Disrupting human resource management with people analytics: a study of applications, value, enablers and barriers in Italy

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Abstract

Purpose – This research aims to explore whether or how organizations adopt people analytics (PA), its value and potential socio-technical factors that can enable or hinder PA projects by disrupting and reshaping human resource management. We do this by focusing on the Italian context.

Design/methodology/approach – We conduct a scoping review of data collected between 2018 and 2022 via Google Alerts (GA), a content change detection and notification service that is gaining popularity in scholarly research.

Findings – Our findings suggest that the diffusion of PA applications in Italy, especially those of a descriptive nature, is growing. Most of the existing PA applications are positioned in a positive technocratic light, envisioning the value of PA for both employees and organizations. The value for the latter appears to be direct, while the value for employees is realized through organizational initiatives. The findings also suggest that while enablers can vary between PA application types, the barriers, especially technological and environmental, are generic for both descriptive and predictive/prescriptive PA applications.

Originality/value – Theoretically, we propose a framework for analyzing PA applications, their values, enablers and barriers. Methodologically, we present and describe in detail a novel approach, drawing on GA that can be used to study PA in specific contexts. Practically, our study serves as a helpful point of reference for managers planning or implementing PA in Italy, for benchmarking PA in Italy over time and for comparative international studies.

Keywords Qualitative, HR Analytics, Human resource management (HRM), People analytics, Google alerts

Paper type Research paper

Introduction

Organizations are progressively turning to disruptive innovative technologies such as big data, data analytics (Priyashantha, 2022) and artificial intelligence (AI) - the use of human

intelligence in machines through technological innovations (Bohr and Memarzadeh, 2020) - to enhance human resource (HR) management (HRM) practices, encompassing recruitment, performance assessment, employee development, healthcare and talent retention strategies (Giermindl *et al.*, 2022). As recently recognized by Minbaeva (2020), data analytics in particular has the potential to disrupt the typical functioning of HRM systems, halt their ongoing processes and potentially inflict harm on the organization. Fortune Business Insights (2022) projected that the global market for big data analytics, valued at $240.56 billion in 2021, will grow to $655.53 billion by 2029.

The use of data analytics in HRM is often referred to as people analytics (PA), which involves utilizing information technologies, data analytics and visualization tools to gain insights into workforce dynamics, human capital and performance (Tursunbayeva *et al.*, 2018). PA is becoming a priority for organizations looking to optimize their effectiveness and improve the employee experience (Cooke and Xu, 2023). A recent survey of 4,061 HR departments from 13 European countries by SD Worx – an HR and payroll service provider – revealed that six out of ten companies are utilizing PA to gain insights into areas like staff shortages, absenteeism and employee turnover. On the other hand, the debate is growing around the potential dark sides of PA such as its use for employee monitoring, surveillance, and quantifying employee performance, as well as privacy concerns around the collection and use of employee (personal) data. Despite this hype and fear perspectives (Willcocks, 2020) around PA, it is still a relatively overlooked topic in academic research and business circles. This lack of knowledge has important consequences. For example, very few organizational PA projects were reported as successful (Bersin, 2021). To address such knowledge gaps, we set out to explore whether or how the adoption of PA actually disrupts and reshapes HRM in organizations. Specifically, in our study, we will investigate the approaches to applying PA in organizations, relevant facilitators, and challenges, as well as the value of PA.

The adoption of PA in organizations differs between countries. In certain contexts, PA has already been successfully tested and is a proven approach to people management. For example, Dutch (67%) and Italian companies (61%) are leading the way in PA in Europe (SD Worx, 2022). However, while in the Netherlands PA has already been studied to some extent (e.g. van den Heuvel and Bondarouk, 2017), PA in Italy has not been explored. Nevertheless, the surge in the number of Italian companies that are aiding their HR departments in their digital transformation journey through innovative disruptive technologies such as PA (Kendall, 2021) makes Italy an interesting scenario to study. This has been confirmed by SD Worx's (2022) survey that reported that nearly half (48%) of the Italian respondent companies have data-driven HR reports or insights, and over half (61%) believed in the added value of PA. Thus, there have been specific calls to pay attention to the intersection of big data and HRM in Italy in comparison to other European countries (Zhang *et al.*, 2021). We aim to generate knowledge from an Italian context, which will permit the generalizability of the research findings to other European contexts that are similar in terms of legislation, culture, religion, politics or economic characteristics (Reis *et al.*, 2020), as well as to other contexts that are still in the early phases of their PA journeys.

In our study, we draw on data from Google Alerts (GA), a content change detection and notification service which is gaining popularity in research areas where scholarly research is still limited (Adams *et al.*, 2017), as in the case of PA (Shet *et al.*, 2021). This study builds on and complements previous studies on PA (e.g. Tursunbayeva *et al.*, 2018; Margherita, 2022), providing a broader overview of the topic by extending the analysis to a wider set of knowledge types, as well as offering a comprehensive understanding of how PA disrupts HRM in specific contexts.

Conceptual framework

People analytics

The current digital transformation is introducing a set of challenges and opportunities for both established industry leaders and emerging players within the field of disruptive innovations (Roblek *et al.*, 2021), and its impact on HRM has been significant. Disruptive technologies are indeed revolutionizing HRM functions by automating processes, increasing efficiency, improving employee experiences, and expanding the accessibility and utilization of HRM tools and strategies (Priyashantha, 2022).

With the arrival of big data, which refers to a vast amount of rapidly produced and diverse data, new opportunities and challenges for HRM have arisen. This has led to the emergence of PA, also known as HR Analytics, Talent Management Analytics, Human Capital Analytics, Workforce Analytics or Talent Analytics, which has gained popularity (Isson and Harriott, 2016; Angrave *et al.*, 2016). PA is an area of HRM that uses information technologies and data analytics to generate actionable insights. It is concerned with understanding workforce dynamics, human capital, and individual and team performance using descriptive and predictive data analytics and visualization tools to optimize organizational effectiveness, efficiency and outcomes, and improve the employee experience (Tursunbayeva *et al.*, 2018). In the context of disrupting HRM, PA has the potential to provide evidence-based decision-making capabilities. Previous relevant studies (e.g. Chatterjee *et al.*, 2021) have shown that with PA, HR managers can quickly and accurately handle a range of decisions, such as when to promote employees, make performance evaluations, implement changes in job roles, relocate staff, understand reasons for employee absences, oversee employee leave, and handle onboarding and offboarding processes. On the other hand, there have also been concerns associated with the disruptive power of digital HRM transformations, such as data privacy concerns and the need for upskilling HR professionals to use the new technologies and data analysis methods more effectively. For instance, Chatterjee *et al.* (2021) demonstrated how PA may compromise the privacy and security of employees' data, as well as enable managers to monitor their movements and observe their conduct, work habits, interactions with colleagues and engagements with customers.

We aim to shed light on the transformative impact and challenges associated with the integration of PA into HRM. Specifically, we focus on exploring the approaches to applying PA in organizations, relevant enablers and barriers, as well as the value of adopting PA. This investigation is based on the knowledge of PA accumulated in Italy, the fourth-largest economy of the EU, accounting for about 12% of total output and a 13% share of the population (Eurostat, 2021, 2023). To achieve our research aim, we built a conceptual framework (see Figure 1) that draws on previous PA research, as well as broader research on technology adoption (see Appendix 1 for a detailed description of the categories used). We discuss the dimensions of this framework in the following section, while acknowledging the work of previous scholars.

PA applications

Previous studies on PA (e.g. Giermindl *et al.*, 2022; Fernandez and Gallardo-Gallardo, 2020; Margherita, 2022), drawing on a well-known categorization from the business analytics literature, proposed classifying analytics maturity also in HRM into descriptive analytics and predictive/prescriptive analytics, based on their analytical focus and capacity.

Descriptive analytics is the base level of analytics (Chatterjee *et al.*, 2021) that looks at past events and their impact on the present. Its main goal is to answer the question, "What happened?" (Isson and Harriott, 2016) by using statistical methods like correlation analysis, simple regressions, mean values and percent changes. Descriptive analytics is important for organizations, as it helps them to realize performance and identify areas of concern and
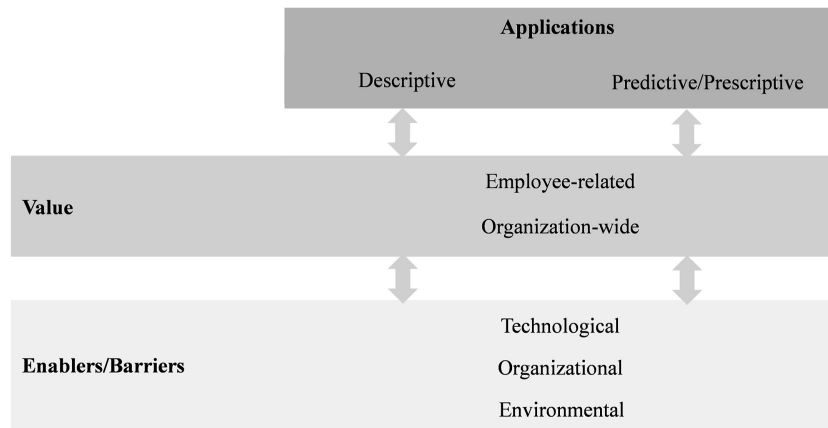
Figure 1.
Conceptual framework

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opportunities for improvement (Fernandez and Gallardo-Gallardo, 2020; Giermindl *et al.*, 2022). It can also identify past or existing trends as well as patterns. For instance, analyzing historical turnover data may show organizations that some specific departments consistently experience higher attrition (Wirges and Neyer, 2023). Descriptive analytics can also quantify diversity within an organization. By examining gender, ethnicity, or age distribution, HRM managers can identify areas for improvement or celebrate successes (Wirges and Neyer, 2023; McCartney and Fu, 2022).

Predictive/prescriptive analytics in relation to PA involves the use of statistical and mathematical methods as well as machine learning algorithms to identify patterns in past or present events to forecast future business developments (Fernandez and Gallardo-Gallardo, 2020; Giermindl *et al.*, 2022). It can help to predict employee behavior and performance, such as attrition or engagement levels, and is often described as an early warning system (Giermindl *et al.*, 2022). Prescriptive analytics forecast trends and recommend actions to optimize outcomes. Thus, if descriptive analytics reveals low engagement scores in a team, prescriptive analytics can recommend targeted interventions, suggesting, for example, mentorship programs or team-building activities (Chatterjee *et al.*, 2021). Jointly employing descriptive and prescriptive analytics is believed to elevate HRM professionals' position to one with strategic influence, benefiting both the organization and its employees (Bonilla-Chaves and Palos-Sánchez, 2023; Angrave *et al.*, 2016).

Although these categories are well-established in the PA and broader business analytics literature, it is still unknown whether organizations currently use descriptive or predictive/prescriptive PA approaches, what their value is, as well as what enablers and barriers that organizations can face in adopting this disruption.

PA value

The value of PA was initially attributed only to organizations (e.g. van den Heuvel and Bondarouk, 2017). For example, in their literature review, Marler and Boudreau (2017) summarized PA as "an HR practice enabled by information technology that uses descriptive, visual, and statistical analyses of data related to HR processes, human capital, organizational performance, and external economic benchmarks to establish business impact and enable data-driven decision-making." This definition was later enriched by the potential value of PA

for employees as well, such as an improved employee experience (Tursunbayeva *et al.*, 2018). The approach to analyzing value for both organizations and employees has been recently applied in the literature review of Margherita (2022) and later also in Budhwar *et al.* (2022). The former concluded that PA is a valuable tool for organizations that enables evidence-based decision-making and leads to increased organizational efficiency and effectiveness. It can help identify trends in employee behavior through attrition and loyalty analysis, supporting informed decisions on how to retain them. PA can also optimize HRM processes, giving organizations a competitive edge, resulting in increased business performance and value creation. Margherita's literature review (2022) also found that PA can add value for employees by improving the hiring process, identifying turnover risks, and providing targeted training and development opportunities that can help employees progress in their careers. However, previous studies on the values of PA have overlooked the fact that such values can differ between descriptive and predictive/prescriptive PA applications, as it has already been noted that benefits from different types of digital HRM can vary (Bondarouk and Brewster, 2016). Acknowledging this limited evidence of value from PA (Di Lauro *et al.*, 2022), our study aimed to investigate the value of various PA applications for both employees and organizations.

PA enablers and barriers

Digital technology adoption in organizations can be shaped by a number of socio-technical factors. One of the most widely used frameworks for analyzing such factors is the Technology, Organization and Environment (TOE) framework of DePietro *et al.* (1990). The technological factors encompass all the technologies or technical aspects relevant to the firm to develop, implement or use innovation. The organizational factors examine the attributes, nature and resources of the firm that need to be considered when adopting innovation. The environmental factors examine the characteristics of the macro-level at which the innovation is adopted, including intense competition incentivizing firms to adopt innovations, the value chain partners who can influence others to adopt new technologies and the regulatory environment (Baker, 2012).

Previously, this framework has been utilized in research to examine the adoption of technological innovations in organizations from various sectors (e.g. Tursunbayeva, 2018) and to analyze the adoption of generic innovations such as inter-organizational systems (Mishra *et al.*, 2007), particularly HRM, or e-HRM innovations (Bondarouk *et al.*, 2017). Recently, this framework has also been applied to studying PA (Gurusinghe *et al.*, 2021). Margherita (2022) drew on its technological and organizational dimensions to examine PA enablers. The recent COVID-19 pandemic is an environmental factor (Chong *et al.*, 2020) that encouraged new digital technology-enabled working arrangements, such as remote work (Alfes *et al.*, 2022). Thus, we believe all the original TOE model dimensions are important to understanding how PA projects unfold in organizations. Previous studies have also suggested that TOE factors can be barriers to digital HRM implementations as well (Rahman and Aydin, 2019). Therefore, to provide a balanced view of PA adoption, in our study we will consider all TOE factors as both potential enablers and barriers for PA.

Methodology

Scoping review techniques are appropriate for developing innovative areas where formal research may be limited, but they are still sources of pertinent evidence and information (Arksey and O'Malley, 2005). Instead of striving to be comprehensive and reproducible, as in systematic evidence reviews, these evaluations are intended to quickly comprehend the

range, essential considerations and advancement of a subject, typically to direct research or policy.

The process of conducting scoping reviews comprises five distinct stages, which we describe below.

Identifying the research question
This study aims to explore whether or how the adoption of PA disrupts and reshapes HRM in the Italian context. We achieve this aim by investigating the approaches to the use of PA in Italian organizations, their value for both organizations and employees, as well as the socio-technical factors that can facilitate or hinder organizational PA projects.

Identifying relevant data
Gray literature, such as blog posts and news articles, has become increasingly important in interdisciplinary research for studying emerging topics and relevant knowledge that is being generated outside academia (e.g. Tursunbayeva *et al.*, 2018). In this study, we review gray literature articles that are outside of conventional scholarly publishing. This type of data is particularly useful in studying PA because it can provide contextual information and real-world examples of its uses and evaluations of its impact, which are challenging for scholars to access otherwise due to organizational confidentiality norms or agreements (Huysman, 2020). Indeed, the Institute of Medicine has even recommended using gray literature in systematic literature reviews (Jedynak *et al.*, 2021).

To collect data on PA in Italy, we relied on GA, a content change detection and notification service. GA is a free tool that monitors the web for new content related to a specific topic and sends users emails when new results show up in Google Search. GA's potential for research has been appreciated by multi-disciplinary scholars who have adopted it in their studies (e.g. Munawar *et al.*, 2021).

To search for gray literature via GA, we adopted the search string developed and validated by Tursunbayeva *et al.* (2018/2022) to search for PA academic and gray literature via the Google Search Engine. Specifically, we used the six PA keywords they employed in their literature reviews on PA, and PA and Ethics (i.e. "HR Analytics," "Human Capital analytics," "People analytics," "Talent analytics," "Workforce analytics" and "Employee analytics"). These PA-related keywords are now accepted as best practices for searching the PA literature (e.g. Bonilla-Chaves and Palos-Sánchez, 2023). As the focus was on the Italian context, we selected to receive returns in "Italian Language." However, we also selected to receive returns from "Any Region," so that we could capture relevant sources hosted outside Italy.

We activated alerts in February 2018 and collected data until December 2022, and all emails were archived and saved in one author's mailbox.

Data selection
A total of 702 alerts were collected between February 2018 and December 2022. Most of them ($n = 230$) were generated by the keyword/topic HR Analytics, followed by PA ($n = 196$), Workforce Analytics ($n = 130$), Talent Analytics ($n = 92$), Employee Analytics ($n = 37$) and Human Capital Analytics ($n = 17$) (see Figure 2).

Almost all alerts ($n = 698$) were classified by Google as "news" (i.e. alerts that appear on news portal sites), except four which were classified as "web" generic sources (i.e. other Internet websites). To analyze the data, we followed Kelly's (2018) methodology and exported all alerts into a predefined spreadsheet. We removed duplicates ($n = 125$) and verified the URLs of the remaining 577 records. At this phase, following Kelly (2018), we excluded 241 GA
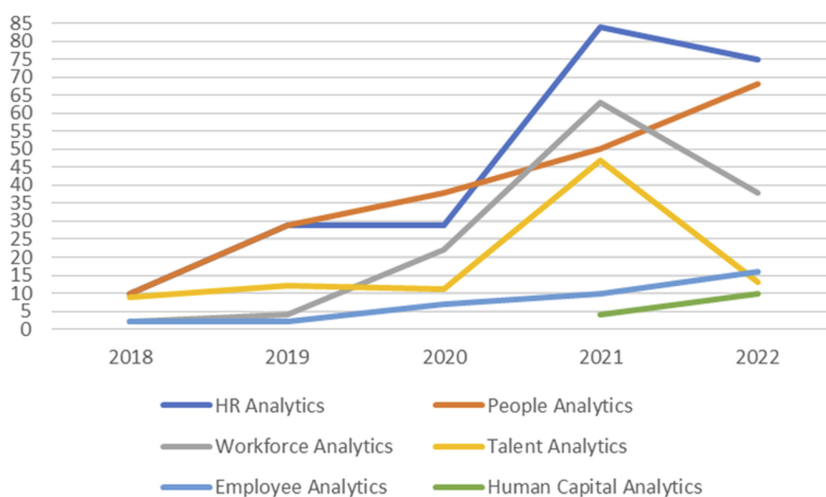
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with "pages not available" ($n = 163$) and spam sources ($n = 78$). The remaining 336 GA were analyzed based on their full text. Here, 27 GA were excluded as they were irrelevant to PA, and 13 which were job advertisements. Thus, 296 GA qualified for the final analysis. The dataset with all GA can be shared upon reasonable written request to the authors, following the recommendation of Stodden *et al.* (2018) to increase the validity and replicability of scientific research.

Charting the data
The text of these GA was copy-pasted into individual Word documents and uploaded to the qualitative data analysis software ATLAS.ti. This software was chosen as its usefulness has been proven, particularly for social science research (Hwang, 2008). Two authors independently read and coded relevant articles using a mutually agreed coding procedure, with cases of ambiguous codes resolved through discussion and examination of the wider context (Palas and Bunduchi, 2021). Disagreements were resolved through consensus or arbitration by a third author.

The data analysis involved the use of ATLAS.ti software to code the data based on the categories from our conceptual framework (see Figure 1), including application types, enablers/barriers and value. The data that did not fit any of these categories were open-coded (Bryant and Charmaz, 2007). These are marked with an asterisk in the findings section to differentiate them from other categories. In our analysis, we also noted whether and how PA applications, their values, as well as relevant enablers and barriers have evolved between 2018 and 2022. Following Gualandi *et al.* (2020), the data were coded in Italian, while the quotes were then translated and reported in English.

Collating, summarizing and reporting the results
Next, we will present the findings following our conceptual framework (see Figure 1). The findings will be presented in a narrative form, with reference to specific articles and illustrative examples that support them (whenever possible).

Results

PA applications

Our analysis revealed discussions on both descriptive and predictive/prescriptive applications of PA, though with a prevailing frequency of descriptive analytics (see Figure 3).

Most of the descriptive applications of PA focus on *employee engagement*, which according to the articles reflects an employee-first approach that places people at the center of the organization and prioritizes organizational practices focusing on making employees feel valued and connected to it. By increasing *employee engagement*, businesses are thought to create a more productive and supportive work environment that can benefit both employees and organizations. We also observed growth in *employee sentiment analysis* applications such as those based on AI and aimed at understanding employee needs and preferences. PA descriptive applications seem to be diffused in *learning and development** activities, particularly in the creation of employee growth, valorization and training paths. By using such PA applications, businesses should be able to develop training plans that are tailored to the real needs of their workers, thereby increasing their overall skill levels and productivity. Other important descriptive PA applications are *online recruiting* and *talent hiring, engagement and retention*. Several sources have discussed that PA is crucial in optimizing (e.g. reducing the time spent analyzing CVs) and simplifying the candidate selection process, shortening the time it takes to find potential candidates. *Organizational network analysis** (ONA) has been mentioned by some as a specific type of descriptive PA application that can be used for effective HRM. An overview of all descriptive PA applications discussed in the analyzed corpus of literature is illustrated in Figure 4.

Predictive/prescriptive PA applications mainly refer to *proactive predictive decision-making on people matters*. In particular, PA was mentioned as key in supporting the transformation of HR decision-making into data-driven decisions (Digital4, 2019). Through the application of AI, predictive models are envisioned to anticipate HRM problems, significantly enhancing emotional intelligence, leadership and the decision-making process. Some sources also reported that predictive models help to make investment decisions on individuals by specifically analyzing HR data and incentivizing employee behaviours targeted at improving organizational structure and skill development
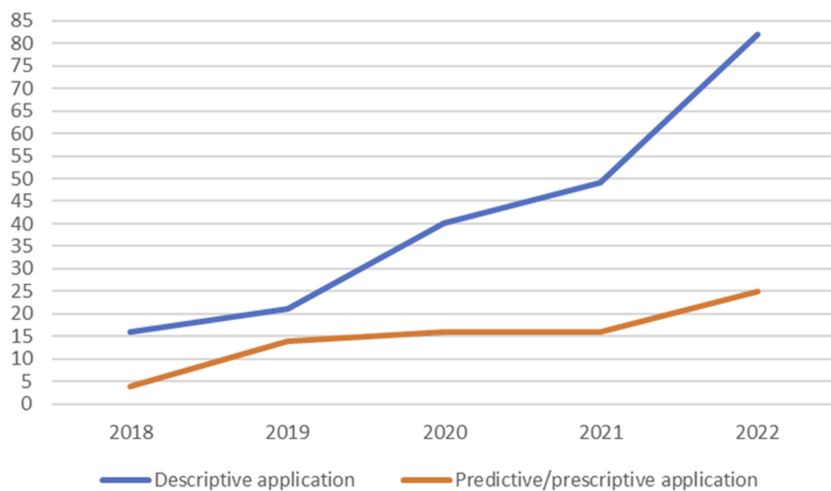

Figure 3.
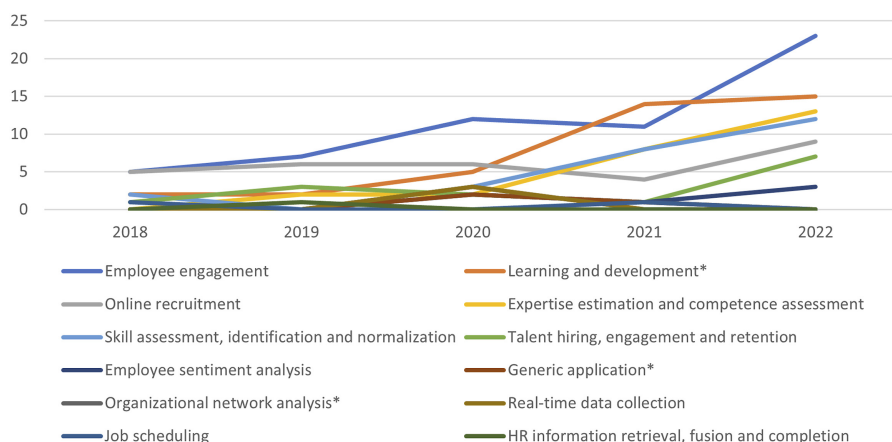PA applications

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processes (Snap Italy, 2021). An overview of all predictive/prescriptive PA applications discussed in the analyzed corpus of literature is illustrated in Figure 5.

PA value
Our analysis revealed discussions on both employee-related ($n = 155$) and organization-wide ($n = 115$) values of PA for both descriptive and predictive/prescriptive PA applications.

Interestingly, while the value for organizations has been discussed at a constant rate, the discussion on the employee-related aspects has increased significantly, primarily during and after the pandemic (see Figure 6).
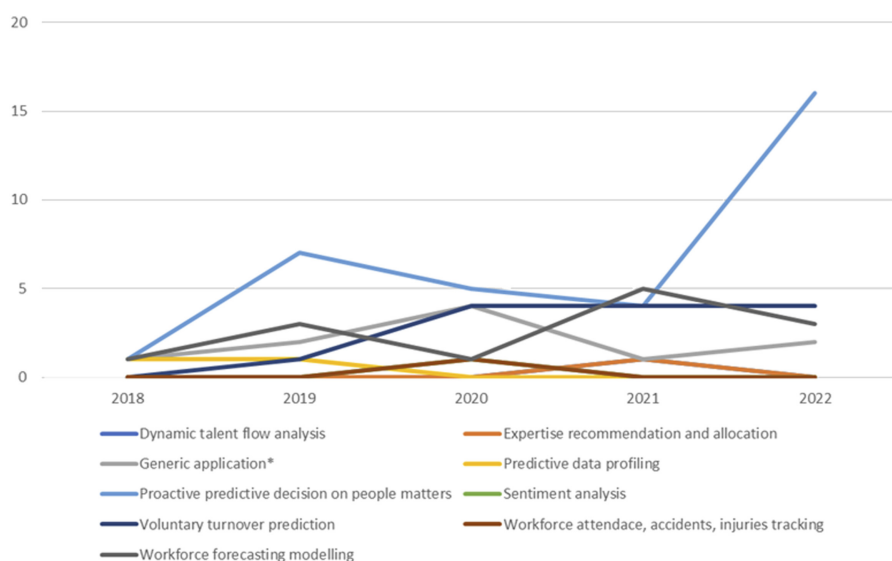

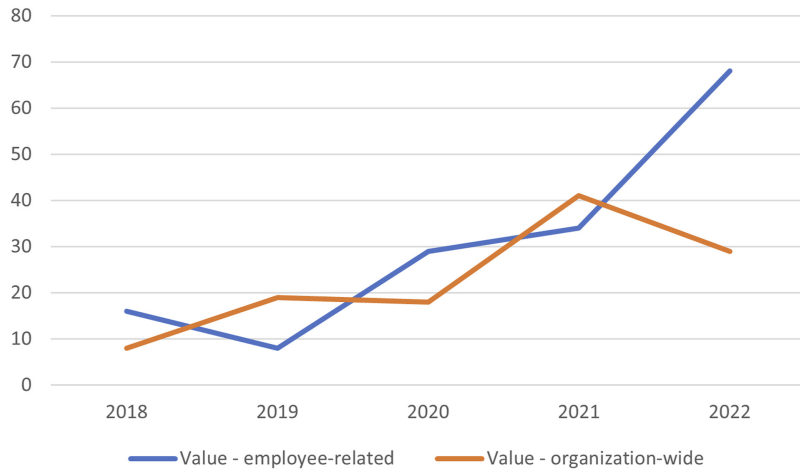**Source(s):** Figure created by authors

Figure 6.
PA value between
2018–2022

Source(s): Figure created by authors

The most frequently mentioned categories of organizational values include *data-driven decision-making (n = 39), business/organizational performance (n = 20), competitive advantage and enterprise analytics (n = 11), managerial efficiency (n = 10)*, and *business value creation and business model innovation (n = 7)* (see Figure 7).

The most frequently referred to employee-related values of PA were *employee engagement and commitment (n = 52), employee reskilling and competence update (n = 33), improved*
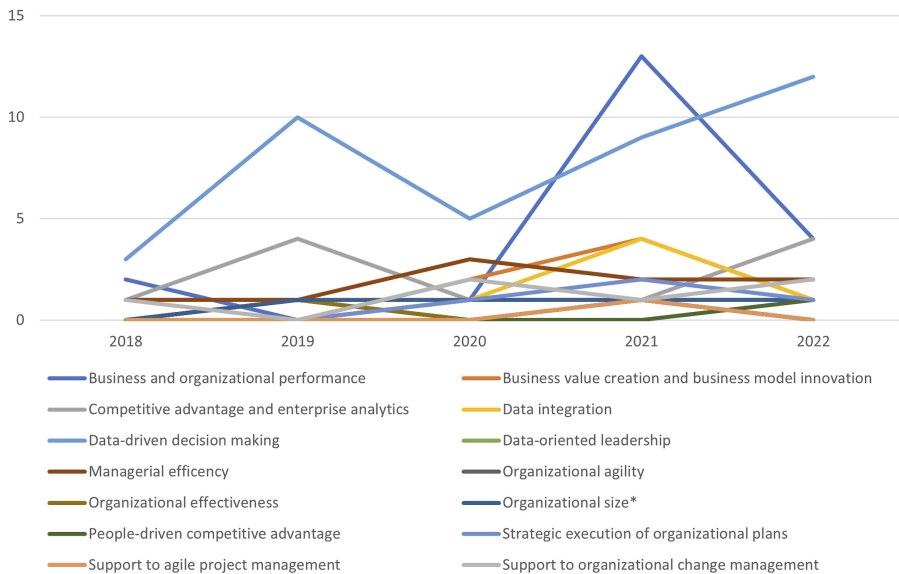

Figure 7.
PA value for
organizations

Source(s): Figure created by authors

*employee experience (n = 31), appropriate recruitment profile selection (n = 16), and skill-job fit,
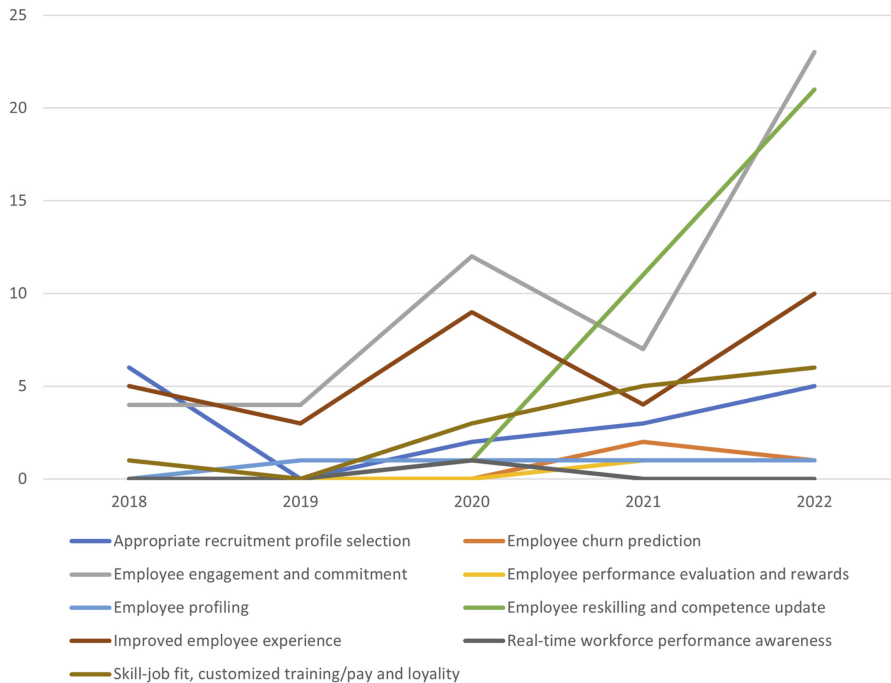customized training/pay, and loyalty (n = 15) (see Figure 8).*

Descriptive PA applications' value
Descriptive applications of PA have been reported to bring value to both organizations and
employees.

The values mentioned specifically for organizations included primarily *data-driven
decision-making* (n = 19) and *business and organizational performance* (n = 9). The value of
data-driven decision-making has frequently been cited as achievable with the assistance of
employee sentiment analysis, considered one of the most innovative descriptive applications
of PA. Through employee sentiment analysis, organizations can make more targeted
decisions on how employees act, listen to how they are doing, and understand their deeper
needs; therefore, by leveraging the data, managers can support the improvement of team
employee engagement (BitMAT, 2021).

Business and organizational performance value can be achieved, for example, through
competence analytics and skill assessment applications. Thanks to a PA-based approach that
allows for the identification and development of "useful skills," through statistical analyses
applied to performance in the first two months of 2021, Choralia, an Italian organization that
provides certified training, recorded a 110% increase in its revenue compared to 2020
(Canali, 2021).

Employee-related values from descriptive PA applications that emerged from our
findings include primarily *employee engagement and commitment* (n = 45); *employee
reskilling and competence update* (n = 25); *improved employee experience* (n = 24); *skill-job fit,*

Figure 8.
PA value for
employees

Source(s): Figure created by authors

customized training/pay, and loyalty ($n = 13$); and *appropriate recruitment profile selection* ($n = 10$). With the implementation of employee engagement descriptive applications, employees' information assets are expected to be efficiently managed, enabling organizations to provide corporate leaders with data that can inform programs to foster employee engagement and cultivate a sense of belonging within the organization (Manni, 2020). They can also capture individuals' preferences and expressed competencies. The data generated are dynamic and ever-changing, extracted from various life moments and aggregated. Hence, they are claimed to be effective in enhancing people's satisfaction (Il Messaggero, 2021). These applications can also help to gain valuable insights into employee behavior and preferences, which can improve *employee experience and engagement* (Digital Innovation Observatories, 2018). For instance, the Italian multinational manufacturer and distributor of electricity and gas company Enel recently received the "HR Innovation Award" in the "People Experience" category from the Polytechnic University of Milan for their "People Digital Transformation" project. The project, launched in 2017, digitized HRM processes across the employee journey taking advantage of the new opportunities offered by technology.

With descriptive *learning and development**, *skills assessment, identification, and normalization*, as well as *expertise estimation and competence assessment* PA applications, employees are expected to be better managed by organizations throughout their professional life cycles. This involves keeping their skills up-to-date and having access to opportunities for *employee reskilling and competence updates*. This translates into expanding their knowledge and expertise, increasing their job opportunities within the company, and becoming more mobile within their roles. Employee reskilling programs can also help employees stay adaptable to new challenges and remain competitive in the job market (Lovati, 2022). According to a Talent Garden study with 40 HR managers from partner companies, data analytics is the best area for reskilling resources aged 40–50 who have been impacted by the crisis. Such PA applications, for instance those offered by HRCoffee, are claimed to strengthen employees' *skills and job fit* by mapping and unifying their competencies, knowledge and strengths, making them easily transferable and traceable over time. Finally, *online recruitment* applications can provide employees with a valuable opportunity to showcase their strengths and abilities and to be placed in project teams where these can be most effectively utilized (WeWelfare, 2022), thus unfolding *appropriate recruitment profile selection* value.

Predictive/prescriptive PA applications' value

The predictive/prescriptive PA applications have also been reported to provide value for both organizations and employees.

PA was mentioned to facilitate organizational *data-driven decision-making* ($n = 27$) in the *decision-making on people-related matters* predictive/prescriptive application. For example, some Italian PA providers (e.g. F2A; i-Genius-Zucchetti) are making significant technological investments in AI to support the digital transformation of HR departments. Their goal is to allow clients to be *competitive* ($n = 4$) in the market by providing analytics tools that improve the insights necessary for their decision-making processes (Brunelli, 2019). The use of AI in HR has been mentioned in relation to *increased business and organizational performance* ($n = 7$), enabling the understanding of the status and performance of business processes and the creation of predictive models useful for strategic business decisions such as employees' productivity (Datamagazine, 2022).

For employees, predictive/prescriptive PA applications can improve *employee engagement and commitment (n = 7)* and *employee experience (n = 4)*. For example, the PA tool of the Italian company Generali allows for "data-driven" decision-making to improve growth

programs and engagement of people by accessing human capital data (Colombo, 2019).
Others reported that having an HR data-driven approach enables summary indicators
reflecting a person's employee journey in a company, which allows understanding of their
level of engagement and motivation, and identifies which dimensions to work on for their
development (Madini and Flecchia, 2020). It has been recognized that throughout the selection
process, AI and predictive analysis (e.g. gamification) allow for faster search times, better
selection quality and improved candidate/employee experience (BitMAT, 2018).
Furthermore, *voluntary turnover* PA applications were demonstrated to be valuable in
predicting employee churn (n = 3), while *data profiling* PA applications aided *employee
profiling* (*n* = 3) and *appropriate recruitment profile selection (n = 4)*. The Italian network of
supermarkets Esselunga could anticipate the turnover within the store population with a
machine learning algorithm. Their model allowed for the identification of situations at risk of
abandonment and gave managers the possibility to prepare any corrective actions. This
project recently won one of the HR Innovation Awards from the Digital Innovation
Observatories of the School of Management of the Polytechnic University of Milan (Digital
Innovation Observatories, 2021).

PA applications enablers

The majority of enablers for the application of PA have been technological (*n* = 133), such as
AI (*n* = 47), *HR big data* (*n* = 19), *cloud-based systems* (*n* = 10) and the arrival of *PA* itself
(*n* = 28), among others (*n* = 29); followed by organizational enablers (*n* = 43). Environmental
enablers (*n* = 18) have only started being discussed in 2022 (see Figure 9).

The findings (where it was possible to classify them) revealed that among technological
enablers, 68 were relevant to descriptive PA, while 40 were relevant to predictive/prescriptive
PA (see Figure 10).

AI was referred to as the main technological enabler for descriptive PA applications
(*n* = 27) including *online recruitment* (*n* = 13) (e.g. "*The recruiter utilizes new tools leveraging
algorithms and AI systems that facilitate the work and enhance its capacity*") (Lavalle, 2022) and
skills assessment and identification (e.g. "*A new model of personnel management based on a
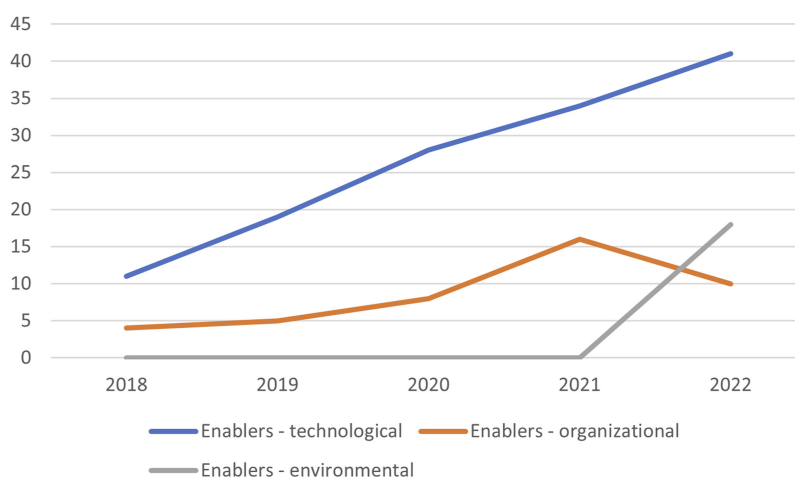people-centric approach, which allows for the emergence of open innovation initiatives, with a*

Figure 9.
PA enablers

Source(s): Figure created by authors

view to continuous evolution, increased engagement, analysis of skills gaps, development of self-assessment processes, mapping of individual skills, upskilling, reskilling, and HR digital twin") (InnovaMI, 2022). AI's predictive/prescriptive modeling capabilities (*n* = 17) were mentioned as permitting *data-driven* (accelerated) *decision-making* models for HRM practices such as talent acquisition, as well as anticipating employee behaviors and outcomes (e.g. turnover). Both descriptive and predictive/prescriptive PA were considered possible thanks to the availability of HR big data (*n* = 11 and *n* = 9, respectively). Finally, predictive PA (*n* = 10) emerged as an enabler of *HR digital transformation**.

Organizational enablers were discussed primarily for descriptive (*n* = 23) rather than predictive/prescriptive PA applications (*n* = 10). The most frequently mentioned organizational enabler was organizational *awareness of analytics opportunities* (*n* = 18) and the *awareness of challenges and criticisms* such as the awareness that the HR world is a reality that is sensitive to changes, technology and emotions and that many companies, both large and small, have to deal with new ways of working and accordingly rethink the models and tools for managing HR (e.g. "*It is necessary to act now to avoid impasses that will be difficult to overcome when throughout Europe the digital management of workforce data will be a fully consolidated and mandatory practice*" (Solari, 2019)). The former awareness was discussed primarily in relation to descriptive PA (*n* = 12). *Organizational readiness* was also mentioned as a generic organizational enabler that reflects a company's willingness to adopt applications dedicated to employees, to invest in the development of their employees (BusinessCommunity, 2020) or to create solutions by integrating active *ONA** and *Sentiment Analysis* to foster a dialogue between employers and employees and improve their connectivity and cross-functional teamwork (KONGNews, 2020).

The emergence of environmental enablers in 2022 seems to be related to the *impact of the COVID-19 pandemic** (*n* = 11) on organizations and their operating models worldwide. Here, *remote working** that was imposed by the social distancing norms was discussed as leading to a central role for HR in defining strategic business goals, as well as the complete digitization and disruption of HR processes to adapt to the changing (remote or hybrid) work environment and evolving employee needs. Environmental enablers (*n* = 12) were mostly discussed in relation to descriptive PA. PA was mentioned as helping organizations gain insights into how employees are adapting to the new work environment. For instance, the COVID-19 pandemic forced many organizations to shift their recruiting processes online, leading to a significant increase in the use of digital recruiting technologies. In-person job fairs, interviews and assessments have been replaced with virtual recruiting events, video interviews and online assessments, with significant time and resource savings and the ability to draw from a broader pool of valuable candidates without geographical barriers or mutual costs (Fiertler, 2022).
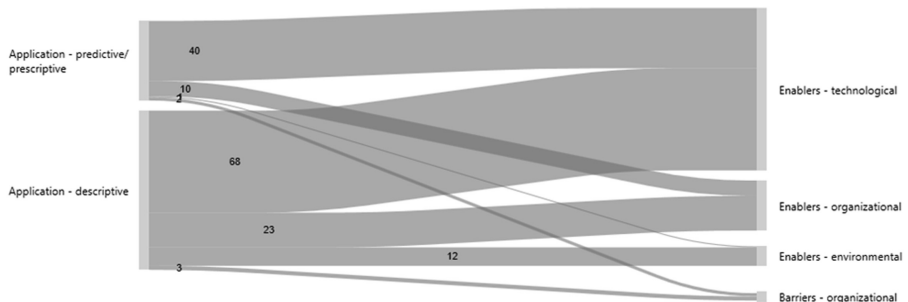

Figure 10.
Relationship between PA applications and enablers/barriers

Source(s): Figure created by authors

PA applications barriers
The discussion of barriers associated with the adoption of PA in the analyzed corpus of literature overall has been limited. Among them, organizational barriers ($n = 20$) were the most commonly discussed ones, followed by environmental ($n = 7$) and then technological ones ($n = 3$). The barriers were mostly discussed in general, regardless of the type of PA application.

The most frequently cited barriers were *cultural** and *privacy issues*, discussed at both organizational and environmental levels. Regarding the former, according to a report by the HR Innovation Practices Observatory of the School of Management of Polytechnic University of Milan, HR directors were found to be at risk due to a lack of a data-driven culture (e.g. "*In HR departments, there is still a lack of a data-driven culture, with only 15% measuring the impact of their practices on the business. The main barriers to data utilization are the lack of a standardized data collection process on HR processes (61%), poor or absent integration of IT systems (41%), and low awareness of the benefits by management (29%)*" (Smartweek, 2021)) and due to cultural and mentality differences between various organizational functions such as finance and HR. To mitigate these risks, strategies have been suggested such as selecting a new generation of managers who possess the necessary skills and understanding of technology to support effective decision-making (Madini and Flecchia, 2020), implementing human-centered solutions, and regularly updating training plans to enhance employee skills (Manni, 2020). The cultural barrier also relates to the low rate of female AI professionals in PA initiatives. Regarding *privacy issues*, there has been an increase in awareness of such barriers over the past year, particularly in relation to the implementation of AI in HR, and in the context of the *General Data Protection Regulation (GDPR)**, which established rules for personal data use in PA in Europe. To ensure trust and transparency in the use of AI tools, it was identified as crucial to inform everyone involved about how the tool works, what data it collects, and how the output will be used. Failing to do so could lead to misuse of the tool, incorrect decisions, loss of trust, and legal and reputational consequences (Balocco, 2022). AI-related privacy issues have been considered organizational barriers for descriptive online recruiting, while fragmented data, data literacy, lack of specialized resources and restrictive constraints on data management and privacy hinder expertise estimation and competence assessment applications.

Companies were also mentioned as facing several *challenges in utilizing data effectively**. These include incomplete data, a lack of knowledge on how to use the data, a shortage of specialized staff and legal restrictions on data management and privacy.

At the environmental level, the topic of *bias/prejudice** has been discussed, as it was reported to be one of the major concerns in the use of AI for HRM activities. Although AI algorithms are often seen as objective and impartial with the potential to reduce prejudice (Balocco, 2022), they actually have the potential to encode and amplify existing biases. For example, technologies that scan people's faces to deduce their emotional states based on facial movements or expressions (Prandi, 2022) could lead to bias.

Finally, the cross-functionality of the various actors involved in different business areas and the intangibility of the know-how developed with algorithms can be barriers if not closely linked to a strong awareness of the importance of data and the predictive capabilities implemented by AI.

Discussion and conclusions
Drawing on previous studies on technology adoption and PA, as well as a unique data source, our scoping review explored how PA is being embedded in HRM by analyzing organizational approaches to applying PA, relevant enablers/barriers and the value of adopting PA for both employees and organizations.

Our findings suggest that there is a growing interest in the use of PA. Most of the PA applications we analyzed were descriptive. However, we also found some cases of predictive/ prescriptive PA applications that involve AI and/or machine learning that have not been noted in previous PA research (e.g. Giermindl *et al.*, 2022). This difference may be attributed to the nature of the studies: academic in the case of the Giermindl *et al.* (2022) study, and more socially curated in our case. The benefit of using the latter type of data in our review is that we were able to identify and discuss some illustrative real-life PA applications seldom covered in the scholarly literature, which demonstrate that PA is already an established practice within organizations.

Our analysis enriched the already comprehensive list of PA applications proposed by Margherita (2022), with additional categories such as ONA and learning and development, illustrating the continuous rapid development and diversification of the PA field, which has already developed way beyond the list of PA applications envisioned for 2025 among the Dutch PA practitioners (van den Heuvel and Bondarouk, 2017). Most descriptive PA applications that emerged from our findings are primarily focused on employee engagement, learning and development, and online recruitment, which can ease the work of HR professionals. Consequently, these applications seem to be more easily accepted by both employees (e.g. Khan and Tang, 2016) and HRM professionals. Meanwhile, most of the predictive/prescriptive applications seem to be focused on enabling and strengthening proactive and predictive decision-making, referred to by previous scholars as smart PA, by embracing analyses of larger sources of data (Budhwar *et al.*, 2022). Although following Margherita (2022) we positioned such PA applications in a rather positive light, many of them have also been suggested as having more negative aspects, such as permitting employee surveillance and monitoring or algorithmic biases (Giermindl *et al.*, 2022).

Some value categories that emerged from our findings are aligned with those identified in the scholarly literature (e.g. Margherita, 2022; Budhwar *et al.*, 2022), such as employee engagement or commitment. However, while previous research on PA discussed the value of PA mostly for organizations (e.g. van den Heuvel and Bondarouk, 2017), such as productivity, cost reduction or operational efficiencies (Torres and Mejia, 2017), our findings reveal values also in terms of organizational effectiveness, such as the creation of worth for employees, which can demonstrate the ambidexterity of organizational objectives or outcomes in relation to the PA use.

The value categories from both descriptive and predictive/prescriptive PA for organizations are similar, such as data-driven decision-making and business and organizational performance. However, our findings imply that organizations could attain these through different PA applications. For instance, in descriptive PA, these values can be achieved in learning and development, talent hiring, engagement, and retention, as well as employee engagement applications. In predictive PA, employee data can be embraced in proactive predictive decisions on people matters, predictive data profiling and voluntary predictions. The value categories for employees are primarily related to the accumulation and analysis of data throughout the employee lifecycle on their engagement or experience, mostly in the context of relevant descriptive PA applications. Interestingly, our findings suggest that the value of PA applications for organizations can be direct. On the other hand, realizing PA value in the form of improved employee experience or engagement requires (proactive) action by organizations. This involves leveraging employee data to design programs to prevent their turnover or implementing training initiatives for reskilling in alignment with employee interests.

Past research has outlined the applications of PA across traditional HRM functions and practices, spanning performance evaluation and enhancement or workforce planning (Isson and Harriott, 2016), along with discerning their success (Keding, 2021). Our analysis suggests

that PA can be applied both within long-standing HRM practices such as recruitment, as well as in more innovative activities such as ONA (Tursunbayeva *et al.*, 2018) or sentiment analysis, highlighting its disruptive nature and its significant transformative impact on HRM processes. Moreover, considering that the value of PA was frequently discussed in relation to employee engagement and experience, it seems that in Italy, PA applications are not positioned as tools for some specific HRM functions or practices; rather their value can be realized when employed throughout the entire employee lifecycle. This necessitates that HRM scholars and practitioners revise current fragmented perspectives on HRM. Indeed, it is not surprising that our analysis indicates that the application of PA in HRM requires a cultural shift in organizations (Chattopadhyay *et al.*, 2017), which seems not to be necessary for broader organizational big data technology applications (e.g. Raguseo, 2018).

In comparison to previous studies that discussed mainly enablers for PA, our study also recognizes that organizations face challenges in their PA initiatives that they need to mitigate (Tursunbayeva *et al.*, 2022). This is particularly important considering that PA projects sometimes do not live up to their promises (McCartney and Fu, 2022). Indeed, Josh Bersin, one of the leading innovators in the field of PA, reported that 42% of rated HR technology projects are not fully successful or failed after two years (Bersin, 2021). Many PA projects also face environmental barriers such as privacy regulations like GDPR or force majeure events such as the COVID-19 pandemic (Giermindl *et al.*, 2022), which have been mostly overlooked by previous PA studies. The findings of our study suggest that while enablers can vary between PA application types, the barriers, especially technological and environmental, seem to be generic for both descriptive and predictive/prescriptive PA applications. The privacy concerns in the Italian context, as revealed in our analysis, have also been noted in other EU countries, such as the Netherlands. Indeed, Van den Heuvel and Bondarouk's (2017) study, which interviewed 20 HR Analytics practitioners, found that challenges related to complying with data privacy legislation and maintaining trust were significant.

As with any research, our study has limitations. One limitation is that it only includes gray literature from GA, which due to its nature might have more of a positivistic and technocratic form. Future studies could address this limitation by incorporating separate searches through the Google Search Engine or consulting with PA users/experts to develop case studies on the development, implementation or use of PA applications. Our study also focuses on a specific context - Italy. Nevertheless, we believe that our findings are generalizable to other EU contexts which are similar to Italy in terms of legislation, culture, religion, politics or economic characteristics (Reis *et al.*, 2020). The findings could also be generalizable to other contexts with similar levels of technology preparedness such as Japan or the USA (Dawson and Desouza, 2022), as well as those that have yet to explore the potential of PA. We believe that our findings are generalizable because we noted an alignment of the types of PA-related keywords used in Italy to those used internationally, as well as the uptake of PA-related international searches for such keywords via Google Search Engine in the same periods as emerged in our research (see Tursunbayeva *et al.*, 2018 for discussion). Still, more specific international and cross-cultural comparison studies could be a fruitful avenue for future research.

Despite such limitations, we believe our findings make important theoretical, methodological and practical contributions. Theoretically, our study contributes to the limited scholarly knowledge of technology and innovation in HRM, digital HRM, algorithmic HRM and PA. Specifically, it proposes a conceptual framework for studying PA applications, their values, and specific enablers and barriers as a whole, in comparison to previous studies that considered these elements separately (e.g. Margherita, 2022). Our study also provides evidence that values and some enablers/barriers of PA can vary depending on the type of PA application, whether descriptive or predictive/prescriptive. Methodologically, we propose and describe in detail a unique qualitative approach that

draws on a free content change detection and notification service – GA – that can be used to conduct PA-related research in other specific contexts. This approach goes beyond conducting exploratory context-specific studies that investigate the state-of-the-art of PA in specific contexts (e.g. in Serbia (Vukmirović *et al.*, 2023) or Poland (Muryjas, 2016)), or quantitative studies aiming to establish a link between PA and talent management (e.g. in Oman) (Al Haziazi, 2023), or how descriptive and prescriptive PA can serve as moderating factors (e.g. in Thailand) to facilitate the impact of organizational culture, technology adoption and HR competencies on organizational performance (Penpokai *et al.*, 2023). Pedagogically, our study provides illustrative examples of PA that have been missing in the literature and can be used in training future PA scholars and professionals. Practically, our study contributes to providing a more comprehensive understanding of the global landscape of PA adoption and its implications for HRM practices. It can serve as a helpful point of reference for managers planning or implementing PA, and as a comprehensive analysis of the PA market in Italy, which could be used as a benchmark over time, or to compare the approaches to the use of PA and its value across EU countries and/or internationally. Our study could also indicate potential training areas or skills needed for HR professionals who would like to embrace descriptive or prescriptive PA. Finally, our study provides a clear response to the question of how HRM researchers can assist HR professionals in managing the disruptions caused by digital technologies, emphasizing their essential role in guiding HR professionals to avoid potential pitfalls associated with the adoption of these digital tools (Minbaeva, 2020).

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(The Appendix follows overleaf)

Appendix

Applications	*Descriptive:* Adaptive scoring algorithm; competence analytics; employee engagement; employee sentiment analysis; expertise estimation and competence assessment; HR information retrieval, fusion and completion; intelligence applicants shortlisting; job scheduling; latent ability modeling; occupational skills normalization; online recruitment; real-time data collection; semantic web human resource resumes; skill assessment, identification and normalization; talent hiring, engagement and retention	*Predictive/prescriptive:* Dynamic talent flow analysis; expertise recommendation and allocation; prediction human resources modeling; predictive data profiling; proactive predictive decision on people matters; probabilistic learning framework; propensity modeling; sentiment analysis; turnover costs and recruitment decision; voluntary turnover prediction; workforce forecasting modeling; workplace attendance, accidents, injuries tracking

Value — *Employee related:*
Appropriate recruitment profile selection; Employee attrition and loyalty analysis; Employee attrition prediction; Employee churn prediction; Employee engagement and commitment; Employee fraud risk management; Employee performance evaluation and rewards; Employee profiling; Employee reskilling and competence update; Employee sentiment analysis; Forecasting of HR capacity and recruitment needs; Global recruitment optimization; HR external and internal marketing; Improved employee experience; Job turnover and transition networks; Leadership development; Real-time workforce performance awareness; Skill-job fit, customized training/pay, and loyalty; Sustainable talent acquisition; Wage transparency
Organization-wide:
Automated decision-making; Automated management style; Business and organizational performance; Business value creation and business model innovation; Competitive advantage and enterprise analytics; Customer satisfaction; Data-driven decision-making; Data-oriented leadership; Evidence-based predictive decision-making; Managerial efficiency; Organizational agility; Organizational effectiveness; Organizational resilience; People-driven competitive advantage; Strategic change; Strategic execution of organizational plans; Support to agile project management; Support to organizational change management

Enablers/ — *Technological:*
Barriers AI; Chatbots; Cloud-based systems; Data clustering tools; Employee information systems; HR big data; HR databases; HR information systems; HR platforms; HR software and applications; HR statistic tools and algorithms; Internet of things devices and sensors; Job search engines; Machine learning applications; Multi-cue semantic information; Natural language processing; Neural fuzzy networks; Social media and professional networks
Organizational:
Academic and practitioner integration; Agile workforce analytics; Analytics function centralization; Analytics skills of HR professionals; Analytics team creation; Awareness of analytics opportunities; Awareness of challenges and criticisms; Data governance and ethics; Degree of individual adoption; Employees' perceived accuracy and fairness; Ethics issues in HR data analysis and use; Focus on actionable insights; HRM team preparation and expertise; Knowledge and competence hubs; Organization and industry implementation barriers; Organizational complementarities; Organizational readiness; Outside-in approach with focus on actionable metrics; People specialist team creation; Performance pay policy; Privacy issues in HR data analysis and use; Six thinking hats approach; Virtue ethics approach
Environmental:
COVID-19 pandemic

Table A1.
Concepts and sources related to enablers, applications, and value of PA

Source(s): Adopted from Margherita (2022) and Chong *et al.* (2020)

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