of a scoping review (Gélinas et al., 2022). The present paper expands upon this paper through a more detailed scoping review, the addition of a research question related to future research into the topic of AI in HRM, and the presentation of a future research agenda to answer this second research question. In the following section, the methodology of the study will be described, leading to the results of the study and its implications.

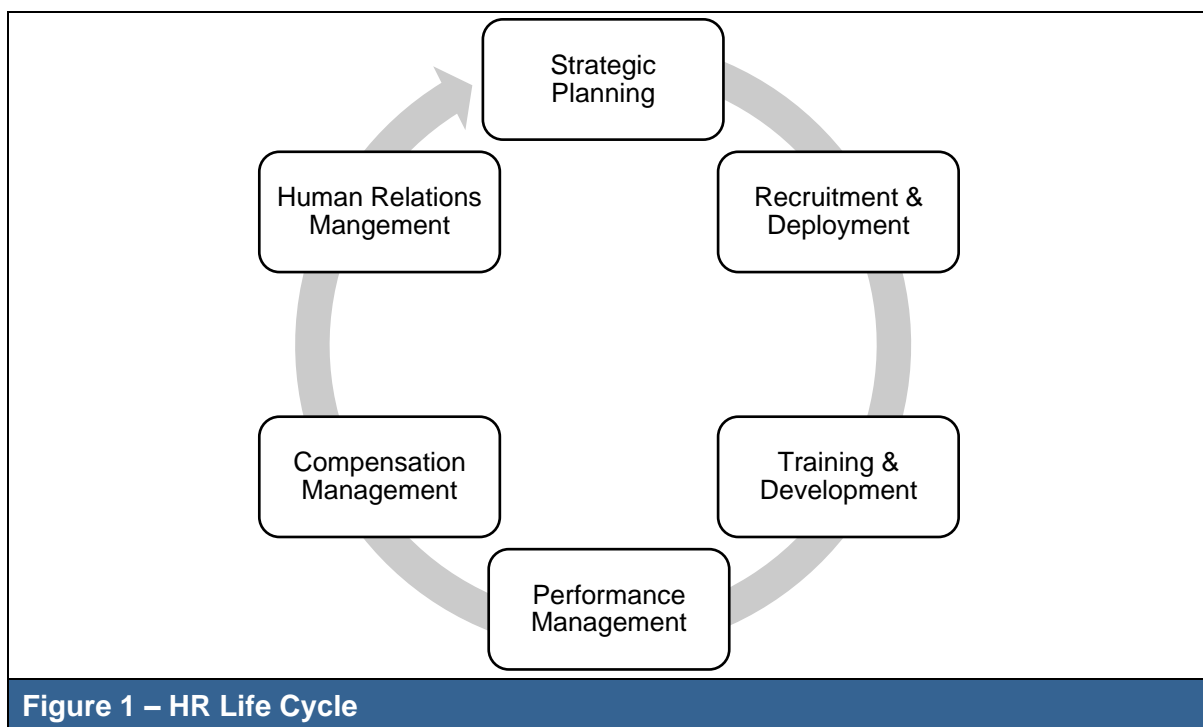


Figure 1 – HR Life Cycle

Methodology

In order to answer the research questions of this study, a scoping literature review was conducted. A scoping review is appropriate for answering these research questions, since scoping reviews attempt to be as comprehensive as possible, by focusing on the breadth of the literature rather than its depth (Paré et al., 2015). In consideration that the topic is inherently interdisciplinary, searches were first conducted in the leading IS journals, as well as the leading HRM and Management journals, as recommended by Webster and Watson (2002). See Appendix A for the full list of journals searched. In addition, searches were conducted in three databases of business journals: Business Source Complete, ProQuest, and ABI/INFORM Global. Due to the interdisciplinary nature of AI research, the inclusion of the three databases ensured we located relevant literature published outside traditional IS, HRM, and Management journals (Nguyen et al., 2022). The journals and databases were searched without any restrictions on publication date¹, to avoid arbitrarily limiting the results. Finally, the results from the databases were limited to “English” results.

Using the standard Boolean operations “OR” and “AND” allowed for the use of a single search string:

(human resource OR personnel OR HR OR SHRM OR management) AND (artificial intelligence OR AI OR machine learning OR ML OR algorithm OR algorithmic)

In order to ensure comprehensiveness, this string was first used to search the full texts of the selected journals and databases. However, for the three databases, this resulted in an excessive number of matches; in order to reduce the results to a practical number, the same search string was also applied to the abstracts and keywords.

These search parameters initially returned 3,958 matches. Therefore, a multi-step process was employed to select the articles for inclusion in the study. In the first step, duplicate results from different databases were removed, along with results that were not articles, such as book reviews, editorials, and “About Our Authors” items. In addition, it was discovered that the search parameters returned a large number of matches to medical journals, where HR = “heart rate” and ML = “milliliters”; these journals were removed from consideration based on the journal title. This first step excluded 927 articles from consideration.

Next, the abstracts for the remaining articles were read and evaluated for inclusion. To be included at this step, the abstract needed to reference AI or related terms (e.g. machine learning), as well as either HRM generally, or a specific HR function or dimension of the HR Life Cycle (e.g. recruitment, training). This step excluded 2,886 articles from consideration. The full text of the remaining 145 articles were then evaluated for inclusion; to be included, an article needed to discuss the use of AI in HRM: articles that mention HR in passing (e.g., because the study collected data from the HR Department of an organization) or that used AI in the analysis of research data (i.e., where AI was a tool used by researchers, not the focus of the study) were excluded. 51 articles were retained after this step.

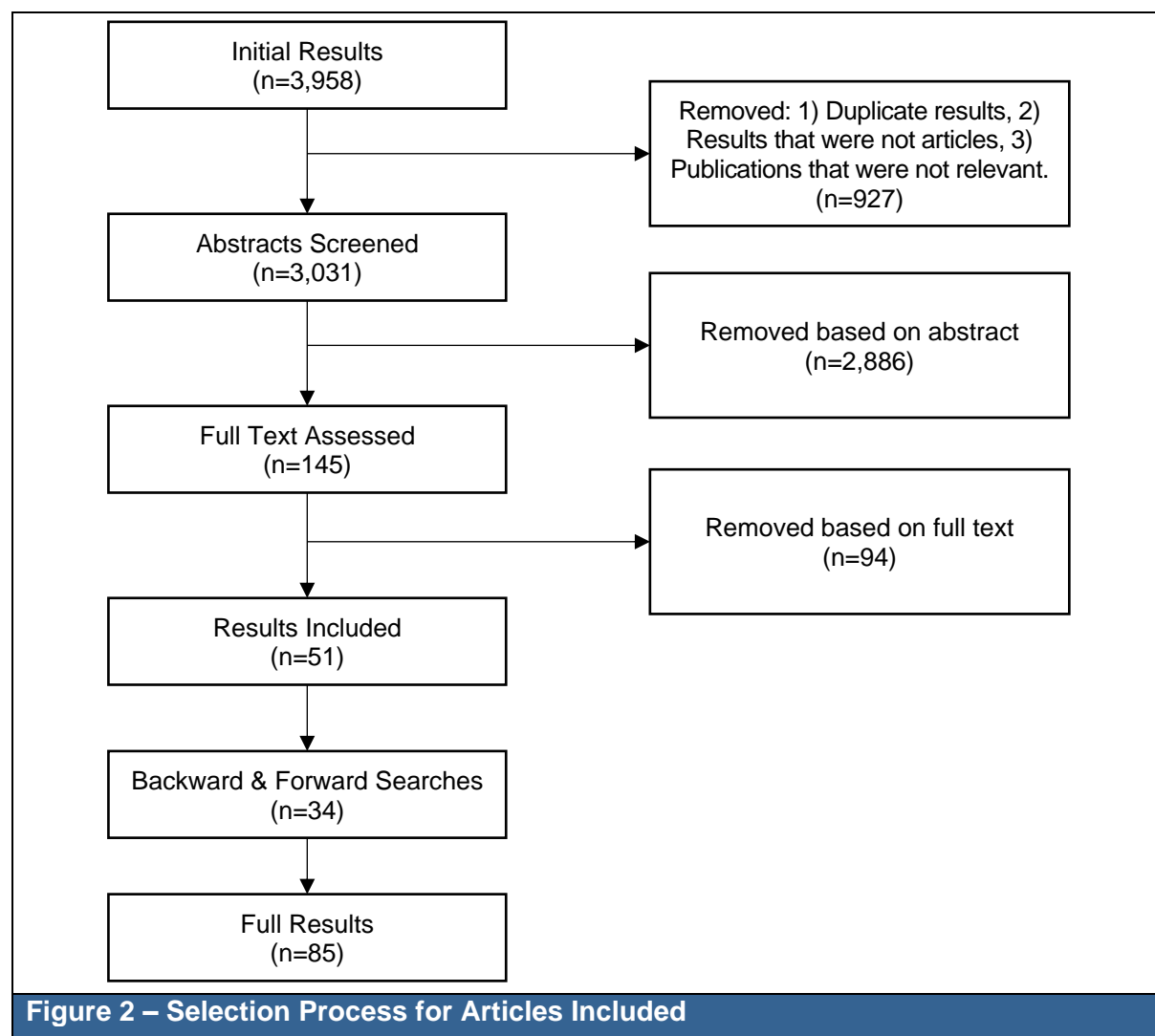
Finally, as recommended by Webster and Watson (2002), a backward search was conducted by reviewing the reference lists of the 51 articles, while a forward search was conducted by entering each of the articles in Google Scholar and examining the “Cited by” data. The backward and forward searches identified 77 potentially relevant articles, each of which was evaluated following the same process. Of the 77 articles, 34 were retained, for a total of 85 articles. See Figure 2 for the selection process of the articles included in this review and Appendix B for the final list of articles.

¹Please note that the search was conducted in October 2021.

Once the 85 articles were selected, each was read thoroughly and coded by the first author based on the dimension(s) of the HR Life Cycle included. In order to be coded as “including” a given dimension, it was necessary for the article to discuss it in a substantive way, either as part of the background of the study being conducted, as part of the results of the study, or as part of the discussion of the study. A passing mention to a dimension that had no relevance to the study was not considered sufficient to be counted. In order to increase the reliability of the coding, a sample of the articles was coded independently by a graduate research assistant. The coding performed by the research assistant was compared to the coding performed by the first author, resulting in a 91% agreement rate. To resolve the discrepancies, the first author met with the graduate research assistant to discuss the coding. As a result of this meeting, the two coders reached agreement. See Appendix C for the final coding of the 85 articles.

Results

Of the 85 articles retained, 6 were from the leading IS journals, while 11 were from the leading HRM and Management journals; the remaining 68 articles were from other journals. Fifteen of the articles were published before 2019, with the remainder being published between 2019 and October 2021 (see Figure 3); the increased interest in the topic since 2019 justifies the need for a scoping review, both to address the existing literature and to guide future research opportunities.



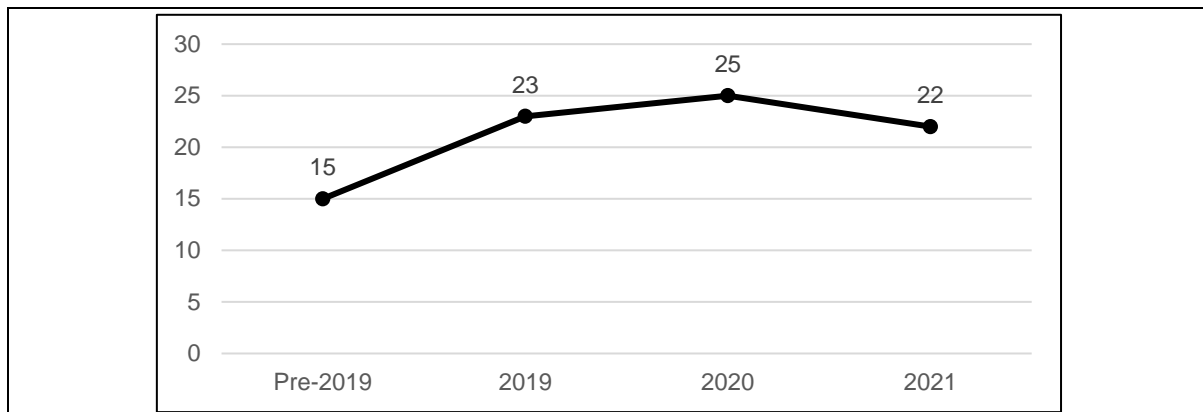


Figure 3 – Timeline of Publications

Human Resources Dimensions

In analyzing the 85 articles, it was found that all 6 dimensions were represented in the existing literature to varying degrees. In addition, a seventh dimension was identified that could not be matched to one of the 6 dimensions of the HR Life Cycle: Legal and Ethical Issues related to the use of AI in HRM. This finding is consistent with the inclusion of legal and ethical issues in the research on AI in other contexts, such as the research on AI in corporate social responsibility (e.g. Pai & Chandra, 2022). Since legal and ethical concerns can be present at any point in the HR Life Cycle, and must inform the use of AI at all levels (Gulliford & Dixon, 2019), this seventh dimension is conceptualized as a contextual dimension surrounding the HR Life Cycle as a whole (see Figure 4).

Table 1 shows the number of dimensions discussed per article, among IS journals and among HRM and Management Journals. Of the 85 articles, 53 discussed only 1 of the 7 dimensions, while 3 discussed 6 of the 7 dimensions. Among IS journals, 19 articles discussed a single dimension, while 7 discussed multiple dimensions; among HRM and Management journals, 34 discussed a single dimension, while 25 discussed multiple dimensions. Only one paper, Jia et al. (2018), which explicitly discussed the HR Life Cycle, included a discussion of all 6 dimensions of the original HR Life Cycle model; no paper discussed all 7 dimensions of the revised HR Life Cycle model. In other words, no paper has fully considered the interrelationships and synergies between the different dimensions as proposed by research in the field of SHRM (Boon et al., 2019). Table 2 shows the number of articles discussing each dimension, among IS journals and among HRM and Management journals. Our analysis revealed that Recruitment and Deployment is the most represented dimension in the literature, among both IS journals (84.6%) and HRM and Management journals (66.1%). Conversely, Human Relations Management is the least represented dimension overall (9.4%) and among HRM and Management Journals (8.5%), though Strategic Planning is the least represented dimension among IS journals (3.8%). The existing literature related to each of the 7 dimensions will be discussed in detail in the following sections.

Strategic Planning

The *Strategic Planning* dimension includes activities related to establishing the HR strategy and vision for the organization, determining present and future personnel needs, as well as providing direction to the other HR functions (Jia et al., 2018). As shown in Table 2 above, the dimension of *Strategic Planning* is the least represented among IS journals, although the existing literature suggests that this dimension would be a good candidate for the application of AI. Articles that discuss the use of AI in human resources *Strategic Planning* focus on AI's capabilities related to cognition (e.g., Chang, 2020; Verma & Jha, 2020) and the analysis of

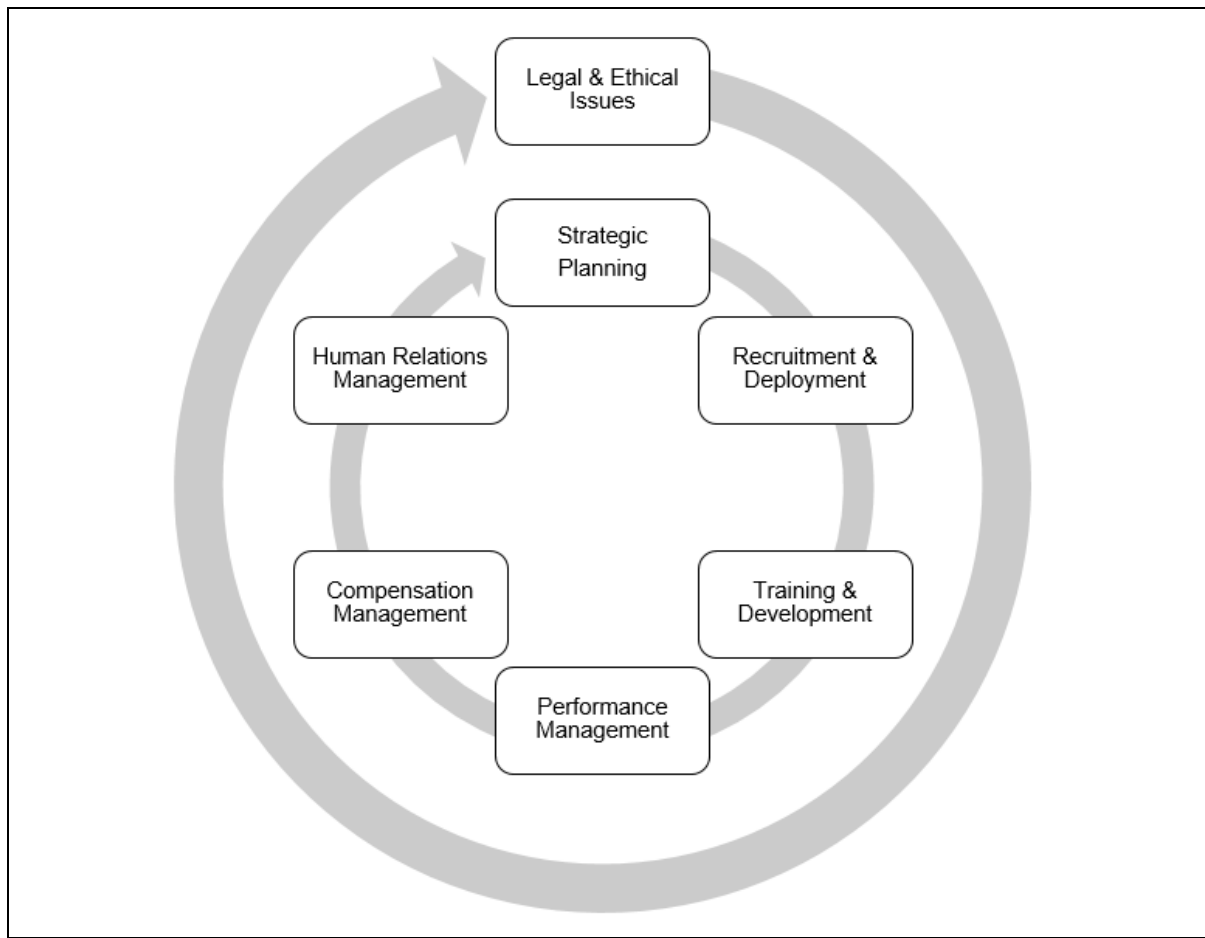


Figure 4 – Revised HR Life Cycle

Table 1 – Number of Dimensions Discussed per Article

# of HR Dimensions	# of Articles in IS Journals	# of Articles in HRM / Mgmt Journals	# of Articles Total
1	19 (73.1%)	34 (57.6%)	53 (62.4%)
2	2 (7.7%)	10 (16.9%)	12 (14.1%)
3	3 (11.5%)	8 (13.6%)	11 (12.9%)
4	1 (3.8%)	4 (6.8%)	5 (5.9%)
5	1 (3.8%)	0 (0.0%)	1 (1.2%)
6	0 (0.0%)	3 (5.1%)	3 (3.5%)

Table 2 – Distribution of HR Dimensions

HR Dimensions	# of Articles in IS Journals	# of Articles in HRM / Mgmt Journals	# of Articles Total
Strategic Planning	1 (3.8%)	12 (20.3%)	13 (15.3%)
Recruitment and Deployment	22 (84.6%)	39 (66.1%)	61 (71.8%)
Training and Development	5 (19.2%)	17 (28.8%)	22 (25.9%)
Performance Management	4 (15.4%)	19 (32.2%)	23 (27.1%)
Compensation Management	2 (7.7%)	8 (13.6%)	10 (11.8%)
Human Relations Management	3 (11.5%)	5 (8.5%)	8 (9.4%)
Legal and Ethical Issues	4 (15.4%)	12 (20.3%)	16 (18.8%)

Note: Totals exceed 85 and 100% due to some articles discussing multiple dimensions.

large and sometimes unstructured datasets, to allow organizations to synthesize data from multiple sources – e.g. financial data, market data, employee performance data – in order to plan HR functions (e.g., Ahmed, 2018; DiClaudio, 2019).

Historically, expert systems were used to analyze and synthesize data for *Strategic Planning* purposes. For example, an article by Lawler and Elliot (1996) examined the use of an expert system in the job evaluation process. Job evaluations serve as the foundation for virtually every HR activity, and by extension are the starting point for HR *Strategic Planning* (Morgeson & Dierdorff, 2011). Lawler and Elliot (1996) hypothesized that expert systems will improve the efficiency and accuracy of the job evaluation process, allowing organizations to develop more detailed strategic plans. In another article, Cabrera and Bonache (1999) presented a theoretical framework for the development of an expert system that would synthesize data from a variety of sources, including HR data, such as staffing data, performance data, and compensation data, in order to assist organizations in developing a “strategic” organizational culture.

Given that *Strategic Planning* is the first dimension in the HR Life Cycle (Jia et al., 2018), these activities make use of data from multiple sources and require detailed analyses. AI has been used for data mining (Jia et al., 2018) and machine learning (Verma & Jha, 2020), which allow organizations to derive more profound conclusions from their HR, thereby making more informed decisions. DiClaudio (2019) suggests that one of the major advantages to using AI in *Strategic Planning* is that it allows the HR function to be proactive rather than reactive, which was considerably more difficult when the analysis was done without AI support. AI allows organizations to better synthesize HR data with data from other functions, in order to prepare more detailed strategic plans (Nawaz, 2020a) and ensure alignment between the HR strategy and the overall business strategy (Verma & Jha, 2020).

In addition to the articles that look at the AI capabilities that could be useful to HRM, other articles consider the outcomes that could be affected by the use of AI in HRM. For example, Chang (2020) presents the AI in Personnel Management (APM) Model, which links the use of AI in HRM with organizational outcomes such as increased organizational performance, increased employee well-being, and decreased employee turnover. Similarly, in an exploration of AI-mediated HRM practices, Malik et al. (2022) found that the use of AI in *Strategic Planning* has several benefits to the organization, including increased job satisfaction, increased organizational commitment, and reduced turnover intention among employees, which in turn results in improved cost-effectiveness in the organization.

As can be seen from the papers presented in this section, a number of threads have already been explored in the literature related to the use of AI in the *Strategic Planning* dimension. These threads confirm that AI can benefit HR *Strategic Planning* and – since it is the first dimension in the HR Life Cycle – the subsequent dimensions of the HR Life Cycle as well.

Recruitment and Deployment

The *Recruitment and Deployment* dimension includes activities related to attracting and selecting external candidates, onboarding new hires, and identifying internal candidates for promotions and transfers (Jia et al., 2018). The use of AI in *Recruitment and Deployment* is discussed in almost 72% of the articles in this study, making it by far the most represented dimension of the HR Life Cycle. This may be due to the fact that this dimension includes a broad range of activities present in organizations of all sizes. It may also be that the *Recruitment and Deployment* process is well-suited for training an AI: 1) many candidates apply for a position, 2) some are rejected while others move on to the next step of the process (e.g., a first interview), 3) the candidate pool continues to be reduced until a final candidate is selected and hired. This step-by-step process, with success and failure criteria at each step, may be particularly fertile ground for the application of AI.

In fact, the full range of *Recruitment and Deployment* activities is already present in the literature, with many articles focusing on AI as a time-saving tool. For example, Verma and Jha (2020) propose using AI to prioritize recruitment activities by evaluating operational needs. Within the context of the HR Life Cycle, this proposed application of AI for *Recruitment and Deployment* is a logical continuation of the application of AI in *Strategic Planning*.

Within organizations, *Recruitment and Deployment* activities follow a step-by-step process, and the literature shows that AI can be used at each step. First, candidates must be identified, before they can be screened and selected (Tambe et al., 2019): Albert (2019) proposes using AI to efficiently search through online databases to identify potential sources of candidates. Similarly, Johnson et al. (2021) suggest recruiters can use AI to develop their candidate pool by identifying and selectively targeting potential candidates that meet the criteria for the job. In addition, recruiters can use AI to search through databases of old candidates to identify previous candidates who might be suitable for the current opening (Bhattacharjee & Saha, 2020; Premnath & Arun, 2019). Once the recruiters have identified potential candidates, AI can again be used to screen their applications and narrow down the list of suitable candidates, thereby saving the recruiter significant amounts of time (Albert, 2019; Garg et al., 2021; Zahidi et al., 2020). The AI could also be used to search for specified keywords in a database of applicants (Kulkarni & Che, 2019). Using natural language processing, chatbots could be used to automate the interview process, contacting the selected candidates, interviewing them, and providing a recommendation back to the human recruiter (Nawaz & Gomes, 2019). Alternately, interviews could be conducted by the human recruiter, with AI-enabled facial recognition used to detect and evaluate candidates' non-verbal cues (Nawaz, 2020b). AI could even use pattern recognition to select the final candidate directly, without human intervention (Kulkarni & Che, 2019).

As can be seen from the papers presented in this section, the potential use of AI in *Recruitment and Deployment* is well-established in the literature. Following the HR Life Cycle, many of the decisions related to *Recruitment and Deployment* are in response to the needs established during *Strategic Planning*. As such, the use of AI in *Recruitment and Deployment* follows from the use of AI in *Strategic Planning*.

Training and Development

The *Training and Development* dimension includes activities related to improving the knowledge, skills, and abilities of employees for their current job (i.e., training), as well as preparing them for future jobs (i.e., development) (Jia et al., 2018). Within the literature, articles discussing AI in *Training and Development* can be divided into two broad categories: the use of AI to analyze training needs, and the use of AI to deliver training. In the first category, researchers have recognized that the skills and competencies needed by organizations are dynamic and always evolving (Bhardwaj et al., 2020; Ruby Merlin & Jayam, 2018). Because of this, AI has been identified as a potential tool for analyzing employee performance, identifying performance gaps that can be addressed through *Training and Development*, and measuring the resulting performance gains (Maity, 2019). Researchers have also proposed that AI can ensure alignment between employee skills and the organization's business strategy, through continuous monitoring of employee skills (Verma & Jha, 2020).

In the second category, researchers have proposed methods for using AI in the delivery of training. For example, Vrontis et al. (2021) discuss the use of AI-powered training simulations, which can reproduce a variety of real-world situations, allowing employees to better understand how the skills they are learning can be used on the job. Similarly, Luo et al. (2021) explore the use of AI to provide coaching to employees: the AI can be trained on past performance data to learn what actions are effective in certain situations. Then, through monitoring of employees as they perform their duties, the AI can provide immediate suggestions and coaching to improve effectiveness.

Interestingly, the existing research shows that AI's own capability to learn is what gives it the potential to be useful in training employees: an AI trainer can monitor and learn about the trainees during the training session, and adapt the training approach – or even the training material itself – to the needs of the trainees in ways that a human trainer cannot (Maity, 2019; Ruby Merlin & Jayam, 2018; Vrontis et al., 2021). Similarly, training delivered by AI trainers can be available on-demand (Yawalkar, 2019), be more easily personalized to the needs of individual trainees (Premnath & Arun, 2019; Zahidi et al., 2020) and provide immediate feedback and guidance (Malik & Mishra, 2020).

As can be seen from the papers presented in this section, the potential use of AI in *Training and Development* is also well-established in the literature. In fact, *Training and Development* is one of the more prevalent dimensions in the literature. Following the HR Life Cycle, many of the decisions related to *Training and Development* are in response to the needs established during *Strategic Planning*, combined with the personnel who have been recruited and deployed to fulfill those needs. As such, the use of AI in *Training and Development* follows from the use of AI in *Recruitment and Deployment*.

Performance Management

The *Performance Management* dimension includes the monitoring of employees as they complete their tasks, as well as the evaluation of their performance on the job (Jia et al., 2018). Within the literature, articles discussing the use of AI in *Performance Management* can be divided into two broad categories: 1) articles that discuss the benefits of using AI in *Performance Management*, and 2) articles that discuss the use of AI to electronically monitor employee performance. In fact, while the *Recruitment and Deployment* dimension is the most represented dimension in the literature, Buck and Morrow (2018) claim that it is the *Performance Management* dimension that has seen the biggest impact from AI in practical terms.

In the first category, the literature shows that AI has been used in the *Performance Management* planning process to review past employee performance data, along with any other relevant data from other sources (e.g. financial data, market data), to set performance targets and key performance indicators (KPIs) – such as revenue targets, cost-saving measures, or individualized productivity goals – for the coming year (Kulkarni, 2021). AI can also be used to monitor these targets and KPIs throughout the year, in turn providing immediate, detailed, and relevant feedback to employees and managers (Jia et al., 2018). In addition, one of the major sources of dissatisfaction with the *Performance Management* process is the perception that the process is subjective or biased (Bowman, 1999), for example due to the perception that the employee is not liked by their supervisor, or that the supervisor is not properly evaluating the employee's performance. As such, the use of AI in *Performance Management* might result in greater satisfaction with the process, since AI is perceived as objective and unbiased – though potentially less transparent – than human evaluations (Bhardwaj et al., 2020; Buck & Morrow, 2018; Ruby Merlin & Jayam, 2018; Zahidi et al., 2020).

In the second category, the literature shows that AI has been used to monitor employees, which is a necessary component of evaluating employee performance. While traditionally it has been the role of the manager to monitor employee performance, there is growing interest in the use of AI-enabled electronic monitoring (Bales & Stone, 2020). Ravid et al. (2020) developed a typology of electronic performance monitoring (EPM) characteristics, which includes four elements: purpose, invasiveness, synchronicity, and transparency. In this typology, purpose relates to the justification for the use of EPM: for *Performance Management*, this would imply using EPM to support desirable behaviours and to discourage undesirable behaviours. Invasiveness relates to the amount and target of the monitoring being conducted: for *Performance Management*, this would imply that employees should only be monitored at

appropriate times and while performing appropriate tasks. Synchronicity relates to the time-based aspects of monitoring – whether continuous or discontinuous – and whether feedback is provided immediately or at specific intervals. Transparency relates to the degree to which employees are informed about the monitoring in place: employees will be more accepting of EPM if the organization has been transparent about its use. In fact, based on their research, the authors recognized that electronic performance monitoring is not limited to *Performance Management*, but is also useful for *Training and Development* purposes, as well as administrative and safety-related uses (Ravid et al., 2020), which further increases the value of AI monitoring for organizations.

As can be seen from the papers presented in this section, the potential use of AI in *Performance Management* can bring many benefits to organizations. From the perspective of the HR Life Cycle, the *Performance Management* dimension is the step where an organization can determine whether its *Recruitment and Deployment* decisions, along with its *Training and Development* efforts, have responded to the organization's strategic goals. As such, the *Performance Management* dimension draws on the data generated in the previous dimensions; in turn, this dimension is crucial in feeding data into the following dimensions.

Compensation Management

The *Compensation Management* dimension includes motivating employees to achieve the organization's goals, rewarding employees for their performance, and retaining employees (Jia et al., 2018). This dimension has not been discussed in the literature as often as the previous dimensions, likely due to the challenges identified by Tambe et al. (2019), notably the challenges related to complexity of HR phenomena, compliance with legal and ethical guidelines, and the effect of HR decisions on employees. That being said, *Compensation Management* is one dimension where the challenge related to small (or non-existent) data sets may be less of a concern, since *Compensation Management* relies more heavily on quantitative data (e.g. employee salary data, competitive market data, investment portfolio data) than some of the other dimensions. In fact, the articles that do discuss this dimension often focus on the various AI-enabled technologies that could benefit *Compensation Management*, such as machine learning (e.g., Tambe et al., 2019), automation (e.g., Kulkarni, 2021), and AI's capability to recognize patterns in large data sets (e.g., Hossin et al., 2021).

In terms of potential applications, several authors focus on the use of AI to increase the fairness and transparency of compensation practices. In particular, Verma and Jha (2020) suggest that AI can be used to provide increased transparency into the compensation process, thereby resulting increased compensation satisfaction among employees. This is echoed by Jia et al. (2018) who suggest that neural networks – a technology modeled after the human brain – could be used to develop a fair salary evaluation system, by establishing a computing model that replicates human cognition but that can respond more quickly to changing conditions than a human could. Similarly, Ahmed (2018) proposes that AI can be used to monitor employee compensation for discrimination based on prohibited factors, such as gender.

Other authors have discussed the use of AI in specific areas of compensation, such as variable compensation and benefits. For example, Zahidi et al. (2020) suggests that the pattern recognition capability of AI could be used to develop a customized, flexible, and quick system for rewarding employees for their performance; Nawaz (2020a) echoes this, suggesting that AI can be used to better reward employees based on their contributions, through transparent and equitable compensation practices. With regards to employee benefits, Tambe et al. (2019) propose that organizations can use AI to determine which benefits are most valued by employees, thereby ensuring that the benefit plan meets their needs, while also assisting employees in making benefit-related decisions. In fact, this last point was anticipated by Besser and Frank (1989), who proposed the use of an expert system to guide employees with their benefits as far back as 1989.

As can be seen from the papers presented in this section, research has begun on the potential uses of AI in *Compensation Management*, but this dimension remains underrepresented in the literature compared to the dimensions discussed above. However, some of the literature on this dimension shows the first signs of researchers drawing on the link between two dimensions of the HR Life Cycle, namely the *Performance Management* and *Compensation Management* dimensions (e.g., Nawaz, 2020a).

Human Relations Management

The *Human Relations Management* dimension includes managing the employer-employee relationship, ensuring compliance with applicable employment legislation and organizational policies, and managing the employer-union relationship (Jia et al., 2018). As shown in Table 2 above, the dimension of *Human Relations Management* is the least represented in the literature overall and among HRM and Management journals. This is perhaps unsurprising: this dimension likely suffers from all four of the challenges identified by Tambe et al. (2019). Notably, *Human Relations Management* must ensure the organization's compliance with the legal and ethical guidelines applicable to the jurisdiction(s) in which the organization operates, thereby adding constraints on the use of AI since any such use must itself be compliant with the applicable legal and ethical guidelines (challenge #3). In addition, since HRM, by its nature, is directly related to employees, decisions made in *Human Relations Management* directly affect employees: any use of AI in *Human Relations Management* must consider the effect on employees (challenge #4). Similarly, the legal and ethical guidelines, as well as the effect on employees, can frequently result in *Human Relations Management* being more complex than the other dimensions, as well as other business disciplines (challenge #1). Finally, many of the activities related to *Human Relations Management* – such as collective bargaining negotiations with unions – are relatively rare events, making it difficult for organizations to develop appropriate data sets for machine learning purposes (challenge #2).

Nevertheless, several potential uses of AI in *Human Relations Management* have already been identified in the literature. For example, Nagar and Saxena (2020) propose that AI can be used to monitor working conditions at the organizational level, which is difficult to do without technological assistance. This might include monitoring communications for signs of harassment, analyzing accident reports to identify health and safety issues, or monitoring employee records for signs of systemic discrimination. Similarly, Nawaz (2020a) suggests that AI can be used to monitor the organization's compliance with applicable legislation in a variety of areas, as well to monitor that managers and employees respect various organizational policies and practices. Improvements in working conditions and improved compliance with applicable employment legislation can result in improved organizational commitment from employees, which in turn can result in a variety of positive outcomes for the organization (Meyer & Allen, 1991). In addition, the literature suggests that AI can be used to collect and analyze data – such as internal and external compensation data, economic forecasts, or job evaluation results – for activities such as collective bargaining negotiations (Nawaz, 2020a), or other litigation, such as employee disputes or grievances (Ahmed, 2018). Sycara (1993) has even provided an example of an application of machine learning for conflict resolution, which could also assist organizations with the resolution of negotiations or disputes, for example by analyzing past cases to propose solutions for the current situation.

As can be seen from the papers presented in this section, some interesting proposals have already been made concerning the use of AI in *Human Relations Management*. This is promising, since *Human Relations Management* is the final dimension in the original HR Life Cycle, which feeds the *Strategic Planning* step of the next cycle. While the challenges identified by Tambe et al. (2019) are a likely reason this dimension is underrepresented in the literature, the existing articles that discuss this dimension show that AI can still be beneficial in *Human Relations Management*.

Legal and Ethical Issues

Unlike the previous six dimensions, which are steps in the HR Life Cycle, the final dimension – *Legal and Ethical Issues* – can be present at any point in the HR Life Cycle. Since one of the challenges identified by Tambe and his co-authors is that HR outcomes must comply with legal and ethical guidelines, it follows that “Legal & Ethical Issues” should be integrated into the HR Life Cycle model. Consequently, this seventh dimension is conceptualized as a contextual dimension surrounding the HR Life Cycle as a whole. See Figure 4 for a revised version of the HR Life Cycle incorporating the *Legal and Ethical Issues* dimension.

Ågerfalk et al. (2021) note that researchers must consider the negative outcomes of AI use, since focusing only on the positive outcomes results in an incomplete picture. In this regard, the *Legal and Ethical Issues* dimension considers the “dark side” of AI in HRM. Bales and Stone (2020) express concerns that the use of AI in HRM may unintentionally lead to discrimination against employees or job applicants; the Amazon example mentioned by Tambe et al. (2019) is a concrete example of this. In fact, Chamorro-Premuzic et al. (2019) remind us that decisions made by the AI are only as reliable as the data that was used to train the model: if the data is biased in any way, the AI may adopt the same bias into its analysis, and then reach inappropriate conclusions. Bales and Stone (2020) point out that AI is often considered a “black box”, because it is not always clear what factors are being used by the AI to make a decision; this becomes a legal or ethical issue if the AI uses prohibited factors, such as gender or race, in its decision-making. To counter this problem, Chamorro-Premuzic et al. (2019) suggest that organizations review the data used to train the model before supplying it to the AI to ensure it is free from bias, though Dattner et al. (2019) go one step further by suggesting that the capacity of AI to avoid legal discrimination is still unproven.

Other issues raised in the literature include concerns over invasion of privacy, such as using AI in the recruitment process to search a candidate’s social media (Dattner et al., 2019) or through monitoring employees’ off-work activity (Bales & Stone, 2020). In one study, Leicht-Deobald et al. (2019) found that the use of AI to monitor employees in the workplace challenges employees’ personal integrity and removes their independence.

Interestingly, the literature also proposes the use of AI in HRM as a way to overcome issues related to discrimination and bias. Given that AI is perceived as objective, unbiased, efficient (Leicht-Deobald et al., 2019), decisions made by AI may reduce concerns related to human bias (Bales & Stone, 2020) and increase perceptions of justice in the organization (Acikgoz et al., 2020). Nevertheless, Cappelli (2020) warns that AI treats everyone equally, but not necessarily fairly.

As can be seen from the papers presented in this section, *Legal and Ethical Issues* related to the use of AI in HRM cannot be ignored. Fortunately, research on the “dark side” of AI in HRM is already well-developed, while research on AI as a solution to *Legal and Ethical Issues* also holds promise for the application of AI in HRM.

Summary of Results

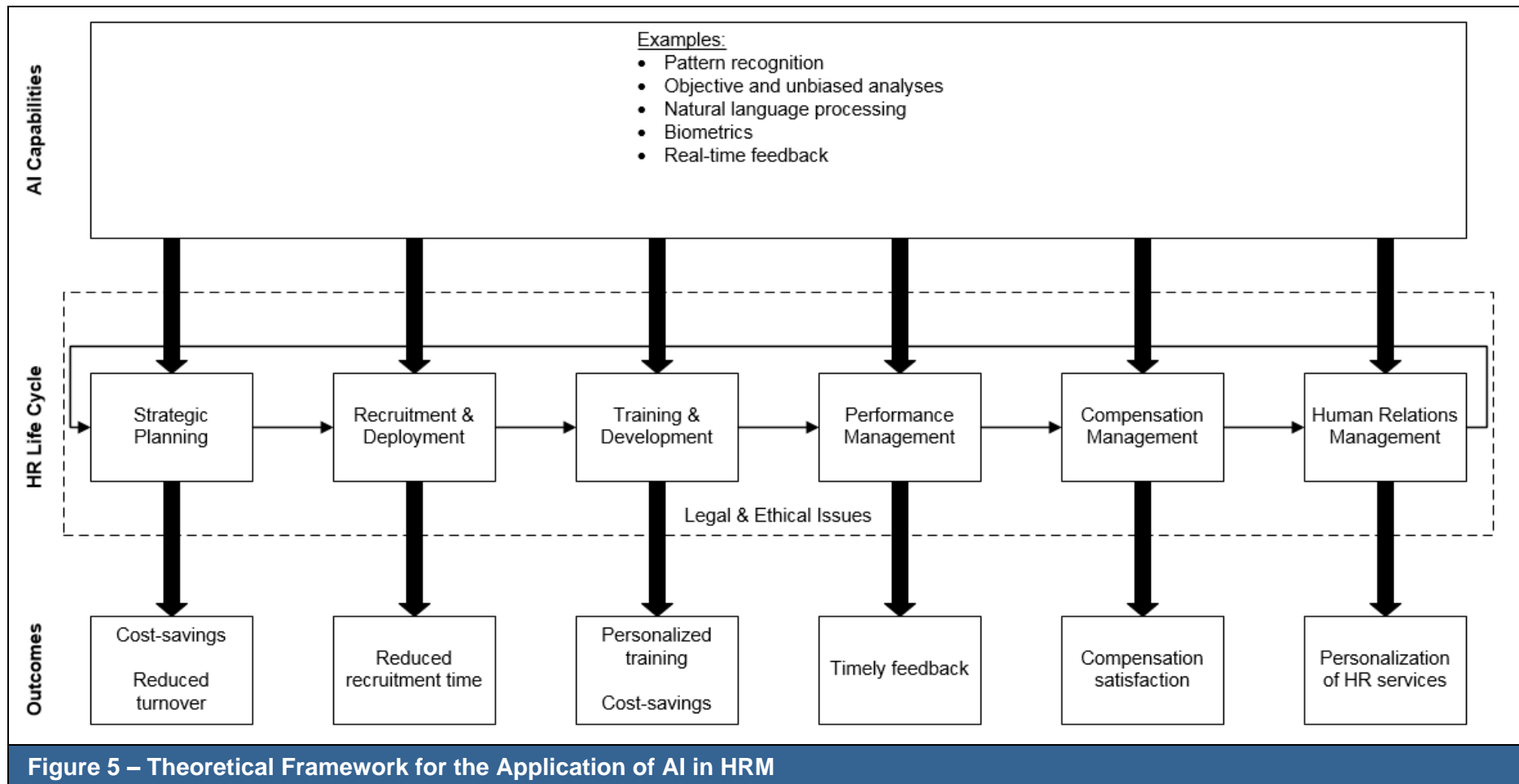
The findings of this scoping review reveal that AI has already been studied in relation to all of the major HR functions found in organizations. In addition, several studies related to the Asia-Pacific Region were identified: countries represented in the literature include Bangladesh (e.g. Bhattacharjee & Saha, 2020; Hossin et al., 2021), China (e.g. Cheng et al., 2021), and India (e.g. Malik et al., 2022; Premnath & Arun, 2020). Consistent with our overall findings, the literature related to the Asia-Pacific Region has also covered all of the dimensions of the revised HR Life Cycle, with Recruitment and Deployment remaining the most represented dimension.

While the challenges identified by Tambe et al. (2019) cannot be ignored, the existing applications of AI in HRM demonstrate that AI remains the solution to many of the issues

facing HRM (Vrontis et al., 2021). In particular, AI's capability to learn from past data to predict future outcomes (Benbya et al., 2021; Tambe et al., 2019), along with its capability to process high volumes of complex, unstructured data (Vrontis et al., 2021), allow HR practitioners to derive insights that were previously impossible or impractical. See Table 3 for some examples of existing capabilities of AI in HRM, as well as the most frequently mentioned organizational and individual outcomes associated with the use of AI in HRM.

Table 3 – Examples of AI in HRM		
HR Dimensions	AI Capabilities in HRM	Outcomes
Strategic Planning	Analyzing unstructured data from multiple sources – financial data, market data, employee performance data – to make strategic HR decisions (DiClaudio, 2019) Analyzing large data sets of past employee data to plan future HR functions (Ahmed, 2018)	Cost-savings through improved strategic planning (Malik et al., 2022) Reduced turnover (Chang, 2020)
Recruitment and Deployment	Objective and unbiased evaluations of applicants (Chamorro-Premuzic, 2019; Kuncel et al., 2014; Raghavan et al., 2020) Natural language processing to evaluate job applications (Hemalatha et al., 2021) Biometrics to evaluate non-verbal communication during interviews (van Esch et al., 2020)	Reduced time between recruitment and a hiring decision (Pandya & Al Janahi, 2021; Saha et al., 2021)
Training and Development	Automation of training delivery (Salmon-Powell et al., 2021) Real-time feedback (Yawalkar, 2019)	Personalization of training (Maity, 2019; Ruby Merlin & Jayam, 2018) Reduced costs for training activities (Kulkarni, 2021; Zahidi et al., 2020)
Performance Management	Automated monitoring of employee performance (Moore & Hayes, 2017) Unbiased performance evaluations (Buck & Morrow, 2018)	Increased timeliness of feedback (Kulkarni, 2021; Zahidi et al., 2020)
Compensation Management	Analyzing large data sets of employee data to make compensation decisions (Ahmed, 2018; Parent-Rochelleau & Parker, 2022) Pattern recognition to design compensation programs (Zahidi et al., 2020)	Compensation satisfaction (Verma & Jha, 2020)
Human Relations Management	Analyzing large data sets to develop negotiation strategies (Ahmed, 2018; Bhattacharjee & Saha, 2020)	Personalization of HR services (Ahmed, 2018; Nagar & Saxena, 2020)
Legal and Ethical Issues	Objective and unbiased data analysis to assist in decision-making (Bales & Stone, 2020; Leicht-Deobald et al., 2019)	Increased perceptions of justice (Acikgoz et al., 2020) Reduction of discrimination and bias (Bales & Stone, 2020)

Note: No relationship or link is implied between the "AI Capabilities" and "Outcomes" columns.



Based on the results of our study, we propose a theoretical framework for the application of AI in HRM (see Figure 5), which shows the linkages between AI Capabilities, the HR Life Cycle, and some of the outcomes that result from the application of AI in HRM. Following our framework, the various capabilities of AI act upon the dimensions of the HR Life Cycle, by automating or augmenting the activities performed by HR practitioners. As shown in Table 3, some AI capabilities (e.g. analyzing large data sets) have already been studied in relation to multiple dimensions of the HR Life Cycle, while other AI capabilities have only been studied in relation to a single dimension (e.g. natural language processing has been studied in relation to *Recruitment and Deployment*, but not the other dimensions). However, as implied by our framework, all of the capabilities of AI might potentially act upon each of the dimensions of the HR Life Cycle pending further research. In turn, the application of the AI capabilities to the HR Life Cycle generates desirable outcomes for each of the dimensions of the HR Life Cycle. Ultimately, it is these outcomes that are sought by organizations and practitioners.

Nevertheless, while the existing applications of AI in HRM are promising, cautionary tales such as those discussed above demonstrate that additional research is required before AI can be fully integrated into HRM. In the following section, this paper will discuss a future research agenda based on the results of this study and the theoretical framework proposed in Figure 5, along with the implications of the findings for research and for practice.

Discussion

Future Research Agenda

In formulating the research agenda, we follow Nguyen et al. (2022) in assuming that research into AI will have better practical relevance if it is aligned with practitioners' interest in AI. Furthermore, Ågerfalk et al. (2021) remind us that it may be necessary to build on the theories and cumulative knowledge of other fields to inform AI research. Given the interdisciplinary nature of the topic of AI in HRM, we propose that researchers turn their attention to the constructs and models that are already present in HRM research, to identify those that might benefit from the application of AI and develop research questions accordingly. Following the theoretical framework proposed in Figure 5, in this section we discuss a few examples of HRM constructs that might benefit from the application of AI, based on the seven dimensions of the HR Life Cycle. These recommended research questions also respond to Nguyen et al.'s (2022) call for more research into AI and Organizations and AI and Individuals.

First, the field of strategic human resource management (SHRM) seeks to identify the human resources that provide an organization with a competitive advantage (Collins & Clark, 2003). As the first dimension of the HR Life Cycle, the *Strategic Planning* dimension is concerned with activities related to the establishment of the vision and strategy of the organization. In HRM research, constructs such as organizational performance (Collins & Clark, 2003) measure the organizational-level outcomes of HR functions. Researchers interested in the *Strategic Planning* dimension would provide a valuable contribution by examining the ways that AI can be used to provide increased insight into HR functions, and can be used to increase the strategic contribution of HRM, by analyzing the data generated by the other dimensions of the HR Life Cycle, and combining it with data from other sources – financial data, market data, etc. – in order to make strategic HR decisions. Since improvements in strategic planning can result in significant cost-savings to organizations (Malik et al., 2022), this research would be of interest to many organizations and practitioners. Some possible research questions for this dimension include “Does AI provide HR practitioners with increased insight into HR functions?” and “How can AI be used to increase the strategic contribution of HRM?”.

Second, the development of recruitment and selection processes that accurately identify high-performing candidates, without discrimination or bias, remains a significant challenge for HR practitioners and researchers (Finch et al., 2009). Researchers interested in the *Recruitment*

and Deployment dimension would contribute by examining the ways that AI could improve recruitment and selection success, as well as the ways AI could be used to improve equity, diversity, and inclusion in *Recruitment and Deployment*. Some possible research questions for this dimension include “Does the use of AI in recruitment result in the selection of better candidates?” and “How can AI be used to improve equity, diversity, and inclusion in recruitment and deployment?”.

Third, a significant concern in research related to *Training and Development* is transfer of training: the extent to which training is actually applied on the job (Salas et al., 2012). Researchers interested in the *Training and Development* dimension would contribute by examining the ways AI can be used to increase transfer of training, through AI-powered training simulations or personalized training plans. Additionally, since training activities can be very expensive for organizations, especially when transfer of training is poor, research into AI as a method of reducing *Training and Development* costs would be of interest to practitioners, such as through the automation of the identification of training needs, as well as the automation of training itself. Some possible research questions for this dimension include “Does the use of AI in training and development reduce training and development costs?” and “How can AI be used to increase transfer of training?”.

Fourth, performance appraisals have been defined as “given by someone who does not want to give it to someone who does not want to get it” (Bowman, 1999). Since AI is perceived as more objective and less biased than human evaluations, researchers interested in the *Performance Management* dimension would contribute by examining whether the use of AI increases satisfaction with the *Performance Management* process, and whether this results in increased productivity and organizational effectiveness (Levy & Williams, 2004). Additionally, since the *Performance Management* process is a key element of the relationship between managers and their subordinates, research into the effect of AI in *Performance Management* affect leader-member exchange would be of interest to practitioners (Dulebohn et al., 2012). Some possible research questions for this dimension include “Does the use of AI in performance management increase satisfaction with the performance evaluation process?” and “How does the use of AI in performance management affect leader-member exchange?”.

Fifth, compensation is one of the largest expenses in most organizations and satisfaction with compensation satisfaction has been shown to have important individual and organizational outcomes. However, employee satisfaction with compensation is frequently low, due to negative perceptions of procedural justice and distributive justice (Williams et al., 2008). Researchers interested in the *Compensation Management* dimension would contribute by examining how the use of AI in compensation affects perceptions of procedural justice and distributive justice, and whether this results in increased compensation satisfaction. Some possible research questions for this dimension include “Does the use of AI in compensation increase compensation satisfaction?” and “How does the use of AI in compensation affect perceptions of procedural justice and distributive justice?”.

Sixth, since people are the foundation of organizations, the *Human Relations Management* dimension – with its focus on the employer-employee relationship – is critical for organizational success. Researchers interested in the *Human Relations Management* dimension would contribute by examining how AI can be used to influence organizational commitment (Meyer & Allen, 1991), turnover intention (Williams & Hazer, 1986), and other similar constructs. Some possible research questions for this dimension include “How does the use of AI in HRM affect organizational commitment?” and “How does the use of AI in HRM affect turnover intention?”.

Finally, since the *Legal and Ethical Issues* dimension surrounds the HR Life Cycle as a whole, it is difficult to isolate specific constructs in HRM research that respond to this dimension. Legal and ethical concerns are present in all areas of HRM research, just as they are in all areas of AI research. In this regard, many of the research questions that are already being explored in AI research, such as whether AI can be unbiased, could also be studied in an HRM context specifically. Additionally, an interesting stream of research would be to explore how

AI can be used to reduce legal and ethical concerns in the workplace, in areas such as discrimination. Some possible research questions for this dimension include “Is unbiased AI in HRM possible?” and “How can AI be used to reduce discrimination in the workplace?”.

See Table 4 for a summary of these potential research questions, as well as some of the constructs present in HRM research that might benefit from the application of AI.

Table 4 – Future Research Agenda		
HR Dimensions	Research Questions	Related Constructs in HRM Research
Strategic Planning	Does AI provide HR practitioners with increased insight into HR functions? How can AI be used to increase the strategic contribution of HRM?	Organizational performance (Collins & Clark, 2003)
Recruitment and Deployment	Does the use of AI in recruitment result in the selection of better candidates? How can AI be used to improve equity, diversity, and inclusion in recruitment and deployment?	Recruitment and selection success (Finch et al., 2009)
Training and Development	Does the use of AI in training and development reduce training and development costs? How can AI be used to increase transfer of training?	Transfer of training (Salas et al., 2012)
Performance Management	Does the use of AI in performance management increase satisfaction with the performance evaluation process? How does the use of AI in performance management affect leader-member exchange?	Productivity, organizational effectiveness (Levy & Williams, 2004) Leader-member exchange (Dulebohn et al., 2012)
Compensation Management	Does the use of AI in compensation increase compensation satisfaction? How does the use of AI in compensation affect perceptions of procedural justice and distributive justice?	Compensation satisfaction (Williams et al., 2008)
Human Relations Management	How does the use of AI in HRM affect organizational commitment? How does the use of AI in HRM affect turnover intention?	Organizational commitment (Meyer & Allen, 1991) Turnover intention (Williams & Hazer, 1986)
Legal and Ethical Issues	Is unbiased AI in HRM possible? How can AI be used to reduce discrimination in the workplace?	Research questions for this dimension can be connected to various constructs related to the previous dimensions, such as: Leader-member exchange (Dulebohn et al., 2012)

Implications for Research

This study provides insights into the current state of research on the role of AI in HRM, which provides guidance for future research in this field. First, by classifying the existing literature based on the 6 dimensions of the HR Life Cycle, the study helps researchers recognize that the various HR functions that exist in organizations do not exist in a vacuum. As seen in the

findings on this study, all 6 dimensions of the HR Life Cycle have been addressed in the existing literature, but papers rarely draw connections between the dimensions.

Second, this study identified a seventh dimension – *Legal and Ethical Issues* – and integrated it into the existing HR Life Cycle framework. This seventh dimension is already presented in the literature and is frequently discussed in association with one or more of the other dimensions. As such, researchers exploring any of the other dimensions of the HR Life Cycle should ensure they consider the relevant *Legal and Ethical Issues*.

Third, by helping researchers recognize the value of the revised HR Life Cycle and its seven dimensions, they will be able to expand on the existing research by exploring the connections between dimensions. This is essential to address the gap between the promise of AI in HRM and its practical application in organizations that was identified by Tambe et al. (2019). By exploring how the AI capabilities used for one dimension impacts the AI capabilities used in next dimension in the HR Life Cycle, researchers will be better equipped to transform research into practical applications.

Fourth, the existing research has associated the use of AI in HRM with desirable organizational outcomes, such as organizational performance (e.g., Chang, 2020), cost-savings (e.g., Kulkarni, 2021), and time-savings (e.g. Zahidi et al., 2020). In addition, researchers have associated the use of AI in HRM to HR-specific outcomes, such as employee engagement (e.g., Tănăsescu, 2021), absenteeism (e.g., Lawrance et al., 2021), turnover intention (e.g., Chang, 2020), employee well-being (e.g., Chang, 2020), perceptions of justice (e.g., Acikgoz et al., 2020) and compensation satisfaction (e.g., Verma & Jha, 2020). However, the link between AI and many of these HR-specific outcomes has not yet been studied empirically; there is considerable opportunity for researchers to examine the link between AI in HRM and HR-specific outcomes using the existing measures and models of HR research. In addition, researchers should explore other HR-specific outcomes to determine which ones can be positively influenced by the use of AI in HRM.

Fifth, since the topic of AI in HRM is inherently interdisciplinary, it would be beneficial for researchers – especially those with an HR or Management background – to draw on existing IS theories to guide their research. Few of the papers included in this study specifically referenced IS theories; some of the IS theories present in the literature on AI in HRM include the Technology Acceptance Model (TAM) (e.g. Singh et al., 2020), the Technology-Organization-Environment (TOE) Framework (e.g. Pillai & Sivathanu, 2020; Pan et al., 2022), and the Task-Technology Fit (TTF) Model (e.g. Pillai & Sivathanu, 2020). Examining the topic of AI in HRM through the lens of a theory of technology adoption such as TAM (Davis, 1989) would also allow researchers to confirm the role of *Legal and Ethical Issues* in relation to the other dimensions of the HR Life Cycle. In addition, other major IS theories could be used to further explore the role of AI in HRM.

Finally, researchers focusing on the application of AI in HRM in the Asia-Pacific Region specifically should consider the socioeconomic conditions of the country or countries being studied. For example, literature in the Bangladeshi context has noted that both the public sector and private sector in Bangladesh are eager to implement AI (Bhattacharjee & Saha, 2020), but that challenges exist, such as the lack of an advanced technological infrastructure (Bhattacharjee & Saha, 2020), the continued use of traditional work practices (Hossin et al., 2021), and the slow progress being made in training employees to use technology in decision-making (Bhattacharjee & Saha, 2020). Similarly, research in the Indian context has noted that India has made great advancements from a technological perspective, but still needs to develop the skills of its workforce to reap the benefits of AI (Malik et al., 2022).

Implications for Practice

While it has been recognized that insights into employees are the greatest competitive advantage to organizations in uncertain times (DiClaudio, 2019), this scoping review will help

practitioners realize that AI is the solution to many of the challenges facing HRM (Vrontis et al., 2021). By classifying the existing literature based on the HR Life Cycle, this study reveals that AI has been studied in relation to all of the major HR functions found in organizations. This will allow practitioners to understand the practical applications that already exist for AI in HRM, as well as the theoretical possibilities that have been identified by researchers. This understanding will better equip practitioners to implement AI in their own organizations.

This study will also help practitioners understand some of the limitations that currently exist concerning the use of AI in HRM. For example, one of the main factors that attracts practitioners to AI is the potential to reduce bias (Chamorro-Premuzic, 2019). However, as Gulliford and Dixon (2019) point out, AI cannot reduce bias on its own: rather, AI requires human operators and human interpretation. Since AI cannot completely replace humans, it is necessary to develop a balance between humans and AI in HRM (Gikopoulos, 2019); organizations seeking to implement AI in HRM will need to foster organizational environments where machines and humans can co-exist (Vrontis et al., 2021).

To do so, organizations will need to invest in the training and development of employees, so that they can develop the skills and capabilities needed to implement, utilize and understand AI in HR (DiClaudio, 2019; Vrontis et al., 2021). Organizations implementing AI in HRM should ensure that feedback and participation is sought from employees and other stakeholders, to ensure that all of the ethical issues related to the use of AI in HRM are considered and addressed (Tambe et al., 2019).

In fact, since this study identified *Legal and Ethical Issues* as a seventh dimension and integrated it into the existing HR Life Cycle framework, practitioners should not neglect legal and ethical considerations when implementing AI in HRM in their organizations (Gulliford & Dixon, 2019). In particular, privacy concerns surround the collection, storage, and use of data by AI cannot be ignored by practitioners (Cappelli, 2020; Vrontis et al., 2021; Chamorro-Premuzic et al., 2019). As a starting point, practitioners should ensure that all existing laws related to privacy are being followed by the organization (Chamorro-Premuzic et al., 2019; Dattner et al., 2019). However, it may also be necessary for legislators to implement new laws to govern the use of AI in HRM.

Finally, it is necessary for organizations to determine whether the current HR practices in place are achieving their objectives to assess whether AI will be a beneficial addition. Before AI in HRM can be implemented, and before legal and ethical questions can be addressed, organizations must ensure that their current practices provide an appropriate foundation (Tambe et al., 2019).

Finally, practitioners in the Asia-Pacific Region must consider the socioeconomic context of the country in which they are operating. The challenges identified by Tambe et al. (2019) apply to all organizations around the world, but the relative importance of each of the challenges may vary depending on the specific context. For example, organizations in Bangladesh that continue to use traditional work practices (Hossin et al., 2021) may face greater challenges related to small data sets (challenge #2).

Conclusion

As with all research, it is important to acknowledge that this study has potential limitations. First, as with all reviews, it is possible that this study failed to identify all relevant articles, either due to technological limitations such as database availability or incorrectly coded metadata. While the authors feel confident that the majority of the relevant articles were identified, future research could expand on this study by using different search terms or databases. Second, the search was limited to articles published in English, so it is possible that relevant research published in other languages has been overlooked. Researchers who are proficient in other languages could expand on this study by considering articles published in non-English sources. Third, since AI in business is a field in which technical advances outpace academic

publications (Nguyen et al., 2022), the results of this study are limited to the articles that had been published by the time the search was conducted. Researchers should consult recent publications to remain up-to-date with the developments in the field.

The objective of this study was to conduct a scoping review of the available literature on the topic of AI in HRM and produce a research agenda to guide future research. This study contributes to the literature by drawing attention to the specific challenges and limitations related to the application of AI in HRM, while also highlighting the technological capabilities of AI that might be of interest to HRM. First, by searching through IS, HRM, and Management journals, this study identified 85 relevant articles, and classified them based on the 6 dimensions of the HR Life Cycle. Second, the study identified a seventh dimension – *Legal and Ethical Issues* – and integrated it into the existing HR Life Cycle framework. Third, a future research agenda was developed from the results of the scoping review, including suggestions of potential research questions, as well as some of the constructs present in HRM research that might benefit from the application of AI. In addition, future work on the topic of AI in HRM should focus on the dimensions of the HR Life Cycle that are underrepresented in the literature, as well as on the connections between the dimensions. By considering the HR Life Cycle in future work, researchers will be better able to contribute to the practical applications of AI in HRM.

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Declaration of Conflicting Interests

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Appendix A – List of Journals Searched

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IS Journals	HRM & Management Journals
<ul style="list-style-type: none"> • European Journal of Information Systems • Journal of Strategic Information Systems • Information Systems Journal • MIS Quarterly • Information Systems Research • Information & Management • Journal of AIS • Information and Organization • Journal of Information Technology • Decision Support Systems • Journal of MIS • MISQ Executive 	<ul style="list-style-type: none"> • Human Resource Management • Journal of Management • The International Journal of Human Resource Management • Management Science • Journal of Applied Psychology • Organization Science • Personnel Psychology • Strategic Management Journal • Industrial Relations • Harvard Business Review • Academy of Management Journal • California Management Review • Academy of Management Review • Sloan Management Review • Administrative Science Quarterly

Appendix B – Final List of 85 Articles

- Acikgoz, Y., Davison, K. H., Compagnone, M., & Laske, M. (2020). Justice perceptions of artificial intelligence in selection. *International Journal of Selection and Assessment*, 28(4), 399-416.
- Ahmed, O. (2018). Artificial intelligence in HR. *International Journal of Research and Analytical Reviews*, 5(4), 971-978.
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- Cappelli, P. (2020). 4 things to consider before you start using AI in personnel decisions. *Harvard Business Review Digital Articles*, 2-4.

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Appendix C – Coding of Articles

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Authors	Journal Discipline	Strategic Planning	Recruitment & Deployment	Training and Development	Performance Management	Compensation Management	Human Relations Management	Legal & Ethical Issues
1) Acikgoz et al., 2020	HRM / Mgmt		X					X
2) Ahmed, 2018	HRM / Mgmt	X	X	X		X	X	X
3) Albert, 2019	HRM / Mgmt		X					
4) Aldulaimi et al., 2021	IS		X					
5) Baldegger et al., 2020	HRM / Mgmt	X						
6) Bales & Stone, 2020	HRM / Mgmt				X			X
7) Balica, 2019	HRM / Mgmt				X			
8) Bekken, 2019	HRM / Mgmt		X					
9) Berhil et al., 2020	IS		X	X	X			
10) Besser & Frank, 1989	HRM / Mgmt					X		
11) Bhardwaj et al., 2020	IS		X	X	X			
12) Bhattacharjee & Saha, 2020	HRM / Mgmt		X				X	
13) Buck & Morrow, 2018	HRM / Mgmt				X			
14) Burnett & Lisk, 2019	HRM / Mgmt				X			
15) Cabrera & Bonache, 1999	HRM / Mgmt	X						

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Authors	Journal Discipline	Strategic Planning	Recruitment & Deployment	Training and Development	Performance Management	Compensation Management	Human Relations Management	Legal & Ethical Issues
16) Capelli, 2020	HRM / Mgmt							X
17) Chamorro-Premuzic, 2019	HRM / Mgmt		X					
18) Chamorro-Premuzic et al., 2019	HRM / Mgmt		X					X
19) Chang, 2020	HRM / Mgmt	X						
20) Chanodkar et al., 2019	HRM / Mgmt		X					
21) Cheng et al., 2021	IS		X					
22) Dattner et al., 2019	HRM / Mgmt		X					X
23) Dickson & Nusair, 2010	HRM / Mgmt		X					
24) DiClaudio, 2019	HRM / Mgmt	X						
25) Gal et al., 2020	IS							X
26) Garg et al., 2021	IS		X					
27) Giermindl, et al. 2021	IS							X
28) Gikopoulos, 2019	HRM / Mgmt		X	X	X			
29) Gulliford & Dixon, 2019	HRM / Mgmt	X	X					X
30) Gupta et al., 2018	IS		X					
31) Hemalatha et al., 2021	IS		X					

Appendix C – Coding of Articles								
Authors	Journal Discipline	Strategic Planning	Recruitment & Deployment	Training and Development	Performance Management	Compensation Management	Human Relations Management	Legal & Ethical Issues
32) Hong et al., 2020	IS		X					X
33) Hossin et al., 2021	HRM / Mgmt		X		X	X		
34) Jatoba et al., 2019a	HRM / Mgmt		X					
35) Jatoba et al., 2019b	IS		X	X	X			
36) Jia et al., 2018	HRM / Mgmt	X	X	X	X	X	X	
37) Johnson et al., 2021	HRM / Mgmt		X					
38) Kelemen et al., 2005	IS		X					
39) Köchling & Wehner, 2020	HRM / Mgmt		X	X				X
40) Kot et al., 2021	HRM / Mgmt		X					
41) Kulkarni, 2021	HRM / Mgmt		X	X	X	X		
42) Kulkarni & Che, 2019	IS		X					
43) Kuncel et al., 2014	HRM / Mgmt		X					
44) Lawler & Elliot, 1996	HRM / Mgmt	X						
45) Lawrance et al., 2021	IS		X					
46) Leicht-Deobald et al., 2019	HRM / Mgmt				X			X
47) Luo et al., 2021	HRM / Mgmt			X				

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Authors	Journal Discipline	Strategic Planning	Recruitment & Deployment	Training and Development	Performance Management	Compensation Management	Human Relations Management	Legal & Ethical Issues
48) Maity, 2019	HRM / Mgmt			X				
49) Malik & Mishra, 2020	HRM / Mgmt			X				
50) Malik et al., 2022	HRM / Mgmt	X	X	X	X		X	X
51) Moore & Hayes, 2017	HRM / Mgmt				X			
52) Nagar & Saxena, 2020	HRM / Mgmt	X	X	X			X	
53) Nawaz, 2020a	IS		X					
54) Nawaz, 2020b	IS	X	X	X		X	X	
55) Nawaz & Gomes, 2019	IS		X					
56) Olsen, 2019	HRM / Mgmt				X			
57) Pampouktsi et al., 2021	HRM / Mgmt		X					
58) Pan et al., 2021	HRM / Mgmt		X					
59) Pandya & Al Janahi., 2021	HRM / Mgmt		X					
60) Parent-Rocheleau & Parker, 2021	HRM / Mgmt		X		X	X		
61) Pessach et al., 2020	IS		X					
62) Pillai & Sivathanu, 2020	HRM / Mgmt		X					
63) Premnath & Arun, 2020	HRM / Mgmt		X	X				

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Authors	Journal Discipline	Strategic Planning	Recruitment & Deployment	Training and Development	Performance Management	Compensation Management	Human Relations Management	Legal & Ethical Issues
64) Raghavan et al., 2020	HRM / Mgmt		X					X
65) Ravid et al., 2020	HRM / Mgmt				X			
66) Rodney et al., 2019	HRM / Mgmt		X					
67) Ruby Merlin & Jayam, 2018	HRM / Mgmt		X	X	X			
68) Saha et al., 2021	HRM / Mgmt		X	X				
69) Salmon-Powell et al., 2021	HRM / Mgmt		X	X	X			
70) Singh et al., 2020	HRM / Mgmt	X						
71) Sipior et al., 2021	IS		X					
72) Sycara, 1993	IS						X	
73) Tambe et al., 2019	HRM / Mgmt		X		X	X		X
74) Tănăsescu, 2021	IS						X	
75) Tong et al., 2021	HRM / Mgmt				X			
76) Twyman et al., 2014	IS		X					
77) van den Broek et al., 2019	IS		X					X
78) van den Broek et al., 2021	IS		X					

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Authors	Journal Discipline	Strategic Planning	Recruitment & Deployment	Training and Development	Performance Management	Compensation Management	Human Relations Management	Legal & Ethical Issues
79) van Esch et al., 2020	HRM / Mgmt		X					
80) Verma & Bandi, 2019	HRM / Mgmt		X					
81) Verma & Jha, 2020	HRM / Mgmt	X	X	X		X		
82) Vrontis et al., 2021	HRM / Mgmt		X	X	X			
83) Yawalkar, 2019	HRM / Mgmt		X	X				
84) Zahidi et al., 2020	IS		X	X	X	X		
85) Zhao et al., 2018	IS		X					
TOTAL		13	61	23	23	10	8	15

Note: Total exceed 85 due to some articles discussing multiple dimensions.

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