

# Artificial intelligence for job seeking:

How to enhance labor intermediation in  
public employment services.

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# Artificial Intelligence for job seeking

How to enhance labor intermediation in Public Employment Services

Manuel Urquidi

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# **Artificial intelligence for job seeking : How to enhance labor intermediation in Public Employment Services**

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## **Abstract**

One of the main challenges of employment services -in particular labor intermediation systems- is to facilitate the adequate matching between the required skills in open vacancies and those that job seekers have. This challenge stems in part from the difficulty of matching the skills, competencies, education, and job experience that a candidate reports to have, with the functions the potential employer wants to assign to this prospect employee. This technical paper focuses on how artificial intelligence (AI) can be used as a tool to enhance the matching approach, to the extent of considering the existing relations in various occupations, which can include more information in the analysis of the profiles of job candidates.

This document is part of the fAIr LAC initiative studies of the Inter-American Development Bank (IDB). Its objective is to promote the ethical and responsible use of technology in artificial intelligence-based systems in the region, especially those that relate to the provision of social services.

JEL Classification: H10, L96, M15, J29

Key words: Artificial intelligence, public services, labor intermediation, employment, public policies.

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\*\* For more Information on the fAIr LAC initiative [click here](#).

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## Executive Summary:

### Artificial intelligence for job seeking : How to enhance labor intermediation in Public Employment Services

In order to value the significance of using Artificial Intelligence (AI) in Public Employment Services (PES), it is important to first understand the basic functions of AI, being one of them the matching approach<sup>1</sup> between labor supply and demand, based upon reliable and updated information. The former allows to offer better services to job seekers<sup>2</sup>, including migrants, and employers seeking to fill vacancies. PES work with multiple employment-related institutions, which include social security agencies, ministries, regulatory agencies, and institutions engaged in labor guidance and training, all of which are interconnected by processes and technologies aimed at providing more efficient services and greater coverage.

Two factors must be considered to implement technologies and undertake PES digitalization: the levels of digital adoption and the maturity of the PES's staff and clients, which benefit them by not creating gaps or discrimination against users, citizens or employers that still need to adopt technologies better or that do not have access to them.

Services must be universal and contemplate all digital and non-digital channels covering all possible segments and levels. AI as a tool<sup>3</sup> can be useful in PES whose level of maturity allows them to incorporate such technology. The implementation of AI ranges from matching labor supply and demand, to profiling vacancies that employers present and the job candidates' applications to those vacancies. AI finds gaps among the job candidates' profiles, which facilitates their training to achieve jobs that are sustainable in the long run.

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<sup>1</sup> For further information on the matching approach theory, see: [\(link\)](#).

<sup>2</sup> In this document, "job seekers" are understood to be job applicants / applicants, who may be unemployed people who want to re-enter the labor market or workers who are looking for better job options.

<sup>3</sup> See Graph 3 for the explanation of maturity levels.



Additionally, AI can be useful for supporting other services provided by the PES. Some of these services are related to improving the management of job counselors in profiling, adequately advising employability routes<sup>4</sup> to job seekers, or conducting better employment matching for people with disabilities (pwd) and those in prison in need of employment.

AI, like any other technology, poses implementation challenges and risks that must be considered. One of them is the risk of biased results and recommendations coming from algorithms developed as part of AI-based systems<sup>5</sup>. The quality and adequate treatment of data --as the citizen and the company's main asset-- is another challenge to be considered, ensuring the respect of universal principles for sensitive data treatment, and the management consent for data security and integrity. Lastly, the strategy for technological implementation must consider the risks involved in having suppliers' dependence, scope assurance versus functional and non-functional expectations, and counting on the adequate documentation and training to ensure the scalability, maintainability, flexibility, and adaptability of the adopted solution.

A key issue to consider is that no technology can ever be successful if the human resources have not been properly trained to use it. Thus, it is necessary to ensure that the PES staff and all the involved teams in its implementation have a solid training.

The private sector already offers several AI-based services aimed at helping job seekers to find the best vacancies, and employers to identify people with the best skills, who fit their hiring needs. Even so, Paraguay being an exception, the use of AI in Latin America and the Caribbean's PES is still incipient. Nevertheless, several countries have already begun to consider AI technologies in such services for future implementations. Peru, Colombia and Mexico have made the most progress so far in this regard, in contrast with several European nations working with AI-based systems with proven results.

As a result of the analysis on the trend of technology suppliers, we assume there will be a wide range of applications operating on AI in the future that could be implemented for both public and private labor intermediation services. All signs point to having platforms in the form of "web services" available for PES use.

Lastly, AI-based implementations provide multiple benefits. From PES's efficiency, to applications covering labor training, as well as the generation of predictive models for the early identification of adjustment needs in public policies or active labor market programs, AI has become a key element in achieving efficiency and effectiveness.

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<sup>4</sup> Employability means "the ability to obtain or keep a position", i.e., the increase of employability would represent an increase in the opportunities to have access to a position, or to keep the job over time. Nevertheless, there is no consensus or a sole indicator to measure said "employability". With regard to an unemployed person, employability could be defined as the reduction of the usual time it takes searching for a job, or the average time for people with the same profile, or how to get a formal employment. On the other hand, with regard to an employed person, employability could be measured by the salary increase, or if the employed one works in a risky-automation position employability could refer to aptitudes, skills acquisition allowing him or her to retrain or switch in labor terms within or beyond his or her working place.

<sup>5</sup> For more information on how to identify and define risks associated with the use of AI, see the fAIr LAC [technical note](#).



# 1. Introduction

Most countries count on labor intermediation services aimed at improving the matching between labor supply and demand, as well as reallocating workers in more productive positions<sup>6</sup>. These services comprise the labor intermediation systems (LIS) including public employment services (PES), private services such as private employment agencies (PEA), and civil society organizations participating in intermediation and linkage processes. The latter operate mainly through trade unions and non-governmental organizations (NGO); the PES promote the social dialogue around the regulation and supervision of private employment agencies to ensure good employment conditions for employees; and the PEA provide specializing services to specific groups (ILO, 2009).

In particular, PES are the contact point between citizens and employment policies, coordinating the entire offer of related services in a logic that pursues the achievement of better employment routes. The spectrum of services offered are diverse, from traditional job boards linking job seekers with company vacancies, to services aimed at the insertion of migrants into the labor market.

As it happens with other public policies and programs, new technologies --artificial intelligence in particular-- not only represent a very important opportunity to increase PES's efficiency and effectiveness, but they also bring great challenges in terms of adoption and usage.

Given the significant opportunities these technologies create, PES in developed countries are increasingly adopting and using AI, particularly for matching and profiling services. Belgian and French PES are good examples<sup>7</sup>, which will be described later in the document. In Latin America and the Caribbean (LAC), with the exception of Paraguay, AI's adoption for the same purposes is still incipient. However, the efforts in Peru, Colombia, and Mexico regarding PES are noteworthy, since they are taking steps to implement it in the near future. A low level of AI adoption affects PES and the country's services, mainly due to issues related to non-available data, interoperability and quality, and the users' lack of capacity, inter alia<sup>8</sup>.

This technical paper discusses the key elements considered by PES when deciding to adopt AI for their operations. First, we will describe PES basic elements, identifying main functions, actors, services, and technological maturity levels. Then, we will discuss how PES can use AI and benefit from it. Ultimately, we will elaborate on the critical factors and risks involved in the implementation of AI.

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<sup>6</sup> See IDB (2016).

<sup>7</sup> See Owlgroup (2019) for a small-scale mapping of the state of AI utilization degree at public employment services.

<sup>8</sup> See Cabrot et al (2020) This study identifies the main challenges the region's countries must face at the moment of AI adoption.

## 2. Basic components of Public Employment Services and the opportunities created by new technologies

According to the International Labor Office (ILO), PES design and implement many of the active labor market policies seeking to help employees enter the labor market. They also promote adjustment; and mitigate the impact of economic transitions. Additionally, PES provide relevant labor market information; and offer assistance in job seeking, along with placement services and the management of unemployment insurance and other labor market programs (ILO, 2016).

### Main functions of Public Employment Services (PES)

From the neoclassical perspective, a job market relying on complete information can equal the labor supply with the demand, meaning job seekers' skills and qualifications perfectly match the job requirements. In such a scenario, no intervention from employment service providers is required, whether public or private.

**In practical terms, labor markets are not perfect because there are information asymmetries between employers and job seekers.** As a result, on one hand, some employers do not get, or take longer time to get employees with the necessary skills, and, on the other hand, some applicants fail to find jobs requiring their skills. This market failure justifies and makes necessary the existence of employment services since the information asymmetry generates inefficiencies in the economy and social welfare (ILO, 2016). New technologies are the window opportunity to enhance the efficiency and effectiveness of each PES function.

Comparing PES with private employment services, the former has the legal obligation to ensure proper recruitment and placements, and in this regard they are key in their traditional role of matching job seekers and vacancies. Nowadays, market labor challenges and complexities are greater due to the number of new occupations and the specific requirements and skills these demand from job seekers. In this regard, PES functions are broader. Box 1 summarizes PES main functions.

### Box 1. PES Functions

**Labor intermediation:** Public disclosure of job vacancies to facilitate an expeditious job match between labor supply and demand.

**Provision of labor market information:** Collecting data of job vacancies and potential applicants.

**Labor market adjustment:** Introduce labor market policies aimed at matching labor supply and demand.

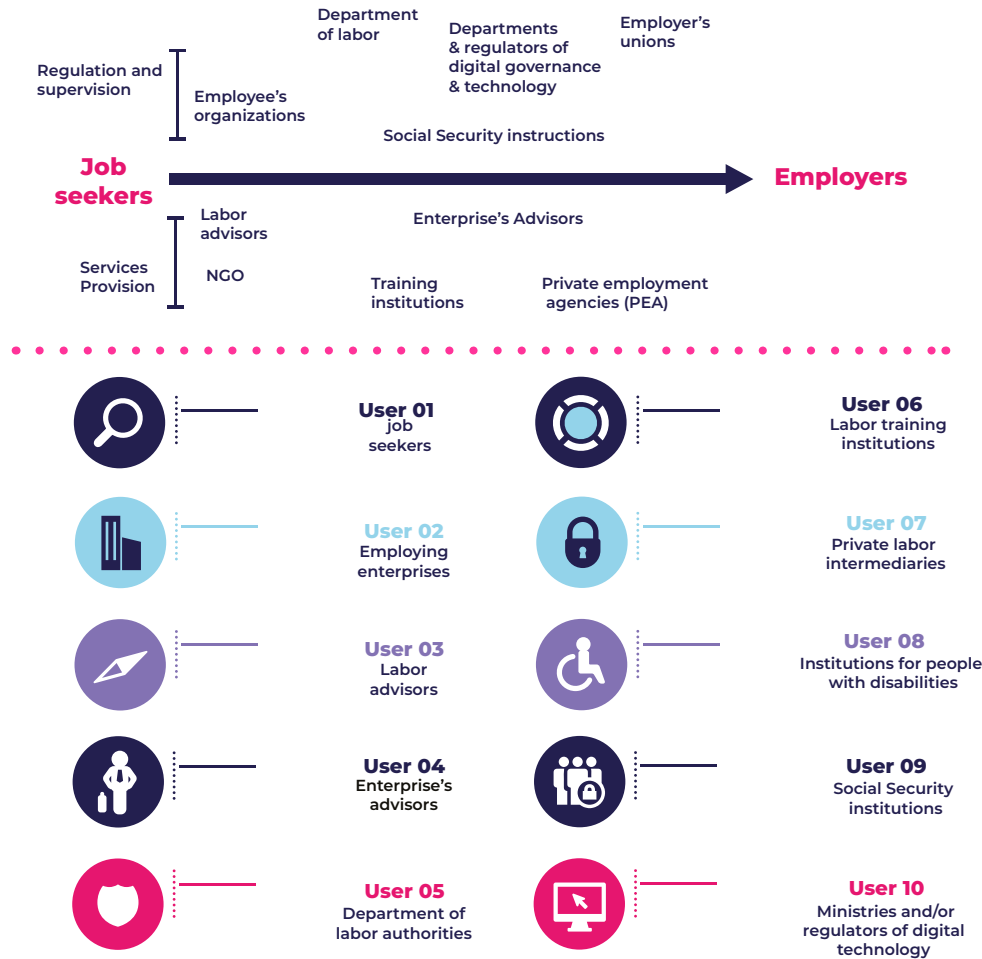
**Management of unemployment benefits:** Support given to unemployed people, including unemployment insurance (benefits are financed by contributions), and unemployment assistance (benefits are usually financed by taxes and their delivery depends on the unemployed person specific situation).

**Management of labor migration:** Coordinating geographic mobility across borders of people wanting to use and develop their skills in a new working environment. This function has become an increasingly important part of the PES's service portfolio in recent years, although in all countries of the world there is still some reluctance to manage them as part of their labor market policies.

## Main actores of Public Employment Services (PES)

There are different actors in the labor markets interacting under the public and private employment service providers' functions. Identifying these actors together with their level of digital transformation has allowed to understand better the sort of opportunities new technologies will create for PES, as well as the challenges its implementation and use will pose to them (Graph 1).

**Graph 1. PES key actors**



PES have two main users (clients): job seekers and companies or employers. Consequently, they offer specializing services to each client depending on their characteristics and needs.

In general, PES offer the following services to job seekers:

- Profiling and segmentation services, including gap detection to achieve a sustainable employment.
- Support services for job seekers through the matching with vacancies, job orientation, referral to job training, and practical suggestions such as CV elaboration, inter alia.
- Plans for action/refund contracts, scholarships, and internships.
- Direct training offer (in-house) for job seekers.
- Referral to employment agencies and specialized providers for customized or special services.

- Differential services for pwd.

Meanwhile, the services offered to employers are as follows:

- Preselection of suitable candidates according to vacancies.
- Information and group tests for candidates.
- Focused field visits to selected enterprises and branches to increase the demand and design specific service packages.
- Organization of job fairs.
- PES personal advice and support in case of firm crisis (e.g. job retention and license management, etc.).
- Vacancy registration service for employers.

The channels through which these services are offered can be face-to-face, digital and through service centers (call centers), or online websites self-managed by job seekers. A combination of these is generally used to reach the different segments of job seekers and employers.

Both employers and job seekers relate to regulatory and supervisory institutions, especially in terms of rules-compliance, active employment policies, and in-force regulations. They also relate to services-supply institutions so that job seekers can improve over time their job opportunities and their employability level. Thus, they can achieve sustainable, quality jobs<sup>9</sup> enabling them to progress as citizens.

In turn, regulatory institutions and providers of related services interact with employers to articulate their needs in accordance to regulations. Also, they offer them relevant job training and profiling services that allow these employers to fill their vacancies with the best available candidates.

An example of this relations between key actors can be found in the life cycle of a job seeker, since the person looking for a job firstly interacts with the PES as part of the process. Afterwards, actors such as job training centers, labor advisors, or subsidy program managers perform a key role in providing job seekers a route leading them to improve their employability and conditions. Once the job seeker joins the workforce, other actors, i.e., Ministries of Labor and Employment and the employee's organization, will play a vital role in developing new interactions with the employee such as deduction of contributions, management of reports, labor inspection, and other records that cannot be isolated from the citizen's life cycle – which involves different stages such as unemployed, employed and so on throughout his / her working life.

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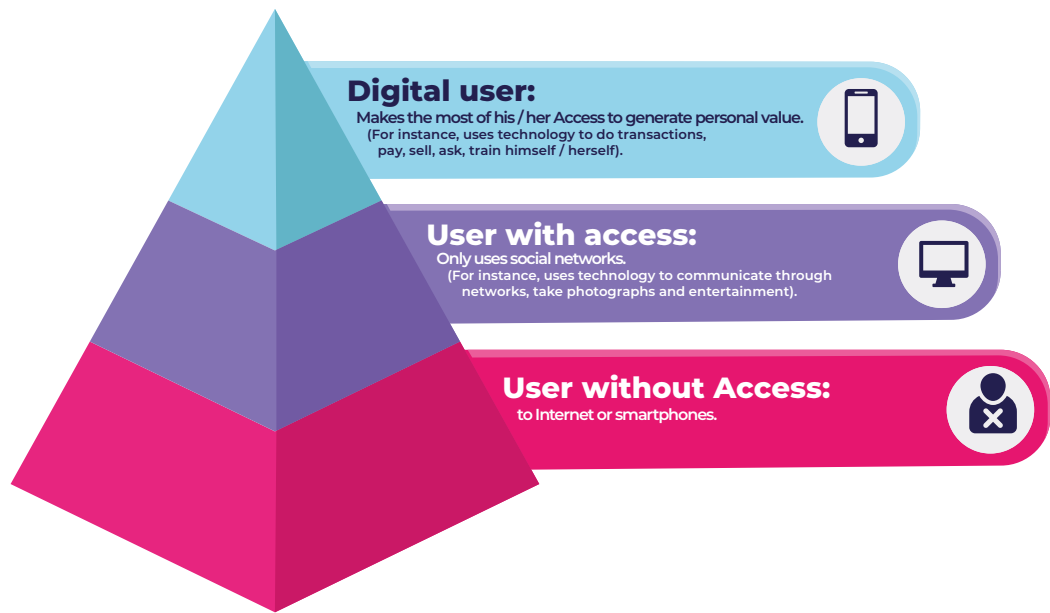
<sup>9</sup> We define quality positions those jobs paying employees adequate remuneration that allow them to cover their needs, to have access to basic labor benefits, and be protected by social security (pension funds and access to social security (the latter contingent to the country's regulations)).

The proper articulation of interactions among job seekers, public employment services, social security services, and all other actors allows for the generation of orderly, complete and organized records. This eliminates any duplicity and inconsistency, allowing for job seekers to find themselves within a single entity that consolidates all these interactions. On the opposite side, the government finds itself in front of a single citizen with consistent, unified, and integrated information. Interactions with such features, between job seekers, key services' providers, and employers, make it easier to understand why technologies, processes and actors perform a fundamental role in the generation of sustainable jobs.

### Levels of digital adoption by key actors

It is essential to understand the levels of digital adoption that job seekers and employers have in order to maximize AI's use and adoption of technologies by PES. Graph 2 displays the levels of users' digital adoption in seven countries in LAC. Although a high percentage of the population already has smart phones or Internet access, this does not necessarily imply the user is digital, i.e., s/he is in a position to adopt new habits in the use of technologies. This situation presents the challenge for the PES of reaching all types of users without discrimination.

**Graph 2. Levels of digital transformation by PES key actors in seven LAC countries\***



*\* Bolivia, Colombia, El Salvador, Haiti, Mexico, Paraguay and Peru.*

The different channels used by PES to offer their services, namely call centers, social networks, and face-to-face attention or self-management, incorporate various technological options, which in turn may have different levels of technological and digital maturity. For example, a PES office can offer services to job seekers by means of: (i) manual registrations, printed forms and manual matching management between labor supply and demand; (ii) basic technologies as the e-mail or Word processor; (iii) advanced technologies as AI, robots or chat-bots, virtual advisors, and other supporting those services offered.

Considering the example above, if adopted technologies achieve higher levels of development, a PES office could implement systems designed to serve job seekers. For instance, the labor advisor (Graph 1) could have electronic forms, as a unique citizen identification, interoperability with other institutions, and workflow tools that allow the office to perform the same tasks without using printed forms. The former allows to automatically derive the processes to the assigned responsible parties, and then generate data and reports from the computer records. Similarly, the tracking of job seekers or enterprises to develop designs of continuous upgrading processes based on measurable results becomes possible. This would also facilitate the interaction with job seekers regardless of the connecting channels used, allowing their adequate profiling and the subsequent proposal of a service adjusted to their needs.

Lastly, a PES office counting on a digital maturity level could implement tools such as AI engines for matching labor supply and demand, virtual labor advisors, predictive analysis of the labor market, and other elements aimed at managing their processes more efficiently as well as using digital contact tools to generate notifications or remote interactions such as email, social networks, WhatsApp, etc. A digital maturity of this level would allow a fluid contact among key actors.

The most important aspect is to ensure job search services available through digital technologies do not end up discriminating people without Internet access<sup>10</sup>. Accordingly, whenever such circumstance is detected, the first step should be to ensure job seekers with no Internet can use conventional means as face-to-face applications and other traditional tools.

## Levels of Technological Maturity of Public Employment Services (PES)

Regional PES<sup>11</sup> have various degrees of technological maturity and digitalization<sup>12</sup>. In those countries where digital maturity is higher, AI can play a key role in several functions, processes, channels and technologies. Graph 3 displays some areas where AI implementation supports the PES staff in their work.

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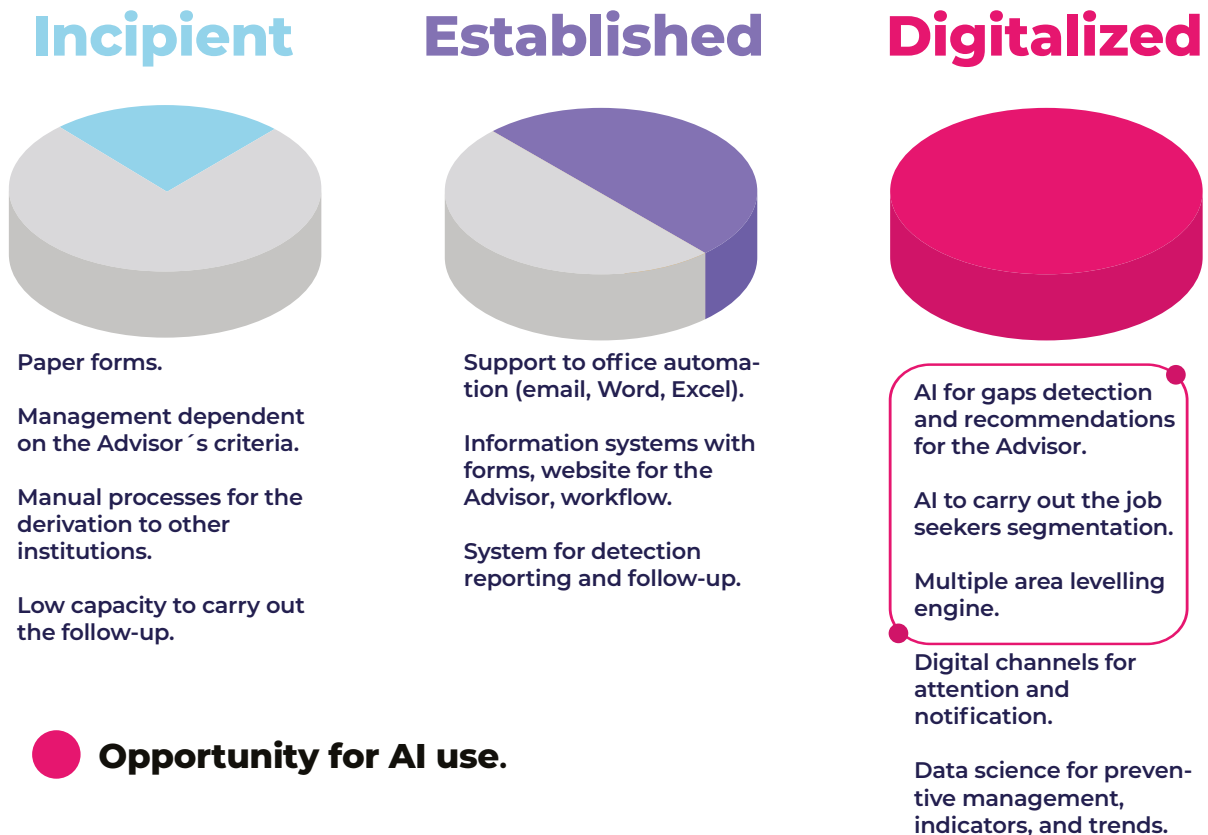
<sup>10</sup> Hence the importance of the need to develop, in parallel, programs or policies to foster digital inclusion together with the promotion of digital skills.

<sup>11</sup> Information collected in Bolivia, Colombia, El Salvador, Haiti, Mexico, Paraguay and Peru.

<sup>12</sup> Digitalization is “the adoption or increase the use of digital technology or computing science by an organization, industry or country”. Source: [https://www.epsu.org/sites/default/files/article/files/EPsU%20position\\_Smart%20Public%20Services%20in%20the%20Digital%20Age%2016.04.19-20%20-%20ES.pdf](https://www.epsu.org/sites/default/files/article/files/EPsU%20position_Smart%20Public%20Services%20in%20the%20Digital%20Age%2016.04.19-20%20-%20ES.pdf)



Graph 3. Levels of technological maturity at PES



### 3. Using Artificial Intelligence in Public Employment Services

Given that it is currently skills - not qualifications - that are at the core of the forecasting and matching processes carried out by employment services, the arising question is “how could PES improve the processes of collecting, analyzing and broadcasting information on current and future demand of labor skills through the use of emerging technologies?” The following sections explore the role AI could play in forecasting which labor skills and competencies will be required and how these could be adapted to the specific needs and circumstances of the market.

PES can use AI and other technologies in several of their services and functions to make them more efficient and effective. Thus, it is possible to set up the algorithms of AI systems to learn and recommend according the specific needs of the labor market. Using information from the support and decision-making systems correctly and responsibly, besides speeding up services processes and customizing them, mitigates all possible biases that could generate any kind of discrimination.

## Potential use cases

The PES services that could receive some AI added value are (i) matching labor supply with demand; (ii) detection and matching of skills' gaps with available training supply; (iii) matching job seekers' aptitudes with skills required by future jobs or with development opportunities in the most dynamic industries of the labor market; (iv) segmentation of the applicant to facilitate the task of the job adviser or employment consultant; (v) defining job seekers' eligibility for active market programs such as scholarships, internships or grants; (vi) identifying employment opportunities for disabled people; identifying employment opportunities, according to their skill profiles, for people seeking to re-enter the labor market after being imprisoned; and, (vii) labor inspection and other work and employment areas.

As it is one of the most demanded services, the use of AI in the match of labor supply and demand is detailed below:

### Using AI to enhance the matching approach between labor supply and demand

The matching service has been widely applied at PES and the private sector using AI's platforms, developments, and solutions. Below, a range of options covering from pre-designed services to the development of customized solutions, including the adaptation of an already existing solution (customization):

- **Vacancy boards.** These platforms, generally available on the Internet, are used by employers to publish vacancies. Job seekers can access them and apply for the vacancy, in other words, getting in touch with the potential employer.
- **Matching portals or platforms based on term concurrence.** These platforms use codes or key names for the vacancies or skills that are added to the labor supply and demand. Usually, matches are managed online through filters that later contact job seekers with employers. These platforms are more effective than vacancy boards or the use of printed documents because they pave the way for the matching of previous vacancies offered with the existing demand.
- **Websites or matching platforms based on multiple criteria and the use of ontology<sup>13</sup> and semantics.** Here, matching labor supply and demand services are offered based on multiple dimensions such as occupation, aptitudes, geolocation, contract type, working hours and aptitudes certifications, among others. These platforms significantly reduce deadlines and increase effectiveness, since they generate indicators of matching levels in multiple dimensions from concrete data that bring labor supply and demand closer together.

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<sup>13</sup> For further information on concepts and uses of positions' classifications, taxonomies and ontologies, see Ospino (2018).

- **Matching platforms with extended modules:** Unlike the type of websites or platforms described before, matching platforms with extended modules services include other modules of information on labor training; profiling and identification of missing skills; and recommendations on training to fill any existing gap. Other modules include the analysis and detection of future skills and training-related offers, whereby job seekers are referred to the appropriate training institutions according to their profiles. The support modules aimed at pwd, migrants, and individuals with some condition of vulnerability are equipped with interfaces to register and monitor the actions defined by the labor advisor besides containing information on active market programs and other relevant support content.

### Using AI in other services provided by PES

As mentioned earlier, PES offer a variety of services within their functions' framework. For example, there is a service addressed to the management of migrants supplying them with labor information. Many of these services use AI as the tool to improve the efficiency of labor advisors and PES staff along with other areas of the Ministry of Labor (e.g., labor inspection).

It is important to establish the contribution of AI to automation or the rules of information systems that support these services. While the latter records data, it also applies configurable rules to generates results, AI provides knowledge-based system that, as data increases and algorithms adjust, provides recommendations based on such information, adding value, but also changing, to the rules that will be applied by information systems themselves.

Below some examples of AI use, beyond the matching of job seekers with vacancies:

- **Correct segmentation of job candidates as a support to the labor advisor.** To provide this service, the knowledge and relations-based system using AI can collect information from external databases, either online or from any information system available and interoperating with other institutions, in order to obtain the correct segmentation of job candidates. In this context, the relation-based system is a support tool allowing PES staff to determine the appropriate client segmentation. An illustrative example would be the AI engine already containing relations created on the basis of socioeconomic, health, education, judicial, migration, past employment, and social security data systems. Then, these data would interoperate with similar cases kept in the knowledge-based system that AI generates from its algorithms to formulate a recommendation about the pertinent segmentation for the job candidate in question. The labor advisors may add tests, interviews and their own criteria to provide an efficient final rating of the segment and the route they recommend, which also arises from the knowledge-based engine which takes into consideration similar successful cases in the data system.

- **Identifying eligible active employment programs or subsidies.** AI can help improve the identification of potential clients, whom could be the beneficiaries of subsidized programs, since obtaining external data on issues such as the socioeconomic status, records of past interactions between jobs, and skills provide information for the algorithm to learn. In this regard, the outcome data from previous programs and subsidies similar to the information of the client add up. Then, such AI engine-made relations and recommendations generate more effective actions and subsidies based on the candidate's profile<sup>14</sup>, while at the same time AI's tracking adds additional cases to the algorithm.
- **Identifying potential vacancies offering comparative advantages for pwd.** The use of AI generates opportunities in vacancies suitable for pwd depending on their characteristics. This option accepts additional information, such as the distance between the job seeker and the working site; transport availability; possibilities to work from home; viable occupations depending on their situations; and, companies counting on the adequate infrastructure or with programs for this segment. Some AI platforms also allow the configuration of algorithms aimed at recommending specific matching for pwd.
- **Identifying clients who are about to finish their imprisonment period and need to be inserted into the labor market.** By using AI together with this segment's records of skills, the appropriate actions and job opportunities available can be identified. AI can be fed back from the results of previous insertions to become aware of the most successful profiles inserted in the labor market and learn about services in labor training and insertion management to finally obtain the best results.

It should be noted that for AI tools working at their best, they must interoperate with external systems to access and manage the necessary data<sup>15</sup>. Ideally, interoperable systems should facilitate the finding of such data.

## AI benefits for PES

AI also assists PES in making more efficient their processes so they can offer their variety of services. The potential benefits of AI are detailed below based on its five key functions summarized in Box 1.

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<sup>14</sup> Although it seems likely to assign benefits by means of AI, there are important ethical implications when doing it, as it will be clear later. Preferably, AI should furnish information to trained personnel in order they are the ones making decisions taking into consideration other factors as well. Similarly, AI presents the imperative need of evaluating periodically the data it uses, the process of its usage along with all other factors involved in the feeding of information with the purpose of assuring no bias could affect beneficiaries or users adversely, or else, there is reputation-related risks for the institutions.

<sup>15</sup> For cases other systems' data is utilized, the required authorization consent must be obtained and follow any effective regulation for personal data protection –or, should not any regulation exist, apply international good practices.

## Matching labor supply and demand

AI is capable of identifying profiles with a good level of information as required by employers (i.e., social-emotional skills, capabilities, experience, certifications, etc.), contributing to **greater equity**. Likewise, to the extent that AI helps to evaluate the job seeker's profile, it assists in the detection of training needs, subsidies and support services so that the job seeker is better prepared and his incorporation into the job is sustainable over time.

Also, the fact that AI makes **matching in several dimensions** possible (the geographical proximity, working hours, type of contract, and enterprise's level of preparation to receive the candidate in case any obstacle exists), facilitates job seekers to choose a vacancy from a variety of options, i.e., one with a shorter distance between work and home resulting in the reduction of their ecological footprint while improving their life standard.

AI also promotes **greater inclusion** of vulnerable groups in labor, since by adjusting its algorithms in certain dimensions, the characteristics of vacancies can be coupled with the barriers of the candidates. This leads to, for example, being offered more options in companies that accept teleworking or where transportation<sup>16</sup> is available.

Ultimately, the value of AI in terms of achieving **greater efficiency** is manifested in the lower use of face-to-face applications, which in turn encourages greater and better registration of digital applications. In addition, it facilitates the follow-up of labor market insertion and the monitoring of results to enhance the service.

## Availability of labor market information

AI is a useful tool for collecting and providing information on labor market conditions. This is done by improving the information on job seekers' **potential geographical migrations**, for instance, record their skills in relation to remote vacancies that would improve their working conditions.

The same goes for the capability of AI to carry out predictive analysis of **unwanted events based on data**. Consider for example, the possibility of mass or temporary layoffs in specific industries, or situations revealing the difficulties of a certain segment into the labor market; hence, requiring specific intervention for workers at risk of being laid off, or changes in the skills required as new technologies<sup>17</sup> are incorporated.

Lastly, AI allows to **manage and monitor information of interventions** better since AI's predictive models enhance referrals and the use of active labor market programs.

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<sup>16</sup> Using AI adequately opens the possibility of holding labor interviews with traditionally excluded groups – due to gender, ethnic or other reasons associated with discrimination bias. Nevertheless, given the final decision of contracting will be the employer's, it is pretty significant to avoid any hiring bias deriving from those decisions permeates AI and generates biases in its subsequent matching proposals.

<sup>17</sup> See Amaral et al. (2018) for an example of how to utilize massive data to comprehend labor market changes.

## Management of active labor market policies

AI has contributed to this area by enhancing the option to provide recommendations on job seekers' **training needs**. This can be achieved as long as the job training institutions adjust their contents based on the information provided by AI regarding the mismatch taking place between the aptitudes offered and those demanded by the market.

## Management of unemployment benefits

In this area, AI facilitates the monitoring of **programs and services outcomes**, for instance, giving the confirmation whether the job training has helped candidates to obtain a job. It also allows verifying the allocation of benefits such as the training or the employability subsidies, based on multidimensional information accounting for the obstacles each person may have to face.

AI also offers the possibility to identify **the best practices of active employment programs** aimed at strengthening employability through the identification of actions that generate the best results for both segments: job seekers and companies. Consequently, actions with better returns are enhanced and actions with ineffective results are eliminated.

Finally, AI, through the information it accesses through different databases, provides a **better processing of subsidies' applications or unemployment benefits**.

## Management of labor migration

In the area of labor migration, AI enables the identification of better employability route options for migrants based on their profiling, matching with vacancies, detection of skills gaps, market information, and active support programs.

## The future of AI in PES

The Fourth Industrial Revolution – where AI belongs along with other advances such as data intelligence, the Internet of things and robots, added to the phenomena as globalization and hyper connectivity – is going to change the way PES operate and offer their services. Among the trends that could be imposed in the future are the following<sup>18</sup> :

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<sup>18</sup> See Pombo et al, (2019) for future AI trends at PES and countries.

- **Organization in the use of AI with equivalent institutions and other sectors at regional and municipal<sup>19</sup> levels.** This organization could increase data flows and generate better results for labor intermediation at PES. This interinstitutional organization trend can already be noticed in several Latin American countries, under the concept of interoperability or information exchange systems (IES)<sup>20</sup>. Although a few AI applications are registered in such systems, in the future they will add value to IES.
- **AI strategy, regulations and legislation in governments.** In the near future, the ethical use of data must be prominently included in each country's digital strategy. This will demand the definition of standards, restrictions, and self-regulation along with governance mechanisms for proper usage.
- **Services improvement and customization.** As more and better data become available, algorithms will be better fed and become upgraded, allowing job seekers' recommendations to be more accurate, and their level of employability will be increased. Cloud services availability<sup>21</sup> to which job seekers and employers can have access online in real time and in a self-management mode, will open the possibility to create virtual assistants that, in turn, will improve the provision of recommendations to optimize matching, missing aptitudes analysis, profiling and the employability route. Such services will also free up PES staff time. Thus, members will be able to devote more attention to conduct customized follow-ups to their cases.
- **Forecasting unemployment in regions, sectors and industries.** The widespread use of AI in labor intermediation systems (LIS) will enhance the effectiveness of support plans aimed at mitigating unemployment and youth unemployment rates as well as predicting situations in sectors or industries with employability difficulties or that require PES services in areas of training, subsidies or others.
- **Adoption of AI as the available service in the cloud for labor intermediation.** The use of AI will continue to expand and, in the near future, it is expected to be available on platforms with cloud services. In that regard, access will be possible from multiple public and private applications for the purposes of matching labor supply and demand, detecting missing skills, predicting job performance, and providing customized training depending on job seekers' needs, and citizens in general, among other services.

## 4. Critical factors PES must consider when adopting AI

In order for AI-based systems to generate valuable recommendations and avoid wrong ones, it is necessary to consider some successful critical factors --mostly related to the data fed to AI engines or systems.

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<sup>19</sup> See Ogwalgroup (2019) for a shared vision of the developed mapping.

<sup>20</sup> See Pombo et al, (2019) for the ABC of the State's services interoperability.

<sup>21</sup> See IDB (2020) for further information about best practices for hiring cloud services.



## Critical factors for succeeding with the AI adoption

For AI's incorporation to improve PES activities, certain factors are required to ensure its success. These include the quality and quantity of the obtained data, the protection of their property and privacy, and the guarantee of its legitimate and non-discriminatory use.

### Data collection and usage

The following must be considered for the correct implementation of AI:

- Availability of quality, standardized, complete, relevant data, without duplication and with all the required attributes.
- Obtaining data through technologies such as intelligent forms or machine learning, which capture sufficient information so that AI engines are equipped with the learning levels that can generate more accurate results and recommendations.
- Accumulation of sufficient labor market data, so that algorithms can be more accurate based on the detailed industry information; geolocation; ideal profiles for human talent development; training offers including skills; occupational standards; skill certifications; salaries offered in the market; qualification system; and, active labor market programs, inter alia.
- Provide feedback on PES actions results (data on percentages of jobs covered; job duration; applicant's development in the vacancy covered; rotation level, etc.) to generate learning and continuously upgrade algorithms.

### Basic principles for data usage

When AI is implemented, PES should put into practice certain basic principles on the use of data feeding into information systems. Such principles (Graph 4) ensure respect for the privacy and ownership of individuals' data and avoid discrimination that may result from its leakage or misuse, generating the opposite to the expected effect.

### Achieving the necessary interoperability

PES can provide a complete range of services to job seekers and enterprises as well as to other key actors such as training centers and other public institutions. However, the former requires their integration or interoperation.

Interoperability allows a greater flow of information to AI engines. In the case of PES, different institutions generate useful information, i.e., social security; ministries of labor, education and health; private employment agencies; and, social programs, inter alia. Besides facilitating access to information and to the above institutions' management records, interoperability has the function to connect data with those records generated from the interactions taking place in the field of employment and applicants, job training centers, and employment enterprises. All this information can be made available to institutions via interoperable systems.

A practical example of interoperability would be when an applicant succeeds in importing his or her information from educational or job training records into the job search platform he or she is using with the aim that his or her acquired skills are considered in the matching process. The same experience is expected when he or she wants to retrieve information about his or her working experience from the social security administrative records. All the foregoing helps to reduce the time needed to enter the information into the system.

## **Risks derived from AI usage**

Although AI is a useful tool for PES, it also carries significant risks due to its technological nature. Nonetheless, its adequate management and mitigation strategies will allow the expected value to be achieved without causing any damages to the interested parties.

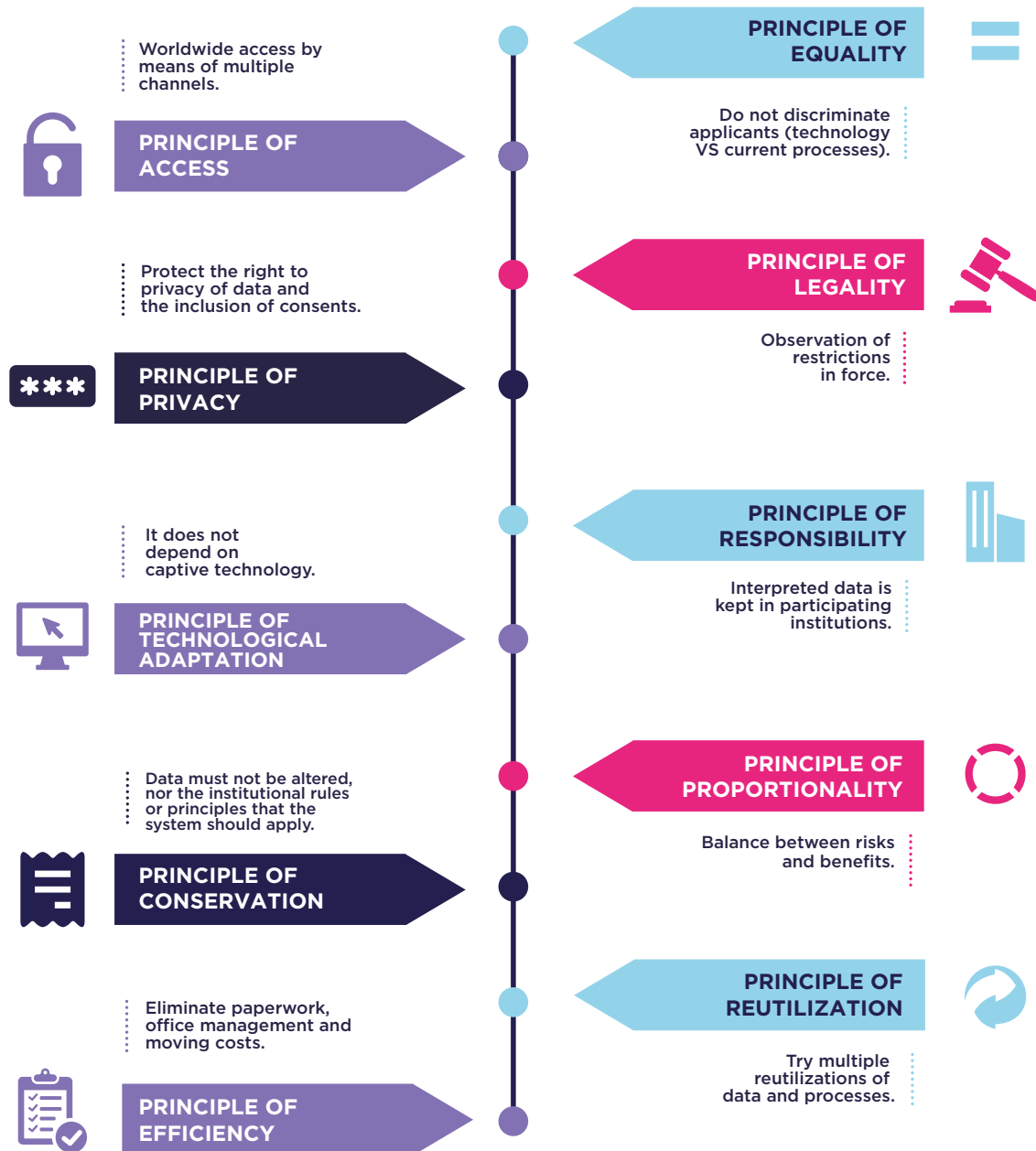
In different countries, these services face specific challenges, including insufficient budgets, lack of continuity, lack of personnel, along with a low level of public outreach and market participation. Among the main identified risks are those related to digital transformation and aptitudes formation; discrimination and exclusion; possible biases in the algorithms; data leakage or information misuse that may affect individuals and enterprises; implicit elements in the technological strategy chosen; and, elements derived from insufficient and imperfect data.

### **Challenges posed by digital transformation and aptitudes formations**

As mentioned earlier, one factor influencing the adoption of digital technologies is the level of digital adoption users have; particularly those supporting PES. Not all job seekers or employers are digital or have the skills to access digital services. Moreover, not all labor advisors or other PES staff are prepared to work with technologies that imply the modification of their working habits, processes, and culture. Consequently, the foregoing entails a problem of lack of capacity in the region, both in users and PES staff providing these services.

Mitigation of these risks involves the development of measurable indicators for labor advisors, which should include motivators inducing them to train and adopt digital technologies for their daily work. Additionally, in order to diminish the risk of non-digital job seekers or employers, the existence of traditional mechanisms of face-to-face or telephone service must be foreseen to allow them to take advantage of said technologies. At employment centers, users should be assisted by advisors or facilitators trained in the use of technologies.

**Graph 4. Basic principles for data usage**



## **The challenges of discrimination and exclusion**

These risks originate mainly from the following factors:

- Lack of coverage or access to the Internet or digital systems in certain locations.
- Lack of adequate guidance due to insufficient training of PES advisors in AI usage.
- Lack of access to pwd due to the use of non-inclusive websites.
- Using the inappropriate tools to counteract the fear employers may have of hiring job seekers with disabilities or with other type of impediments (formerly in prison, or victims of trafficking and smuggling, for example). The use of technological tools without the support of other incentives and accompaniment by specialized personnel can eventually hinder job access of groups requiring special support and attention.
- Incorrect analysis of gaps or misidentification of opportunities for the applicant may prevent providing them with an effective labor intermediation service.
- Lack of support measures for employers that can be applied to answer the needs of job seekers with disabilities.
- Lack of adequate training of PES personnel to manage job seekers in a vulnerable situation. Well trained staff can prevent any discrimination by gender or because they belong to ethical minority groups.

PES personnel performance evaluation can be conducted through random checks on the results of their management with the intention of mitigating such risks.

## **Challenges produced by biases and data management**

Mainly, these risks originate from the following factors:

- Data serving for algorithm training to be used by PES could present intrinsic biases from patterns of past discrimination.
- Incomplete data or scarce volume of information prevent from counting on a sufficient and quality base, which in turn, hinders machine learning.
- The absence of the sample representativeness with respect to certain sectors, gender, race, skills, academic training, etc.

- Lack of protocols for data use - such data are for public or private use, owner's authorization is required explicitly.
- Theft of confidential data due to the lack of controls over databases.

To mitigate these risks, the algorithm can be audited and adjusted to avoid discrimination or unwanted preferences.

### **Challenges in the model development and use**

Mainly, these risks originate from the following factors:

- Leakage of users' personal information and the lack of data clearing can generate errors in the model outcomes and produce inappropriate matching.
- The algorithm design could be biased if it has not been calibrated correctly.
- The concentrated use of the AI tool by a sole sector or population segment (for example, intensive use by men versus use by women). Insufficiency of ongoing monitoring of the system's performance (to determine, for example, if the vacancy's intermediation was successful, work time, job permanence, and salary grid to validate growth and development, inter alia). These situations can lead to the degradation of results or generate biases in the recommendations.
- Unavailability of correct parameterization of AI engines, which do not adapt to the languages and names of occupations, aptitudes, and skills used locally.

In order to mitigate these risks, it is recommended to count on the proper administration of use consents, along with the application of data clearing and integrity processes; and, the management of information privacy and ethical standards..

### **Challenges posed by the adopted technological strategy**

Technologies can be implemented through different strategies: custom designed systems; the acquisition of already existing platforms available as services; or to be installed at the customer's premises. Conditioned to the chosen strategy, there are associated risks:

- If the decision is a custom design strategy provided by an information system development company, several risks are involved, including the implementation time and system coverage that in turn depend on future users' expectations, both in terms of functional requirements (processes, forms and use cases), and non-functional ones (security, servers' infrastructure, access networks, etc.). Another aspect to consider is the change of functional actors since the new ones could modify the requirements halfway the development of the solution --which could produce cost overruns and damage its scalability.

- As for existing platforms, acquired or contracted as services, (SaaS and PaaS: security as a service and Platform as a service)<sup>22</sup>, their risks derive from their lack of quality or inadequate control, which can cause the loss of data or the crash of systems and services. In addition, there is the risk of provider dependence and that the knowledge remains concentrated in them. Consequently, the technical and functional PES responsible people are not handed out the pertinent documentation transfer or given the adequate training; or else, the trained staff rotates or leaves, without transferring knowledge to the new one.

Among the mitigation measures proposed, is the correct use of proven methodologies for the life cycle of information systems, whose most important strategic pillar is the systems' architecture<sup>23</sup>.

## 5. Conclusion

New technologies, in particular AI, offer an excellent opportunity for PES in LAC to increase their efficiency and effectiveness, regardless that their proper use entails challenges that must be mitigated or eliminated.

This technical paper has discussed the main potentialities and challenges of AI adoption at PES. These potentialities will allow the region's PES to better understand the benefits of adopting AI-based systems while capitalizing the lessons learned from the Paraguayan case, and they determine a transformation strategy towards the adoption of digital processes and services. Nevertheless, there are related risks involved like the discrimination of users, who may not be prepared to adopt digital processes or to count on the correct configuration of AI algorithms. For the neutralization of such risks, the efforts must be directed to the selection of systems or providers that have proven to have the standards of AI-based matching systems along with the readiness to prepare PES staff to adequately manage such new technologies.

Considering the future, the changing labor scenario will keep generating more new occupations, whose aptitudes, skills, and capabilities will be the key to matching jobs with vacancies. AI will not only be a fundamental support tool to matching job seekers' skills (or those they can develop over time), with job offers that can consume them, regardless of the occupation itself, but also AI usage will generate more and better opportunities for the parties involved, achieving sustainable jobs over time. PES together with key actors will require technologies and digital transformation for their processes at the same time actors adapt to them and become efficient in confronting such emerging challenges.

Apropos of AI adoption expansion in LAC employment services, it is expected that systems using AI will increase and will have a broader coverage scope. AI will not only be used for matching labor supply and demand, but for the use of virtual advisors, job seekers profiling, matching available labor training to specific needs and others. AI application will be the means to achieve more efficiency and better recommendations.

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<sup>22</sup> See the definition at: <https://www.ibm.com/es-es/cloud/learn/iaas-paas-saas>.

<sup>23</sup> See IDB (2020) for using systems' architectures in employment services. New technologies to overcome old challenges. Entrepreneurial architecture for Public Employment Services PES.

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