

Smart Model To Reduce Employment Barriers For Women With Visual Impairments

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Abstract—This research examines the labor market marginalization of women with visual impairments (VI), who experience a 57% inactivity rate compared to 40% among men. Disparity is exacerbated by structural disability biases, employer indifference, discrimination, inadequate accessibility, and limitations in personal mobility and transportation. Standard recruitment and evaluation processes frequently overlook candidates with visual impairments, while physical workspaces are often poorly designed. The central research question addresses how to effectively connect women with VI to employment despite these pervasive barriers. A literature review identifies the historical legacy of the religious model of disability and persistent employer indifference as key contributing challenges. In response, this study proposes a four-stage methodological framework: first, to identify multidimensional factors by age cohort; second, to perform data analysis; third, to conduct clustering; and fourth, to design a smart process model. The results yield 60 belief dimensions, 3 multifactor associations, and 3 distinct clusters. Smart model consists of three integrated processes: 1) creating a labor profile for a woman with VI, paired with personalized job recommendations; 2) proposing reasonable adjustments to both job requirements and the company's physical workspace; and 3) facilitating the application process. The model's effectiveness is tested in two ways, first, a comparative analysis with current free AI tools (Copilot and Gemini) demonstrates its superior utility and benefits. Second, testing personal characteristics of women with VI provides a realistic assessment for profile generation. The study underscores the importance of fostering cultural awareness within companies, providing a foundation for future initiatives.

Keywords— Job, barriers, multidimensional factor, smart model, visual impairment

I. INTRODUCTION

The eyes require direct exposure to the external environment to receive light stimuli, which also increases their vulnerability to pathogens. Certain viruses can enter the body through the eyes, potentially leading to ocular diseases and impaired visual function. According to the World Health Organization, at least 220 million people worldwide had a visual impairment by 2019 [1].

Visual impairment (VI) has multiple etiologies. While a common cause is congenital (present from birth), it can also be acquired later in life through accidents or illnesses that may affect anyone at any time.

Socially, disability is often perceived as incapacity, a deeply conditioning view that results in individuals becoming subjects of either admiration or pity—both profoundly discriminatory attitudes. A vision-related disability can restrict opportunities for professional development [2].

The most frequently cited barriers to employment include: negative employer attitudes; inadequate workplace accommodations; restricted mobility; and the presence of an additional disability or health condition. Women reported that these experienced barriers adversely affected their self-confidence [3].

Contemporary studies identify further obstacles, such as not receiving interviews after application, employer discrimination, transportation issues, lack of qualifications for available positions, absence of job openings, and inadequate job search knowledge, among others [4]. Furthermore, persistent cultural challenges include stigma and indifference, often stemming from uncertainty about the capabilities of blind women [5].

New barriers may be emerging in the wake of the COVID-19 pandemic, as professional activities become increasingly dependent on visual technologies. This shift has led to intensified workloads, employer demands for faster response times, a pervasive reliance on virtual training platforms, the inability to interpret body language in online meetings, and an heightened emphasis on personal appearance in virtual settings.

"Blind women face enormous barriers to accessing employment. They have very limited job opportunities, mostly confined to the educational sector, while they are often deemed unsuitable for office jobs" [6]. Employers often perceive them as more likely to be absent or less productive, contributing to a tendency for people with disabilities to receive lower wages [7]. Beyond gender discrimination, additional barriers include financial exploitation and sexual harassment in professional settings.

According to [8] references the Religious Model of disability, which frames disability as a punishment. This model posits a religious origin, viewing disability as a divine punishment for parental sins or a warning of imminent catastrophe. It also asserts that persons with disabilities contribute nothing to society, portraying them as unproductive individuals and a burden on their families or community.

Persons with disabilities are largely excluded from the labor market, with 57% of women being inactive, compared to 40% of men. However, rather than reflecting a choice of self-exclusion, these inactivity rates suggest the existence of systemic barriers to job seeking and hiring that prevent many fully competent individuals from joining the workforce [7]. This context helps explain, on one hand, why employers hold negative attitudes and, on the other, why persons with disabilities may lack confidence in their job performance or be reluctant to pursue further education and training. Other significant barriers include transportation challenges, a lack of job-search knowledge, and insufficient resources to pursue opportunities.

Further obstacles include: a mismatch between skills and job demands; inadequately adapted work environments and processes that create barriers for workers with disabilities; and persistent discrimination. Women with disabilities appear to earn less on average than their male counterparts, and the type of disability can influence an individual's position on the wage scale [9].

"Precarious working conditions lead to a shortage of personal assistants (Purhonen, 2023; UNI Global Union, 2023; Westberg, 2010; Woolham et al., 2019). In some cases, this is because the role is considered low-skilled, as it may not require formal or regulated training (Bañez & Comas-D'Argemir, 2021; Riobóo-Lois et al., 2023, 2024; SIIS, 2017)" [10].

According to Peru's National Institute of Statistics and Informatics [11], 10.3% of the population has a disability, with a higher prevalence among women (11.5%) than men (9.0%). Visual impairment is the most frequent type, at 48.3%. Notably, 90.11% of this population is of Working Age (PET), with women comprising 57.7% and men 42.3% of this employable group.

Other barriers to employment reported by those with VI include inaccessible job application processes, concerns regarding disclosure of impairment to employers, difficulties commuting to work, and technological challenges in the workplace [12].

According to [13] categorizes barriers as follows: There are eight key barriers, including two structural ones—stigma and discrimination, and harmful norms and stereotypes. The other six are: additional transportation costs, non-inclusive environments, lack of labor insertion strategies, lack of access to education or healthcare, limiting family dynamics, and lack of personal autonomy.

The motivation for this study is to assist women with visual disabilities who lack resources in securing employment.

The research question is: How can we provide women with visual disabilities with better

employment opportunities, particularly by leveraging recent technological advancements?

II. STATE OF THE ART

"It is necessary to plan, implement, and manage gender-responsive infrastructure that can act as an enabler for sustainable development without compromising gender equality. This requires the identification of existing differences and inequalities in the local context and addressing the different needs, responsibilities, and expectations of women, men, girls, and boys" [14].

Nowadays it is an exponential growing of using generative AI (GenAI) tools, for any people. "For blind people, using mainstream GenAI tools in everyday practices involves leveraging their strengths for content creation and information retrieval while navigating various accessibility issues, inaccuracies, and idiosyncrasies" [15].

"Effort Expectancy indirectly influences academic achievement through Behavioral Intention mediation. Likewise, the findings emphasize the value of peer mentorship and the need to improve the usability of AI-powered assistive technologies (AIATs) for these learners" [16].

Recent advancements in artificial intelligence (AI) have enabled the development of sophisticated assistive technologies tailored to the needs of visually impaired individuals. Key developments include:

Computer Vision Systems that empower users by converting visual data into accessible formats.

Natural Language Processing (NLP) technologies that are foundational in enabling communication, interaction, and access to digital content.

Wearable Assistive Devices that combine AI with portability to provide real-time environmental support [17].

The next Table 1 shows a resume of tech concepts.

TABLE 1. TECH FOR HELP PEOPLE WITH VI

Tech Concept	How it Helps
Gender-Responsive Design	Identifies local inequalities and addresses the differing needs, responsibilities, and expectations of all genders.
GenAI Tools	Aids in content creation and information retrieval.
Assistive Technologies	Converts visual and other data into accessible formats.

According to [18] proposed using NLP via the Natural Language Toolkit (NLTK) to enhance a job portal by scanning seeker information for relevant keywords, thereby identifying the best-matched applicants. To address the "cold start" and scalability problem between job descriptions and candidate profiles, an enhanced Deep Semantic Structure Modelling (DSSM) system has been developed, which provides satisfactory results across datasets [19].

Such NLP techniques can assist visually impaired people in finding suitable jobs that match their qualifications, skills, and personal needs [20].

Other approaches include a recommender system based on Latent Dirichlet Allocation (LDA) and k-nearest neighbors to find job positions most similar to a user's profile, allowing for an incremental search where users can add new requirements at each stage [21]. Another system identifies suitable jobs from a set of user skills using co-occurrence statistics (Revealed Comparative Advantage) and distributional semantics via word embeddings [22].

While progress in candidate-job matching is significant, applicants often still fail to meet all listed requirements. Employers, including in the public sector, increasingly use hiring technologies for tasks such as: targeting job advertisements; screening applicant qualifications; conducting video interviews; administering skills tests; and scoring resumes [23].

Voice-activated chatbots using speech recognition and synthesis can be particularly useful for visually impaired persons, providing information, assistance, and emotional support. Future applications could expand into educational aid, navigational assistance, and enhanced social interaction [24]. AI devices now help visually impaired individuals read text, navigate streets, and even create art. However, reading assistance research is often language-specific and restricted to certain text carriers (e.g., paper or screens). Mobility wearables typically take the form of smart canes or glasses [1].

AI presents a dual-edged sword for employment. It creates new prospects by automating tasks and enabling people with disabilities to perform previously inaccessible work (e.g., via assistive reading tools or voice-controlled environments). Conversely, its expanded implementation risks job displacement, particularly in sectors like manufacturing already affected by automation [25].

Chatbots have become prevalent tools for communication and information retrieval. However, their use has also exposed significant algorithmic biases. Such biases can disadvantage qualified candidates in hiring processes, particularly women with disabilities. While ChatGPT may generate coherent responses, domain experts can identify critical shortcomings, which are exacerbated in complex scenarios.

Furthermore, the algorithms employers use to screen applicants are highly susceptible to systematic biases against women in male-dominated fields, even when those women are the best qualified [26]. While technology evolves—offering new tools beyond traditional canes and tactile exploration to guide people with visual impairments [27].—significant workplace challenges persist.

Notable ongoing issues include high rates of occupational segregation, low employment levels, and a persistent lack of reasonable workplace accommodations. Despite regulatory efforts, a more comprehensive approach is needed to drive structural and cultural change, warranting future research on policy impacts across different labor contexts [28].

In summary, while AI proposes technological solutions to equip persons with disabilities for the workplace, the fundamental problem of securing employment remains. AI tools themselves can harbor biases, and many job platforms still function primarily as information boards, lacking intelligent mechanisms to effectively connect women with disabilities to potential employers.

The next Table 2, shows some advantages and disadvantages of Generative AI and rules for application.

TABLE 2. TECH FOR HELP PEOPLE WITH VI

Technology	Advantages	Disadvantages
GenAI	Generates coherent, contextually appropriate responses; assists in screening applicants.	Can produce inaccurate/irrelevant responses; lacks full situational understanding; can encode systematic biases against qualified women.
Policy & Regulation	Establishes a framework for inclusion and accommodation.	Has not resolved labor segregation, low employment rates, or the lack of reasonable accommodations.

III. METHOD

The primary objective is to develop a smart model designed to replace existing barriers with a new process. This process will connect women with visual impairments (WVI) to prospective employers and guide them through an assessment protocol, culminating in a confirmed employment contract.

To do that a four-stage process is created. The first stage involves creating a multidimensional context by collecting data on personal and socioeconomic profiles. The second stage consists of data analysis, the third focuses on identifying hidden patterns by clustering techniques, and the final stage is for design processes for smart model and get a preliminary validation about functionality.

The data obtained in the first phase of the multidimensional factors for WVI are presented in Table 3, separated by beliefs and multidimensional factors.

Table 3. Multidimensional Factors for Women with Visual Impairments

	Belief and Multidimensional Factor	Belief Dimensions	Survey Item No.
1	Lifestyle/Perception of Equal Opportunities	10	1-10
2	Support Mechanisms/Employer	9	11-19
3	Urban Barriers/Physical Accessibility	2	20-21
4	Income	3	22-24
5	External Support	3	25-27
6	Association Membership/Contact with Others	2	28-29
7	Level of Protection/Discrimination	7	30-36
8	Technical Education/Higher Education	3	37-39
9	Family Work Environment/Attitude Towards Work	4	40-43
10	Emotional Well-being	7	44-50
11	Personal Motivation	3	51-53
12	Accessibility Technology	2	54-55
13	Knowledge Updating	2	56-57
14	Disposition for Independent Learning	3	58-60
TOTAL		14	60

Table 4 presents the constructed association for analyzing the "Age" variable. This includes several known multidimensional factors, such as age-based discrimination against older individuals or transportation-related difficulties. It also encompasses factors that are typically less recognized, including the employer's negative perception, a lack of awareness or refusal to comply with relevant laws, and biases related to educational attainment levels. On the other hand, supportive factors are also identified. These consist of affiliation with advocacy associations, self-awareness of one's abilities, a willingness to leverage new opportunities, and commitment to improve educational levels.

TABLE 4. ASSOCIATIONS FOR THE NOMINAL VARIABLE: AGE

Nro	Belief Dimensions	Associations for the Age Variable
1	13	The employer should ask applicants if they have any disability.
2	17	I have had good experiences in my previous job.
3	21	I prefer to have a job close to my home (maximum half-hour commute).
4	26	The State enforces the General Law for Persons with Disabilities – Law 29973.
5	27	Belonging to an association, union, or group is important.
6	31	When I apply for a job, interviewers treat me the same way they treat persons without disabilities.
7	32	I live in a society that marginalizes [people like me].
8	39	Knowing my skills has allowed me to find work.
9	40	I am willing to take advantage of any opportunity I am given to be able to work.
10	42	Career guidance is useful.
11	45	I am optimistic about my future.
12	47	I have learned to accept myself with my flaws and virtues.
13	54	I prefer to spend money on other necessities before spending it on using a computer
14	55	I am interested in participating in a knowledge-upgrading program before applying for a job.
15	59	I wish to participate in a research program to help women with disabilities improve their working conditions.

An additional multidimensional factor is "Place of Residence". Table 5 presents some multidimensional factors for the impact of transportation distance, analyzed not as an isolated variable but in combination with factors like community belonging and shared activities.

TABLE 5. ASSOCIATIONS FOR THE NOMINAL VARIABLE: PLACE OF RESIDENCE

Nro	Belief Dimensions	Associations for the place of residence variable
1	48.	I consider myself a valuable person.
2	28.	I like sharing common tasks with other people.
3	56.	It is important to stay up-to-date with new knowledge.

4	27.	Belonging to an association, union, or group is important.
5	47.	I have learned to accept myself with my flaws and virtues.
6	56.	It is important to stay up-to-date with new knowledge.
7	46.	I get carried away by anger when things don't go as I wanted.
8	47.	I have learned to accept myself with my flaws and virtues.
9	41.	My family encourages me to keep working.
10	39.	Knowing my skills has allowed me to find work.
11	28.	I like sharing common tasks with other people.
12	7.	I consider myself a shy person.
13	42.	Career guidance is useful.
14	38.	A professional degree from a Higher Technical Institute is not very useful.

Some individuals, particularly women, may exhibit greater sensitivity to affective stimuli and a heightened attention to detail, which can serve as foundational elements in the development of optimistic or pessimistic outlooks. These associations are presented in Table 6 around currently employed variable.

TABLE 6 ASSOCIATIONS FOR THE NOMINAL VARIABLE: CURRENTLY EMPLOYED

Nro.	Belief Dimensions	Associations for the current employed Variable
1	52.	I feel good when I manage to accomplish things.
2	38.	A professional degree from a Higher Technical Institute is not very useful.
3	12.	I am familiar with what reasonable accommodations entail.
4	44.	My coworkers at work treat me the same as others without disabilities.
5	3.	A man with a disability has a better chance of getting a job than a woman with a disability.
6	37.	I feel prepared to begin university studies to achieve a better standard of living.
7	50.	My mood declines when I face difficulties.
8	42.	Career guidance is useful.

In second stage, techniques for data processing and analysis were used: the Chi-square test of independence (χ^2) with its degrees of freedom (df) and p-value; Cramér's V as the measure of effect size for the association; the Kruskal-Wallis test (H_{kw} , p_{kw}) and epsilon-squared (ϵ^2_{kw}) as a non-parametric effect size measure, along with an assumption validation (some cells with >20% of expected frequencies <5).

Data preprocessing is required after generating the target data to make it ready for use. In the next step, the prepared data is used for analysis and generating insights by applying data mining techniques. Preprocessing techniques include five activities: Data Cleaning, Data Optimization, Data Transformation, Data Integration, and Data Conversion [29].

Chi-square (χ^2 , p): Compares frequency distributions between categories. A p-value < 0.05 suggests a significant association. Cramer's V: Measures the strength of association between two categorical variables. Values around 0.1 $\approx$ small, 0.3 $\approx$ medium, 0.5 $\approx$ large. Kruskal–Wallis (H, p, ε^2): A non-parametric test comparing response medians between groups. ε^2 indicates the effect size: 0.01 small, 0.06 medium, 0.14 large.

The following imputation method was implemented:

a) Variables with less than 5% missing data: Numerical variables were imputed using the median, and categorical variables using the mode, to reduce missing data in variables with few omissions.

b) Variables with 5% to 10% missing data: These were imputed using the k-Nearest Neighbors algorithm (kNN, k=5) to estimate values based on similarity with other records.

c) Nominal variables: An initial imputation was performed using kNN, followed by imputation with the mode. Categories were standardized by correcting variants. The variable was cleaned, and finally, variables on a Likert scale were imputed.

Third stage utilizes the clustering concept via the K-Means technique to identify patterns in the multidimensional factor variables, as described by [30]:

"It groups instances based on their similarities. It involves the iterative assignment of each instance to a cluster, based on its distance to the centroid (mean of each cluster) and the subsequent calculation of the updated centroid, until the centroids stop changing. The algorithm seeks to minimize the sum of squared distances between the data instances and their assigned cluster centroids, known as the within-cluster sum of squares (WCSS). Given a set of instances, $X = \{x_1, x_2, \dots, x_n\}$, k-means clustering seeks to assign the n instances to k clusters ($k \leq n$) $S = \{S_1, S_2, \dots, S_k\}$ to minimize the following function (within-cluster sum of squares)."

[Formula would be inserted here as in the original: $\sum_{i=1}^n \sum_{j=1}^k ||x_i - \mu_j||^2$ where μ_j is the mean of cluster S_j and $||x_i - \mu_j||$ is the chosen distance metric between the data point x_i and the corresponding mean).

[31] presents the concepts for assigning each observation to a cluster. K-Means uses the Euclidean distance between the observation's response vector and the centroid of each candidate cluster. Since Euclidean distance is sensitive to variable scale, Likert-type variables were normalized before applying K-Means in this study to prevent any item with greater numerical variability from dominating the distance.

There are 74 variables from the survey administered to WVI. From this data, those measured on a Likert scale (1–5) were selected, as they are suitable for analyzing attitudinal and perceptual profiles. Next, the process of imputing floating data was performed; missing values in responses were imputed using the median for each item to maintain coherence with the ordinal scale and avoid distorting averages. Finally, variables were normalized, and the number of clusters was set to $K = 3$, based on interpretability criteria and prior analysis of WCSS behavior.

Fourth stage, the smart model processes is designed. One process identifies the presence of a WVI and helps assess her job aptitude profile based on multidimensional factors. It then connects with companies to facilitate outreach and application for a job position, second one is to propose reasonable adjustment and third one for close application.

IV. RESULTS

A conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

TABLE 7 STATISTICAL ASSOCIATIONS FOR THE AGE VARIABLE

N°	n_to tal	chi2	d f	p_c hi2	cram ers _v	supue stos _chi 2	H_k w	p_k w	epsil on 2_ kw
54	22	20.8 873 4	1 6	0.1 82 9	0.240 6	>20%< 5	11.7 417 5	0.01 938	0.3687
45	22	29.0 714 3	1 6	0.0 23 5	0.415 7	>20%< 5	10.3 732 1	0.03 459	0.3035
55	22	18.4 511 9	1 6	0.2 98 1	0.154 0	>20%< 5	10.0 082 9	0.04 029	0.2861
26	22	19.0 972 2	1 6	0.2 63 7	0.181 1	>20%< 5	9.95 197 6	0.04 124	0.2834
31	22	24.1 297 2	1 6	0.0 86 7	0.321 6	>20%< 5	9.07 585	0.05 923	0.2417
32	22	19.7 847 2	1 6	0.2 30 1	0.206 0	>20%< 5	6.99 14	0.13 634	0.1424
39	22	16.9 430 6	1 6	0.3 89 3	0.050 4	>20%< 5	6.53 454 3	0.16 263	0.1207
47	22	21.5 634 9	1 6	0.1 57 9	0.259 6	>20%< 5	6.38 416	0.17 224	0.1135

Statistically significant associations were found for: optimism about the future ($\chi^2=29.07$; $p=0.0235$; Cramér's $V=0.4157$; moderate-high effect), equal treatment in job interviews ($\chi^2=24.13$; $p=0.0867$, a trend; Cramér's $V=0.3216$), and desire to participate in labor research ($\chi^2=24.60$; $p=0.0771$; Cramér's $V=0.3318$). In the non-parametric test, several items showed significance at $p<0.05$, most notably the preference to spend money on other necessities before spending it on a computer ($H=11.74$; $p=0.019$; $\varepsilon^2=0.369$, high effect).

Consequently, age influences attitudes toward technology, employment expectations, and perceptions of inclusion. The effect sizes range from moderate to high, being particularly

notable in perceptions of social acceptance, optimism, and confidence in the future.

TABLE 8 STATISTICAL ASSOCIATIONS FOR THE PLACE OF RESIDENCE VARIABLE

N	n_total	chi2	df	p_chi2	cramer's_v	supuestos_chi2	H_kw	p_kw	epsilon_on_2_kw
46	22	34.07381	24	0.0834	0.3541	>20%<5	10.7056	0.09791	0.2241
47	22	18.53704	24	0.7762	0.000	>20%<5	10.33569	0.11121	0.2065
41	22	27.80556	24	0.2683	0.1933	>20%<5	9.644022	0.14047	0.1735
39	22	36.28472	24	0.0515	0.3955	>20%<5	9.527541	0.14601	0.1680
28	22	31.11574	24	0.1505	0.2896	>20%<5	9.525362	0.14612	0.1679
7	22	30.60648	24	0.1655	0.2769	>20%<5	9.385524	0.15303	0.1612
38	22	25.00317	24	0.4056	0.000	>20%<5	8.585001	0.1983	0.1231

Regarding place of residence, knowing one's skills ($\chi^2=36.28$; $p=0.052$; $V=0.395$) and anger in the face of frustration ($\chi^2=34.07$; $p=0.083$; $V=0.354$) show significant trends. As a result, geographical location partially influences self-perception and emotional control, although the effects are more moderate. It influences emotional attitudes and self-confidence. However, there is another hidden reality concerning the commute time from home to the workplace, and the problems related to money and alternative transportation options when delays occur. This ultimately affects job performance and employment retention: Data are show in Table 9.

TABLE 9 STATISTICAL ASSOCIATIONS FOR THE EMPLOYMENT ASPECT VARIABLE

N	n_total	chi2	df	p_chi2	cramers_v	supuestos_chi2	H_kw	p_kw	epsilon_2_kw
38	22	6.875	4	0.1426	0.3579	>20%<5	5.58871	0.01808	0.2185
44	22	3.476543	4	0.4815	0.000	>20%<5	3.188406	0.07416	0.1042
3	22	3.17778	4	0.5285	0.000	>20%<5	2.347795	0.12546	0.0642
37	22	4.354167	4	0.3602	0.0884	>20%<5	1.753188	0.18548	0.0359
50	22	3.433862	4	0.4880	0.000	>20%<5	1.734234	0.18787	0.0350

A moderate association was found with: 'Professional degree not very useful' ($\chi^2=6.88$; $p=0.143$; $V=0.358$). Other associations were not significant or had calculation errors due to low frequencies.

As a result, current work experience is weakly related to the valuation of a professional degree. This component also involves a combination of emotions and pessimism, as women with visual impairments have more fears and fewer educational opportunities, leading to emotional self-exclusion.

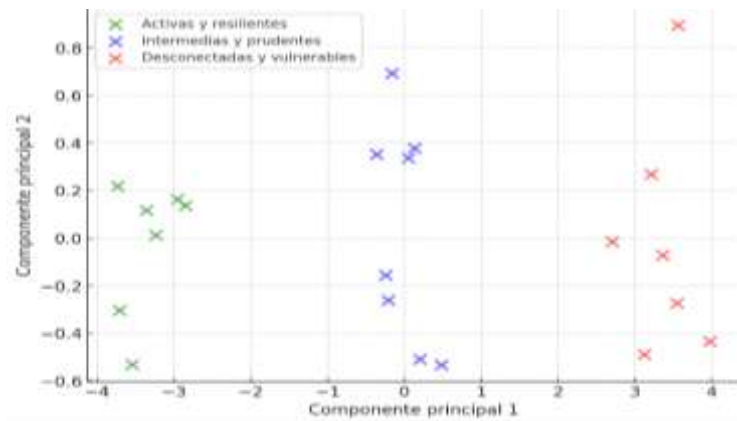
K-Means was applied with 3 as the optimal number of clusters:

Group 0 (Active and Resilient) exhibits high motivation, resilience, and willingness to learn. They excel in: a) work adaptability (≈ 4.5), b) interest in knowledge updating (≈ 4.69), c) motivation for personal achievements (≈ 4.9). They represent a proactive profile with a strong orientation toward personal growth.

Group 1 (Intermediate and Prudent) show moderate responses in most items. Some notable traits are: Work adaptability ≈ 3.1 , Shyness ≈ 2.9 , Social concern ≈ 3.4 . They represent a profile in transition, with potential for improvement through training programs and emotional support.

Group 2 (Disconnected and Vulnerable) reflect low self-confidence and a high perception of discrimination. They are characterized by: Work adaptability = 1.0, very low personal motivation (≈ 1.0), high perception of gender inequality (5.0), fragile mood (5.0). They require psychological and motivational support, as well as socio-labor integration programs. Figure 1 shows how clustering is analyzed.

FIGURE 1. CLUSTER ANALYSIS OF PERSONAL PROFILES



The groups are plotted in 2 dimensions: Principal Component 1 (PC1) as a new variable that explains the greatest variability in the data—it represents the "direction" where your respondents differ most from one another—and Principal Component 2 (PC2) as the second "direction," orthogonal to the first, which explains the second largest portion of the remaining variability.

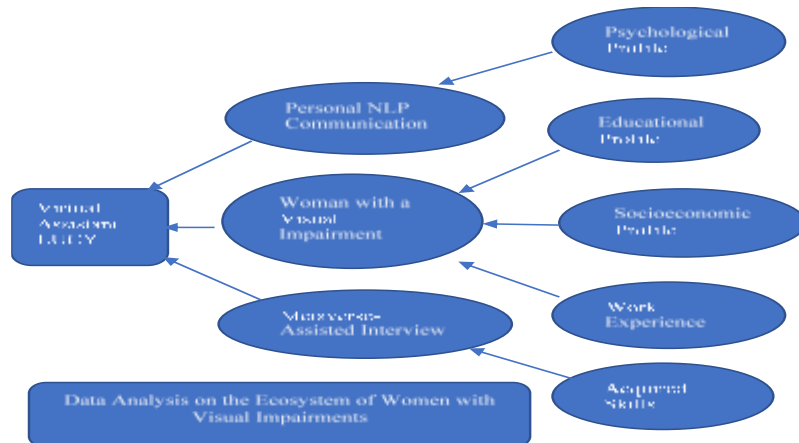
In the graph, each point represents a surveyed WVI (Woman with Visual Impairments) in the 2-dimensional space defined by PC1 and PC2. The groups are color-coded in green, blue, and red. Using the final centroids, the three resulting profiles were described: Active and Resilient, Intermediate and Prudent, and Disconnected and Vulnerable. This description was based on interpreting the average item values within each cluster.

An initial interpretation is that, while support should certainly be provided to highly motivated individuals seeking employment, the more complex work will involve supporting women who are more cautious and, with greater emphasis, those who are vulnerable and disconnected from the system.

The Smart Model has three processes, first to assessment skills of women with VI, second for propose reasonable adjustment for Companys and the last one for final application.

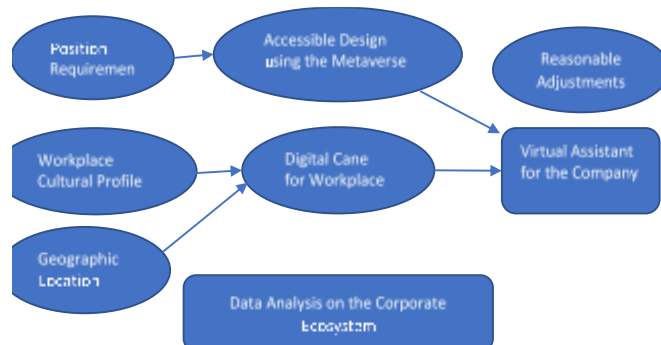
Figure 2 presents Woman with Visual Impairment (WVI) process defining characteristic of the model for women with visual impairments is understanding their psychological and educational profile while simultaneously assessing the skills acquired due to their disability.

FIGURE 2 PROCESS FOR ASSESSMENT WOMEN SKILLS



Company process, in Figure 3, is based on three established processes: first, the analysis of a job position's requirements; second, the requirements of the work environment's cultural climate regarding operational and management needs; and third, the geographic location, which presents either facilitators or barriers for transportation.

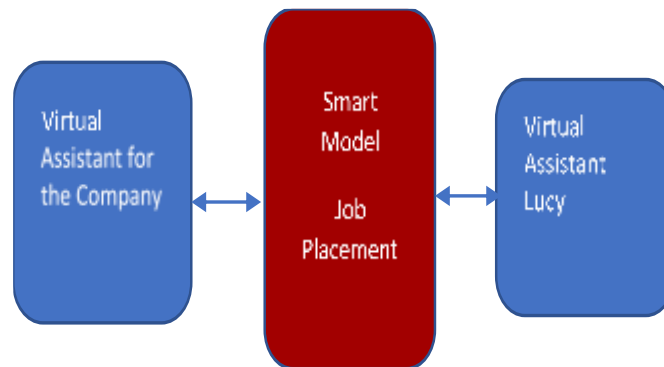
FIGURE 3 PROCESS FOR REASONABLE ADJUSTMENT FOR COMPANIES



The design contributes three new processes: an automated, accessible design process; employment management from contract signing through job performance; and data analysis to generate recommendations for designing reasonable accommodations, accessible work processes, and physical environments.

Integration job-matching process for WVI is completed by the overarching process depicted in Figure 4.

FIGURE 4. META MODEL FOR LABOR MARKET INTEGRATION FOR WVI.



To process employment applications a comparison was conducted with the functionalities offered by AI technologies. The results are presented in Table 9.

TABLE 9 COMPARISON OF AI TECHNOLOGIES

Functionality	Gemini	Copilot	Lucy
Evaluates psychological profile	NO	NO	SI
Evaluates educational profile	SI	SI	SI
Evaluates socioeconomic profile	NO	NO	SI

Evaluates work experience	SI	SI	SI
Evaluates acquired skills	NO	NO	SI
Creates a customized user database	NO	NO	SI
Evaluates job aptitude	NO	NO	SI
Features a company interface	NO	NO	SI

The results demonstrate that the virtual assistant Lucy possesses superior functionalities compared to current generative AI technologies. Its advantages lie in evaluating psychological and socioeconomic profiles, skills acquired due to visual impairment, and job aptitude. Additionally, it features its own database for updating the life history of the WVI and interfaces for linking with companies.

V. DISCUSSION

The first point of discussion concerns education and employment. It is well-established that employers seek well-educated individuals capable of driving change; thus, education serves as a fundamental baseline for securing employment.

AI should aim to include students with learning difficulties or disabilities and those studying in a language other than their mother tongue. A concerted effort is recommended to reduce the gender gap in digital skills, promote the development of AI tools to empower girls and women through AI literacy, and ensure that AI applications in education are free from gender bias [32].

We recognize that the difficulties in obtaining an education are typically fewer than those in securing a job. A key difference is that individuals seeking education often have access to resources, whereas those searching for a job frequently lack them. A significant challenge is determining how to change this disparity.

The integration of user-centered design and feedback from visually impaired individuals is crucial to ensure that AI-based tools effectively address their real needs. Furthermore, policymakers and developers should consider the affordability and accessibility of these technologies to enhance their widespread availability [33].

The most effective way to address the real needs of women with visual impairments is to understand who they are—their personal and socioeconomic profiles. This represents a significant challenge for any initiative and requires a foundation for sustainability.

Public policies are crucial for inclusion, although gaps exist in their implementation. Future research must address these challenges, and evidence-based policies focused on equity, accessibility, and sustainability—while also considering workplace mental health—need to be [34].

The exclusion of persons with disabilities is a complex, multidimensional problem. This stems from the inherent heterogeneity of disability and the ways in which environments, difficulties, identities, and socioeconomic conditions produce highly specific situations requiring tailored solutions. A shift toward inclusion is undoubtedly possible, although centuries of segregation cannot be undone immediately [7].

Transportation represents a big problem of employment, particularly for attending job interviews or commuting to work. The findings of this study reveal that a large proportion of participants face obstacles in this regard. Previous research on transportation and employment for individuals with visual impairments [4] highlighted the importance of reliable public transportation from home to the workplace and back, as individuals with visual impairments cannot drive [35].

The transportation problem is a major issue. While women with VI are willing to face various situations, when circumstances make it impossible for them to commute reliably, they often need to seek understanding for lateness due to disability-related challenges.

"...progress towards greater equality is slow and stalling; without appropriate action, the academic and career success of generations of Blind and partially sighted people will continue to be at risk" [36].

VI. CONCLUSIONS

This study has successfully analyzed the principal challenges faced by women with visual impairments in securing employment. This was achieved by associating multidimensional factors, which enabled the identification of patterns in beliefs and behavior.

Regarding the application of AI, new approaches are proposed to address personal needs. One significant barrier is age, which disproportionately affects women with disabilities due to historical marginalization. Consequently, emphasis has been placed on developing friendly communication protocols.

Other, more formidable challenges include the mental models of employers and existing workplace processes and environments, which are often unprepared with universal accessibility resources.

To address these challenges, a smart model is created with three processes. The first utilizes traditional AI to identify the needs of women with VI based on multidimensional factors. The second employs emerging technologies to analyze accessibility resource problems within companies, and the third is for applications job process, opening numerous avenues for future work and research.

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REFERENCES

1. Wang, J.; Wang, S. and Zhang, Y. (2023). Artificial intelligence for visually impaired. School of Computing and Mathematical Sciences, University of Leicester, Leicester LE1 7RH, UK b Department of Information Systems, Faculty of Computing and Information Technology, King Abdulaziz University, Jeddah 21589, Saudi Arabia. <https://www.sciencedirect.com/science/article/pii/S0141938223000240>
2. UN WOMEN (2023). No woman left behind: Closing the gender and inclusion gap in eye health: Why improving women's eye health is essential to achieving the SDGs
3. <https://www.unwomen.org/en/digital-library/publications/2023/09/policy-brief-closing-the-gender-and-inclusion-gap-in-eye-health>
4. Coffey, M., Coufopoulos, A. y Kinghorn, K. (2014). Barriers to employment for visually impaired women. International Journal of Workplace Health Management, DOI: 10.1108/IJWHM-06-2013-0022. https://www.researchgate.net/publication/265733053_Barriers_to_employment_for_visually_impaired_women
5. Cmar, J. and Steverson, A. (2021). Job-Search Activities, Job-Seeking Barriers, and Work Experiences of Transition-Age Youths With Visual Impairments. Journal of Visual Impairment and Blindness, Article2021. DOI: 10.1177/0145482X211059182Copy to clipboard. The National Research and Training Center on Blindness and Low Vision, Mississippi State University, Mississippi State, MS, United States

6. Ortega, A. y Ramirez, J. (2025). Inclusión laboral de personas con discapacidad: desafíos y oportunidades. *Revista de estudios contemporáneos del Sur Global*. ISSN 2697-3677 Vol. 6 No. 17
7. Yaqoob, U.; Rana, Z. and Nazeer, B. (2025). P-ISSN 2664-0422 *Pakistan Social Sciences Review* July-September 2025, Vol. 9, No.30-ISSN 2664-0430
<https://doi.org/10.35484/pssr>
8. Banco Mundial. 2021. Inclusión de las personas con discapacidad en América Latina y el Caribe: Un camino hacia el desarrollo sostenible. Resumen ejecutivo. Washington, DC: Banco Mundial.
9. UNICEF (2025). Personas con discapacidad en Perú: Costos que enfrentan para participar en igualdad de condiciones.
<https://www.unicef.org/peru/media/18571/file/Costos%20Adicionales%20Personas%20con%20Discapacidad%20Per%C3%83%C2%BA.pdf.pdf>
10. Ananian, S., Dellaferrera, G. (2024). A study on the employment and wage outcomes of people with disabilities, ILO Working Paper 124 (Geneva, ILO).
<https://doi.org/10.54394/YRCN8597>
11. Ministerio de Derechos Sociales (2024). MPULSA IGUALDAD: Análisis comparativo de la Asistencia Personal en Europa.
<https://campus.impulsaigualdad.org/theme/almond/files/biblioteca/2-analisis-comparativo-ap-europa.pdf>
12. INEI (2019). Perfil sociodemográfico de la población con discapacidad, 2017. Perú.
https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1675/libro.pdf
13. Castle CL (2024) Attitudes of employers towards people with visual impairment: a scoping review. *Front. Rehabil. Sci.* 5:1383984. doi: 10.3389/fresc.2024.1383984.
14. UNESCO. (2020). Resumen y recomendaciones para generar condiciones favorables para la inclusión laboral de personas con discapacidad con énfasis en las mujeres. Primera edición, 2020. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura (UNESCO).
https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40americas/%40oro-lima/documents/publication/wcms_760023.pdf
15. UNOPS (2020). Infrastructure for gender equality and the empowerment of women.
<https://content.unops.org/publications/UNOPS-Infrastructure-for-Gender-Equality-and-the-Empowerment-of-women.pdf>
16. Adnin, R. and Das, M. (2024). I look at it as the king of knowledge: How Blind People Use and Understand Generative AI Tools. The 26th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '24), October 27–30, 2024, St. John's, NL, Canada. ACM, New York, NY, USA, 14 pages.
<https://doi.org/10.1145/3663548.3675631>
17. Elshaer, I.; AlNajdi, S.; Salem, M. (2025). Sustainable AI Solutions for Empowering Visually Impaired Students: The Role of Assistive Technologies in Academic Success. *Sustainability* 2025, 17, 5609. <https://doi.org/10.3390/su17125609>.
18. Naayini, P.; Myakala, P. and Bura, C. (2025). AI-powered assistive technologies for visual impairment. *arXiv:2503.15494v1 [cs.HC]* 14 Jan 2025.
<https://arxiv.org/pdf/2503.15494>.
19. Soni, M.; Gomathi, S.; and Adhyaru, Y. (2020). "Natural language processing for the job portal enhancement," 2020, doi: 10.1109/ICSSS49621.2020.9202046.
20. Mishra, R.; and Rath, S. (2021). "Enhanced DSSM (deep semantic structure modelling) technique for job recommendation," *J. King Saud Univ. Comput. Inf. Sci.*, Jul. 2021, doi: 10.1016/J.JKSUCI.2021.07.018.

21. Azimah A. (2022). Feninferina Azman ,Masyura Ahmad Faudzi , Hasventhran Baskaran, fiza abdul rahim (2022). job opportunities recommendation for visually impaired people using natural language processing.
<https://www.jatit.org/volumes/Vol100No2/20Vol100No2.pdf>
22. Bellini et al.(2020). "GUapp : A Conversational Agent for Job Recommendation for the Italian Public Administration"
23. Giabelli, A.; Malandri, L.; Mercorio, F.; and Mezzanzanica, M. (2021). "Skills2Job : A recommender system that encodes job offer embeddings on graph databases," Appl. Soft Comput. J., vol. 101, p. 107049, 2021, doi: 10.1016/j.asoc.2020.107049
24. US Department Justice (2022). Algorithms, Artificial Intelligence, and Disability Discrimination in Hiring. Civil Rights Division. <https://www.ada.gov/resources/ai-guidance/>
25. Chaflekar, S.; Pawade, S.; Thakur S.; Vaidya, A.; Gajapure, A. and Chaudhari M. (2023) Assistant Professor, Department of Information Technology¹ Students, Department of Information Technology Priyadarshini Bhagwati College of Engineering, Nagpur, Maharashtra, India.
26. Abid, M. ; Ben-Salha, O. & Kanetaki, Z. (2024). Does the Impact of Artificial Intelligence on Unemployment Among People With Disabilities Differ by Educational Level? A Dynamic Panel Threshold Approach. Digital Object Identifier 10.1109/ACCESS.2024.3456962.
<https://unesdoc.unesco.org/ark:/48223/pf0000376162>
27. Ip, E. (2025). Fair AI in hiring: Experimentalevidence on how biased hiringalgorithms and differentdebiasing methods affect thequality and diversity of applicants. Behavioral Science & Policy2025, Vol. 11(1) 44–54© Behavioral Science& Policy Association 2025 Article reuse guidelines: sagepub.com/journals-permissions DOI: 10.1177/23794607251353585
28. Voutsakelis, G.; Dimkaros, I.; Tzimos, N.; Kokkonis, G.; Kontogiannis, S. (2025). Development and Evaluation of a Tool for Blind Users Utilizing AI Object Detection and Haptic Feedback. Machines 2025, 13, 398. <https://doi.org/10.3390/machines13050398>
29. Santana, F. y Ortega, M. (2025). Análisis de la inclusión laboral de personas con discapacidad DOI: <https://doi.org/10.23857/dc.v11i1.4259>.
<https://dominiodelasciencias.com/ojs/index.php/es/article/view/4259>
30. Joshi, A. and Pavel, B. (2020). Data Preprocessing: the Techniques for Preparing Cleanand Quality Data for Data Analytics Process. Oriental Journal of Computer Science and Technology. SSN: 0974-6471, Vol. 13, No. (2-3) 2020, Pg. 78-81
31. Gratos, K., Ougiaroglou, S. (2023). A Web Tool for K-means Clustering, DOI:10.1007/978-3-031-44097-7_9. In book: Novel & Intelligent Digital Systems: Proceedings of the 3rd International Conference (NiDS 2023) (pp.91-101)
32. Saqr, M., Lopez-Pernas, S. (2024). Learning Analytics Methods and Tutorials. ISBN 978-3-031-54463-7 ISBN 978-3-031-54464-4 (eBook) University of Eastern Finland. Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>). <https://doi.org/10.1007/978-3-031-54464-4>.
33. UNESCO (2021). Understanding the impact of artificial intelligence on skills development International Centre for Technical and Vocational Education and Training.ISBN: 978-92-3-100446-9.
https://unevoc.unesco.org/pub/understanding_the_impact_of_ai_on_skills_development.pdf

34. Lukman, L. (2025). The Use of Artificial Intelligence in The Development of Vision Aids for The Visually Impaired. *Riwayat Educational Journal of History and Humanities* 8(1):251-268. DOI:10.24815/jr.v8i1.43491
35. Pacheco, J. (2026). Trends and Advances in Labor Inclusion: A Bibliometric Analysis of the Last Vicennium. *European Public and Social Innovation Review* ArticleOpen Access 2026. DOI: 10.31637/epsir-2026-1632Copy to clipboard.
<https://www.scopus.com/pages/publications/105017052728?origin=resultslist>
36. Hossen, M. M. (2024). A Descriptive Exploration of Selected Employment Barriers and Supports for Individuals With Visual Impairments in Bangladesh [Doctoral dissertation, The University of Texas Rio Grande Valley].
<https://scholarworks.utrgv.edu/etd/1524>
37. Foulds, M., Duguid, B, and Yu, Y. (2025). Understanding International Approaches to Achieving Equality of Blind and Partially Sighted People. Thomas Pocklington Trust.
<https://www.pocklington.org.uk/wp-content/uploads/2025/07/Achieving-Equality-Report-DIGITAL-1.pdf>