

Customized Artificial Intelligence for Talent Recruiting: A Bias-Free Tool?



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Abstract In recent years, technological innovations in e-recruitment systems have seen an explosive expansion, allowing Human Resource professionals to find the talents who are supposed to be the most suitable to their organizations. In particular, the purpose of this paper is to explore the contribution that Artificial Intelligence Technologies can give in order to increase the efficiency of the recruitment process and overcome human errors, by comparing theoretical convergences among the various approaches and platforms addressed to companies. A case study was conducted to explore the research questions of this study. A brief study of limits, risks, as well as managerial and business implications linked to the use of AITs in HRM will be also conducted.

Keywords Talent acquisition · Gamification · AI in recruitment process · Predictability · Bias

1 Introduction

The recent transition from a discrete paradigm of information processing (programming for Turing machines) to a continuous paradigm (learning of artificial intelligence) allows faster and more accurate adapting to environmental requirements. In the modern conditions of business, it becomes more relevant for organizations to use the Artificial Intelligence Technologies (AITs) for decision-making. This also led to the application of AITs to Human Resource Management (HRM), since AITs enable the prompt analysis (cleaning, investigating, and making conclusions) of data by people that do not have special skills in data analysis.

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The HR sector is aware of the progressive change that HR boards are stimulating, by shifting the focus from automation to the impact upon business and engagement, that are supposed to define HR strategies and mold the future of the sector since 2018. Many analyses conducted by HR professionals agree that one of the major trends in HRM will be Artificial Intelligence to serve HRM, and that three key areas of recruitment will be revolutionized by AI:

1. AI will bring more efficient and fairer candidate screening, in order to free up time to focus on the human aspect of recruitment and offer a more personal service to clients and candidates.
2. AI will ensure a better candidate fit through online job boards.
3. AI will help safeguard future talent pipelines in order to improve employee retention and development.

There is a growing body of scientific research pointing toward the use of behavior, rather than self-report, as a better assessment tool. This is because behavior can be objectively measured, and this direct measure can be used to counteract some of the conscious and unconscious bias that is inherent to all human self-report measures. In many big companies the validation of selection process through AITs is now in place, from screening/indexing of the resume (almost obsolete in comparison to social profiles), up to automated interviews by screening facial mimics and eye movements. Common opinion in recent research states that a correct parameterization of AI guarantees better hiring (efficient and durable) compared to hiring made by managers, since it allows to eliminate cognitive biases and judgment subjectivity, and to seek in the profiles just the features that have proved successful by individuals embedded in the organization and acknowledged as effective members of the team. Although these technological innovations have generated a transformation of the recruitment process [1] and their implementation has been widely embraced by large companies, many outstanding issues with regard to AITs have remained unanswered. Despite the pervasive impact of technology on HR in organizations, and the enormous potential to improve talent recruitment process [2], there has been relatively little research examining its effectiveness and its capacity to remove the potential bias in the selection process and to evaluate a wide variety of knowledge, skills, abilities, and other characteristics of candidates. Thus, we believe that further research is needed to assess to what extent AITs enable organizations to achieve their goals. In particular, based on the case study of Pymetrics platform, the aim of this paper is to explore the contribution that AITs can give in order to overcome human errors by comparing theoretical convergences among the various approaches and platforms addressed to companies. A brief study of the limits linked to the use of AITs will be also investigated. Actually, there are still many open questions. If it is true that the possible errors of assessment, inevitable when the human component comes into play, represent a cost and a problem for companies, it is also true that the selection algorithm is based on data collected by humans, with the same possibility of error.

In particular, our goal was to answer the following research questions:

- How accurate is the system in order to remove bias and judgment subjectivity from selection process?
- Do Artificial Intelligence Technologies attract and select the talented who can perform successfully in organizations?

Often then, in writing down the characteristics of an open position one can be tempted to resort to too general descriptions, which artificial intelligence, unlike the selector who knows the company well, may not be able to grasp. For this reason, we will examine the “cognitive traps” in relation to skills. By comparing the methodology and the theoretical background adopted by the above-mentioned actors, especially the case of Pymetrics platform, we suggest however that at this stride these systems can present limits as to parameterization, that there is an urgent need to theoretically define the relation between actual skills and desired skills (the latter being a request from companies), that the pretense of unbiased hiring can be partially criticized and finally, that bias must not be confused with subjectivity, which has to be preserved instead.

The rest of the paper is organized as follows. First, key concepts are defined and situated within the academic literature. Next, the research methodology employed is detailed. Finally, we provide a summary of the key findings and discuss the implications for organizations.

2 Literature Review

2.1 Talent Management

In the world economy, human capital is one of the most valuable assets of an organization, and employee recruitment and selection cover the important function of attracting and retaining talented workforce [3, 4]. These goals have become extremely important in recent years because organizations compete on the basis of the skills and talents of their workers [5]. For these reasons, the field of recruitment and selection has traditionally been one of the most important domains of research and practice in the field of Human Resource Management in organizations. Michaels [6] defined talent as a person’s ability, which include a person’s abilities, knowledge, and potential for future development. Talent consists of those individuals who can make a difference to organizational performance, either through their immediate contribution or in the longer term by demonstrating the highest levels of potential (chartered institute of personnel and development). Over the years, there has been a dramatic shift in the role of human resources in an organization. Nowadays companies focus on their potential/talented employees rather than having a neutral attitude for all the employees working in the organization as talented people act as a critical resource for achieving success. Furthermore, in many parts of the global economy there is a

talent shortage and many companies still struggle to recruit and retain key talent [7]. Demographic trends such as a smaller supply of younger workers and retirements among baby boomers indicate that recruitment and applicant attraction will be even more important in the future [8]. As a result, recruitment has become one of the most critical human resource functions for organizational success and survival [9]. Talent management is the process of identifying, attracting, engaging, and retaining highly qualified and talented individuals. Acquiring and retaining the best talent acts as competitive advantage, but it is equally important and difficult to find the right person for the right job. The increased competitiveness in the recruitment market has led to organizations spending more time, effort, and resources in order to develop tools for the efficient selection of employees with the required skills and aptitude to meet current and future organizational needs [6, 10]. A critical task in the talent management is to identify all the essential skills that are required by employees for their development in all the key areas of business [6, 11] and to ensure that the organization has a continuous supply of highly productive individuals in the right job, at the right time. Rather than a one-time event, talent management is a continuous process that plans talent needs, builds an image to attract the very best, ensures that new hires are immediately productive, helps to retain the very best, and facilitates the continuous movement of talent to where it can have the most impact within the organization [12].

Among strategic priorities, diversity is an important aspect of any organization. It is no longer just a legal compliance issue but a key business strategy [13]. Many studies based on worldwide collected data point out that the top quartile of gender-diverse companies is 21% more likely to experience above average profitability than companies in the bottom quartile [14]. Diversity has also been linked with higher rates of employment retention [15]. This fact couples with the corporate need to prop up the organizational change in a context of lacking appropriate leadership (so-called “leadership drought”) and market instability at a global level.

But a diverse workforce does not happen on its own [13]. In general, companies are not always aware of the perspective they are looking at things from and keep on being self-centered. Anyway, companies know they have to reach the above-mentioned goals. Often, though, they run after shortcuts: they tend to use innovative methods and technology, while not changing their organization by assessing themselves in relation to the adoption of such innovations. Since diversity is not just about hiring, a gap has been emerging between HR managers (and middle managers in general) and the adoption/acceptance of the new methods of recruiting/retention. Organizational behavior can cause diversity to dauntingly fail. Tech evolution should be understood, integrated, tailor-designed, gradually implemented—if necessary, underpinned by supporting measures—undoubtedly.

In fact, in the Internet Era the traditional method of recruitment and selection has been revolutionized. The internet helped attract potential candidates to an organization from the recruitment process, which is referred to as e-Recruitment. It is usually defined as “a way of implementing strategies, policies and practices in organizations through a conscious and direct support of and/or with the full use of web-based channels” [16]. Over time, various forms of technology were introduced to

attract applicants, ranging from passive, one-way technologies (e.g. web-based job ads, job boards) to more interactive techniques (such as virtual job fairs). Recent developments in digital technologies have enabled new possibilities for improving recruitment and selection processes. In particular, the talent acquisition highlights how leading organizations use social networking, analytics, and cognitive tools to find people in new ways, attract them through a global brand, and determine who will best to the job, team, and company. In particular, Internet facilitates the use of tools suitable for gamification, that is the use of games and game mechanisms in a non-game context [17–20], such as business. The more innovative ideas and solutions are focused on cognitive technologies such as artificial intelligence (AI), neuroscience assessment, predictive algorithms, and data science analytics and algorithms.

2.2 Gamification in Talent Selection

Recently, there is an increasing number of large organizations that used gamification in the selection process in order to assess cognitive, social, and personality traits. Gamification is the use of game attributes to drive game-like behavior in a non-game context [21]. Many organizations are turning to a job simulation software which could improve hiring by giving candidates tasks they would do on the job. Allowing potential candidates to experience various jobs within different departments of the company. To fill the gap between the need to measure soft skills and the inadequacy of traditional interviews, some companies have developed pre-screening online assessments—user-friendly tests that take candidates about 20 min to complete and give employers a sense of their soft-skill strengths and weaknesses. Whether candidates play neuroscience-inspired games or answer straightforward questions, these online tests let companies screen large pools of talent quickly and make smarter hiring decisions. A series of behavior games collect millions of data points, measuring cognitive and personality traits. There is no right or wrong way to play the games because every trait makes a great fit for a certain job. These tools can be utilized for different goals. First and foremost, they guarantee that these models will help build a more diverse workforce by carefully detecting and removing bias from the selection process. Nonetheless, they will raise efficiency by increasing the yield, reducing missed talent, and expanding the reach of recruiting team. Furthermore, they help companies fight attrition and retain employees by modeling different roles within the company and matching current employees who are ready to leave with a new position.

Despite the growing popularity of gamification in recruiting and the apparent success in some cases, little is known about how these processes influence applicant attraction or if the return on investment is positive. Companies can support this new approach to talent acquisition by starting with a degree of centralization to gain the benefit of scale and efficiency and create a strong and competitively differentiated candidate experience.

Some researchers found gamification to be providing a number of generally positive outcomes: use people's behavior to assess cognitive, social, and personality traits. In research contexts, behavior-based assessments have largely replaced self-report instruments wherever possible. There is a growing body of scientific research pointing toward the use of behavior as a better assessment tool. This is because behavior can be objectively measured, and this direct measure can be used to counteract some of the conscious and unconscious bias that is inherent to all human self-report measures. These games provide a snapshot of a person's unique characteristics. For example, some games focus heavily on traits that are the hardest to train—such as flexibility, learning ability, and decisiveness. Some scholars [22, 23] point out that gamifying the employee recruitment process has the potential reduce bias in employment decisions and help employers make better decisions in hiring, performance evaluations, and promotions. For most organizations, the use of games in recruitment and selection process offers massive economic savings to companies, and also the opportunity to assess large number of their applicant pool.

The use of data-driven algorithms does not automatically guarantee fairness—the conclusions drawn from a data set can only be as inclusive as the input data itself. Meaning, the use of sophisticated algorithms alone cannot remove bias. Fairness will only be achieved through active debiasing of the data on which the tools rest. To guarantee the removal of all bias when evaluating a candidate, some tools allow the companies to the removal of any residual bias found in the data. Adding this third step to the bias removal methodology is essential for ensuring a bias-free final outcome. This last step in bias elimination starts after data are acquired from science-based games. Data are acquired from candidates and from high performing incumbents at a specific job. Statistical methods are then used to measure bias in the incumbent dataset. Once bias has been identified, this information is used to guide the model parameter selection process so that the final candidate recommendation model is bias-free.

2.3 Development of AI Systems for Recruiting: An Overview of Multifarious Approaches

AI use in recruiting is a quite new phenomenon linked to the creation of candidate databases through modern software, which has made storing and retrieving of resumes easier. Its implementation is considered crucial, in particular by multinationals, which have an overall urgent need for scalability, also in HRM. Indeed, with the advent of AI, there is a vision for HR where successful innovations are combined with existing point solutions to form a suite that can deliver a user-friendly experience for both candidates and administrators [24].

The recruitment software landscape has further expanded with the evolution of many tech companies catering to various activities in the recruitment value chain. The recruitment landscape has thus seen extensive changes over the years and has

evolved with the creation of new recruitment tools and processes. For example, Xref and Skill Survey conduct candidate reference checking; Hackerrank, Hackerearth, Aspiring Minds, ELitmus, and Cocubes conduct online tests; Ideal, IBM Watson, X.ai, Glider.AI, belong.co, and param.ai handle Artificial Intelligence and automation in recruitment; Skype, SparkHire, WePOW, Google Duo conduct video interviewing; and BambooHR, KinHR take care of onboarding [25]. Many are also cloud-based SaaS analytics solution providers, such as PredictiveHire and other SaaS architectures [25–27], which reinvent the applicant tracking systems (ATS), and which are augmenting the ATS with other TA technologies, including candidate relationship management, video interviewing, and analytics [25].

Then, implemented systems comprise a wide spectrum of solutions. In many big companies, the validation of selection process through AITs is now in place, from screening/indexing of the resume (almost obsolete in comparison to social profiles), up to automated interviews by screening facial mimics and eye movements. Common opinion states that a correct parameterization of AI guarantees better hiring (efficient and durable) compared to hiring made by managers, since it allows to eliminate cognitive biases and judgment subjectivity, and to seek in the profiles just the features that have proved successful by individuals embedded in the organization and acknowledged as effective members of the team. In order to reach this goal, companies are using some tech platforms trying to:

1. Simplify the operations: ClearFit (automatic candidate search), Wade & Wendy (virtual assistant at the first contact between candidate and company);
2. Improve the effectiveness of the process: Textio (creation of distinctive and customer-specific job ads), Engage Talent (search of candidates not actively looking for a job), Ansaro (predictive model aimed at helping companies hire new employees), Helena (the first AI-powered Headhunter, looking for passive job seekers);
3. Suggest ad-hoc tests: Harver (that generates simulation job-like tests to assess the candidate’s skills), Filtered (that automatically generates coding activities to test potential candidates).

On the one hand, chatbots are now clearly established. They are considered as “Partially Intelligent Systems” that exhibit Perception of the data, Heuristic values, Memory, Consciousness in the surroundings [26]. For this reason, they behave as first screening actors in the recruitment process.

On the other hand, more refined forms of predictive analytics aimed to exploiting big data are advancing, in order to meet the urgent demand for a customized recruitment strategy based on AI. This need is covered by companies like Pymetrics, which combine neuroscience games, customized AI, and the use of client-specific algorithms, rejecting candidates who do not match the characteristics required by that company.

For sure from companies’ perspective, there is a tendency to automating processes, to saving costs, and to maximizing human capital in a whirling and fast-paced labor market, which especially big companies are willing to dominate and mold according

to their own exigences. In general, though, there is a lack of amalgamation throughout the industry related to AI.

In the academic literature, several analyses have been conducted in relation to organizational implications caused by AIT. In Strohmeier [28, 29], AIT use in HRM is explored in six selected scenarios: turnover prediction with artificial neural networks; candidate search with knowledge-based search engines; staff rostering with genetic algorithms; HR sentiment analysis with text mining; resume data acquisition with information extraction; employee self-service with interactive voice response [28, 29]. In Bissola and Imperatori [30], the main focus is on transitional HRM, so on building trust in an organization through e-HRM. In Furtmueller [10], an interesting research is developed on the requirements and traits of resume contents in relation to e-HRM. Provided that all of the aforementioned approaches and outcomes are taken into account, in the present paper we aim to explore the contribution that Artificial Intelligence Technologies can give in order to overcome human errors by comparing theoretical convergences among the various approaches and platforms addressed to companies. In this case, we will link our study to some research to identify how companies are utilizing pre-hire assessments, and how these assessments are evolving in the technology and talent age [31]. Though, we will provide evidence that the enthusiastic business-driven aim at obtaining aseptic outcomes could hide some perilous and biased consequences.

3 Research Method

Basically, we needed to question whether the human component, which is a critical component in the hiring process, was considered. We wanted also to ask ourselves, how can we assess and evaluate whether individual constraints, subjectivity, and biases have been accounted for while designing the recruitment tool. Finally, in an overall overview, if we contemplate the vision of the elimination of frictional unemployment, albeit an aspirational, we should question the unavailability of frictional unemployment [27], since economy is empirical and inefficient, as labor market is. Given the scarcity of research works in that field a qualitative methodology can be considered a proper solution to investigate a contemporary phenomenon within its real-life context. The single case study approach has been used as it is well suited to exploratory investigations where phenomena are not well-understood [32, 33] from a qualitative point of view, since our goal was not to explore the quality of the implemented scientific method (which is unquestionably excellent), rather to debate the intimate justification of the whole as a successful and optimistic system. The case under consideration is Pymetric platform, a neuroscience-based assessment developed by Pymetric an innovative company worldwide in the field of neuroscience applied to HRM through AITs. The data mainly consists of primary data collected through qualitative explorative and semi-structure interviews. Secondary data such as reports, patents, and other materials retrieved on the web are also used.

3.1 The Case Study

The case study setting is Pymetric platform, a neuroscience-based assessment developed by Pymetric an innovative company worldwide in the field of neuroscience applied to HRM through AITs, working with the most important multinational corporations, like as Unilever, Randstad, Accenture, LinkedIn, Tesla, Mercer, Arla, Sutherland. Pymetrics platform is based on neuroscience games assessing different qualities of the candidate (cognitive traits and emotional traits) in a framework of a methodology aiming at predictive and debiased staffing services. Pymetrics claims to bring innovation through its platform in terms of overriding the key loopholes of traditional hiring practices, which are considered ineffective (70%), biased (50%), and offering poor experience (50%). Pymetrics platform can be also defined as a game-based recruiting tool that assesses the strengths of candidates and recommends the right careers and companies for them. On the background, Pymetrics assumes that traditional hiring is ineffective, biased, and offers a poor experience. That is the reason why they are proud of four own innovations: Neuroscience games, Customized AI, Bias-free Algorithms, and Common Application. Hiring is based on neuroscience and data science, with the aim of democratizing career search and hiring. In particular, Neuroscience Games measure established building blocks of cognitive and emotional functioning, so that measuring traits through behavior allows Pymetrics to profile people very accurately and in high-dimensional space. Pymetrics defines itself as the Netflix-like recommendation algorithm for jobs, since they build a custom, cross-validated profiles for each role and company, based on top performers. What is more interesting, Pymetrics poses itself the question of bias in recruitment processes, that is why its team contrived Bias-free Algorithms, i.e. algorithms extracted from an iterative algorithmic auditing technique aimed to identify and remove bias. This technique is made of a reference set of tens of thousands of people to check for any potential biases, and of reweighting inputs in the model. When candidates play the games, 77 different traits are assessed, both emotional and cognitive, in order to identify tasks that would most reveal the traits that recruiters and hiring managers to want to know (Fig. 1).

Cognitive Traits	Emotional Traits
Processing speed	Risk profile
Continuous attention	Reward sensitivity
Memory span	Emotional identification
Cognitive control	Tolerance for ambiguity
Planning	Ability to delay gratification
Sequencing	Learning from feedback
Learning	Learning from mistakes

Fig. 1 Some of the candidate’s most important traits after Pymetrics’ collaboration with the company Mercer. Retrieved from www.mercer.com

When candidates play the games, there is no losing or winning, just the assessment of different qualities. The attributes required are vastly different. The game is designed in such a way that it helps an organization assess candidates' capabilities, like processing speed, attention to details, memory, emotion detection, risk-taking, fairness, and focus. Then there is also an assessment of emotional traits of candidates by analyzing an image of person's eye while viewing the given conception. Together, data coming from trait assessment provide a snapshot of a person's unique characteristics. Pymetrics games are non-directional, meaning that unlike school or standardized tests, there are no right answers or preferred scores. Instead, they measure traits where either end of the spectrum can be beneficial based on the demands of a particular profession. That is why they also provide career recommendations based on these traits. The assessment also includes a top career report, suggesting the best professions for you based on your strengths. In addition, Pymetrics also suggests jobs based on these reports and lets candidates connect with recruiters and companies with suitable job offers for them.

4 Results and Discussion

The analysis of literature and the case study shows that philosophical discussions and decisions about the proper use of AI need to be based on a proper understanding of the way AI-scientists achieve their results—in particular, in their dependence on the initial planning input of human beings. In this regard, evidence outlined by data and by the interview(s) are particularly interesting as long as they allow to shed a brighter light on the data and the theory provided by Pymetrics' white paper, patent, and scattered data to be found on websites and articles related to the platform.

In fact, the most highlighted outcomes by client companies around the world are related to cost shrinking, which is considered the most significant advantage. In the interview to Unilever Italy that is mentioned below, one can see that emphasis is put on data, few are said about the organizational change needed to reach diversity inclusion or HR professional inclusion in the new processes. Data related to the new pre-hiring assessment method are not coupled nor matched with organizational data.

Most emphasized data by Unilever are those related to the hiring process, in which Pymetrics platform was used to assess 280,000 applicants in 68 countries and in 15 languages, replacing the resume as a first-pass filter and meeting the following KPIs:

- 100% increase in hire yield;
- 75% reduction in time to hire;
- 25% decrease in recruiting costs;
- Record diversity across gender, ethnicity, and socioeconomic status.

In a more general framework related to all clients, Pymetrics itself declared in the interview that some of the clients have seen the following outcomes:

- 75% reduction in time to hire: 4 months–4 weeks;
- 75% reduction in recruiter time;
- 6x improvement in applicant to offer yield: went from 150 resumes to fill 1 role to only 25 resumes at a global financial institution;
- 3x improvement in interview to offer yield: baseline of 8.5% improved to 25% for global consulting firm.

These outcomes were confirmed by HR managers of the client companies, like the HR manager of Unilever Italy. The HR manager explained that the resume amount the company receives has notably increased (in the first 90 days, comparing this period with the same in the previous year, applications rose from 15.000 up to 30.000 in the United States only). Nonetheless, save up time and resources are greater than through traditional recruiting, and selected talents can be hired in roles where they can exploit their added value. Unilever, Google, and Uber use gamification in recruiting with the goal of maximizing their operational efficiency, increasing candidates' engagement, cutting time spans, and building brand awareness.

On the side of the candidate, the key area of investigation is actually the definition of talent, linked to the concept of bias. Requested to define talent on the basis of Pymetrics motto "Matching talent to opportunity, bias-free," Pymetrics replied: "For us, talent means a job candidate's inherent cognitive, emotional and social traits. Our role is to identify these traits using our neuroscience-based games and then match the candidate to a job where their traits predispose them for success."

This might seem a quite neutral and consistent assumption. Instead, we should stress a couple of words here, i.e. "inherent" and "predispose." In the framework of the background bias-free assumption, those words should be reassuring. Instead, they help us better investigate the risk of intrinsic bias. Outside of medicine, the use of artificial intelligence in predictive policing, bail decisions, and credit scoring has shown that artificial intelligence can actually exaggerate racial and other bias. As a matter of fact, it is difficult to construct a virtual environment that accurately portrays real-world dynamics and stochasticity without error, leading to simulation bias. What should be stressed is, for example, that games are available in 15 languages (English, Spanish, French, Italian, Mandarin Chinese, etc.), but human biases are baked right into our language and the language-usage data AI systems learn from.

Applying machine learning to ordinary human language results in human-like semantic biases. In addition, predisposition and commonly desired traits by companies (this is meant by 'inherent') leads to doubt that companies do not hire the best candidates in general but the best candidates among a selected group based on a dataset of strict parameters which may seem a kind of Darwinian trap.

Finally, this last point reveals a risk of intimate tendency to hindsight bias.

In order to give a more colorful picture, we are going to focus also on aspects related to the latter. Indeed, when it came to questions regarding the choice of emotional and cognitive traits, the parameterization method, and the determination of useful and not useful data, we also found some interesting aspects.

When asked about the choice of the 77 traits, Pymetrics points out that that two things are taken into consideration:

- (1) traits that are most commonly desired by companies evaluating job candidates; and
- (2) which traits can reliably be measured by neuroscience-based games?

Furthermore, at the question of whether there are other traits which are initially selected, and later left behind for being considered useless, we were replied that Pymetrics regularly reviews the traits to be measured with the aim to determining whether to add or remove any traits. This determination is made using factors such as client demand, and developments in neuroscience regarding trait measurement. Further we asked, either emotional traits are measured only by using gamification, or this process is also deployed with aptitude tests, for instance. The reply was that Pymetrics platform solely uses neuroscience-based games to assess traits, and no other assessment tool is used. A final aspect we were willing to scrutinize regarded how Pymetrics attributes the weight to every parameter, and how parameters are measured.

The answer was quite expected, i.e. weights are data-driven, determined by commonalities in existing top-performing employees. Pymetrics has developed a proprietary machine learning algorithm which finds the combination of cognitive and emotional traits that distinguish top-performing current employees from the general population. The weighting of the traits is determined by the data: for some roles, memory might be a crucial trait, while other roles might emphasize attention or risk. Just for this reason, it was also crucial to investigate if they are aware to miss some quintessential components in human behavior by using predictability and people analytics, that could be also necessary while working in a company. At this last question, the answer was that the Pymetrics platform is the preliminary screening process for clients looking to hire talent. Employment decisions are not made solely based on the data our platform provides. All candidates that match with a given role via our platform then move on to interview(s) with hiring managers on the client side. During these subsequent interview(s) managers further assess candidates to determine if they should be offered the position. However, this point leads us to a pivotal argument raised by recent literature regarding about human–AI interaction, i.e. machine’s accountability.

Still, meaningful was the answer given with regard to the definition of “error,” and to the errors Pymetrics aims to avoid in the selection process.

For Pymetrics, errors are any factors that are considered during the matching process that are not predictive of a candidate’s success in a given role, such as a candidate’s gender, socioeconomic status, and ethnicity. However, this counter-bias effort can mirror “socially legalized” biases [34, 35].

Related to the notion of error, a question was devoted to the future of AI in recruitment, namely if one day these methods could possibly eradicate any kind of error from the selection process. The reassuring answer is that there will likely always be a human element to the hiring process, meaning that platforms like Pymetrics will always be paired with evaluations by hiring personnel during the hiring process.

Because eradicating bias in humans is nearly impossible, introducing bias or errors into the hiring process is always a possibility. Unlike what Russian hiring robot Vera aims to do in the future, i.e. taking the final decision of hiring a person, Pymetrics is cautiously confident that human component is still “likely” to play the decision-making role. Though, that “likely,” and the sentence following it, could betray a certain degree of wariness toward human inefficiency. However, some scholars point out that it is imperative not to forget the “human” in HR, since we still desire a personal interaction and this topic is more than just about an efficiency game [36].

5 Conclusions and Managerial Implications

Provided that the advent of AI poses major challenges to the skill set, competence, and capability of humans on the one hand, and that machines have the ability to learn, adapt, make decisions, accumulate experience, and even take actions on the other hand [37], we should focus on organizational change as key to success of AI. Organizational change can be achieved by two factors:

1. collaboration human—AI;
2. accompanying measures to reciprocal understanding.

As to point 1, to take full advantage of such collaboration, companies must understand how humans can most effectively augment machines and, conversely, how machines can enhance what humans do best and how to redesign business processes to support the partnership [38].

As to the point 2, companies (and even governments) should contrive and implement some accompanying measures to foster mutual understanding between humans and AI, and between staff/management and company.

From an organizational point of view, human—AI collaboration involves redesigning business operation and improving five elements of the business process: flexibility, speed, scale, decision-making, and personalization. The hiring process belongs to the third element, since poor scalability is the primary obstacle for improvement [38]. Indeed, e-recruiting practices should succeed in integrating them within the organizational vision, and to do so a fair discussion should be set up in order to decide how to interpret data, with regard to both recruiters, and middle/top managers. Also, another point is intertwined with the latter, i.e. machine’s accountability. Machine’s authority is considered unquestionable and fair: what kind of consequences can this sort of impunity have upon management and society? What relationship should an, as human, “inefficient” manager (recruiter, top manager, etc.) establish with an authoritative machine?

There is an urgent need to realign, reshape, and reinvent the profession [37], and integrate e-HRM and i-HRIS (Integrated Human Resources Information System) into HRM practice [39]. In order to achieve this, we should ask ourselves how we can complement and empower the human capability and improve the processes that surround it, by means of an honest assessment of the pros, the cons, and the actual

output [36]. As a matter of fact, technology in and of itself is of limited utility if companies and government organizations lack people who can use it, effective strategies for how to use it, and training to be good at using it [40].

Actually, the HR industry is still in the trial phase of figuring out how to implement the technology and decide how swiftly to deal with it [41]. This hinges on a couple of key factors:

1. need of career reinvention, bound to generation and expertise gap.
2. company-centered implementation.

As to point 1, we see that career reinvention will be critical, as being much more fast-paced than it was in the past and based on fluidity. As a consequence, companies are centering their recruitment efforts on Millennials and the new selection processes follow this track, as we have seen. Millennials have in-demand STEM skills and fresh perspectives but almost all types of organizations say they are confronting a leadership drought, simply because Millennials lack experience [42]. Conversely, experienced people are required to manage complex chameleonic processes, which they should be able to rapidly grasp and learn. Paradoxically, companies think they are preparing the future by hiring Millennials, but they will not have the in-house experience to manage their creativity and bridge the gap between generations, and between workers. In addition, large segments of the global workforce risk being excluded and discriminated by a too rigid hiring scheme that is hidden behind a customized, goal-targeted AI-based recruitment process.

Point 2 leads us to focus on the concept of company itself to be envisioned for the future. Traditionally many HR practices take the needs of the organization as the starting point, and recruitment is a major example of this maybe outdated (mis-) conception: there is a fixed structure, a defined hierarchy, a top-down approach, and well-defined jobs, so how do we find candidates that can fill this specific, pre-defined vacancy? [43]. For sure, more efforts should be done toward the following goals:

- more interaction with candidates in the pre-screening and hiring phase but also in the retention phase;
- machines cannot be allowed to determine how good people are, corporate ethics should be structurally embodied in evaluations in order to generate real value: this means changing the approach toward what someone has lately defined “anaethics” (see, [43]), as well as toward flipped hiring practices (see [44]);
- gauge the expectations of workforce analytics and technology outcomes to a well-rounded, aware, and people-centered corporate leadership, which is lacking nowadays.

Strategizing is key to both recruitment and talent acquisition but far less strategy is considered to be necessary in the recruitment process. For this reason, during talent acquisition companies should formulate preventive strategies to find and maintain a group of potential candidates. But there is also an urgent need to kick off a fair discussion about practices in managing reward systems, job performance evaluation systems, and diversity systems [45].

Last but not least, it should be noticed that the interview question about a possible relation between the word “quality” and word “skill” a/o “performance” was skipped by Pymetrics. Indeed, the word “skill” does not occur too many times in Pymetrics’ reports and papers, and this pushes us back to the urgent need of theoretically defining the relation between actual skills and desired skills. This point is crucial to shape the collaborative intelligence we would like to see in the future of our society.

6 Future Research Directions

From previous literature, it is observed that some pivotal topics need to be further investigated. Some scholars have pointed out the following points to be scrutinized in the future: transition push model to pull model in the assessment market; efficiency vs. fairness; evolving legal compliance; companies’ tendency to mirror software the way work is structured; unconscious biases perpetuation; risks related to society uberization, consistency of language related to interpretation; recalibration and upkeep; risks linked to scalability and customization; awareness of candidates/recruiters about the hiring process; machine learning vs. human learning; actual skills vs. required skills; strategic competition; holistic approach (i-HRIS); companies awareness in the fast changing context.

Central issue will be to evaluate the impact of these trends, which are sometimes a critically acknowledged, and to better research the implications of Human–AI interaction. This has to be achieved both on organizational and on societal level, with the broadest possible multidisciplinary approach.

If it is true that Huzinga’s [46] concept of *homo ludens* can lead us to gamification, nonetheless we should try to avoid that the game we are playing would eventually turn into a Russian roulette.

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