AI and public contests: a model to improve the evaluation and selection of public contest candidates in the Police Force

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AI and Public Contests: A model to improve the Evaluation and Selection of Public Contest Candidates in the Police Force

ABSTRACT

Purpose - The number of candidates applying to public contests is increasing compared to the number of human resources employees required for selecting them for the Police Force. This work intends to perceive how those public institutions can evaluate and select their candidates efficiently during the different phases of the recruitment process. To achieve this purpose, AI was studied. This paper focuses on analysing the AI technologies most used and appropriate to the Police Force as a complementary recruitment strategy of the National Criminal Investigation police agency of Portugal – *Polícia Judiciária*.

Methodology - Using design science research as a methodological approach, we suggest a theoretical framework in pair with the segmentation of the candidates and comprehend the most important facts facing public institutions regarding the usage of AI technologies to make decisions about evaluating and selecting candidates. Following the PRISMA methodology guidelines, a systematic literature review and meta-analyses method was adopted to identify how the usage and exploitation of transparent AI positively impact the recruitment process of a public institution, resulting in an analysis of 34 papers between 2017 and 2021.

Findings – Results suggest that the conceptual pairing of evaluation and selection problems of candidates who apply to public contests with applicable AI technology such as K-means, Hierarchical clustering, ANN, and CNN algorithms can support the recruitment process and could help reduce the workload in the entire process while maintaining the standard of responsibility. The combination of AI and human decision-making is a fair, objective, and unbiased process emphasising a decision-making process free of nepotism and favouritism when carefully developed. Innovative and modern as a category, group the statements that emphasise the innovative and contemporary nature of the process.

Originality - The main contribution is the AI-based theoretical framework, applicable within the analysis of literature papers, focusing on the problem of how the institutions can gain insights about their candidates while profiling them; how to obtain more accurate information from the interview phase; and how to reach a more rigorous assessment of their emotional intelligence providing a better alignment of moral values. This work aims to improve the decision-making process of a Police Force

institution recruiter by turning it into a more automated and evidence-based decision when recruiting an adequate candidate for the job vacancy.

Research limitations - There are two main limitations in this study that should be considered. First is the difficulty regarding the timetable, privacy, and legal issues associated with public institutions. Second, a small group of experts served as the validation group for the new framework. Individual semi-structured interviews were conducted to alleviate this constraint. They provide additional insights into an interviewee's opinions and beliefs.

Social implications - Ensure that the system is fair, transparent and facilitates their application process.

Keywords - Artificial Intelligence; Sentiment Analysis; Facial Recognition; Police Force; Transparency; Design Science Research

Paper Type - Research paper

1. INTRODUCTION

This research aims to understand better Artificial intelligence (AI) and how AI technologies might innovate public contests (PC), particularly in the Police Force (PF), having the recruitment process in the National Criminal Investigation police agency of Portugal – *Polícia Judiciária* (*PJ*) as a real example. The selection of the AI technologies that best fit the purpose and answer this specific context will be addressed.

This study constructs an innovative and AI-based theoretical framework for the recruitment process of a PF institution and is suitable to be applied in *PJ*. This suggestion will contribute to employing future Criminal Inspectors who are sincere, professional, transparent, and present ethical and deontological principles aligned with the institution's values.

An online survey was conducted to understand the perception of candidates from the 2019 Criminal Inspector *PJ* course from age and gender-related perspectives. Concerning the content of social media (SM) and if it should be considered in the recruitment process of the candidates, 39 agreed with the topic against 29 candidates. Hence, it served as a motivation for our main idea.

Highly specialised public institutions, like PF, require a prolonged recruitment process of different evaluations to ensure that the most competent candidates are selected. Even after the five assessments that constitute the *PJ* recruitment process, some questions remain on the recruiters' side, who need to ensure they are exercising good judgment about contracting the candidate. AI technologies can have an impact and can be beneficial in linking the gaps between the evaluation and selection of PC candidates and the recruiter.

This paper provides a broad overview of AI opportunities in public institutions; the theoretical framework also covers other focus areas. It is essential to be aware of the feelings and opinions expressed across the Internet and SM, increasing the number of user-generated sentences containing sentiment information crucial to analyse (Abd El-Jawad et al. 2018). Two noticeable approaches to text classification are used for Sentiment Analysis (SA): lexicon-based and machine learning (ML) (Dhaoui *et al.*, 2017).

From an organisational perspective, they avoid relating with someone who does not share their culture and principles for fear of ruining their reputation, such as controversial or unethical behaviors. These two aspects can be beneficial to take the necessary conclusions and consequently ascertain a complete picture of the candidate.

2. BACKGROUND

With the advance of smarter cities, sharing data and delivering real-time information on specific events is possible due to the rapid distribution of linked mobile devices mediated by the network (Tundis *et al.*, 2020). This evolution is also observed in police agencies that resort to Information Technology and improve their intelligence systems via data collection to solve crimes, reduce the crime rate or even capture offenders (Tundis *et al.*, 2020).

In USA police agencies, AI is already being applied to interrogators for deception detection to promote a non-biased environment (Noriega, 2020) and has contributed to an automated fingerprint identification system used to find matches in a criminal laboratory, converting evidence into information (Whitford *et al.*, 2020). This system demonstrates this ability through three parameters: AI facial emotional recognition, AI verbal emotion recognition, and Deception recognition software.

Social media (SM), where users have the will to express their feelings and opinions, are changing human interactions (Boudlaie et al., 2019). Although users have the right to express their own opinions, employers can use the information to manage their job candidates (Boudlaie et al., 2019). That information can affect their credibility, and 70% of the surveyed recruitment managers say they rejected job applicants because of an untrustworthy online reputation (Boudlaie et al., 2019).

The Sentiment Analysis technique is employed when analysing those platforms and their content, specifically the sentiment attached to the online sentence. This technique is recent in Public Administration, but it is being used more regularly because of its ability to analyse large volumes of SM data (Hand and Ching, 2020). This technique is used to classify any textual document into predefined categories displaying the polarity of sentiment in the text (Dhaoui *et al.*, 2017).

AI is a technology that facilitates problem-solving, so it efficiently finds solutions to a defined set of challenges. "It can develop methods and conduct inductive reasoning to derive general principles learning from experience" (Marius *et al.*, 2018). AI strategy can be based on public sector data analytics and allows the exploitation of already-existing public sector data (Loukis *et al.*, 2020). Detecting online radicalisation is possible following a two-step approach: the first one applies a "Radicalisation Score" composed of four elements: Average sentiment score percentile, Volume of negative posts, Severity of negative posts, Duration of negative posts; and a second step applies ML techniques (SVM, K-NN). The issue of handling the effects of sharing personal data raises itself, given that AI can analyse data without human participation (Chatterjee and Sreenivasulu N. S, 2019).

In terms of AI principles, transparency and explainability are needed, among others, and the model should rely on them to improve human trust. Many benefits appear when transparent models are preferred over black-box models, where the inputs and operations are not visible to the user. Transparency becomes a primary value, particularly to the Public Administration, whose mission is to implement the ethics policy founded at various levels of administration (Androniceanu, 2021). Public value for citizens is generated by AI-enabled services as well (Chatterjee, Khorana, *et al.*, 2021).

2.1 PRISMA METHOD

With the adoption of the PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses, guidelines (Moher *et al.*, 2009), the Systematic Literature Review (SLR) was performed in September 2021 to analyse publications, their titles, abstracts, or keywords with Boolean expressions.

The following PRISMA flow diagram (Figure 1) illustrates the SLR data collection process (Moher et al., 2009). The remaining 34 papers were considered eligible for further analysis in our systematic review. Of these, 27 articles were published in scientific journals, and seven were published in conference proceedings.

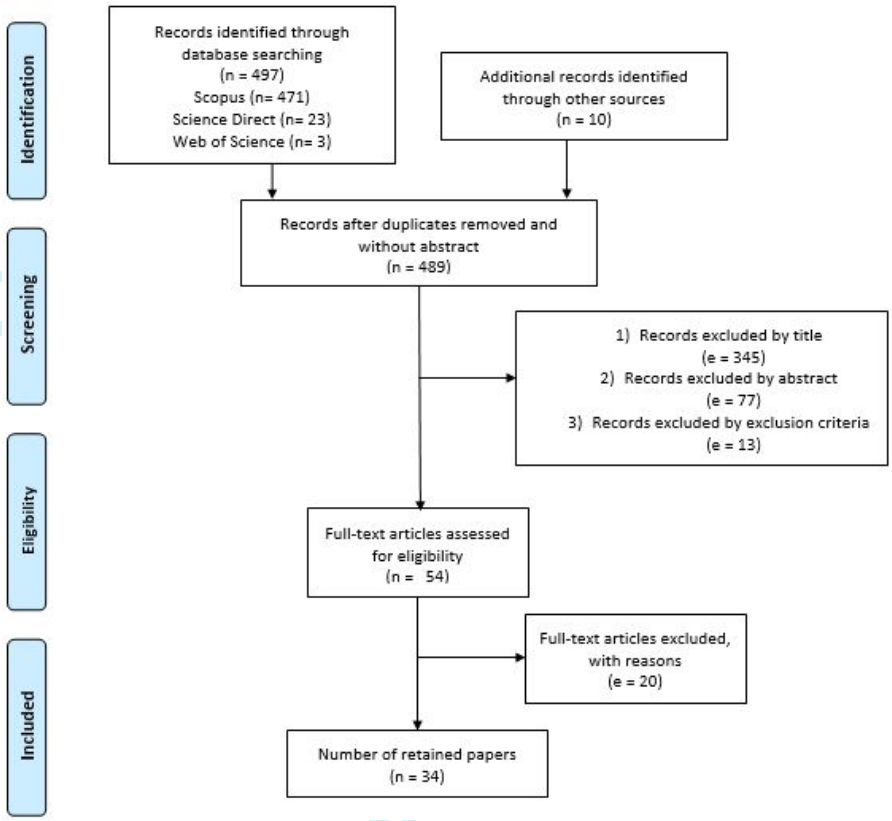

Figure 1- PRISMA flow diagram (n = maintained; e = excluded)

Trying to answer the proposed research questions as follows:

- RQ1: "What are the most key facts facing public institutions regarding the usage of AI technologies to make decisions about evaluating and selecting candidates?"
- RQ2: "How can the usage and exploitation of transparent AI positively impact the recruitment process of a public institution?"

2.2 Research Questions Discussion

To answer the first research question, it was necessary to understand the existing gaps in the selection criteria of the PC that are in vigor, specifically in the Police Force (PF). It is relevant to understand who the candidates are statistically, meaning that profiling based on sociodemographic characteristics of the future criminal inspectors according to the provided dataset will be elaborated.

Regarding the second research question, the SLR analysis shows that the two main problems addressed by the SA techniques are ML and lexicon-based applications to SM networks.

The reviewed papers concluded that ML techniques are preferred when predicting the polarity, namely the negative polarity assigned to a sentence (Dhaoui *et al.*, 2017). A study demonstrated how the

polarity of a text was assessed by comparing the words in the text with a word list that assigns a positive or negative weight to each word (Hofmann *et al.*, 2013).

Other studies opted for implementing decision trees and Naive Bayes (Abd El-Jawad *et al.*, 2018; Hassani *et al.*, 2020), while others used black-box models like artificial neural networks (ANN), SVM, random forests, KNN (Abd El-Jawad *et al.*, 2018; Dhaoui *et al.*, 2017; Hassani *et al.*, 2020; Lee *et al.*, 2019; Yin *et al.*, 2018). This framework aims to be transparent and free of bias. It will help the recruiter deduce new insights about a candidate while suggesting new complements to evaluate the candidate's behavior and speech in their professional interview and on social media.

The literature affirms facial expression and emotional recognition as one of the most crucial ways of interpersonal communication (Song, 2021). CNNs model can be a helpful tool for that recognition and candidates' employment while being evaluated in an AI-assisted interview.

Recruiters check the candidate's social media (SM) before recruiting (Allal-Chérif et al., 2021), indicating that they should receive this automated, evidence-based solution. Choosing candidates that present ethical, political, social, and other values aligned with the values and vision of the institution will lead to the optimisation of time and costs, as well as the acquisition of new perspectives, a better understanding of morals, manners, and thoughts (Boudlaie *et al.*, 2019). The current challenge is to develop effective, robust, and flexible regulatory frameworks to ensure that the risks and threats that AI holds for our societies can be foreseen and acknowledged while ensuring that the development of AI and, thereby, innovation centred on it and its ecosystem are not suppressed. This is due to advances in AI and related technologies that have moved from research to application (Visvizi, 2021).

2.3 Research gap discussion

The SLR analysis concluded that the primary research gap is related to the election of the AI technologies that best fit and present a better performance to solve the different problems announced within a PC in the PF institution's scope. It aims to accelerate an evolving process that is still ongoing. Consequently, it will be shown how the suggestions presented in the TO-BE model improve the evaluation and selection in the recruitment process for a police institution once adequate talents are selected rigorously and efficiently.

3. METHODOLOGY

DSR is the methodological approach used to connect and pair relevant challenges in the recruitment processes of PF with AI tools that might reveal the potential for purposes related to those challenges. Three studies employ this novelty type of paradigm (Anastasiadou, 2019; Anastasiadou *et al.*, 2021; Rosenberger *et al.*, 2017). Since it is a problem-solving paradigm, it tries to create a designed final artifact or solution to a precise problem (Anastasiadou, 2019).

Figure 1 illustrates the DSR instantiation applied to this research. In the first phase, the environment

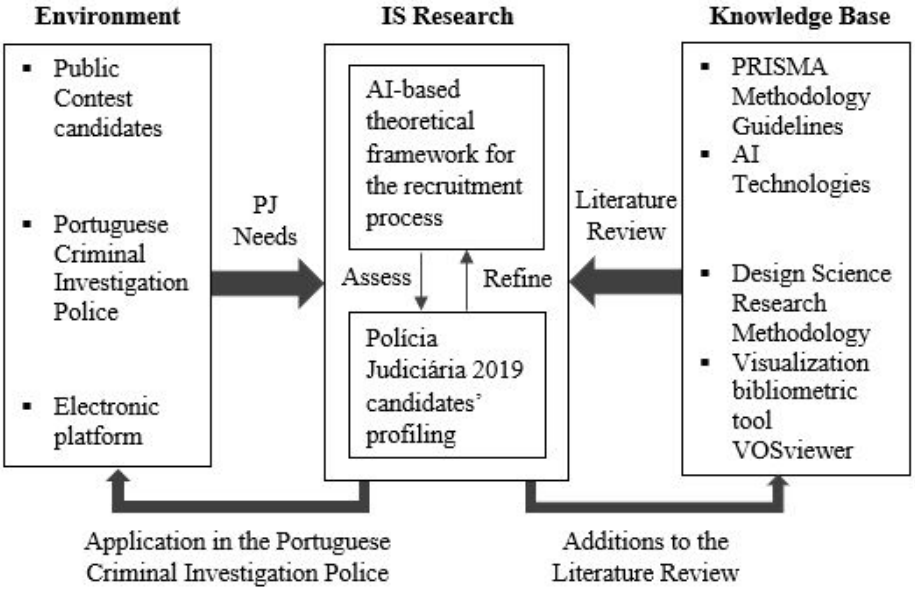

Figure 2 - DSR applied to the context

and the literature review are explained. Then it will be crucial to understand the context, conditions and needs, the employees, and the technology employed there from an organisational perspective, the *PJ*. The focus is on the candidates who apply to the National PC, and the police will initially manage their applications through an electronic platform. The literature review will provide the background for the initial framework proposal once it is based on obtaining what is previously known in the research area about a specific field.

The objectives will be defined in a second phase, and the development will be described in the IS research background. First, compare and categorise AI technology techniques according to those found while performing the SLR. Secondly, create a paired AI conceptual framework to characterise and outline each gap found in the evaluation and selection of the *PJ* recruitment process. Each AI technology will create a typology between the problems encountered and the corresponding solution.

The next phase corresponds to the data collection. This study was obtained through a comprehensive literature review and interviews with experts of *PJ*.

Relatively to the data analysis, quantitative data is also collected for performing clusters. Considering this, segmentation will be elaborated with the quantitative dataset provided by *PJ* related to the candidates of the last PC held in 2019. The results of this segmentation are shown in the results chapter.

After being evaluated and validated in the next phase, the conceptual framework (artifact) will be presented and corresponds to the typology between the problems associated with assessing and selecting candidates during the recruitment process and the corresponding AI technologies solutions. This artifact corresponds to our key contribution.

Finally, the summary is presented, the results of this study are elaborated on, and the limitations are analysed. A suggestion for future research might be to study a possible implementation of an automated recruitment system meaning an AI recruitment system in a Police Force context, to address the current gaps. The main concern is ensuring that the system is fair with extra features to reduce the bias presented, transparent, and facilitate their application process. According to (Paesano, 2021), there are five complementary value-based principles for proper monitoring of reliable AI, and transparency and explainability are among them. The author also refers that it should demonstrate how accessible to users the technology's internal logic and fundamental principles are, as this is thought to be essential for fostering trust in new technology. A step in the direction of more transparent AI is suggested by Explainable Artificial Intelligence (XAI). The objective is to develop a collection of methods that generate explainable models that are more understandable while still performing efficiently. Rather than referring to a formal scientific idea, the term "XAI" generally relates to the movement, initiatives, and efforts made in response to AI transparency and trust problems (Adadi and Berrada, 2018).

4. NATIONAL CRIMINAL INVESTIGATION POLICE AGENCY OF PORTUGAL

According to Hevner ("DSR", 2021), the environment represents understanding the context and conditions of the people, the organisation, and the technology.

Figures 2 - 7 represent the AS-IS, a descriptive model, of the current recruitment process from a single candidate perspective in PJ ("Portaria n.º 248/2021 | DRE", 2021). Bizagi Modeler was the software used for creating the AS-IS diagrams in this study ("Bizagi", 1989) to express the logic of steps in the recruitment process followed by *PJ*.

4.1 AS-IS DIAGRAM

4.1.1 Process "Check the general and specific requirements"

The process "Check the general and specific requirements" (Figure 2) is performed by the DRE, BEP, and the PJ website to announce the requirements and results. The HR department and the Jury are two other actors involved in this process.

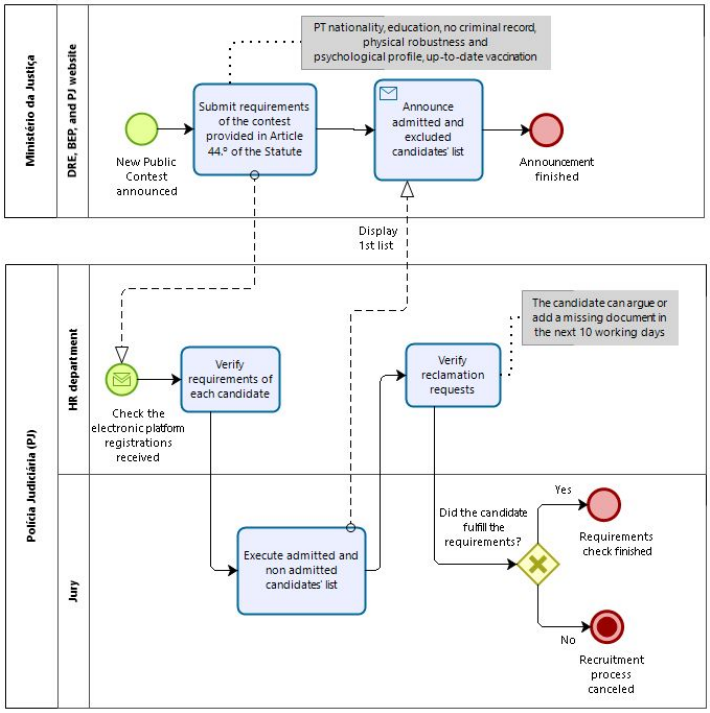

Figure 3 – AS-IS, Check the general and specific requirements

4.1.2 Process "1st phase of the recruitment process."

The "1st phase of the recruitment process" (Figure 3) is performed by the Jury and the HR department. The candidates' list is published on the PJ facilities and their website.

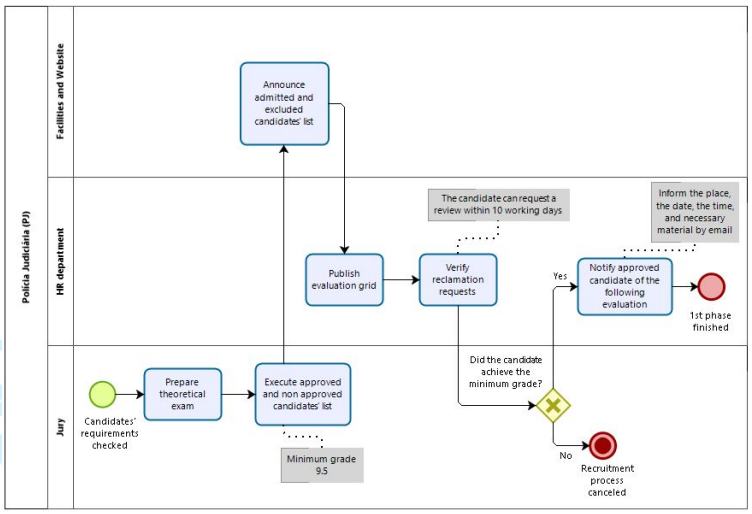

Figure 4 – AS-IS, 1st phase (theoretical exam)

4.1.3 Process "2nd phase of the recruitment process."

The "2nd phase of the recruitment process" (Figure 4) is performed by the Jury and the HR department. The candidates' list is published on the PJ facilities and their website.

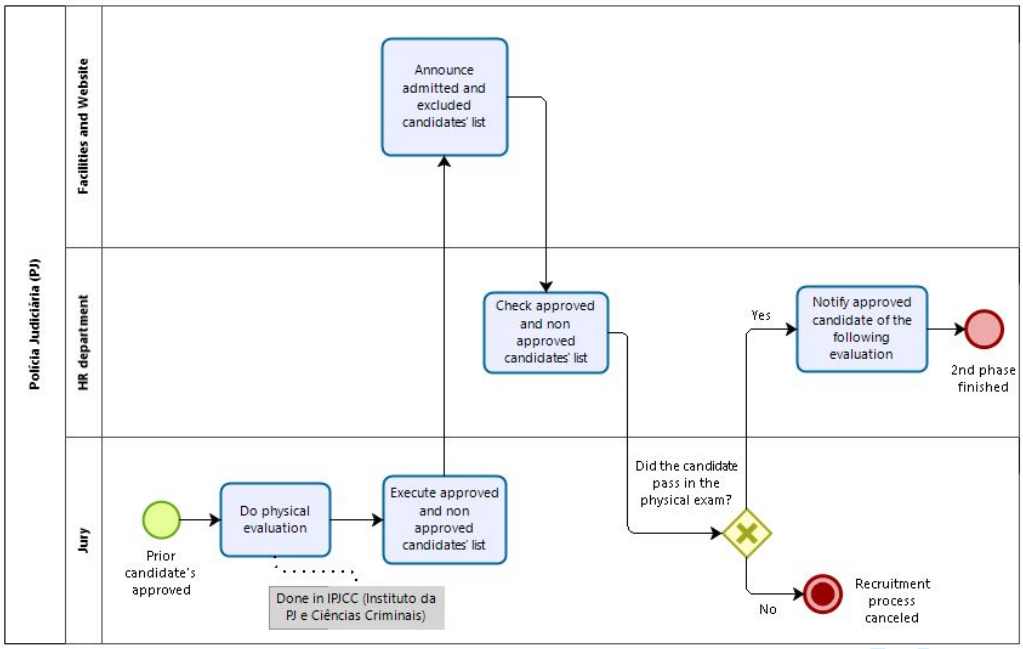

Figure 5 – AS-IS, 2nd phase (physical evaluation)

4.1.4 Process "3rd phase of the recruitment process."

The "3rd phase of the recruitment process" (Figure 5) is performed by the Psychology and Selection department, the Jury, and the HR department. The candidates' list is published on the PJ facilities and their website.

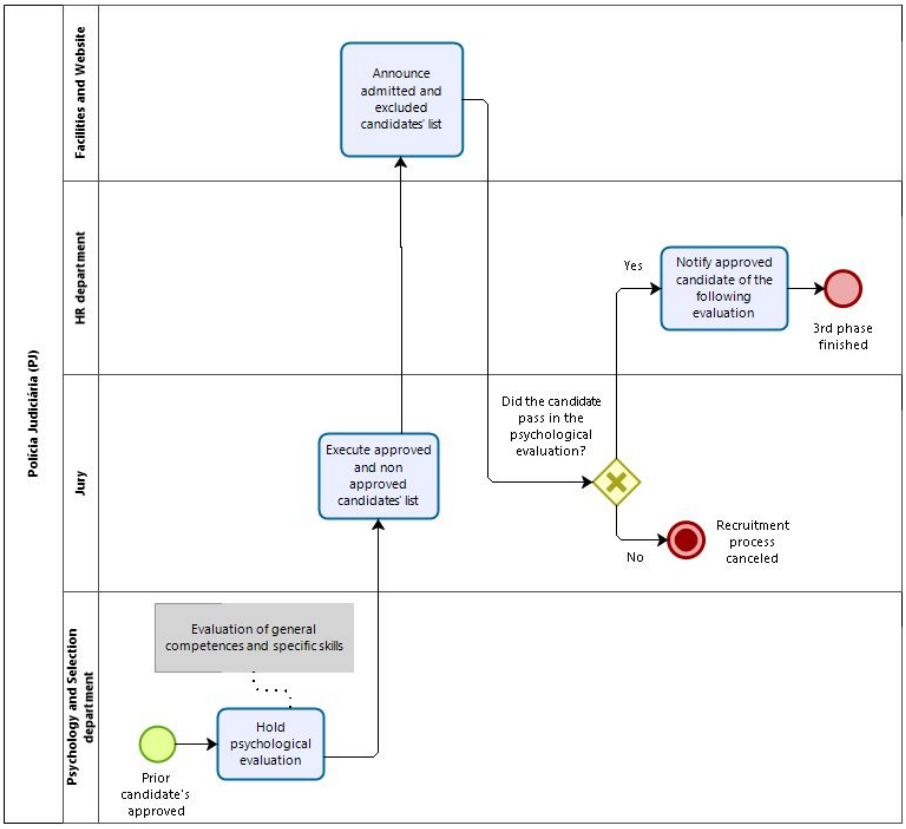

Figure 6 – AS-IS, 3rd phase (psychological evaluation)

4.1.5 Process "4th phase of the recruitment process."

The "4th phase of the recruitment process" (Figure 6) is performed by the Doctor (externally contracted), the Jury, and the HR department. The candidates' list is published on the PJ facilities and their website.

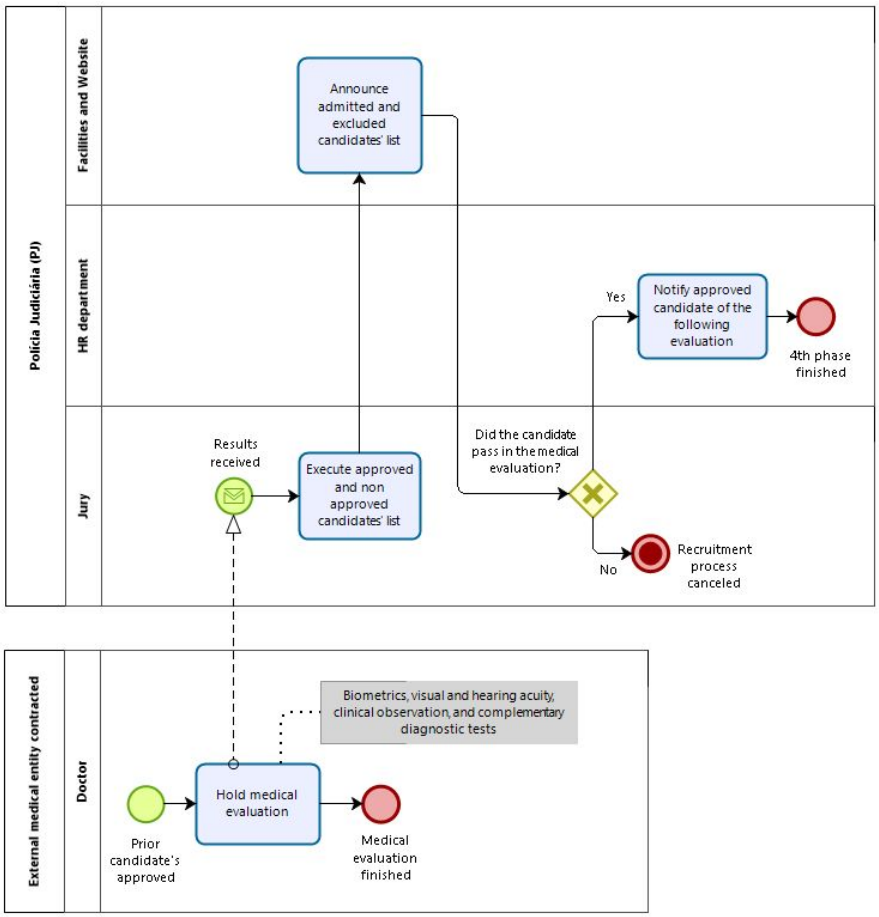

Figure 7 – AS-IS, 4th phase (medical evaluation)

4.1.6 Process "5th phase of the recruitment process."

The "5th phase of the recruitment process" (Figure 7) constitutes the final phase of the recruitment process and is performed by the Jury and the HR department. The candidates' list is published on the PJ facilities and their website.

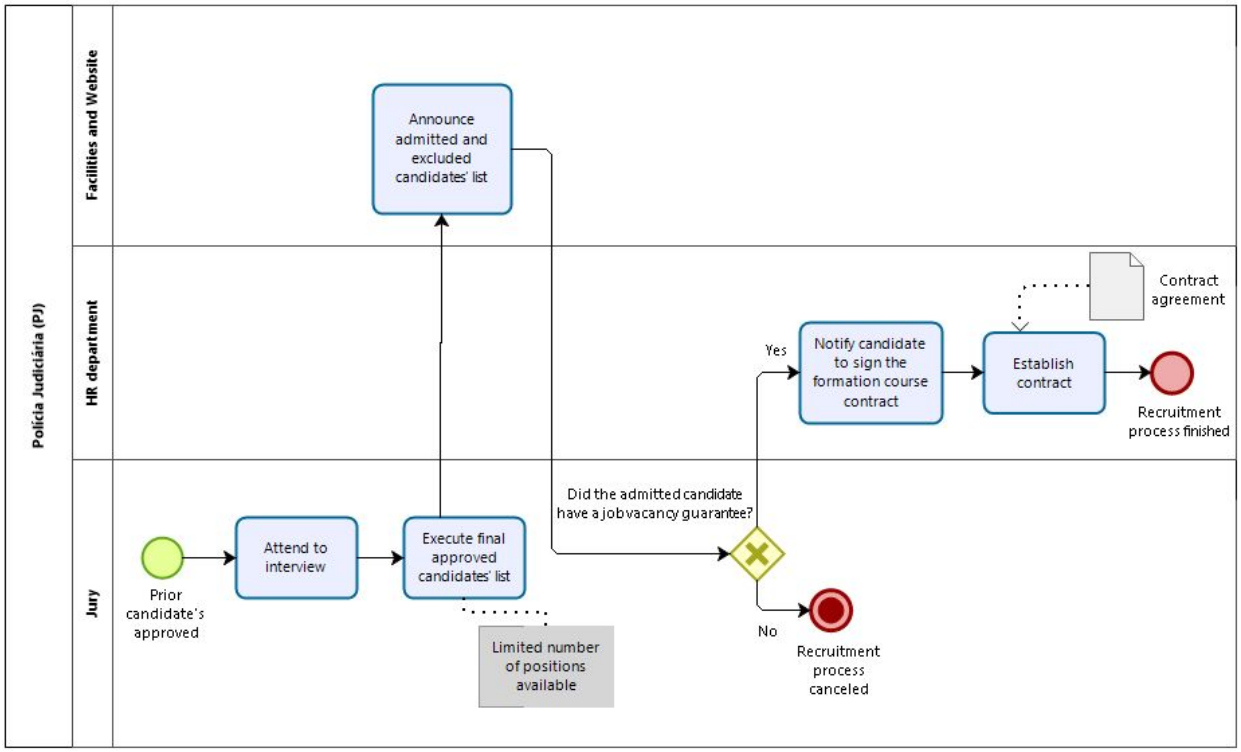

Figure 8 - 5th phase (interview) – AS-IS Diagram

4.1.7 Identify the gaps associated with those phases

Two gaps were identified by the President of the Jury of *PJ* with no current solution. The first one is associated with the electronic platform that receives all the candidates' applications. The platform was not developed to follow the entire process from the beginning until the end. It only generates an excel list after receiving the applications. The remaining information needs to be treated by paper and email, so there is a lack of automation associated with the information system. The second gap, pointed out by the President of the Jury, is related to the reduced number of internal human resources workers that cannot efficiently manage all the processed work delivered to them.

4.1.8 Integrate a new procedure into the current recruitment strategy

In the TO-BE model, prescriptive modelling of the future recruitment process for a single candidate exists two steps where AI can be implemented according to expert suggestions. Consequently, the

model includes a lane regarding the Applicant Tracking System and the AI Tracking system step utilised for, respectively:

- In the screening stage, the entire analysis of the requirements (all the documentation) would be accelerated, and the human errors diminished.
- The second system for the interview within facial recognition to discover more about non-verbal communication.
- For implementing a SA technique at the end of the process.

This redesign of the TO-BE model at a process level followed the Heuristic 9 – Process Automation (Dumas *et al.*, 2013). This heuristic was selected to be applied to the data sharing of PJ (intranets and packaged enterprise systems) towards increasing the availability of information to improve visibility and decision-making.

5. RESULTS

Based on the information transmitted through the interviews with the experts, problems were pointed out in the framework. The technologies that might reduce the likelihood of those problems' existence are explicit, and the artifact follows the same structure as Figure 2 (Lee *et al.*, 2019).

The problems pointed out through the semi-structured interview by the expert (President of the Jury) correspond to the gaps found during the entire recruitment process over the five phases and are the starting point for improving it. The problems identified are the following:

- The lack of electronic platform functionalities (the system is not automated).
- Profiling the candidates (detecting the identical characteristics shared between the candidates while belonging to the same cluster).
- Interview phase (understanding the facial expressions that undercover the corresponding emotions).
- Sentiment analysis model for SM (analysing SM platforms to ascertain that the candidate presents ethical and deontological principles aligned with the institution's values).

Evaluation and selection problems of candidates who apply to PC are paired with applicable AI technology solutions in the conceptual framework (Figure 8). It depicts the relationship between the challenges during the recruitment process in any Criminal PF and the answers provided by AI. Using AI tools to support the recruitment process could help reduce the workload involved in the entire process while maintaining the standard of responsibility. Notice that the "X" symbol represents the first option to be followed acknowledged from the SLR; meanwhile, the "*" symbol are algorithms suggested that can also fit the purpose.

					Problems of Public Contests in the Evaluation and Selection of Candidates		
					Profiling the candidates	Interview phase (facial emotional recognition)	Social media insights
AI Technologies	Lexicon based Approach	Dictionary based Approach					*
	Machine Learning Approach	Supervised Learning	Black box models	ANN		X	*
				SVM			*
				Bagging			*
				Random forest			*
				KNN			*
			White box models	Decision trees			X
				Naive bayes			X
		Unsupervised Learning	Clustering	K-means	X		
				Hierarchical clustering	X		

Figure 9 - AI-Based Theoretical Framework

AI Technologies tackle challenges encountered during the evaluation and selection phases in the recruitment process of PC while developing programs that can assist and act quickly. The chosen algorithms are:

- K-means or Hierarchical clustering: these two unsupervised models allow the performance of clusters in a dataset. The institution can understand which similar characteristics their candidates share between them.
- Using CNN, a type of ANN, it will be possible to create a new automatised step in the 5th phase, transforming it into an AI-assisted interview supported by facial emotion recognition.
- Decision trees or Naive Bayes: these two supervised white models can be a solution for interpreting the SA presented on the PF Candidates' SM platforms and obtaining more insights in a new step after the interview in the 5th phase.

Segmentation was performed to help the PJ analyse and cluster their database of all candidates. The methodology for this data mining project followed the CRISP-DM approach (Chapman *et al.*, 2021).

5.1 SEGMENTATION

For this study, the provided sample of 2399 candidates from the PJ's active database was used, referring to those who applied to the National public contest held in 2019. The dataset has 2399 candidates and six features.

The first model to be tested was the K-means algorithm. The inertia plot and the average silhouette metric were used to find the most effective number of clusters. The other model tested was a Hierarchical Clustering over K-means. Initially, discovering what linkage method fitted better by inspecting the plot of the R squared for various hierarchical methods. The K-Means algorithm was necessary to perform the centroids and plot the dendrogram.

The Hierarchical Clustering over K-Means gives the best segments, with a final solution of 5 clusters, since it achieves the best silhouette score. The major characteristics of the five clusters in terms of sociodemographic data (Age, Gender, Nationality, Educational level, Area, and District) are:

- Cluster 0 with 581 candidates

Predominant Portuguese female candidates belong to this cluster. These candidates have approximately 24 years old, and the degree is their highest level of education. The areas of their education fit the Law, Social, and Science categories. They live in the north of Portugal, in the centre, Alentejo, Algarve, and Região Autónoma da Madeira. This regional division of Portugal, also presented in the next clusters, follows the NUTS II criteria ("PORDATA - O que são NUTS?", 1998).

- Cluster 1 with 611 candidates

This cluster includes the highest number of candidates, and their age is around 27 years old. Most of them are Portuguese female candidates with a degree. The study areas fit the Law, Social, Health, and Art categories. These candidates reside in the country's capital, Lisboa, in Alentejo, in the centre and the north.

- Cluster 2 with 482 candidates

These candidates are the youngest, around 22 years old, and the majority are Portuguese female candidates. Surprisingly, it is the only cluster with a master's degree in business, Science, and Social, even though they are young. This detail might mean that these candidates applied for a master's without any scholarly interruption after succeeding in their undergraduate degrees. They are in the north of Portugal, in the centre of Alentejo, and outside the country in England.

- Cluster 3 with 303 candidates

This cluster includes the lowest number of candidates. These candidates are characterised by being the oldest, around 29 years old, and the majority are Portuguese male candidates with a degree. Their study areas fit the Law, Business, or ICT categories. They are scattered across the country; they reside

in the capital, Lisboa, Setúbal, the centre, in the north, in Alentejo, the Algarve, on the island, and outside the country in Switzerland and China.

- Cluster 4 with 353 candidates

Like cluster 1 but with prevalent Portuguese female candidates around 26 years old. They have a degree that fits the Law and Social categories. They live in Portugal's two most populated districts, Lisboa, Porto, Braga, and Leiria. Due to their commonalities, clusters 1 and 4 could be merged.

In the end, the institution will reduce the costs associated with the ineffective analysis of its candidates, meaning that the target of future PC will be understood and fulfilled the institution's needs. These algorithms will obtain groups of similar applicants as dissimilar as possible from the applicants in the other groups based on their behavior and features.

5.2 TO-BE Diagram

The "TO-BE" diagrams for each phase of the recruitment process will be provided. These prescriptive models suffered a redesign from a single candidate perspective of the recruitment process ("Portaria n.º 248/2021 | DRE", 2021). The TO-BE diagrams were performed using the Bizagi Modeller tool ("Bizagi", 1989).

5.2.1 Process "Check the general and specific requirements"

The redesigning of the "Check the general and specific requirements" process (Figure 9) resulted in a diagram with only one more step. It is more efficient and saves time due to the initial automatisation of the recruitment process provided by the Applicant Tracking System. The system receives every registration and proceeds with the screening stage sub-process. After the screening, the new step added before concluding the process is related to profiling the candidates who have been accepted. The activities associated with the Jury maintains the same, and the HR department is only in charge of certificating the challenges.

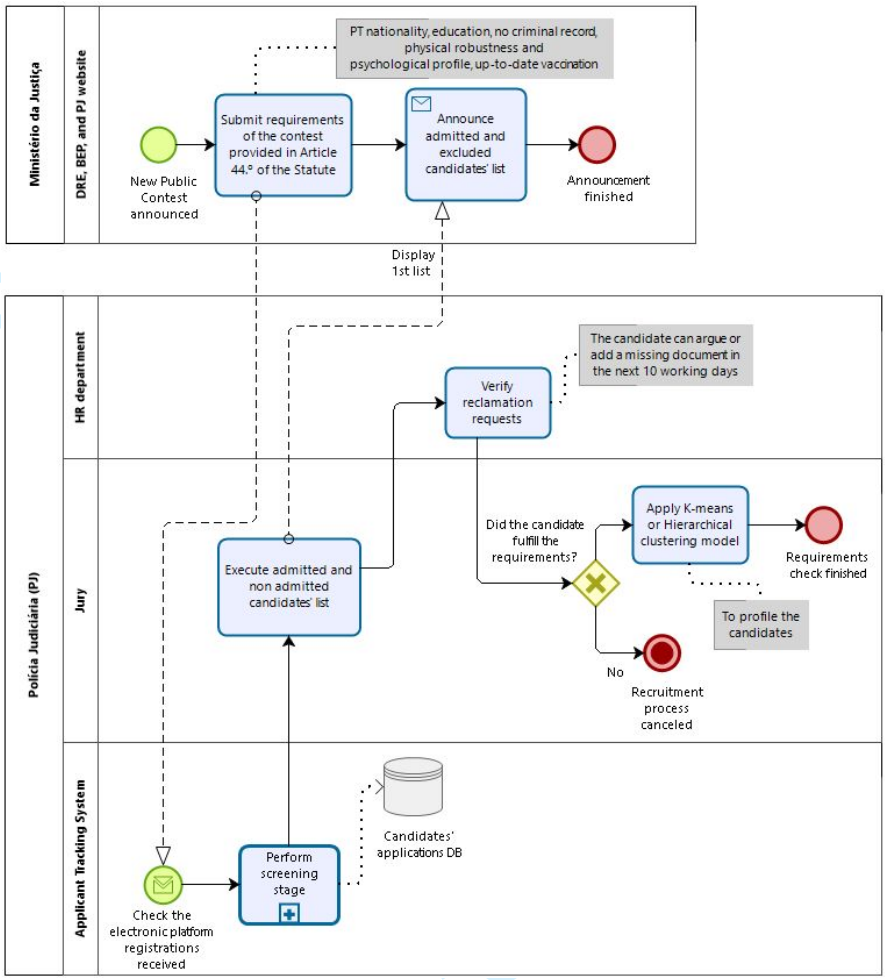

Figure 10 - TO-BE Check the general and specific requirements

5.2.2 Sub-process "Screening stage."

Sub-process "Screening stage" (Figure 10) is a detailed description of each parameter that is verified during the process. "Check the general and specific requirements" (Figure 2). Initially, it was developed by the HR department, although the suggestion is to start being performed by this new system. After the documentation is received, all the parameters for any PJ and special careers are also assessed. The dates of each document will be validated, or if there is any repeated document uploaded by mistake. The parallel gateway allows the continuation of the next activity ("Evaluate the results") if every parameter is according to the established under Decree-Law No. 138/2019 Article 44.º.

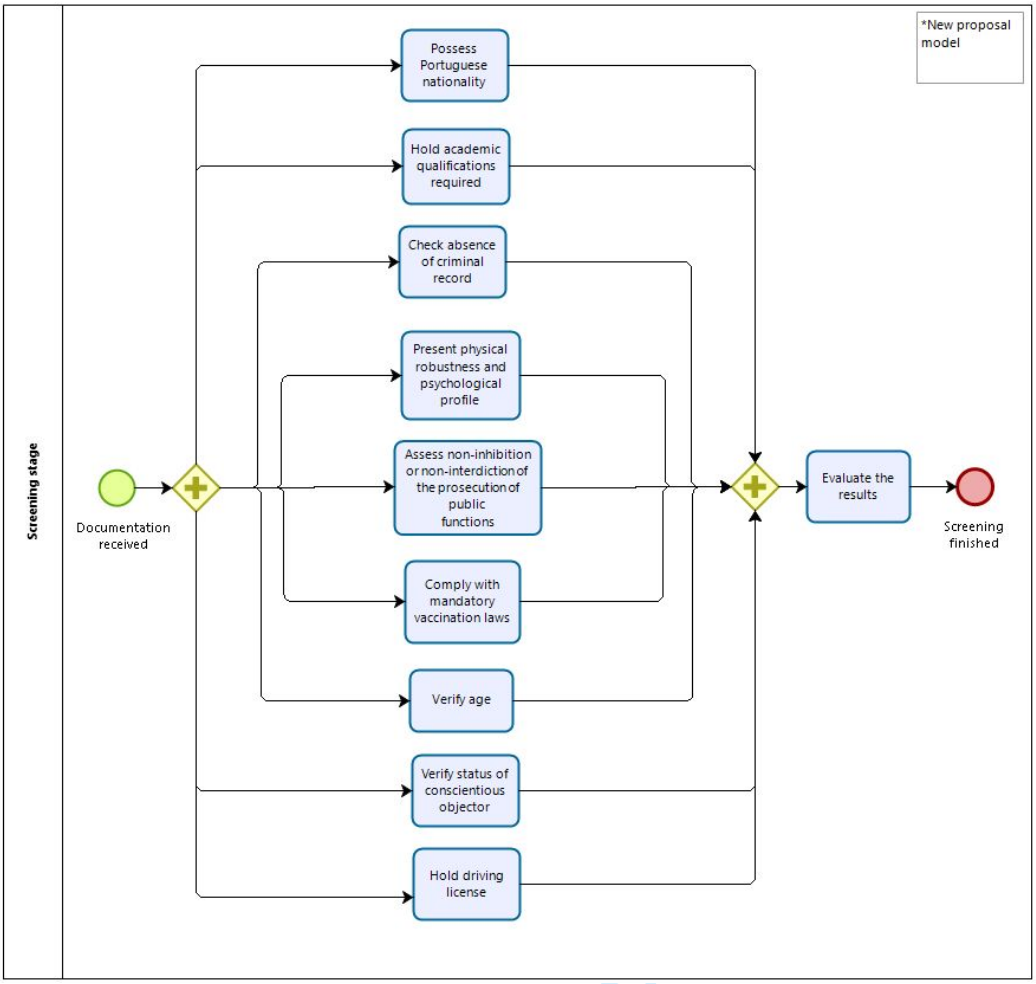

Figure 11 - TO-BE Screening stage

5.2.3 Processes "1st phase, 2nd, 3rd, and 4th of the recruitment process."

Figures 11-14 did not suffer any alteration according to the guidelines explained by the experts in the semi-structured interviews. Thus, the same performers executed the "1st, 2nd, 3rd, and 4th phase of the recruitment process", and no further activities were added.

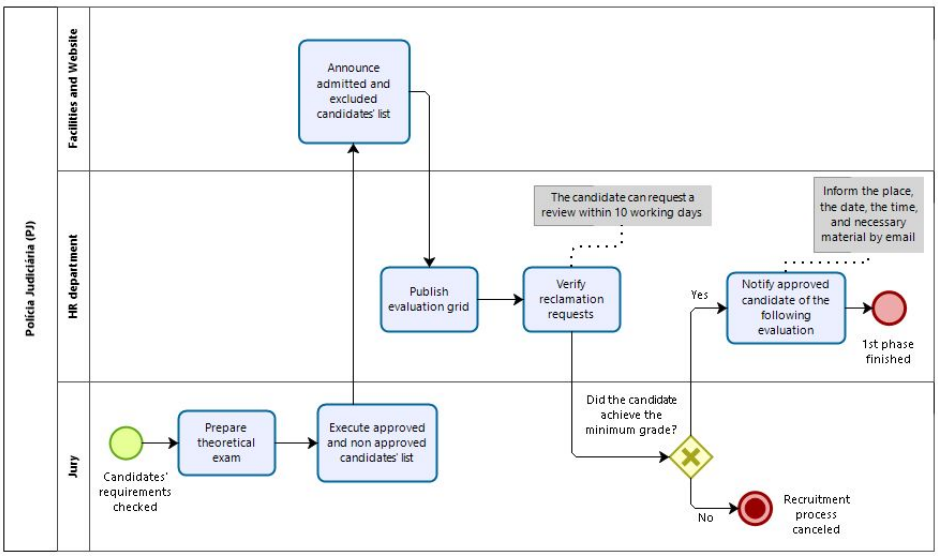

Figure 12 - TO-BE 1st phase (theoretical exam)

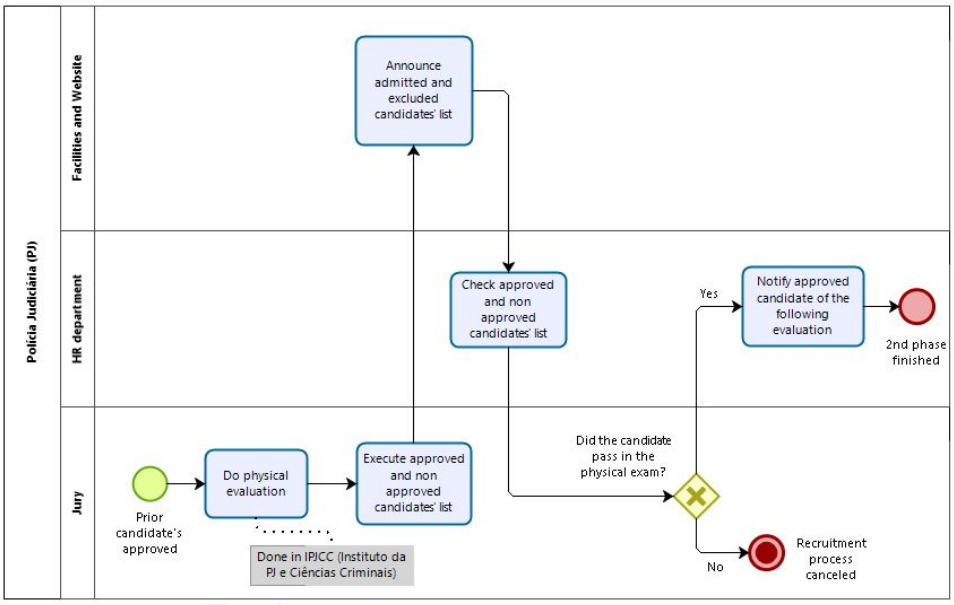

Figure 13 - TO-BE 2nd phase (physical evaluation)

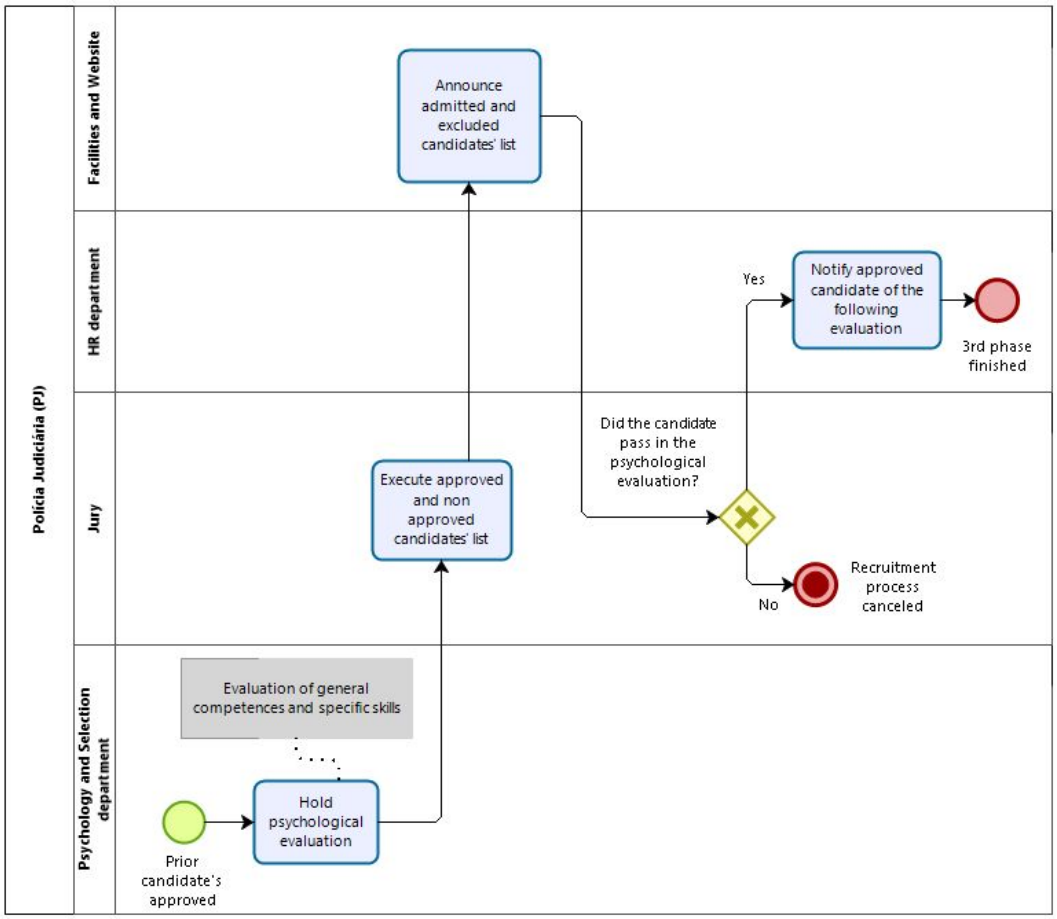

Figure 14 - TO-BE 3rd phase (psychological evaluation)

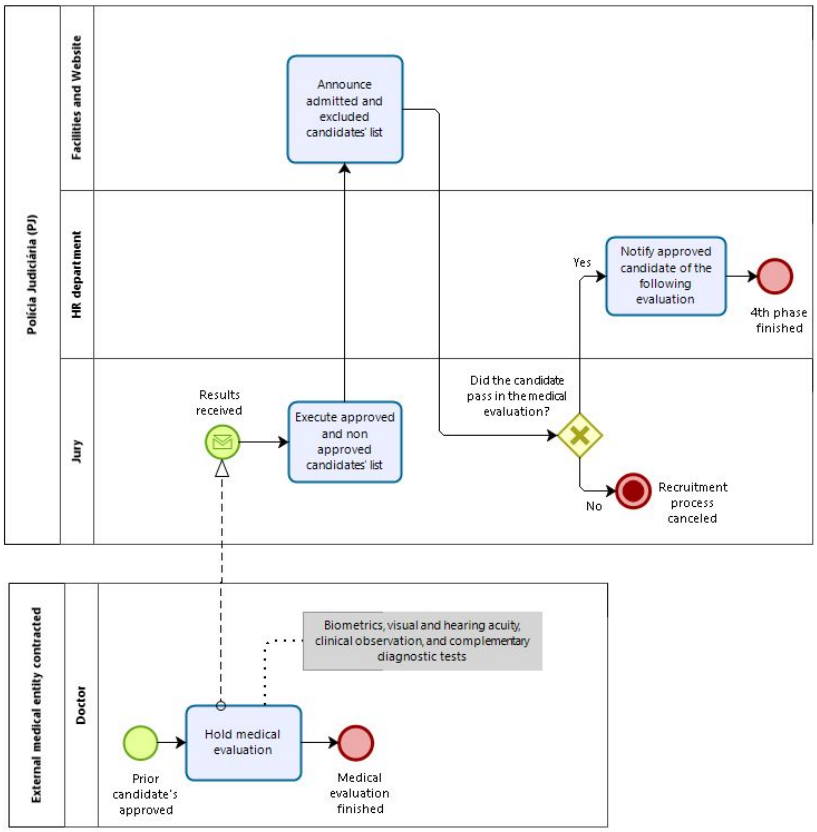

Figure 15 - TO-BE 4th phase (medical evaluation)

5.2.4 Process "5th phase of the recruitment process."

In the "TO-BE" diagram for the process "5th phase of the recruitment process" (Figure 15), the parallel gateway will connect the presential interview in the presence of the Jury and the AI Tracking System. This way, selecting every candidate who presents ethical and deontological behavior face-to-face or on their SM platforms is possible.

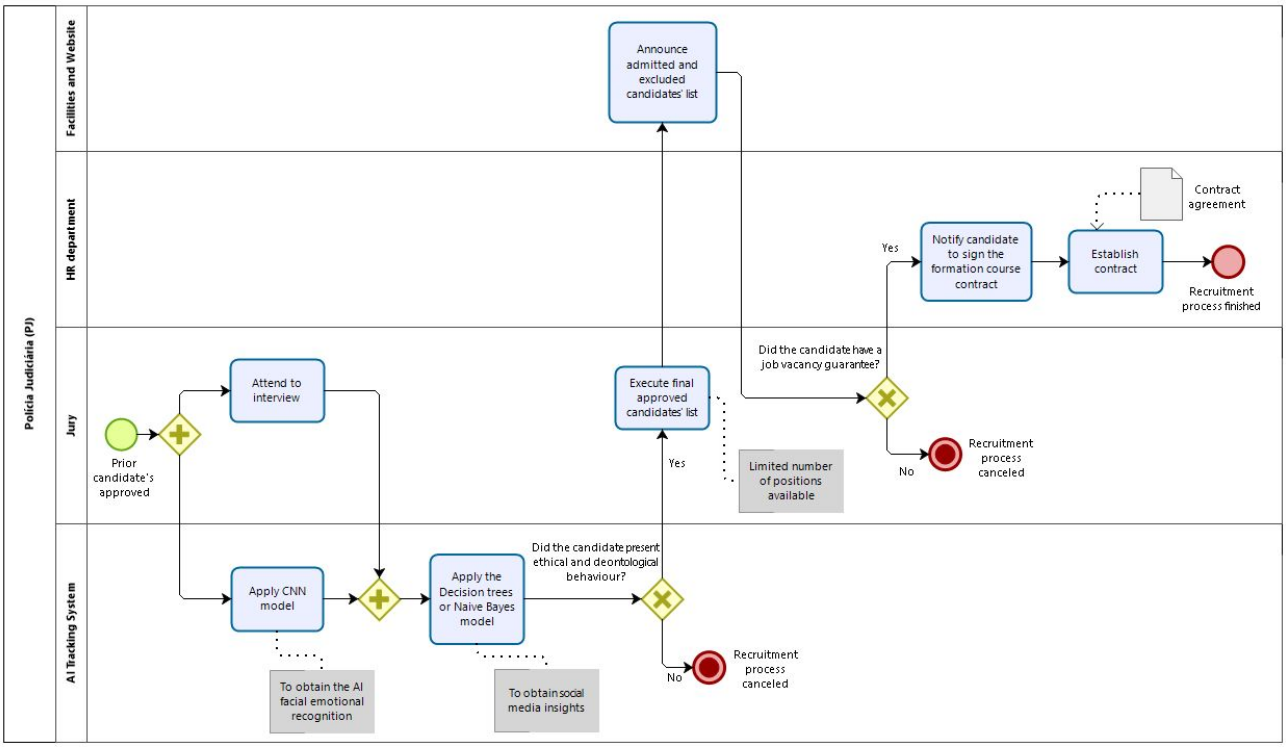

Figure 16- TO-BE 5th phase (interview)

An interview was conducted in the last phase of the research to evaluate how prone the PF is to implement and use this technology. Considering another study (Wesche and Sonderegger, 2021) and the opinion of the experts, the advantages and disadvantages of implementing AI in the evaluation and selection phases of the recruitment process in *PJ* can be inferred.

The combination of AI and human decision-making indicates comments expressing positive attitudes towards a selection process in which an AI takes decisions in the screening stage. At the same time, a person conducts the interview with the support of AI. It is a fair and objective process emphasising a decision-making process that is free of nepotism and favoritism when carefully developed. Efficiency and speed reflect the statements indicating the efficiency and timesaving of adopting a more automated recruitment process. Innovative and modern as a category group the statements that emphasise the innovative and modern nature of the process.

The negative aspects and the eventual lack of capabilities summarise the doubts about AI's ability to accept such decisions. Lack of control and possibilities to perform beliefs that there is less chance to influence decision-making in automated personnel selection laboriously. The lack of explanation emphasises the participants' concerns about not having enough knowledge and comprehension of how the automated selection procedure operates and makes decisions. This factor could be reduced when applying white-box models instead of preferring black-box models. Missing inclusiveness is the category describing concerns about potential prejudice against certain groups of individuals because of automated selection procedures.

6. CONCLUSIONS

In this work, an analysis of a Police Force institution's recruitment process was performed; based on that; an innovative AI-based theoretical framework was constructed. This framework expects to improve the evaluation and selection in the recruitment process while suggesting some new AI technologies to the *PJ*.

This article was developed to improve the recruitment process by considering the ethical and deontological values of the institution, among them fairness, transparency, integrity, and accountability. Both research questions were answered through an investigation in the field supplemented with the existing literature. The first one was answered through interviews with experts to understand the existing gaps in the PC of Police Force selection criteria. The second research question was answered while reading and comprehending other scholars' work in the same field. The most used AI tools were pointed out according to their specific contexts. Conjugating the results of both research questions helped to elaborate the framework. The gaps that deal with how to profile the candidates with factual results, obtain more accurate information from the interview phase, and gauge a complete picture of a candidate's SM profile; are the AI tools found in the SLR.

We argued that the public sector could improve its service while making transparent decisions that are more automated and efficient while saving time—ensuring at the same time an enlightened combination of AI and the human factor.

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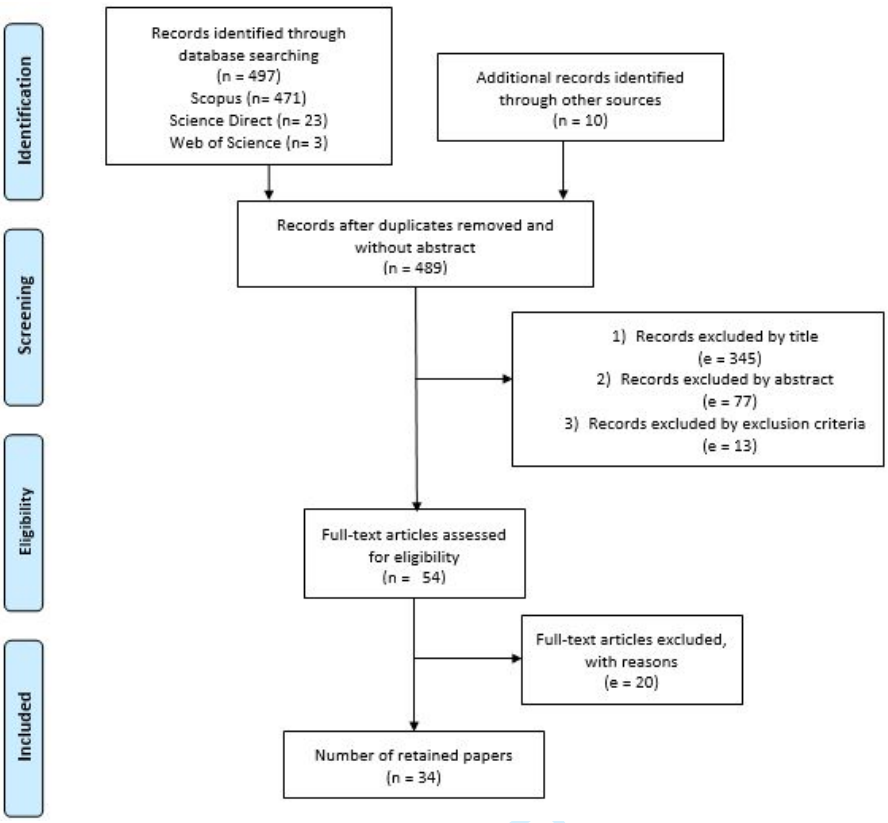

Figure 1- PRISMA flow diagram (n = maintained; e = excluded)

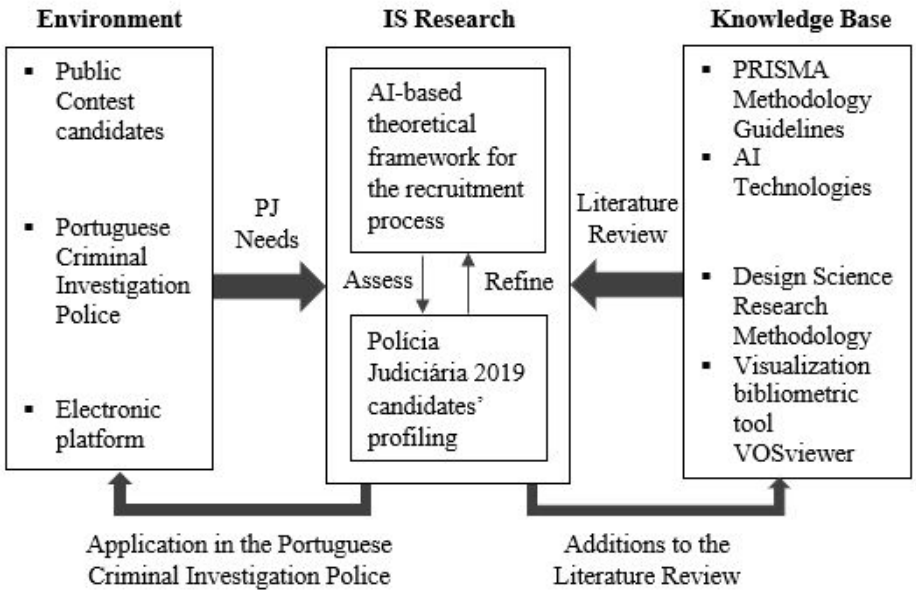

Figure 2 - DSR applied to the context

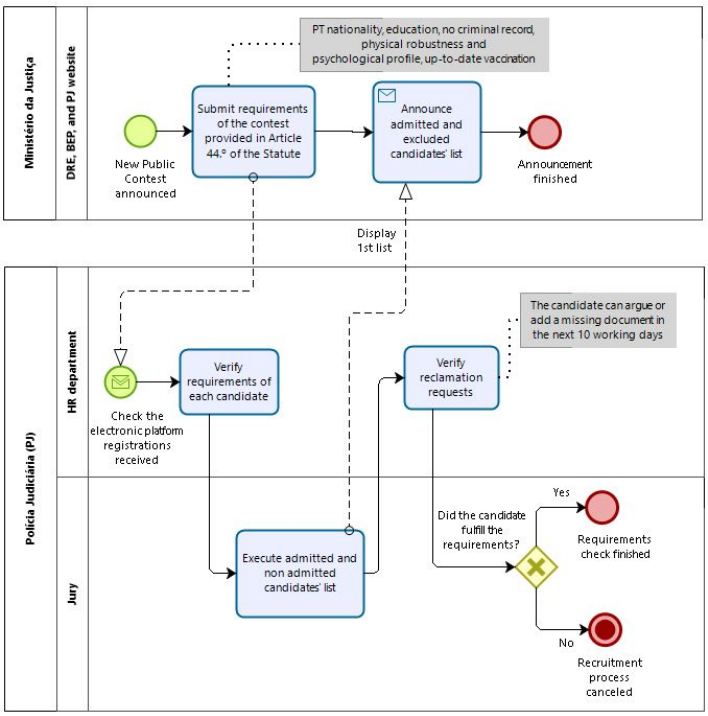

Figure 3 – AS-IS, Check the general and specific requirements

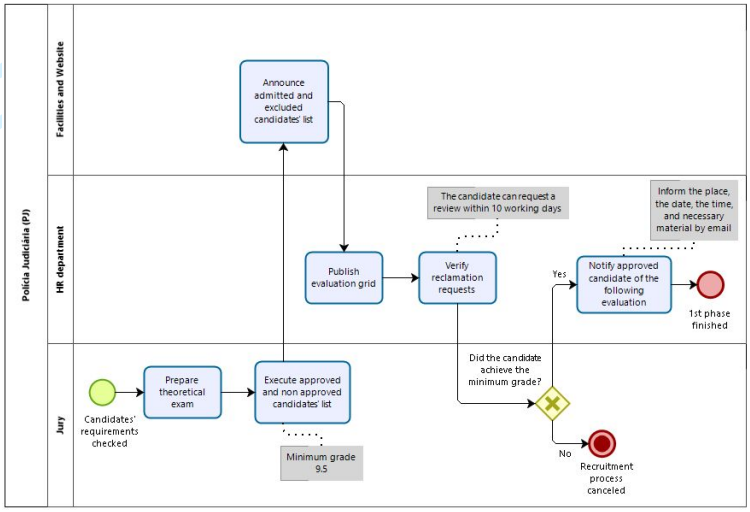

Figure 4 – AS-IS, 1st phase (theoretical exam)

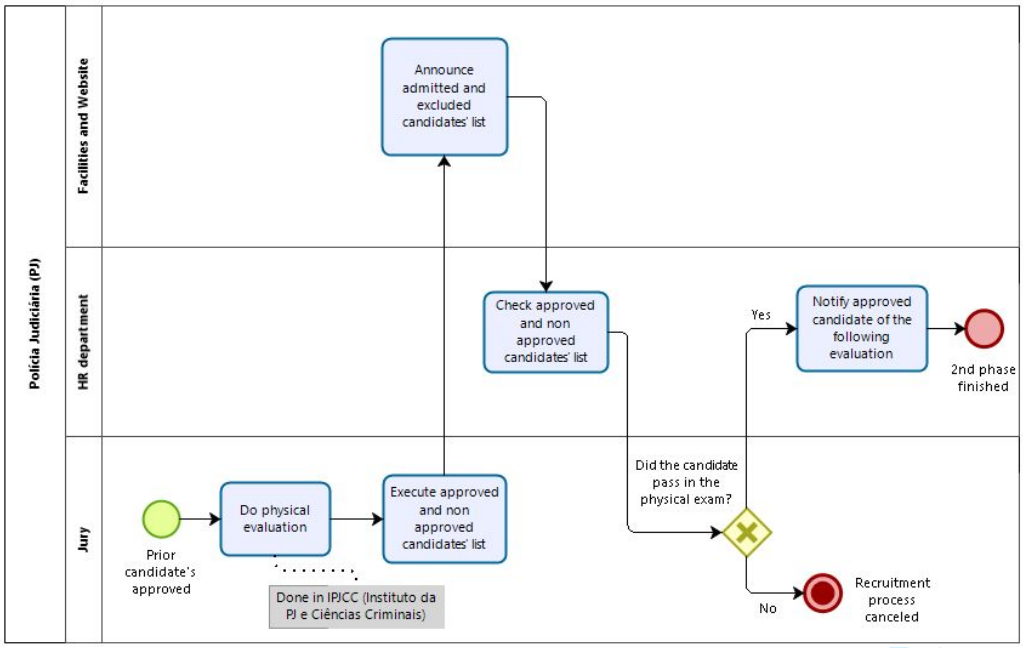

Figure 5 – AS-IS, 2nd phase (physical evaluation)

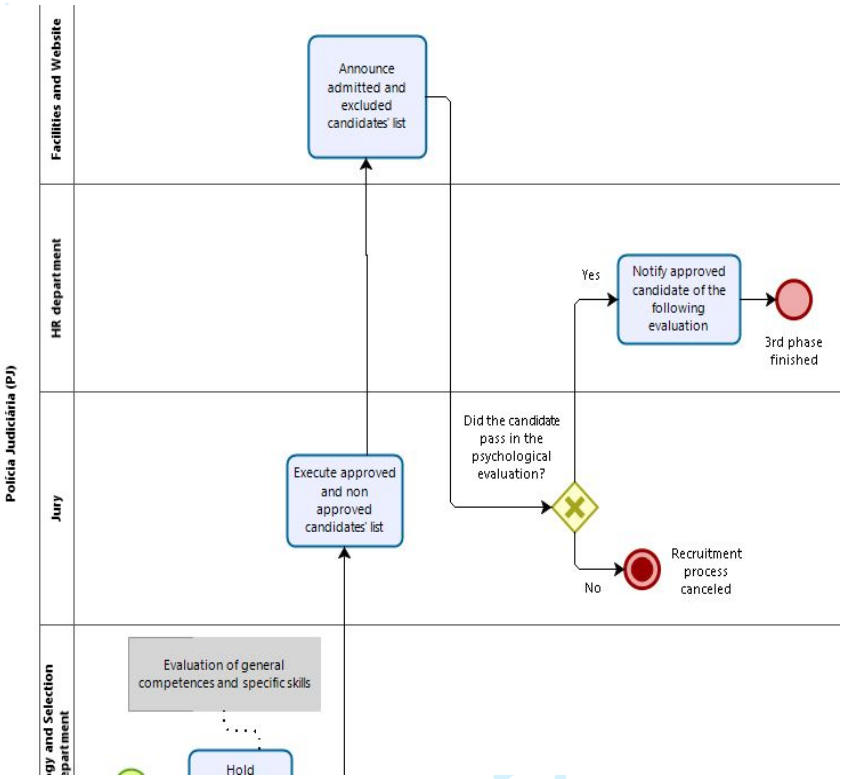

Figure 6 – AS-IS, 3rd phase (psychological evaluation)

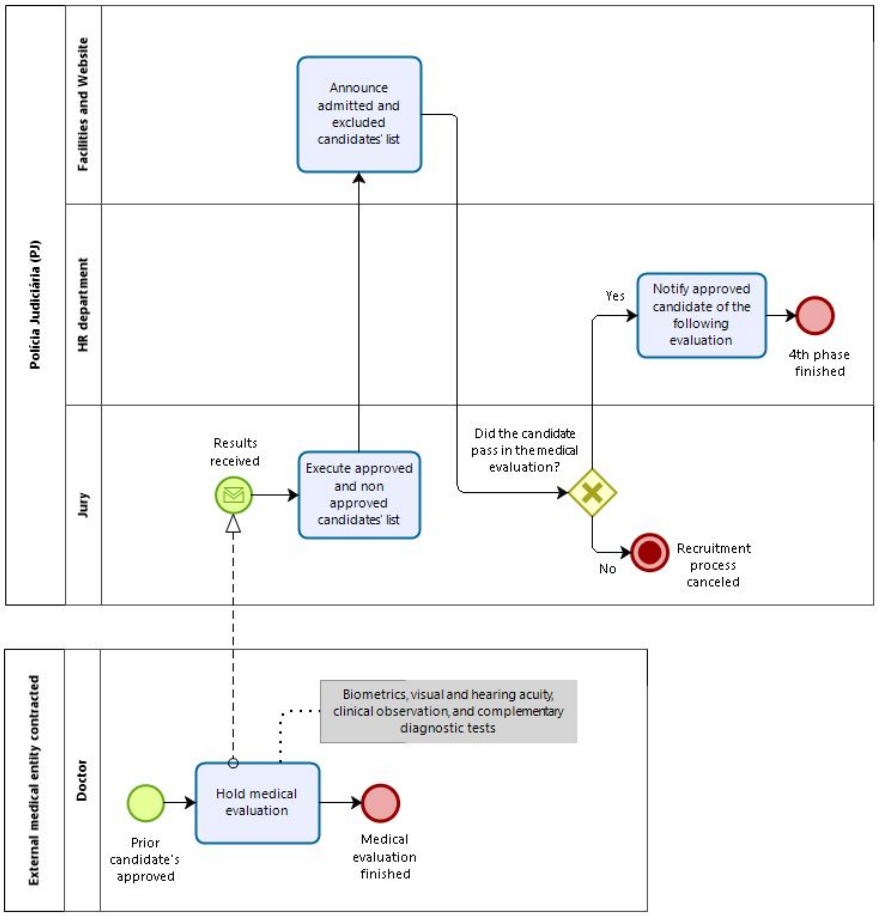

Figure 7 – AS-IS, 4th phase (medical evaluation)

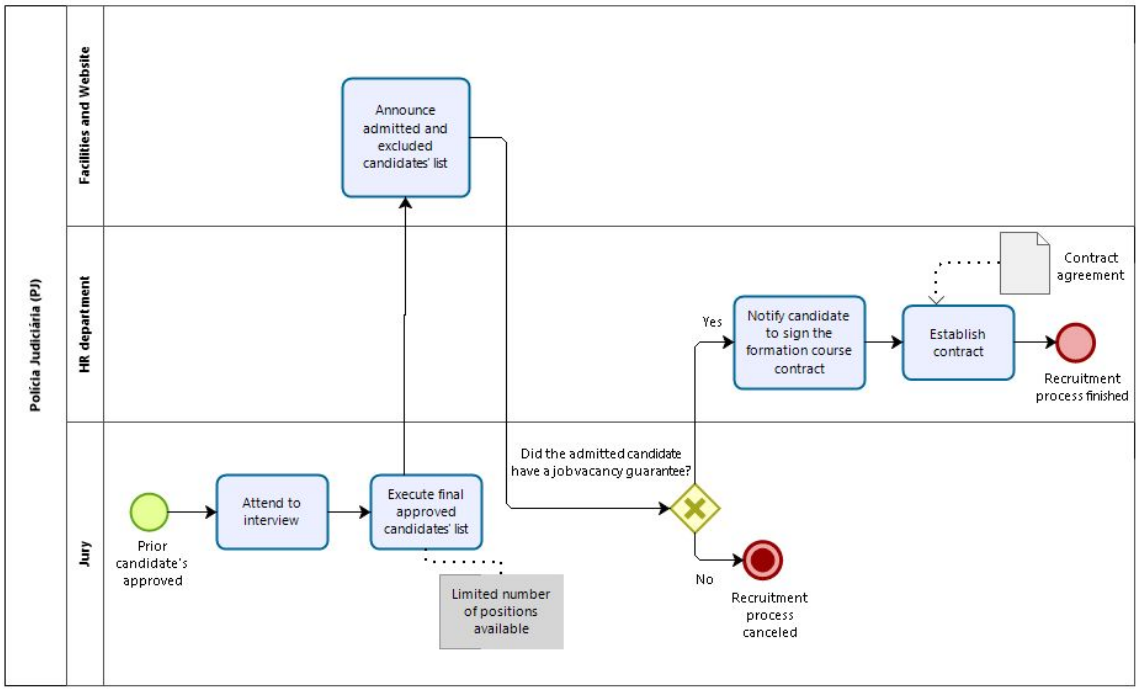

Figure 8 - 5th phase (interview) – AS-IS Diagram

					Problems of Public Contests in the Evaluation and Selection of Candidates		
					Profiling the candidates	Interview phase (facial emotional recognition)	Social media insights
AI Technologies	Lexicon based Approach	Dictionary based Approach					*
	Machine Learning Approach	Supervised Learning	Black box models	ANN		X	*
				SVM			*
				Bagging			*
				Random forest			*
				KNN			*
			White box models	Decision trees			X
				Naive bayes			X
		Unsupervised Learning	Clustering	K-means	X		
				Hierarchical clustering	X		

Figure 9 - AI-Based Theoretical Framework

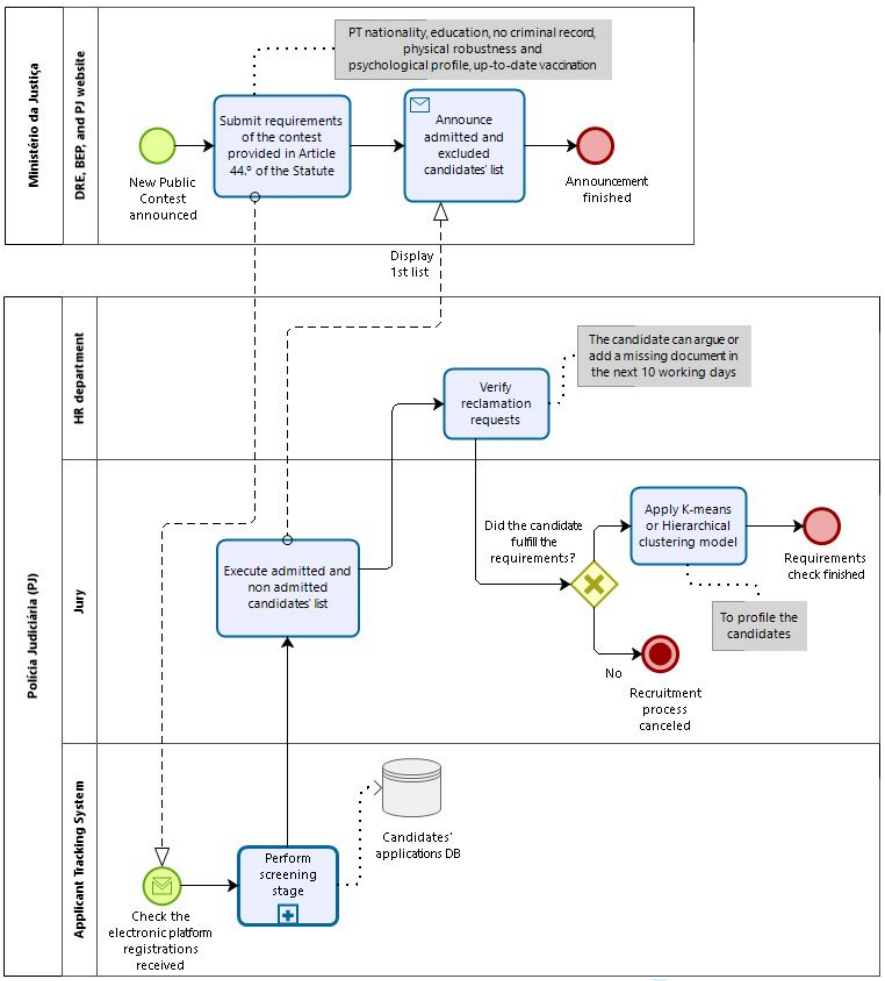

Figure 10 - TO-BE Check the general and specific requirements

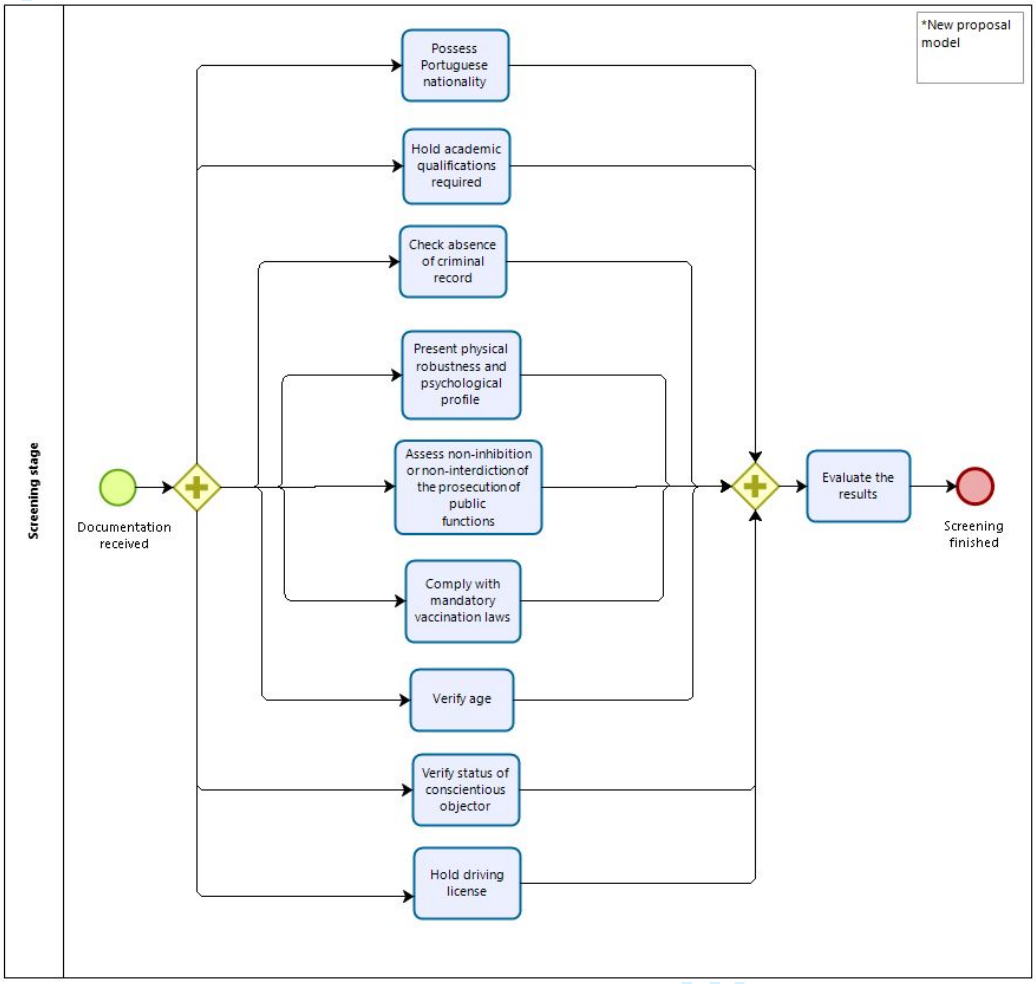

Figure 11 - TO-BE Screening stage

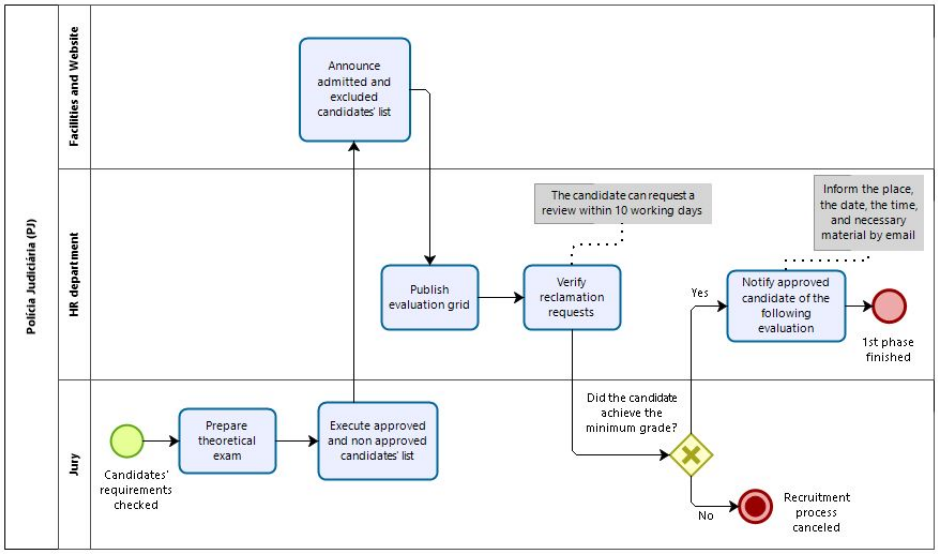

Figure 12 - TO-BE 1st phase (theoretical exam)

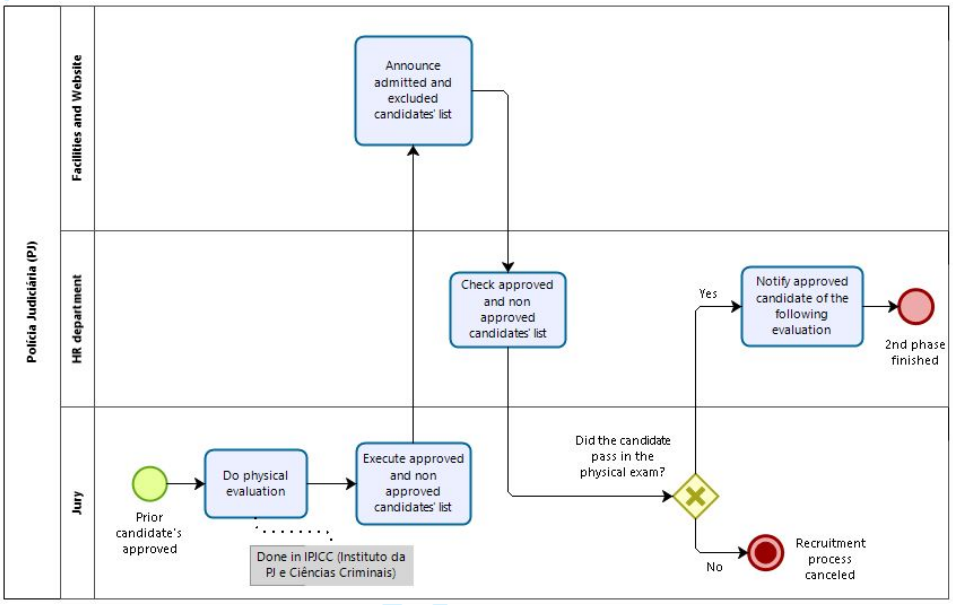

Figure 13 - TO-BE 2nd phase (physical evaluation)

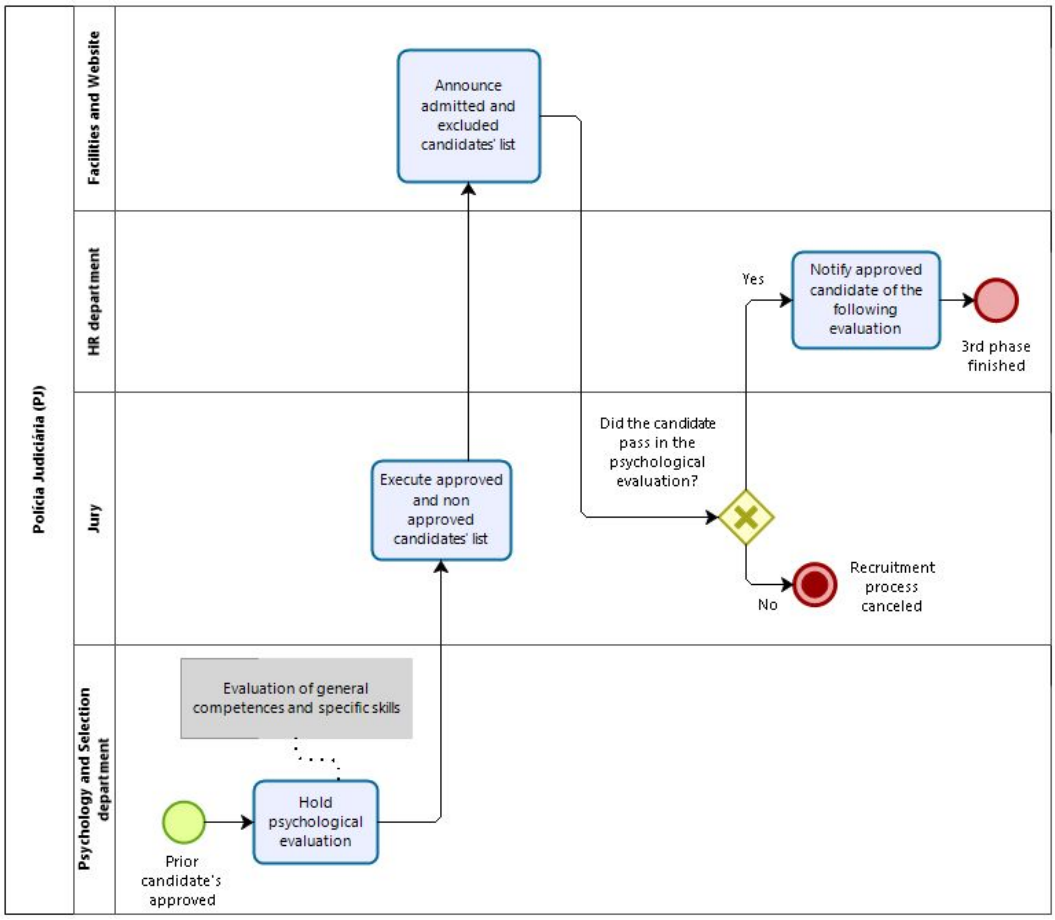

Figure 14 - TO-BE 3rd phase (psychological evaluation)

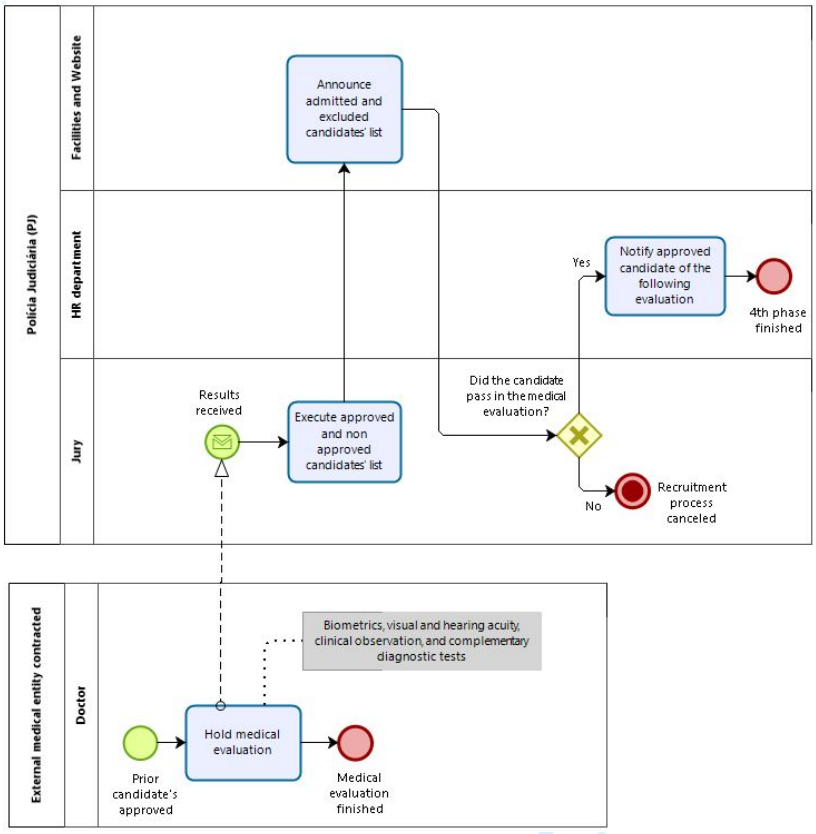

Figure 15 - TO-BE 4th phase (medical evaluation)

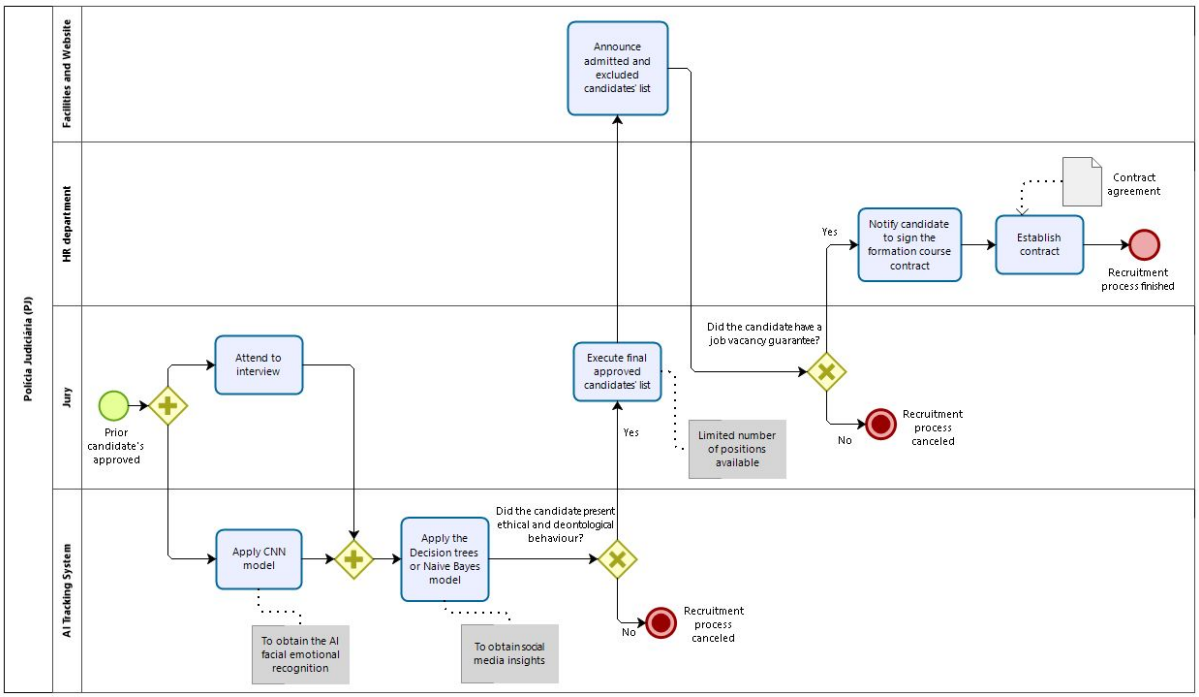

Figure 16 - TO-BE 5th phase (interview)

Article Title Page

AI and Public Contests: A model to improve the Evaluation and Selection of Public Contest Candidates in the Police Force

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We would like to acknowledge all the Polícia Judiciária (National Criminal Investigation Police agency of Portugal) experts that participated in the course of this research and who contributed with knowledge and skills. As well as all the candidates of the last Public Contest held in 2019 who took the time to answer the online survey that served as motivation.

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Structured Abstract:
Purpose - The number of candidates applying to public contests is increasing compared to the number of human resources employees required for selecting them for the Police Force. This work intends to perceive how those public institutions can evaluate and select their candidates efficiently during the different phases of the recruitment process. To achieve this purpose, AI was studied. This paper focuses on analysing the AI technologies most used and appropriate to the Police Force as a complementary recruitment strategy of the National Criminal Investigation police agency of Portugal – Polícia Judiciária.

Methodology - Using design science research as a methodological approach, we suggest a theoretical framework in pair with the segmentation of the candidates and comprehend the most important facts facing public institutions regarding the usage of AI technologies to make decisions about evaluating and selecting candidates. Following the PRISMA methodology guidelines, a systematic literature review and meta-analyses method was adopted to identify how the usage and exploitation of transparent AI positively impact the recruitment process of a public institution, resulting in an analysis of 34 papers between 2017 and 2021.
Findings – Results suggest that the conceptual pairing of evaluation and selection problems of candidates who apply to public contests with applicable AI technology such as K-means, Hierarchical clustering, ANN, and CNN algorithms can support the recruitment process and could help reduce the workload in the entire process while maintaining the standard of responsibility. The combination of AI and human decision-making is a fair, objective, and unbiased process emphasising a decision-making process free of nepotism and favouritism when carefully developed. Innovative and modern as a category, group the statements that emphasise the innovative and contemporary nature of the process.
Originality - The main contribution is the AI-based theoretical framework, applicable within the analysis of literature papers, focusing on the problem of how the institutions can gain insights about their candidates while profiling them; how to obtain more accurate information from the interview phase; and how to reach a more rigorous assessment of their emotional intelligence providing a better alignment of moral values. This work aims to improve the decision-making process of a Police Force institution recruiter by turning it into a more automated and evidence-based decision when recruiting an adequate candidate for the job vacancy.
Research limitations - There are two main limitations in this study that should be considered. First is the difficulty regarding the timetable, privacy, and legal issues associated with public institutions. Second, a small group of experts served as the validation group for the new framework. Individual semi-structured interviews were conducted to alleviate this constraint. They provide additional insights into an interviewee's opinions and beliefs.
Social implications - Ensure that the system is fair, transparent and facilitates their application process.

Keywords: Artificial Intelligence; Sentiment Analysis; Facial Recognition; Police Forces; Transparency; Design Science Research

Article Classification: Research Paper

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Running Heads: