Final Year Project Proposal
JobIntel PK
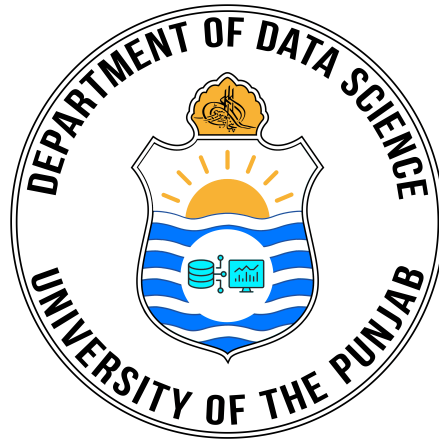
By

Muhammad Rehan	BSDSF22A001
Durrab Jah	BSDSF22A017
Hafiz Talha Anjum	BSDSF22A019
Haris Ahmad	BSDSF22A035
Saad Jamil	BSDSF22A042

Under the supervision of

Dr. Khurram Shahzad

Bachelor of Science in Data Science (2022-2026)

FACULTY OF COMPUTING & INFORMATION TECHNOLOGY (FCIT),

UNIVERSITY OF THE PUNJAB, LAHORE.

JobIntel PK

A project proposal presented to

University of the Punjab, Lahore

In partial fulfillment of the requirement for the degree of

Bachelor of Science in Data Science (2022-2026)

By

Muhammad Rehan	BSDSF22A001
Durrab Jah	BSDSF22A017
Hafiz Talha Anjum	BSDSF22A019
Haris Ahmad	BSDSF22A035
Saad Jamil	BSDSF22A042

FACULTY OF COMPUTING INFORMATION TECHNOLOGY (FCIT),

UNIVERSITY OF THE PUNJAB, LAHORE

Executive Summary

JobIntel PK is an AI-powered labor market intelligence system that supports the acute demand for real-time and data-driven analytics of employment patterns in Pakistan. Current trends saddle the job market with a mismatch of skills and a lot of pressure from rapid technological change and, in addition, demographic pressure. The project aims to fill the gap between the traditional forecasts of the job market and the live hiring information and utilizes web scraping, machine learning, and large language models to this end.

In comparison to periodically issued phrases that collect surveys like the Future of Jobs Report by the World Economic Forum, JobIntel PK scrapes job postings from sites such as Rozee.pk, Mustakbil, Indeed, and LinkedIn continuously. It qualifies and normalizes these listings into a worldwide acknowledged system of task groupings and abilities that are coupled with natural language processing (NLP). The resultant data then forms the basis of the **Pakistan Employment Trends Report**, which provides the stakeholders with near real-time insight into labor demand.

The architectural design is composed of the scaling back-end designed with FastAPI and NLP transformers and GPT-based tools to generate reports and supported by PostgreSQL, Qdrant, and AWS S3 to provide a structured and semantic database. A web interface developed with React.js will enable job seekers, professionals in HR, academic institutions, and policymakers to view a dashboard, navigate job data, and download reports.

Nevertheless, not counting informal employment, the use of third-party platforms, and other weaknesses are to be considered, JobIntel PK presents a baseline solution to the problem of a lack of employment data in Pakistan. Through its contribution toward locally-based job dynamics and global frameworks as well as its provision of actionable insights, the project can facilitate evidence-based decision making on an evidence-based workforce.

Contents

List of figures

List of tables

Chapter 1

INTRODUCTION

1.1 Background

The world of work is shifting very fast due to technological change, digitalization, demographic change, and new forms of economic organization. Well-known reports, such as the Future of Jobs Report, presented by institutions like the World Economic Forum (WEF), are based on surveys and adaptive analyses of employers and experts predicting future job functions and skills [1].

But those reports suffer serious limitations: they are based on periodic, subjective surveys; provide little national detail, particularly in developing countries; and too frequently do not discuss the dynamics of unscripted hiring on a real-time basis. It is a temporal lag which might blur the changes caused by local economic, political, or technological changes, which makes such a prediction less useful in making decisions in time [2]–[4].

On the other hand, online work and job publication boards, such as Rozee.pk, Indeed, LinkedIn, or Mustakbil, create huge crunching real-time statistics by providing live job opportunities every day. Such listings will provide a first-hand, objective picture of employer demand and skill needs, a valuable, relatively untapped resource in Pakistan.

Such insights are more needed by Pakistan due to its demographics. The country is more than 241 million people (2023 census) and roughly 64% below the age of 30, which means there could be a youth dividend [5]. However, the population that continues to provide such a strong labour force is also threatened: the general unemployment rate in Pakistan is currently 6.3%, yet there is an 11.1% unemployment rate in the 15-24 age group, with 44.9% percent unemployment rates in the cities [6].

In most cases, there is usually a mismatch in skills: graduates often lack practical, industry-oriented competencies. Approximately 40% of the graduates who are new report having no luck in getting appropriate jobs, and close to 30% of the literate youngsters do not have any job at all [7]. These are further aggravated by economic insecurity, inadequate infrastructure, and poor rural–urban integration.

Despite the pressure on upskilling, digital literacy, and lifelong learning according to the reports of McKinsey, LinkedIn, OECD, and World Bank across global countries [2], [8]–[10], little information is provided country-specifically to Pakistan. Similarly, Lightcast points out

that today, 92% of all job advertisements in the world require digital skills [11], but there is no local analogue monitoring job demand rates within Pakistan.

The JobIntel PK project attempts to fill this gap by scraping real-time job ads off the major platforms in Pakistan, utilizing NLP to label positions, and matching them to the international job taxonomy (e.g., WEF clusters) and producing a frequently updated **Pakistan Employment Trends Report**. The initiative will deliver timely and accurate labor market intelligence relevant to the Pakistani situation, which provides job seekers, employers, educators, and policymakers with relevant labor market intelligence they can use to act on.

1.2 Problem Statement

There has been observed an information gap in the fast-changing job market in Pakistan. Although most of these studies in the world, like the WEF Future of Jobs, give excellent forecasts on the state of the labor force, they are mostly based on surveys conducted periodically, do not include up-to-date statistics, and are seldom dedicated to the Pakistani job market. This means there is no continuously updated, data-driven source that monitors trends in the labor market in Pakistan in real time [1], [2].

Without such tips, job applicants, schools, policy-makers, and companies will have no reference point but to know:

What are the expanding or decreasing job positions?

What skills are needed now?

The way the trend of hiring is changing in different industries.

This absence in real-time observation results in mismatched skills, inefficient curriculum design, job destination, and strategic human staffing policies.

Although there are active job platforms in the market such as Rozee.pk, Indeed, Mustakbil, and LinkedIn, there is still no central mechanism to scrape and analyze this large chunk of job data and utilize it in the form of insights into the labor market. This kind of system would fill the considerable need to have a real-time reflection of the pattern of hiring decisions instead of guesswork.

1.2.1 Target Users / Market Need:

College Career and Curriculum Planners

- **Need:** Understanding of what is required to prepare courses with regard to the fields and skills needed.

- **Market Size:** There are more than 200 institutions of higher learning in Pakistan.

Job Seekers and Career Counselors

- **Negotiating need:** To be able to be in tune with new positions and what is needed to remain competitive.

- **Market Size:** More than 3 million available job seekers every year (Pakistan Bureau of Statistics, 2024).

HR Professionals and Hiring Agencies

- **Need:** Industry standards of job content, job titles, and job requirements.

- **Market Size:** There are thousands of SMEs, startups, and enterprise companies that participate in recruitment.

1.3 Project Goals & Objectives

The primary goal of this project is to develop JobIntel PK, an intelligent labor market analytics system designed to support the local economy by analyzing the real-time characteristics of job opportunities across Pakistan. Unlike traditional labor market studies that rely on static and infrequent surveys, JobIntel PK uses automated web scraping and artificial intelligence to provide continuous, real-time insights into the evolving employment landscape in the country. This approach allows for a dynamic understanding of job demand and supply, making it highly responsive to the changing needs of the industry [1], [11].

By modeling the structure of the World Economic Forum's Future of Jobs Report but grounding it in live data sourced from Pakistan, the project aims to produce a **Pakistan Employment Trends Report**. This report will be generated periodically by AI and will serve as a reliable, data-driven resource for all relevant stakeholders.

To meet this overarching objective, several key system-level goals will be pursued. First, the system will implement robust and adaptive web scrapers to collect structured job data

from platforms like Rozee.pk, Mustakbil, LinkedIn, and Indeed. The scrapers will be designed to handle website structure changes efficiently and will ensure that job data is refreshed on a regular basis to maintain accuracy and relevance.

Second, the project will include a job classification engine built using natural language processing (NLP) and machine learning techniques. This engine will classify job listings into a standardized taxonomy, such as Engineering, Sales, or Data & AI, and normalize job titles and required skills across different platforms. This standardization will allow for meaningful comparisons and trend analysis, as highlighted in existing literature and job intelligence sources [8], [11].

Third, a global mapping module will be developed to align local Pakistani job categories with globally recognized clusters, such as Data and AI, Green Jobs, and Customer Service. This module will enable comparisons between local employment trends and those observed worldwide, particularly in alignment with WEF classifications.

Fourth, the project will integrate GPT-based large language models to automatically generate readable summaries and analytical insights for the **Pakistan Employment Trends Report**. These summaries will be accompanied by visualizations, including industry-specific dashboards and skill demand heatmaps, offering clear and accessible data presentations.

Finally, the project aims to deliver maximum value to its stakeholders by presenting findings in a format that is both practical and actionable. These stakeholders include universities seeking to align curricula with market demand, policymakers aiming to improve labor policies, HR professionals looking to refine hiring strategies, and job seekers interested in identifying in-demand skills. The ultimate goal is to create a system that can guide decision-making and workforce planning, supporting Pakistan's economy through evidence-based labor market intelligence [9], [12].

1.4 Scope

The scope of this project encompasses the development of JobIntel PK, a real-time and AI-driven labor market analytics system specifically designed for Pakistan's formal employment sector. The system focuses on collecting, classifying, and analyzing online job advertisements using web scraping, machine learning, and natural language processing. The core aim is to extract structured data from job portals and use this information to generate insights and trend reports on the evolving employment landscape. However, the project is strictly limited to officially advertised jobs on the web. It will not consider informal or offline job markets, nor will it include data from freelance or gig platforms.

Within the defined scope, several features are included. JobIntel PK will scrape publicly available job listings and metadata from popular platforms such as Rozee.pk, Mustakbil,

LinkedIn, and Indeed. The scraping process will be periodic to ensure that the system reflects near real-time hiring activity. Once collected, the data will undergo processing through NLP-based machine learning models to classify job listings into a consistent, standardized taxonomy. This step will normalize job titles and associated skill sets across different platforms, making cross-platform analysis more reliable and meaningful [8], [11].

Another major component of the system is global job mapping using the World Economic Forum's predefined job clusters. These clusters include, but are not limited to, areas such as Data and AI, Green Jobs, and Customer Service [1]. Local job listings will be translated into these globally recognized categories, allowing for international benchmarking and comparative labor market analysis.

Furthermore, JobIntel PK will employ statistical analysis and GPT-based natural language generation techniques to extract trends and generate narrative summaries. These insights will be compiled into the **Pakistan Employment Trends Report**, which will be released on a periodic basis. While a web dashboard is considered optional within the current scope, an interface may be developed, time permitting, to visually represent trends, job clusters, and skill requirements in a user-friendly format.

Certain features are explicitly out of the scope of this project. Job boards that require premium access, API keys, or advanced authentication methods (such as CAPTCHA solving) will not be included, in adherence to ethical and legal boundaries [9]. Additionally, the system will not cover post-hiring analytics such as salary prediction, employee satisfaction, or workforce retention. It will also not provide personalized job recommendations to users, nor will it collect data from informal or offline labor markets.

1.5 High-level System Components

The proposed system, JobIntel PK, will be developed as a modular and scalable application, consisting of multiple components responsible for data collection, processing, analysis, and presentation.

These components are organized into two primary layers: the **Web Application** and the **Backend Services**.

1.5.1 Web Application

The web application serves as the user-facing component of the system, offering a friendly and interactive interface through which users can explore insights and engage with the system's core functionalities.

- **Login Module:** A login module will provide secure authentication through an email and password mechanism, along with support for password reset via email verification.

- **Dashboard Module:** The dashboard module will deliver a dynamic, real-time visual overview of job market trends, including the most in-demand job types, emerging skills, and platform-specific hiring patterns. These insights will be presented in the form of interactive charts and tables, making complex data easy to interpret.

- **Job Data Explorer Module (JDEM):** The Job Data Explorer Module will enable users to explore the database of scraped job listings. Jobs can be browsed by category, platform, or region, and users will be able to apply filters or sorting options to locate specific types of listings quickly.

- **Report Access Module:** A Report Access Module will allow users to view and download the latest version of the **Pakistan Employment Trends Report** in PDF format, ensuring easy dissemination of key findings.

- **Trend Comparison Module (Optional):** Additionally, an optional Trend Comparison Module may be included to provide comparative views of job trends over time. This module would allow analysis across different industries or skill domains, helping to identify long-term shifts or emerging areas of growth.

1.5.2 Backend Services

- **Core Operations and Scraping:** The backend services handle all core operations of the system, including data collection, processing, analysis, storage, and automation. The Job Scraping Service collects job listings and metadata from platforms like Rozee.pk, Indeed, LinkedIn, and Mustakbil using adaptable scrapers that run periodically to maintain real-time data.

- **Classification and Skill Mapping:** The Job Classification Service processes the scraped data using NLP and transformer-based models to categorize jobs based on a predefined taxonomy aligned with World Economic Forum job clusters. Complementing this, the Skill Extraction and Mapping Service identifies key skills from job descriptions and aligns them with global skill clusters for consistency and comparison.

- **Report Generation:** The Report Generator leverages large language models, such as GPT-4 or LLaMA-3, to generate structured, narrative insights that form the **Pakistan Employment Trends Report**.

- **Data Storage:** Data is stored using a layered system: PostgreSQL for structured data, Qdrant for semantic embeddings, and AWS S3 (or local alternatives) for file storage. This ensures efficient, scalable management of both raw and processed data.

- **Scheduling and Monitoring:** To keep everything running smoothly, the Scheduling and Monitoring Service automates scraper execution and system health checks, ensuring timely data updates and reliable report generation while maintaining system stability.

1.6 List of Optional Functional Units

The following features are considered optional and may be implemented if time and resources allow. While they are not critical to the core functioning of the JobIntel PK system, they can significantly enhance its utility, user engagement, and overall value.

- **Google Authentication:** One optional feature is Google account authentication, which would allow users to log in using their Google credentials via OAuth 2.0. This would streamline the login process and enhance account security.

- **Trends Alert System:** Another potential addition is a trends alert system, where registered users can receive email notifications about major shifts in job trends, emerging occupations, or significant changes in in-demand skills.

- **Historical Data Visualization:** The system could also support historical data visualization by storing past job data snapshots and generating simple trendlines over time for key job categories or skill clusters.

- **AI Chatbot Assistant:** An AI-powered chatbot assistant, built on a GPT API, may also be integrated to allow users to query insights about the labor market based on live data.

- **Skill Gap Analysis:** Lastly, a skill gap analysis feature could be provided to help students or job seekers compare their current skill sets with those most in demand, based on real-time job postings. This would assist in personal career planning and upskilling decisions.

1.7 Application Architecture

The JobIntel PK system is designed using a **three-tier architecture** that is modular, scalable, and promotes separation of concerns. This architectural design enables efficient collection, analysis, and real-time presentation of labor market information. The three primary layers include the **Presentation Layer** (Frontend), the **Business Logic Layer** (Backend), and **the Storage & Data Layer** (Indexing).

1. The **Presentation Layer** is responsible for user interaction and provides labor market insights through a responsive and user-friendly web interface built with React.js. It includes features such as interactive dashboards, filtering options, visual charts, and access

to downloadable reports. Secure user authentication is supported through both email/-password login and optional Google OAuth integration. Additionally, this layer allows graphical exploration of job types, required capabilities, and labor trend lines, enhancing user engagement with the platform.

2. The **Business Logic Layer** forms the core of the application and handles the ingestion, processing, classification, and reporting of job data. Developed using FastAPI in Python, this layer manages all scraping tasks and job scheduling routines. It executes NLP models for job classification, performs mapping of extracted skills to World Economic Forum (WEF) categories, and uses GPT-based APIs to generate the narrative content of the **Pakistan Employment Trends Report**. This layer orchestrates the flow of data through the system, from scraping and processing to storage and presentation.

3. The **Storage & Data-Layering** component manages persistent data storage and indexing to support fast and efficient data retrieval and semantic search. Structured job data and metadata are stored in PostgreSQL. Semantic embeddings generated during processing are saved in the Qdrant vector database to enable similarity analysis and advanced search functionalities. Additionally, all generated reports, logs, and raw scraped data are archived using AWS S3 or local storage solutions, depending on system deployment.

Overview of Data Flow:

1. The process begins with scrapers collecting job descriptions from various job portals.

2. The raw data is then cleaned and stored in the database.

3. Jobs are categorized and mapped to WEF-defined groups using machine learning models.

4. The processed data is transformed into visual insights and comprehensive reports.

5. Finally, the frontend layer presents these results through dashboards and downloadable reports, allowing users to explore real-time labor market trends.

This architecture ensures that the system is capable of delivering scalable, real-time employment intelligence while maintaining flexibility and sustainability for future growth.
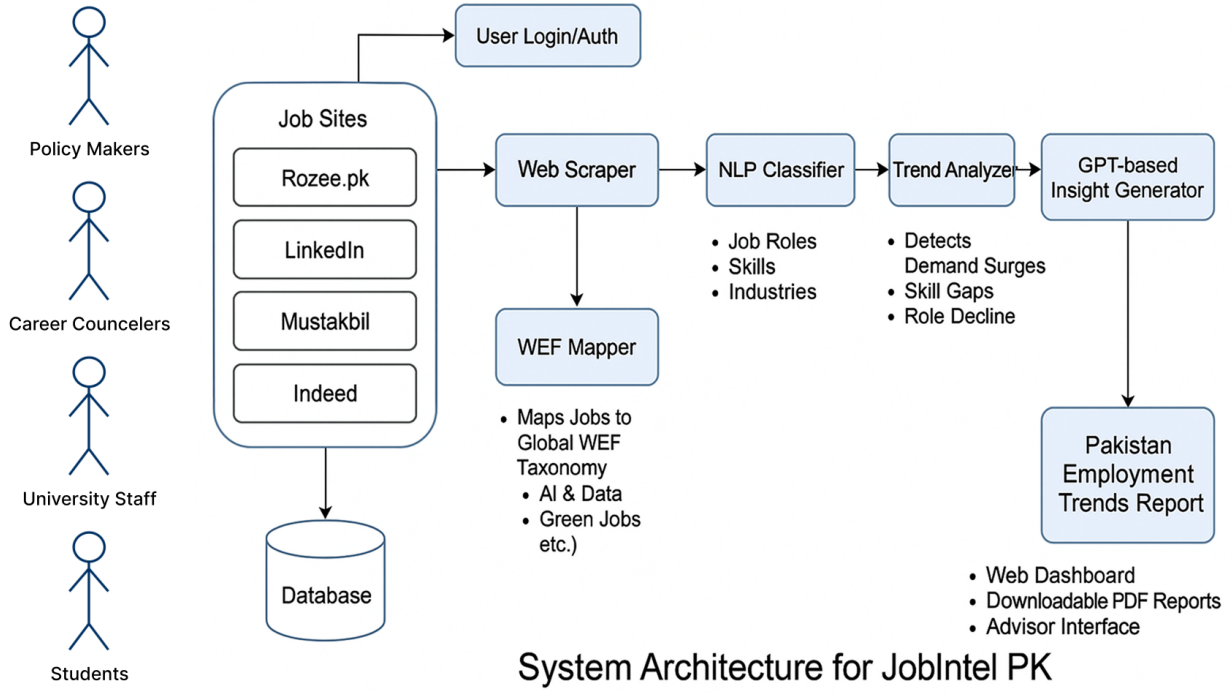
Fig. 1.1. Application Architecture

1.8 System Limitations and Constraints

1.8.1 Limitations

While JobIntel PK is designed to provide real-time, data-driven insights into Pakistan's job market, it faces several limitations inherent to the nature of its data sources and technology stack.

1. **Dependency on Third-Party Platforms:** A significant limitation is the system's reliance on third-party job platforms such as Rozee.pk, Mustakbil, LinkedIn, and Indeed. The accuracy and continuity of data scraping depend on uninterrupted access to these sites. If any platform changes its structure or implements anti-bot mechanisms, the scraping tools may fail and require manual adjustments, which could temporarily halt updates [11].

2. **Data Quality and Consistency Issues:** Additionally, there is considerable variation in the quality and formatting of job postings across platforms. Inconsistent terminology, vague job descriptions, and irregular layouts can impact the accuracy of automated job classification and skill extraction, particularly for poorly written listings [8].

3. **Language Limitation:** Another limitation is the system's initial focus on English-language job advertisements. While English is commonly used in formal listings, many

postings also appear in Urdu or mixed-language formats. This version of the system will not support multilingual analysis, though it may be considered for future upgrades.

4. **Exclusion of Informal Economy:** A major structural limitation is the system's exclusion of Pakistan's informal economy, which accounts for over 70% of employment [13]. Since JobIntel PK relies solely on digital job boards, it is unable to capture trends in informal or unadvertised employment.

1.8.2 Constraints

The development of JobIntel PK is subject to several practical constraints.

1. **Timeframe Constraint:** The project is aligned with an academic calendar and must be completed within the timeframe of one academic year (Q3 2025 to Q3 2026). This requires phased implementation and prioritization of core functionalities to meet academic milestones.

2. **Team Capacity:** Team capacity is another key constraint. With a student team of five members, only essential modules can be guaranteed for delivery. Secondary features such as advanced dashboarding or multilingual capabilities may be deferred depending on available time and technical expertise.

3. **Compliance and Ethics:** Compliance and ethical considerations also shape the project's scope. Web scraping will be carried out in accordance with the terms of service of each job platform. No bypass techniques such as CAPTCHA solvers or scraping content behind authentication will be used [9].

4. **Budgeting for LLM APIs:** Finally, the use of large language models such as OpenAI's GPT for automated report generation introduces a budgeting constraint. If API usage costs become prohibitive, the team may scale down high-frequency automation or switch to locally hosted open-source models to reduce dependence on paid services.

1.9 Tools and Technologies

The development of **JobIntel PK** integrates a modern and efficient tech stack that supports data scraping, storage, analysis, and visualization. This stack ensures system scalability, performance, and the ability to apply advanced AI capabilities. Below is a detailed overview of the core technologies used across the system:

Table 1.1. Tools and Technologies Used

Tool/Technology	Description and Version
React.js	Frontend framework for building responsive, interactive UIs. (v18.2)
FastAPI	High-performance Python framework for backend REST APIs. (v0.115)
PostgreSQL	Relational database for storing structured job and user data. (v16)
Qdrant	Vector database for job embeddings and semantic search. (v1.10)
AWS S3 / Local	File storage for scraped data, reports, and backups.
Python	Core language for scraping, backend, and AI integration. (v3.13)
SQLAlchemy	ORM for interacting with PostgreSQL using Python. (v2.0)
Playwright / Selenium	Tools for automating browsers and scraping dynamic content.
spaCy / Transformers	NLP libraries for classification, extraction, and processing.
GPT-4 / LLaMA	LLMs used to generate summaries in the report.
Git & GitHub	Version control and collaboration tools.
Docker (optional)	For consistent app deployment across environments.

This toolset ensures a seamless pipeline from data ingestion to intelligent reporting. It enables the JobIntel PK platform to process large-scale labor market data and present meaningful insights to its users with reliability and ease.

Chapter 2

Related Literature Review

2.1 Related Work

Around the world, leading institutions are tracking how work is changing, fueled by automation, AI, and the evolving demands of the modern economy. Their findings highlight a clear message: real-time, locally relevant labor insights are no longer optional—they're essential. JobIntel PK is designed to fill that gap in Pakistan, offering a timely, data-driven solution grounded in global trends.

World Economic Forum (WEF)

The World Economic Forum publishes its flagship Future of Jobs Report biennially, surveying over 1,000 employers across 55 countries, representing 14 million workers. The 2025 edition forecasts a net gain of 78 million jobs by 2030—driven by a mix of automation, green transitions, and economic restructuring. Of these, 170 million jobs will emerge while 92 million will be displaced [1]. Employers identified AI, big data, and digital platforms as top drivers of change. Additionally, the report emphasizes that 39% of core job skills are expected to change, prompting 85% of firms to invest in upskilling [1].

LinkedIn Economic Graph

LinkedIn's Workplace Learning Report 2025, released as part of its annual series, highlights an emerging "skills crisis", with 49% of learning leaders emphasizing the need to teach the "superskill" of learning itself [8]. The report stresses internal mobility and AI-supported personalized learning as key strategies for future-ready workforces. It also finds that organizations prioritizing career development exhibit higher AI maturity and stronger talent retention [8].

McKinsey Global Institute

McKinsey's Race to Deploy AI and Raise Skills report estimates that by 2030, 30% of U.S. work hours and 27% in Europe could be automated—double the pre-pandemic levels [2]. This will require large-scale occupational transitions, especially for middle-skill and aging workers.

McKinsey underscores the importance of reskilling in higher cognitive and social-emotional skills, with demand projected to rise by 11–14% within five years [2].

PwC Global AI Jobs Barometer

PwC's 2025 Global AI Jobs Barometer, a first-of-its-kind global study, analyzes nearly 1 billion job ads across six continents. It finds that jobs in AI-exposed industries offer wage premiums almost double those in less automated sectors. Surprisingly, even traditionally automatable roles show signs of growth—indicating augmentation over replacement [3]. The report also reveals that AI-linked roles are evolving 66% faster than others [3].

OECD Employment Outlook

The OECD Employment Outlook 2024, part of its annual labor series, notes a growing demand for green jobs and a corresponding decline in high-emission sector roles. It urges a redesign of employment services and workforce upskilling to support climate-resilient labor markets [9]. As of May 2024, unemployment in OECD countries stood at 4.9%, with women showing stronger job growth [9].

World Bank

The World Bank 2025 Report, part of its ongoing regional labor monitoring, reports that while 1.4 million low-skill jobs were displaced across East Asia and the Pacific, 2 million new jobs were created—resulting in net job growth. However, only 10% of jobs in the region were AI-complementary, compared to 30% in advanced economies. The report emphasizes inclusive upskilling policies for disadvantaged workers [10].

IBM Institute for Business Value

IBM's 5 Business Trends for 2025, part of its annual insights series, highlights the growing role of agentic AI—AI capable of autonomous decision-making. The report identifies the need for hybrid cloud infrastructure, people-centered transformation, and ongoing reskilling to stay competitive in the AI-driven era [4].

Coursera, edX, and Udemy

According to Coursera's Job Skills Report 2025, released annually, generative AI is the fastest-growing skill category, with an 86.6% year-over-year surge in demand [12]. The report, based on millions of learner engagements, also notes increasing interest in cybersecurity, data governance, and AI ethics.

Lightcast (Burning Glass)

Lightcast's Digital Skills Outlook 2024, part of its recurring labor analytics series, reveals that 92% of job postings now require digital skills—ranging from Microsoft 365 proficiency to generative AI literacy. These demands have grown by 64.77% in just one year [11]. Their city-level dashboards serve as a global reference for real-time, location-specific labor insights.

The Pakistan Context: Why We Need JobIntel PK

Pakistan finds itself at a critical demographic turn, with more than 56% of its population under 25 and over 3 million youth entering the job market annually [5], [14]. This has created a significant gap in the education-to-employment pipeline, demanding greater alignment with shifting skill needs and new career pathways.

Despite initiatives by NAVTTC, MoFEPT, and PIDE, a disconnect persists between labor market dynamics and public access to actionable insights. The absence of real-time, technology-enabled tools deprives job seekers, educators, and policymakers of timely guidance.

JobIntel PK aims to fill this vacuum by providing a live, AI-powered portal that delivers current insights into hiring trends, skill demands, and industry shifts—elements that are crucial for a future-ready workforce but are currently unavailable in Pakistan.

2.2 Gap Analysis

Although findings of the reports released by the global labor market are valuable in predicting job roles and skills that are emerging, there seems to be a huge gap between these high-level projections and realities in terms of local realities in developing nations such as Pakistan.

The majority of international reports (the World Economic Forum, McKinsey, PwC, and LinkedIn) use employer surveys, expert interviews, or aggregated data of platforms available on the global level to make the corresponding conclusions [1]–[3], [8]. These sources tend to be maintained on a yearly or biyearly basis and are targeted on developed economies, which lack granularity, topicality, and regional specificity for regions like South Asia.

Furthermore, although real-time intelligence in labor markets is beginning to emerge in the form of platforms such as Lightcast and LinkedIn Economic Graph, these systems are either closed, prohibitively expensive, or disconnected from local market integration [8], [11]. Conversely, public or academic efforts in Pakistan have failed to create a scraping, categorizing, and analyzing tool for job information in real time that can correspond to dynamically changing employer needs.

Census-based labor force surveys or offline interviews remain the primary data sources used by institutions like PIDE and NAVTTC, and thus lack the frequency and responsiveness required for dynamic labor analysis [14]. Moreover, such initiatives rarely utilize AI or natural language processing to extract skill-level trends from large-scale data, leaving a technological vacuum in labor intelligence infrastructure.

In short, there is a lack of:

- Real-time, data-driven online analysis of the Pakistani job market.

- Calibration of international taxonomies (e.g., WEF job clusters) to Pakistan-specific employment data.

- Incorporation of AI models to track trends in hiring, skills, and industry transitions.

- Open-source platforms in Pakistan that offer dynamic labor market scorecards or periodic insight reports.

The JobIntel PK initiative is designed specifically to bridge these gaps by developing a localized, scalable, and AI-powered system to monitor Pakistan's employment trends using real-time job data.

References

[1] World Economic Forum, *The future of jobs report 2025*, `https://www.weforum.org/publications/the-future-of-jobs-report-2025/`, [Online]. Available: https://www.weforum.org/publications/the-future-of-jobs-report-2025/, 2025 (cited on pp. 7–9, 11, 18, 20).

[2] McKinsey Global Institute, *The race to deploy ai and raise skills in europe and beyond*, `https://www.mckinsey.com/mgi/overview/the-race-to-deploy-ai-and-raise-skills`, [Online]. Available: https://www.mckinsey.com/m race-to-deploy-ai-and-raise-skills, 2024 (cited on pp. 7, 8, 18–20).

[3] PwC, *2025 global ai jobs barometer*, `https://www.pwc.com/gx/en/issues/artificial-intelligence/ai-jobs-barometer.html`, [Online]. Available: https://www.pwc.com/gx/en/issues/artificial-intelligence/ai-jobs-barometer.html, 2025 (cited on pp. 7, 19, 20).

[4] IBM Institute for Business Value, *5 business trends for 2025*, `https://www.ibm.com/thought-leadership/institute-business-value/en-us/report/business-trends-2025`, [Online]. Available: https://www.ibm.com/tho leadership/institute-business-value/en-us/report/business-trends-2025, 2024 (cited on pp. 7, 19).

[5] Pakistan Bureau of Statistics, *Pakistan population census 2023 summary*, `https://www.pbs.gov.pk`, [Online]. Available: https://www.pbs.gov.pk, 2024 (cited on pp. 7, 20).

[6] A. Ahmed, *Pakistan's youth unemployment crisis: A wake-up call*, `https://thefridaytimes.com/14-Nov-2024/pakistan-s-youth-unemployment-crisis-a-wake-up-call`, [Online]. Available: https://thefridaytimes.com, 2024 (cited on p. 7).

[7] H. Yousuf, *Youth unemployment in pakistan: Challenges, impacts, and strategic solutions*, `https://technologytimes.pk/2024/12/08/youth-unemployment-in-pakistan-challenges-impacts-and-strategic-`

solutions, [Online]. Available: https://technologytimes.pk, 2024 (cited on p. 7).

[8] LinkedIn Learning, *2025 workplace learning report: The rise of career champions*, `https://learning.linkedin.com/resources/workplace-learning-report`, [Online]. Available: https://learning.linkedin.com/resources/workplace-learning-report, 2025 (cited on pp. 7, 10, 11, 15, 18, 20).

[9] OECD, *Oecd employment outlook 2024*, `https://www.oecd.org/employment-outlook/`, [Online]. Available: https://www.oecd.org/employment-outlook/, 2024 (cited on pp. 7, 10, 11, 16, 19).

[10] World Bank, *World development report 2025: Digital jobs and inclusion*, `https://www.worldbank.org/en/publication/wdr2025`, [Online]. Available: https://www.worldbank.org/en/publication/wdr2025, 2025 (cited on pp. 7, 19).

[11] Lightcast, *Digital skills outlook 2024*, `https://lightcast.io/resources/research/the-lightcast-digital-skills-outlook-2024`, [Online]. Available: https://lightcast.io/resources/research/the-lightcast-digital-skills-outlook-2024, 2024 (cited on pp. 8–11, 15, 20).

[12] Coursera, *Job skills report 2025*, `https://www.coursera.org/skills-reports/job-skills`, [Online]. Available: https://www.coursera.org/skills-reports/job-skills, 2025 (cited on pp. 10, 19).

[13] International Labour Organization, *Pakistan employment trends 2023*, `https://www.ilo.org/islamabad/info/public/fs/WCMS_865234/lang--en/index.htm`, [Online]. Available: https://www.ilo.org/islamabad/info/public/fs/WC−en/index.htm, 2023 (cited on p. 16).

[14] Pakistan Institute of Development Economics, *Labour market dynamics in pakistan: Insights and policy recommendations*, `https://pide.org.pk/research/labor-market-dynamics-pakistan/`, [Online]. Available: https://pide.org.pk/research/labor-market-dynamics-pakistan/, 2023 (cited on pp. 20, 21).