

**THE QUALIFICATIONS AGENCY
OF THE REPUBLIC OF SERBIA**

HARNESSING WEB DATA FOR NEXT-GENERATION SKILLS INTELLIGENCE CEDEFOP AND EUROSTAT RESEARCH CONFERENCE

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LEVERAGING MACHINE LEARNING FOR PERSONALIZED LABOR-MARKET- RELEVANT TRAINING PATHWAY RECOMMENDATIONS IN SERBIA

BRIDGING LABOR MARKET NEEDS AND ADULT EDUCATION USING AI

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**THE QUALIFICATIONS AGENCY
OF THE REPUBLIC OF SERBIA**



CONTEXT: ADULT EDUCATION AND LABOR MARKET IN SERBIA

Serbia faces a skills mismatch problem affecting employment rate and workforce shortages, requiring strategic reskilling and upskilling initiatives for adults.

In line with “The EU Reference Framework for Lifelong Guidance”, this study emphasizes the need to integrate labour market forecasting and skills data in order to personalize training pathways and improve the alignment between individuals, qualifications, and evolving labour market needs.

BRIDGING LABOR MARKET NEEDS & ADULT EDUCATION



01 **LIFELONG LEARNING IMPERATIVE**

Essential for adapting to changing job market demands and technological shifts

02 **SKILLS MISMATCH**

Gap between workforce skills and employer needs impacts employment rates

03 **EU STRATEGY ALIGNMENT**

Supporting digital transition and lifelong guidance EU frameworks



THE QUALIFICATIONS AGENCY

ESTABLISHED IN 2018 BY A DECISION OF THE GOVERNMENT OF THE REPUBLIC OF SERBIA, IN LINE WITH THE LAW ON THE NQFS, QA CARRIES OUT QUALITY ASSURANCE TASKS AND PROVIDES EXPERT SUPPORT TO COMPETENT ORGANIZATIONS IN ALL ASPECTS OF THE DEVELOPMENT AND IMPLEMENTATION OF THE NQFS.

CENTRE FOR DEVELOPMENT OF QUALIFICATION STANDARDS & PROVIDING SUPPORT TO SSC

The Centre considers initiatives and prepares proposals of qualification standards, provides professional support to the work of 12 Sector Skills Councils consisting of 281 SSCs members and maintains the NQFS Register.

CENTRE FOR ACCREDITING ORGANIZERS OF ADULT EDUCATION ACTIVITIES (JPOA)

The Centre is granting adult education providers the status of Publicly Recognized Organizer of Adult Education Activities (JPOA), performs external quality assurance of JPOA and maintains the Sub-Registry of JPOA.

ENIC/NARIC CENTRE FOR RECOGNITION OF FOREIGN QUALIFICATIONS

The Centre carries out the recognition of foreign school documents as well as the procedure for the recognition of foreign higher education diplomas for the purpose of employment (professional recognition).

KEY DATA ON QUALIFICATIONS

THE NATIONAL QUALIFICATIONS FRAMEWORK OF SERBIA

Adopted in April 2018, the NQFS Law officially established the National Qualifications Framework of Serbia.

Serbia has referenced its NQF to the European Qualifications Framework in 2020, i.e. 8 levels of its NQF to 8 levels of EQF.



162 QUALIFICATION
STANDARDS ADOPTED



52 QUALIFICATION STANDARDS
ARE ADAPTABLE TO NFAE

2, 3 AND 5 LEVEL OF
QUALIFICATIONS CAN BE
ACQUIRED THROUGH NFAE



QUALIFICATION STANDARD

BASIC QUALIFICATION CHARACTERISTICS



CLASSNQFS / ISCED-F 2013
NQFS Level
EQF Level
Type
Scope
Preconditions
Form of learning
Type of public document

QUALIFICATION STANDARD REFERENCE DATA



Effective Date
Revision date
End date

RELEVANCE OF QUALIFICATION FOR EMPLOYMENT AND FURTHER LEARNING



Permeability within the qualifications system
Occupation(s) to which qualification is related
Occupational standard
Duties and tasks

LEARNING OUTCOMES



General description
Knowledge
Skills
Abilities and attitudes
Type of assessment of the achievement of learning outcomes

QUALIFICATION QUALITY ASSURANCE

Qualifications of programme organizers/teachers
The body competent for issuing the document



WHAT IS JPOA?

PUBLICLY RECOGNIZED ADULT EDUCATION PROVIDERS

DEFINITION

Adult education providers, which include schools and training organizations, with official government approval to deliver adult education training programs in Serbia.

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PURPOSE: COMPETENCIES & CAREER SKILLS

Qualification standards can serve as a basis for developing training programs, which can lead to full or partial qualifications or a set of learning outcomes.

JPOAs provide qualifications, competencies and career transition skills to help adults succeed in the labor market.



ACCREDITATION SYSTEM IN SERBIA



SUB-REGISTER OF PUBLICLY RECOGNIZED ADULT EDUCATION PROVIDERS

As a part of the NQFS Registry, JPOA Sub-registry contains data on approved organizations, training programs and employers included in programs. It contains description of training programs, NQF and EQF level, ISCED 13-F code, data on qualifications, competencies, skills for occupations or learning outcomes that trainees can acquire, the type of (public) documents issued upon successful completion of training, etc.

JPOA search

Close filter

Q Enter a keyword

JPOA data

JPOA status

Active

Archiving

All

Name JPOA

PIB

Place / Municipality of JPOA headquarters

Изаберите општину

Изаберите место

Types of activities

Program information

Program status

Active

Archiving

All

Name of the program

ISCED 13-F according to KLASNOKS

Изаберите сектор

Изаберите ужи сектор

Изаберите подсектор

Qualification acquired by the program

Competence acquired by the program

Place / Municipality of program implementation

Изаберите општину

Изаберите место

Type of public document

Program duration (in hours)

From

To

Employer information

Employer status

Active

Archiving

All

Name of the employer where the program is implemented

Input field

CANCEL

FIND

CURRENT SYSTEM – KEY DATA

JPOA REGISTRY OVERVIEW

Serbia's accreditation ecosystem provides a strong foundation for adult education. Programs span vocational qualifications and skills, digital competencies, personal development courses designed for workforce readiness, as well as programs for providing career guidance and counselling services.

AI-POWERED TRAINING PATHWAYS



205 ORGANIZATIONS
GRANTED JPOA STATUS



910 APPROVED TRAINING
PROGRAMS

171 TRAINING PROGRAMS
BASED ON QS LEADING
TO FULL QUALIFICATIONS



PROBLEM STATEMENT

KEY CHALLENGES

Job market demands do not align well with available training programs.

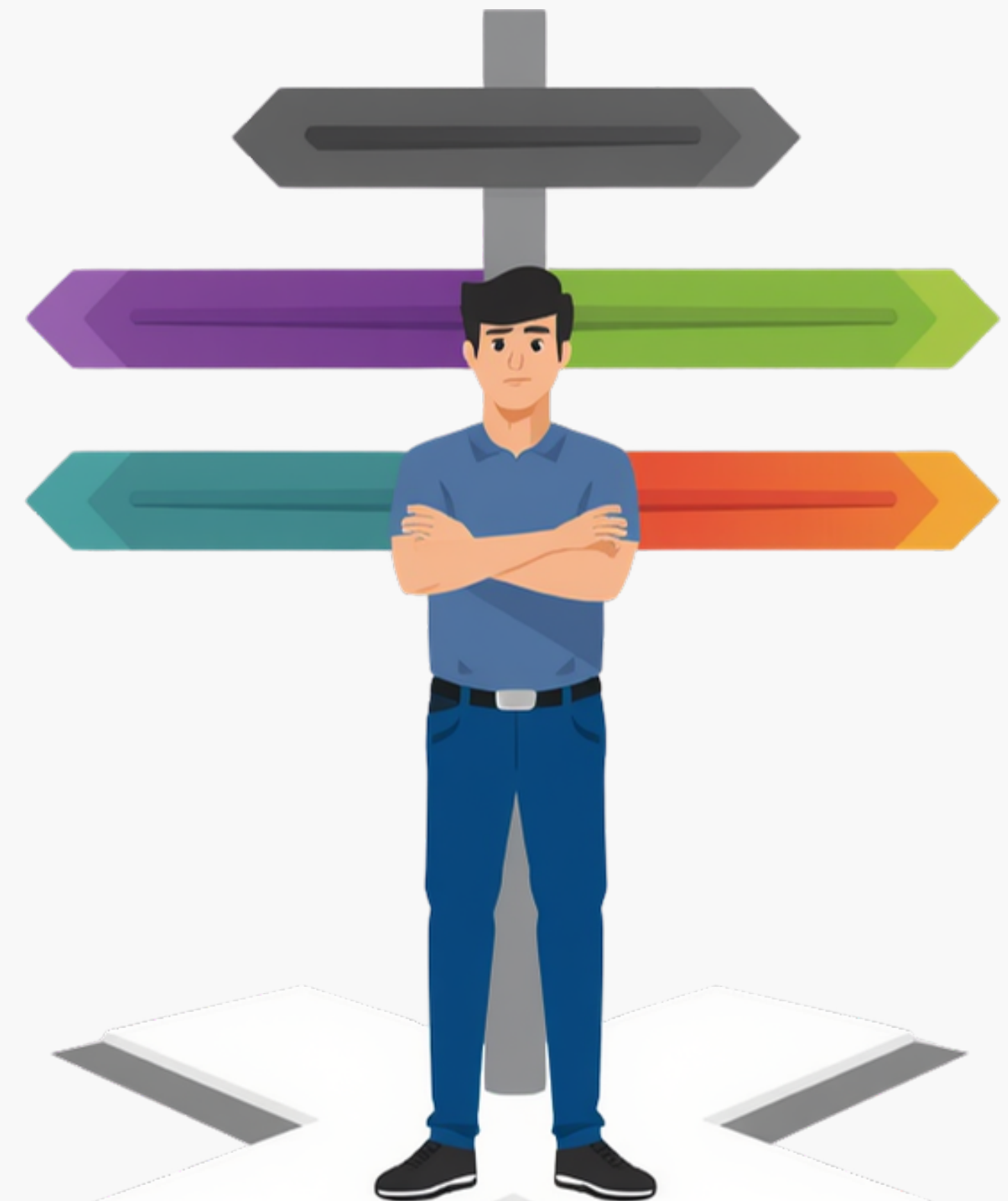
Employers struggle to find workers with relevant, up-to-date skills for evolving industry needs.

JPOA SERBIA | AI TRAINING PATHWAYS

FRAGMENTED ECOSYSTEM & SKILL MISMATCH

Valuable data exists across systems and platforms but remains unconnected.

Integration between labor market data, qualification standards and training offerings is lacking.



01 JOB MARKET DATA SOURCE

Online job advertisements from national public and private OJA platforms, as well as local portals provide real-time insights into skills demand, job titles and emerging trends in the Serbian labor market.

02 JPOA SUB-REGISTER INTEGRATION

The JPOA Sub-registry contains information on accredited training programs and providers, as well as data on qualifications, competencies, skills, learning outcomes and occupations that can be matched to market needs.

BRIDGING THE GAP WITH DATA & AI

THE VISION

Goal: Create a personalized training pathway tool that guides adult learners to relevant training programs based on real labor market demand and their career aspirations.



THE OBJECTIVE

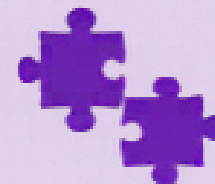
The study explores how machine learning techniques can be employed to link OJAs with approved training programs in order to generate personalized training pathway recommendations in Serbia.



01

IDENTIFY SKILLS

Identify and structure qualifications, skills and competencies requirements embedded in online job advertisements.



02

MAP TO QUALIFICATIONS

Map these requirements to official qualification standards and learning outcomes associated with approved training programs listed in the JPOA sub-register.



03

ML RECOMMENDATIONS

Develop a machine-learning-based recommendation framework that proposes individualized training pathways leading towards relevant competencies and targeted occupations.



PUBLIC AND PRIVATE OJA PLATFORMS IN RS

- 01 NATIONAL EMPLOYMENT SERVICE
NSZ.GOV.RS
- 02 POSLOVI.INFOSTUD.COM
- 03 POSLOVI.RS
- 04 JOOBLE.RS
- 05 LAKODOPOSLA.COM
- 06 KLIKDOPOSLA.COM
- 07 HALOOGGLASI.COM





KEY ML&NLP TECHNIQUES

- 01
- NATURAL LANGUAGE PROCESSING
(NLP)
- 02
- TOKENIZATION
- 03
- SKILL AND OCCUPATION
EXTRACTION
- 04
- CONTEXTUAL EMBEDDINGS
- 05
- HYBRID RECOMMENDATION ALGORITHMS
- 06
- SIMILARITY-BASED MATCHING



STRUCTURED DATASETS SHOULD ENABLE CREATING A SHARED SKILL ONTOLOGY THAT ALIGNS LABOR MARKET TERMINOLOGY WITH FORMAL QUALIFICATION-SPECIFIC LANGUAGE.

SYSTEM ARCHITECTURE

01 DATA LAYER (JOB ADS & TRAINING DATA)

Collects and stores online job advertisements data from national public and private platforms, alongside the JPOA sub-registry data.

02 ML LAYER (NLP, EMBEDDINGS, GRAPH MATCHING)

Processes data using NLP, semantic embedding, and skill network matching to understand relationships between jobs and training.

03 RECOMMENDATION ENGINE

Performs skill gap analysis to match users with relevant jobs and training programs.

04 FRONTEND INTERFACE

User-friendly platform where learners input profiles and receive personalized training pathways.

AI AGENTS ARCHITECTURE

A MULTI-AGENT ML RECOMMENDATION PIPELINE

Four specialized AI agents work together to power the recommendation system, each handling a distinct function in the data-to-training pathway pipeline.

It is important to feed AI agents with structured data in order to generate relevant personalized training pathway recommendations.

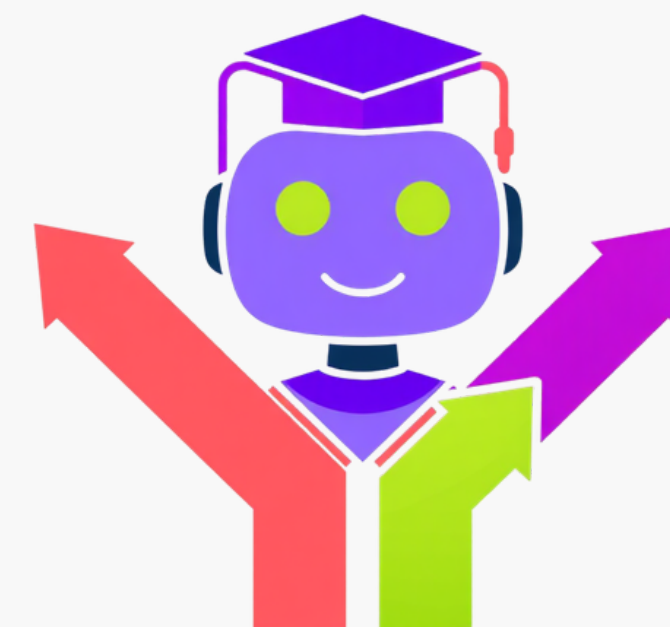
01 JOB MARKET ANALYZER & TRAINING PARSER



Agent 1: Scrapes job ads, extracts in-demand skills and trends.

Agent 2: Reads JPOA registry, structures program and skills&competencies' data.

02 SKILL MATCHER & TRAINING ADVISOR AGENT



Agent 3: Matches job requirements with training outcomes.

Agent 4: Generates personalized training pathway recommendations for each learner.

LEARNER-CENTERED CONCEPT OVERVIEW

ANONYMIZED LEARNER PROFILE DATA DESCRIBING PRIOR EDUCATION, WORK EXPERIENCE AND CERTIFICATIONS

USER PROFILE INPUT



EXAMPLE USER JOURNEY

USER INPUT: "I HAVE
BASIC IT SKILLS"



AI ANALYZES SKILLS
GAP AGAINST JOB
MARKET



SUGGESTED ROLES:
DATA ENTRY

REQUIRED SKILLS
IDENTIFIED BY AI



RECOMMENDED JPOA
PROGRAMS

PERSONALIZED TRAINING PATHWAYS



KEY BENEFITS

FOR GOVERNMENT

Data-driven insights enable strategic investment in adult education programs that address actual labor market needs in Serbia, better workforce alignment and evidence-based policy decisions.

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01 CLEAR CAREER PATHS AND REDUCED TRIAL- AND-ERROR LEARNING



For Individuals: Personalized recommendations would help adult learners find the most relevant training programs aligned with their career goals and current skill levels.

02 INCREASED VISIBILITY AND DATA- DRIVEN PROGRAM DEMAND



For JPOA Organizations: AI-powered matching increases program visibility to the right learners, while demand analytics help organizations develop courses that meet real market needs.

CHALLENGES

KEY HURDLES

Implementing AI-powered training pathways could face certain challenges: constant job market data updates needed, integration complexity with public employment system and resource requirements for ongoing maintenance.

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01 DATA QUALITY AND STANDARDIZATION ISSUES



Inconsistent data formats across JPOA registry and job portals. Missing standardized skill taxonomies. Incomplete training program data.

02 SERBIAN NLP LANGUAGE LIMITATIONS



Limited Serbian language NLP models available. Specialized vocabulary for technical skills. Need for custom training data and local language processing tools.

ETHICAL & LEGAL CONSIDERATIONS

BUILDING TRUSTWORTHY AI SYSTEMS

Building trustworthy AI systems requires careful attention to data privacy, fairness and transparency. Responsible AI deployment that protects learners while delivering personalized training recommendations is essential.

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01 **GDPR COMPLIANCE**

Full compliance with Serbian personal data protection law in line with EU data protection regulations

02 **ADDRESSING AI BIAS**

Regular audits to detect and mitigate algorithmic bias in recommendations

03 **TRANSPARENCY & EXPLAINABILITY**

Clear explanations of how AI makes recommendations for users

FUTURE DEVELOPMENT

NEXT STEPS AND INTEGRATION PLANS

Serbia is working on aligning skills taxonomies and job descriptions with ESCO, while ETF has announced the possibility of creating a data system for analysis of OJAs in Serbia.

The AI-driven training pathway system should evolve through strategic partnerships with national institutions, bodies and services, enabling real-time responsiveness to labor market shifts and personalized career guidance.

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01 **EMPLOYMENT SERVICES INTEGRATION**

Direct connection with national employment service for seamless job matching

02 **REAL-TIME LABOR MARKET ANALYTICS**

Continuous updates tracking emerging skills demands and industry trends

03 **AI CAREER CHATBOT**

24/7 personalized guidance helping learners navigate training options



BUILDING THE FUTURE OF ADULT EDUCATION IN SERBIA

STRONG FOUNDATION

Serbia already has a structured adult education ecosystem, with 205 JPOA organizations and 910 training programs approved so far. However, an AI-powered training recommendation tool can align more effectively training offerings with labor market needs.



CALL TO ACTION

Success requires collaboration across government bodies and agencies, JPOA organizations, employers and technology professionals. Together, they can create a future where every adult learner has a clear path to meaningful employment.



THANK YOU FOR YOUR ATTENTION!



LET'S COLLABORATE!



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