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The contribution of big data technology in the recruitment process in Morocco

Asmaa BENHMAMA, *(PhD Student)*
Research Laboratory in Development Economics and Organizational Governance
Faculty of Legal, Economic and Social Sciences Ain CHOCK
University of HASSAN II-Casablanca Morocco

Yasmina BENNIS BENNANI, *(Professor)*
Research Laboratory in Development Economics and Organizational Governance
Faculty of Legal, Economic and Social Sciences Ain CHOCK
University of HASSAN II-Casablanca Morocco

Correspondence address :	Faculty of Legal, Economic and Social Sciences Ain CHOCK 8 Route d'El Jadida, Casablanca, Casablanca-Settat 20410 University of HASSAN II Morocco (Casablanca) +212 6 14 000 400
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Abstract

The advent of the fourth generation of industrialization has empowered companies to embrace new technologies that streamline data analysis. Among these tools, big data technology has played a pivotal role in assisting organizations in effectively managing vast amounts of data. This study aims to investigate the impact of big data technology on company performance. A sample of 150 Moroccan companies was divided into three groups: a control group that does not utilize any big data-based technology in their recruitment process, a group that partially relies on this technology, and a group that extensively relies on it. The findings reveal significant distinctions among the groups, showcasing qualitative advantages such as minimizing error risks and quantitative benefits such as reducing recruitment costs and time investment in the group relying on big data technology. Nevertheless, it is important to acknowledge certain limitations of our study. Firstly, the absence of quantifiable data from participating companies restricts our ability to fully validate the accuracy of their self-reported claims in the questionnaire. Secondly, the ongoing ambiguity surrounding the role of human recruiters within these structures warrants further investigation and clarification.

Keywords: Big Data Technology, Recruitment, HR Digitalization, OCR Matrix, Recruitment Performance
JEL Classification : M51, J60, J71, O33
Paper type: Empirical research

Résumé

L'avènement de la quatrième génération d'industrialisation ou bien *industrie 4.0* a permis aux entreprises d'adopter de nouvelles technologies qui optimisent l'analyse des données. Parmi ces outils, la technologie de la Big data qui joue un rôle crucial pour aider les entreprises à gérer efficacement de vastes quantités de données en ressources humaines. Cette étude a pour objectif d'étudier l'impact de la technologie des Big Data sur la performance de l'entreprise en matière de recrutement. Un échantillon de 150 sociétés marocaines a été divisé en trois groupes : un groupe de contrôle qui n'utilise aucune technologie basée sur la big data dans son processus de recrutement, un groupe qui s'appuie partiellement sur cette technologie et un groupe dont l'utilisation est étendue. Les résultats révèlent des différences importantes entre les groupes, montrant des avantages qualitatifs tels que la minimisation des risques d'erreur et des bénéfices quantitatifs comme la réduction des coûts de recrutement et de temps dans le groupe qui s'appuie sur la technologie des Big Data. Néanmoins, il est important de reconnaître certaines limites de notre étude. Premièrement, l'absence de données quantifiables provenant des entreprises participantes limite notre capacité à valider pleinement l'exactitude de leurs revendications auto-déposées dans le questionnaire. Deuxièmement, l'ambiguïté persistante qui entoure le rôle des recruteurs humains au sein de ces structures mérite d'être poursuivie et clarifiée.

Mots clés : la technologie de la Big Data, le Recrutement, la digitalisation des ressources humaines, Matrice OCR, la performance du recrutement
JEL Classification : M51, J60, J71, O33
Type de papier : Recherche empirique

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1. Introduction

The recent industrial revolution has ushered in a remarkable technological evolution for businesses, particularly with the emergence of advanced algorithmic technologies capable of digitizing their operational endeavors. Digitalization entails a transformative process whereby tasks and functions are automated, eliminating the need for human intervention. The early stages of digitalization can be traced back to the mid-1980s, coinciding with the advent of groundbreaking information and communication technologies (Schallmo et al, 2018).

In recent years, the momentum of digitalization has surged exponentially, primarily driven by the widespread integration of the internet into corporate networks. Harnessing the power of the internet has enabled companies to elevate their operational performance and explore novel avenues for business expansion and growth.

Human resource management has been profoundly influenced by digital advancements that have impacted businesses in recent years (Fernandez & Gallardo-Gallardo, 2021; Kristoff et al, 2018; Mihova & Ivanova, 2020). This transformation has brought about significant benefits, revolutionizing the role of HR managers in two key areas: (a) the procedural aspect, where digitalization has largely replaced or significantly reduced human involvement in functions such as employee administrative tasks (payment processing, timekeeping, social security contributions, bonuses, etc.). This shift has enabled companies to gain better cost control, anticipate expenses, and achieve unbiased performance outcomes (Halid et al, 2020). (b) the managerial aspect: HR digitalization has empowered managers to gain clear visibility into employee operations, performance, and outcomes through automatically generated real-time dashboards (Samson & Agrawal, 2020).

The digitalization of human resources, whether in procedural or managerial aspects, is driven by the emergence of technology capable of effectively managing and leveraging large-scale data, commonly referred to as "Big Data."

Big data technology refers to a comprehensive set of data originating from both conventional and digital sources, both within and outside the organization (Lisa, 2013). In essence, it is a technology that enables the management of vast and diverse datasets collected from sources within the company or external to it. In recent times, this technology has witnessed significant growth, particularly due to the dynamic and complex nature of markets. This has prompted companies to adopt mechanisms capable of detecting fluctuations and anticipating market volatilities to safeguard their market shares. Big data has revolutionized the field of human resource management, particularly in the realm of recruitment (Bâra et al, 2015a; Dahlbom et al, 2020; Fairhurst, 2014; Garcia-Arroyo & Osca, 2021; Nocker & Sena, 2019).

Nowadays, large enterprises rely on platforms dedicated to harnessing massive datasets to ensure efficient and effective hiring processes. This article aims to explore the impact of big data on the recruitment performance of Moroccan companies. To achieve this objective, our work is structured into five sections: the first section provides a theoretical overview of the role of big data technology in the recruitment process, the second section outlines the research methodology and hypotheses, the third section presents the projected results, the fourth section delves into a comprehensive discussion, and finally, the concluding section summarizes the key findings. By analyzing the influence of big data on recruitment, this article contributes to a deeper understanding of how Moroccan companies leverage this technology to optimize their talent acquisition strategies.

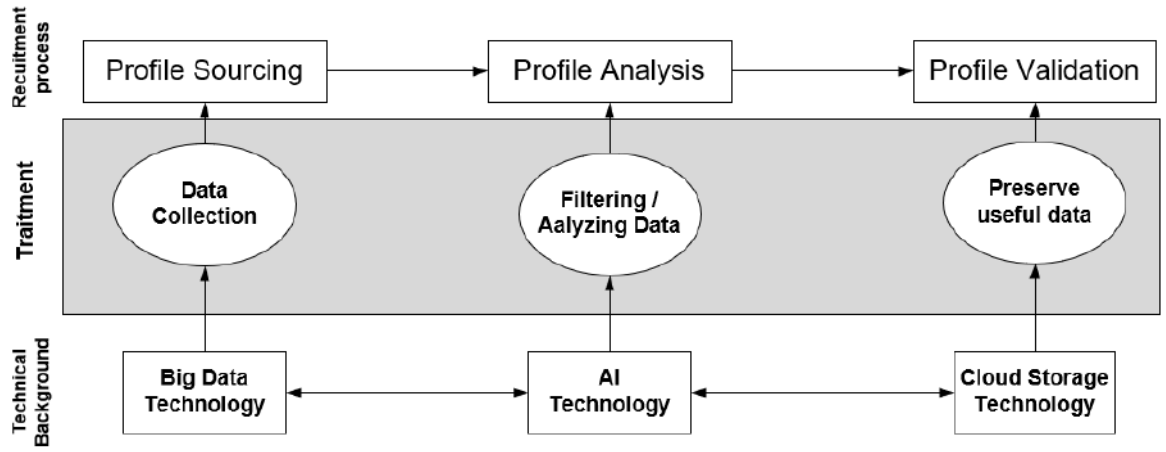
2. The Contribution of Big data to the digitalization of recruitment process

The recruitment process encompasses three crucial phases: (1) Profile Sourcing, this initial phase involves the development of technology to process extensive data sets, aimed at

collecting valid information on a wide range of profiles. This is achieved through online exploration of professional platforms (e.g., LinkedIn) or offline by delving into CV databases. (2) Profile Analysis, the primary objective of this phase is to filter and analyze the collected data in line with predefined objectives. This process is aided by artificial intelligence technology, which can sift through the vast dataset to identify desired outcomes. This action can take two forms: a fully automated «AI-Enabled Autonomy» or a hybrid approach known as « Human-Centered AI». (3) Profile Validation, in this phase profiles that meet the criteria and conditions established by the recruiter are preserved. With the use of cloud storage technology, companies have the capability to store the acquired data for future reference. It's important to note that any unused collected data is also stored for potential future use.

The significance of Big Data technology is notably evident in the profile sourcing phase, particularly concerning the selection of CVs, personality assessment of candidates, the identification of suitable profiles, and the establishment of comprehensive profile histories (Ou, 2021). Hang & Tat (2023) underscore that Big Data technology broadens these horizons by automatically scouring diverse sources, such as social media platforms, to identify individuals who might otherwise be overlooked. Traditionally, these horizons were restricted by manual searches within internal databases or job boards for identifying candidates with the necessary skills or qualifications for a position. Furthermore, the application of advanced algorithms enables organizations to more effectively align job requirements with candidate skills, thereby enhancing selection outcomes.

Figure 1. The Technical Context of Applied Processes in a Recruitment Process



Source: Authors

The absence or improper use of this technology can lead to a wastage of financial resources for the company, as the collected data may be missing or irrelevant. Figure 1 provides a simplified diagram outlining the primary technologies employed in the recruitment process. Typically, big data technology is applied to collect data about candidates (Fernández, 2022; Illingworth et al, 2015). According to Coron (2018), one of the most critical functionalities of big data technology in recruitment is its capacity to conduct predictive analyses and offer valuable insights into the potential performance of candidates aligned with the organization. These analyses facilitate more informed hiring decisions by examining historical recruitment patterns and employee success metrics such as tenure and performance ratings. Emphasizing objective measures over subjective evaluations, big data technology can also reduce biases and subjectivity in the hiring process, leading to fairer outcomes.

On the organizational front, Big Data technology automates administrative tasks such as candidate screening and interview scheduling, which traditionally consume a significant amount of time for HR professionals. This automation reduces the likelihood of human error

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and ensures consistency throughout the recruitment process (Shahbaz et al., 2019). Furthermore, HR professionals can rapidly monitor key performance indicators (KPIs), such as open positions and cost-per-hire, using real-time analytics provided by Big Data technology. Organizations can leverage this information to make data-driven decisions continuously, thereby improving their recruitment strategies (Dahlbom et al., 2020; Huselid & Minbaeva, 2019). Ikram et al. (2017) explored the role of social networking platforms (Social Networking Sites) as sources of data for recruiters and how they are harnessed in the recruitment process. Research findings suggest that the implementation of Big Data technology not only enhances organizational management performance but also improves accessibility and reputation through social media channels. Abdul et al (2020) underscored the importance of employing Big Data processing technology for data protection and user security.

The digitization of recruitment processes has ushered in numerous advantages for businesses, particularly with the integration of technology driven by big data analysis. Our aim is to explore the benefits that companies have reaped through the adoption of this technology. We have developed the assumptions on the basis of several work including (Geetha & Bhanu, 2018; Coron, 2013). To this end, our performance analysis will be centered around three criteria: The first criterion seeks to ascertain whether the implementation of big data technology can help mitigate the risk of hiring incompetent candidates:

(H1). The application of big data technology in recruitment impacts the risk of hiring suitable candidates.

The second criterion delves into the role of Big Data technology in streamlining the time spent during the recruitment process:

(H2). The application of big data technology in recruitment impacts the time invested in the recruitment process.

The third criterion focuses on the financial dimension, particularly the costs incurred by companies during the recruitment process, especially in the sourcing phase:

(H3). The application of big data technology in recruitment impacts the costs generated during the recruitment process.

2. Methodology & Assumptions:

2.1. Presentation of the sample (N= 150)

Let’s start with a brief presentation of the main sectors of economic activity. Clark (1949) established a classification system for commercial activities based on their economic nature. The primary sector encompasses businesses engaged in the exploitation of natural resources (e.g., agriculture, fishing, mining, concrete production, etc.). The secondary sector involves companies that transform raw materials into manufactured or industrial goods (e.g., construction, manufacturing, real estate, etc.). The tertiary sector includes businesses active in trade and service provision (e.g., various forms of commerce and services). Selstad (1990) introduced a fourth sector that encompasses companies offering knowledge-based services and knowledge management (e.g., R&D, NTIC).

The criteria we have taken into account are: (1) Sector of activity; (2) Annual turnover; (3) Staff. These three criteria play an important role in the technology applied at the recruitment level. The business sector is an indirect indicator of the company's ability to digitize its internal system. Generally, the quaternary and tertiary systems are more likely to implement digitized recruitment systems. The annual turnover shows the company's market weight and its ability to seize a significant market share. The staffing is an illustration of HR services in enterprises. Of course, a company with a large workforce will be better equipped to put in place a human resources management system, including recruitment, to manage all the complex tasks.

Table 1. Presentation of the sample

Global Characteristics	Moroccan compagnies (N = 150)		
	Group 1	Group 2	Group 3
Sector			
Primary	14	9	9
Secondary	14	14	18
Tertiary	11	14	13
Quaternary	11	14	10
Annual Turnover			
Under 10 MMAD	16	9	11
Between 10 and 50 MMAD	15	15	22
Upper 50 MMAD	19	26	17
Number of Staff			
Under 50 persons	22	6	8
Between 50 and 100 persons	8	11	7
Upper 100 persons	20	33	35
Total	**50**	**50**	**50**

Source: Authors

2.2. Data Collection and Analysis Methodology:

The sourcing process assisted by Big Data technology comprises a combination of three key steps. Firstly, the candidate selection process involves data exploration or data mining techniques, where data is extracted from local or external databases and social networks like LinkedIn (Wei & Wang, 2018). Subsequently, the selected candidates undergo a matching process with an ideal candidate or "persona" who precisely meets the job requirements. This matching is based on predictions made by artificial intelligence or data from previous employees who have held the position. This step enables the evaluation of the candidate's suitability or rejection through a validation process that assigns a score indicating the degree of resemblance to the ideal candidate.

The figure (2) offers a simplified representation, developed by us, to distinguish between the three groups of companies included in the study. We have utilized this standard model to categorize the level of digitization in the sourcing phase, which initiates the recruitment process. Group (1): These are companies that do not incorporate big data analysis technology into their recruitment processes (control group). Group (2): These companies partially rely on this technology in their recruitment processes. It represents a hybrid approach, where the technology is used in some tasks that require substantial effort, such as the candidate selection process, while matching and validating selected candidates still rely on manual processes. This partial utilization may be driven by financial constraints, preventing companies from implementing a fully digitalized system, prompting them to opt for more affordable and limited technological solutions. Group (3): These are companies that wholly depend on this technology in every aspect of the recruitment process. The technology solutions employed are capable of collecting, sorting, matching, and filtering applications to identify the candidate(s) best suited to a job without any human intervention. We focused on companies operating in the Moroccan market (N=296) using a questionnaire directed at HR managers in these organizations. We employed the Computer Assisted Personal Interviewing (CAPI) method for data collection. To collect and centralize responses from the companies, we used « Google Forms», a service provided by Google, the response rate received is 98,66%.

Through the method of stratified sampling, which is a probabilistic technique aimed at studying subpopulations, we divided the overall population into three homogeneous subgroups. We

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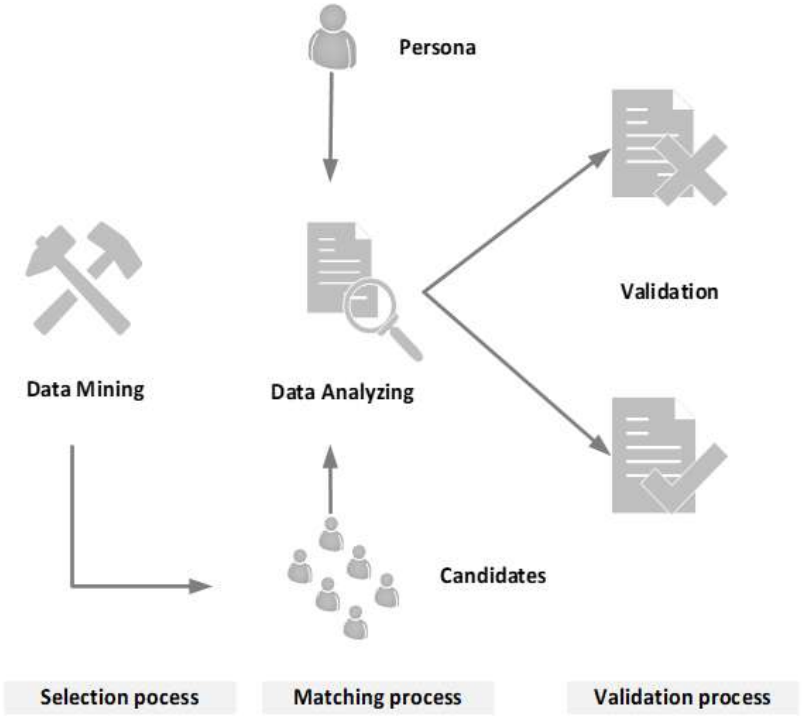
randomly selected 50 companies from each subgroup to create a comprehensive sample of 150 companies.

Figure 2: Simplified Schematic Presentation of the Use of Big Data Technology in Recruitment.



Source: Authors

The questions have been formulated as direct inquiries with binary response options. This method is particularly effective in eliciting responses by offering respondents the choice of 'yes' or 'no.' We have set up three easy-to-answer direct questions to make the evaluation mission for the HR manager accessible and easy. The three questions are: (1) Did you notice a decrease in the risk of inappropriate recruitment? (2) Has the recruitment time been reduced? (3) Did the cost of recruitment go down?

Its objective is to assess whether the partial or complete adoption of Big Data technology has contributed to mitigating the risks associated with suboptimal candidates, time mismanagement, and cost control for companies in the second and third groups. In addition, the questions also targeted the management of companies in the first group, which serves as our control group, to identify any changes in these parameters. Data analysis was conducted using the JAMOVI software (The jamovi project, 2022).

2.3. Analysis Model

We propose employing the OCR matrix for result analysis. The OCR matrix is an analytical methodology designed to assess dynamic situations. Developed by Groutel (2017) based on the SWOT framework, the OCR matrix offers a more specific perspective on the strategic context between companies. It provides a framework that challenges a context of instability and subsequently offers recommendations to ensure favorable changes. The OCR matrix is constructed around three interrelated key components:

- **Opportunities (O):** This phase involves the analysis of the environment surrounding the specific situation we intend to assess and modify. Similar to the SWOT method, the opportunities within the OCR matrix represent the advantages that impact the environment. In the context of a dynamic situation, the environment plays a

predominant role in the process of change, as it harbors factors that drive towards specific solutions.

- **Challenges (C):** This phase resembles a combination of the "weaknesses" and "threats" from the SWOT matrix. It encompasses all internal and external difficulties that encompass a company, whether they are internal or external challenges caused by its environment. Both of these phases are grounded in an objective approach, with the analysis based on observable and real-life facts.
- **Recommendations (R):** This phase is dedicated to the analyst's observations and the proposal of solutions, pathways, or actions to mitigate threats and capitalize on opportunities.

The OCR matrix empowers its users to gain a comprehensive understanding of a specific situation and develop strategies to positively influence this situation.

3. Results:

We employed a statistical approach based on Multivariate Analysis of Covariance (MANCOVA) to determine the distinctions among the three groups, with the sector variable used as a control variable. First, we will present the sectoral distribution among the three groups, and subsequently, we will analyze the differences between the groups in terms of performance.

3.1. The descriptive statistics

In terms of the descriptive statistics in our study, the sectoral distribution in the first group is as follows: 28% of the companies belong to the primary sector, 28% are part of the secondary sector, 22% are in the tertiary sector, and 22% fall into the quaternary sector. In the second group, the distribution is as follows: 18% are in the primary sector, 28% are part of the secondary sector, 28% are in the tertiary sector, and 26% are in the quaternary sector. In the third group, the distribution is as follows: 18% are in the primary sector, 36% belong to the secondary sector, 26% are in the tertiary sector, and 20% are in the quaternary sector. Regarding annual revenue, 38% of the companies in the first group generate annual revenues exceeding 50 million MAD, while in the second group, this figure stands at 52%, and in the third group, only 34% achieve this level of revenue. In terms of the workforce size, we note that a significant portion is concentrated in companies with over 100 employees. In the first group, the workforce accounts for 40%, while in the second group, it reaches 66%, and in the third group, it rises to 70%. Our aim is to assess the performance variation associated with the partial or full utilization of Big Data technology in the recruitment process.

3.2. Recruitment performance

The MANCOVA analysis revealed the presence of significance between the groups, particularly concerning the Risk variable: $F(2) = 6.315$; $p < 0.005$, Wilks $\lambda = 0.680$, indicating that the risk of recruiting incompetent profiles varies when transitioning from one group to another. Additionally, the Time variable also showed significance: $F(2) = 12.808$; $p < 0.001$, Wilks $\lambda = 0.680$, indicating that the time required to complete recruitment differs across the groups. We also found significance regarding the Cost variable: $F(2) = 13.905$; $p < 0.001$, Wilks $\lambda = 0.680$, indicating that the cost incurred for the recruitment process varies among the groups.

In Group 3, we observed that the continuous application of Big Data technology allowed companies in this group to benefit from certain advantages compared to Control Group 1: a reduction in the risk of recruiting inappropriate profiles, a decrease in the time spent on recruitment, particularly in the sourcing phase, and a reduction in sourcing costs.

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However, in Group 2, it was noted that the partial application of Big Data technology enabled companies to avoid the risk of recruiting unsuitable profiles and reduce recruitment time, but recruitment costs were considerable, as these companies did not subscribe to long-term packages (software, platforms, etc.), which are generally more cost-effective than the partial use of these services.

The inclusion of a control variable, namely the sector of activity, did not yield any significant impact on the performance across the groups. This is evidenced by the lack of effect on the risk, where $F(1) = 0.1521$; $p = 0.697$, Wilks $\lambda = 0.680$, as well as on the time, with $F(1) = 0.0478$; $p = 0.827$, Wilks $\lambda = 0.680$, and cost, where $F(1) = 0.7492$; $p = 0.388$, Wilks $\lambda = 0.680$. This indicates that the sector of activity has no discernible influence on the performance of the recruitment process.

4. Discussion:

The presented results have demonstrated the importance of employing big data processing technology in the recruitment process. Indeed, big data technology is based on three principles:

- The Velocity principle is associated with the temporal dimension, in which big data reduces the execution time of a task by providing an optimal and efficient outcome. In our study, companies in the third group felt that the recruitment duration had decreased thanks to the use of this technology.
- The Variety principle enables the processing of various types of data, be it structured, unstructured, or semi-structured. The ability to handle all these types of data makes the company more proficient in candidate analysis and matching with the desired position, allowing for the precise identification of a suitable profile without the need for additional support technologies. This was expressed by the third group, which digitized its entire recruitment process, while the second group relied on a more limited form that only handles the selection phase, preventing it from benefiting from cost advantages.
- The Volume principle drives this technology to process a massive amount of data in a partially reduced time. This principle is advantageous for the company, particularly in the selection phase, as it presents multiple candidates that match the desired profile. This was beneficial for both groups that adopted big data technology.

In a broad sense, Big Data empowers companies to swiftly and effectively select candidates who meet their criteria without incurring additional expenses. With this in mind, we can assess the opportunities that Moroccan businesses can harness through this technology.

Moreover, we can pinpoint potential weaknesses that can at times impede the efficacy of recruitment based on this technology, presenting challenges for companies to surmount. We aim to delve further into this subject, and to accomplish that, we will employ an OCR matrix to investigate the opportunities, challenges, and recommendations. Naturally, these aspects will be substantiated with references from the literature.

The selection of the OCR matrix allows for a more in-depth analysis of the Moroccan context, given that Moroccan companies have recently started to familiarize themselves with this new technology. The real advantages of Big Data technology have yet to be fully harnessed in the Moroccan market, presenting an opportunity for Moroccan companies to embrace Big Data to enhance their organizational and competitive performance in a rapidly evolving market.

Additionally, this adoption should be accompanied by ethical vigilance, such as safeguarding candidate data, combating any form of discrimination during the candidate selection process. From a procedural perspective, the use of the OCR matrix presents a structured approach. It first explores the opportunities offered by this technology for Moroccan companies, then delves

into the challenges that may threaten these entities if the technology is misused or overused. Finally, it provides recommendations based on our research findings.

4.1. The advantages of Big Data in the recruitment process

On the same logic as our study, several studies have shown the advantages of big data technology on the recruitment process of companies. Qin et al (2019) pointed out that Big Data technology helps to identify the right candidates for vacancies. The authors showed that companies use social networks in their recruitment processes. This approach generates a set of untreatable data, which highlights the implementation of an artificial intelligence technology specialized in the analysis of big data. Companies use outsourcing services for this type of activity, since the results obtained from these companies in terms of applicants' relevance are more interesting than the ones achieved by the company itself. Or (2021) was interested in the issue of the impact of Big Data on the recruitment process. The introduction of this technology at the level of HR services has enabled companies to collect applications to create databases or Talent Pool. It is a database that stores information about all candidates who have applied for an offer proposed by the company for a possible job offer in the future. The researcher points out that companies are mobilizing big data to obtain the talent pool as the benefits offered by this system are many: (1) reduce recruitment costs, including sourcing costs, (2) reduce recruiting time.

4.2. The challenges of Big Data in the recruitment process: Application of the OCR matrix to analyze the use of Big Data analysis technology in Moroccan companies.

Utilizing the OCR matrix will facilitate a more comprehensive understanding of the significant impact of big data analysis technology on the recruitment performance of Moroccan enterprises.

Table 2. Application of OCR Matrix

Opportunities	• Facilitating the sourcing process in recruitment (Fernández, 2022) • Achieving efficient results in profile identification (Lim et al, 2019; Wei & Wang, 2018) • Reducing costs related to sourcing; • Minimizing the time dedicated to recruitment (Bâra et al, 2015)
Challenges	• Potential for profile discrimination (King & Mrkonich, 2015) • Increase in fear and apprehension among human recruiters (Ore & Sposato, 2022) • Risk of hiring unsuitable profiles
Recommendations	• Strengthening other phases such as interviews to mitigate the risk of hiring unsuitable profiles • Pre-determining the gender of profiles and/or implementing a post-selection verification protocol • Adopting a complementary system between human recruiters and AI recruiters.

Source: Authors

The OCR matrix has proven instrumental in providing a more nuanced understanding of the subject, particularly when it comes to the benefits and drawbacks associated with the application of Big Data analytics technology in the recruitment process, with a specific focus on the sourcing phase.

5. Conclusion

In conclusion, the digitalization of the recruitment process has provided numerous advantages for companies. In this study, we aimed to explore this notion by conducting a comparative

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analysis across three groups of companies operating at different recruitment levels. Our findings indicate that leveraging fourth-generation industrialization technology, specifically big data-based analysis, has yielded significant benefits by mitigating error risks, reducing costs, and streamlining recruitment timelines.

In today's competitive market, finding top talent has become a challenge, prompting companies to employ rigorous strategies for talent identification and recruitment. With the rise of artificial intelligence and big data processing, organizations have incorporated these tools into their recruitment processes to effectively scout for exceptional candidates. This research underscores the managerial benefits of integrating data analysis technologies and emphasizes the need for implementing such solutions to optimize recruitment outcomes.

In principle, the digitization of the recruitment process enables the entire process to be optimized, thereby improving the efficiency, then the effectiveness and finally the performance of recruiting. This is seen as an opportunity for the company that wants to preserve its resources for actions more focused on its operational activity. In another context, we have found that the introduction of Big Data in the Moroccan market is still in its early stages, which makes it a little complicated if the case of Morocco's companies is adequate to the principles of digitization.

Nevertheless, it is important to acknowledge certain limitations of our study. Firstly, the absence of quantifiable data from participating companies restricts our ability to fully validate the accuracy of their self-reported claims in the questionnaire. Secondly, the ongoing ambiguity surrounding the role of human recruiters within these structures warrants further investigation and clarification.

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