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Economic and Social Commission for Western Asia (ESCWA)

REPORT

EXPERT GROUP MEETING ON:

The Fourth Industrial Revolution and the Future of Work in Arab Countries: Towards More Jobs and Greater Innovation 21 DECEMBER 2020

Summary

ESCWA conducted an Expert Group Meeting on the Future of Work in Arab countries. The aim of this virtual meeting was to discuss with regional and international experts the proposed methodological framework used to build ESCWA's Job Monitor and receive feedback on accomplished tasks. The discussion informed the final version of the monitor and proposed a roadmap to improve the framework in its final format. Participants included experts engaged in the labour market policies and the future of work as well as experts in data science, machine learning and artificial intelligence, big data experts and web developers. The meeting also included a tour of ESCWA's demo web application displaying some analysis on the collected data and showing the different parts of its infrastructure. The online meeting was managed through the MS Teams platform over two sessions.

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I. Introduction

1. The aim of this virtual meeting was to discuss with experts from the region and around the world the methodological framework used to build ESCWA's Job Monitor and receive feedback on accomplished tasks as well as propose a roadmap to improve the presented framework.
2. The meeting also included a tour of our demo web application displaying some analysis on the collected data and showing the different parts of the infrastructure in place allowing it to happen.
3. ESCWA job monitor is expected to help ESCWA member states prepare better for the 4th Industrial Revolution (4IR) while factoring in the number of jobs needed between now and the attainment of the 2030 Agenda.
4. The key aim is to support ESCWA Member States for the upcoming change in jobs and skills due to technological advancements taking place, while considering national characteristics.
5. The Expert Group meeting was organized over 2 sessions: the first covering the Job Monitor Methodology and Algorithms and the second covering the Job Monitor Tool Structure.
6. Through the presentations, the team walked invited experts through the entire process starting from collecting the information (job description), cleaning and processing it, the NER employed in place, adding the models results and finally the web application accessible to the users.

II. RECOMMENDATIONS

7. Based on meeting deliberations and discussions, several recommendations were proposed:
 - a. Create an end user group that could provide feedback on the monitor.
 - b. Ensure that the Job monitor includes load balancing mechanism.
 - c. Secure the architecture of the Job Monitor to avoid the intrusion to databases.

1. PRESENTATIONS AND DISCUSSIONS

8. The meeting was opened by Dr.Mehrinaz El-Awadi. It spanned over two sessions. The first session featured presentations on: representation and limitations of data coverage; job monitor methodology on skill extraction; and EMSI approach for skills extraction and classification. The second session featured presentations on: job monitor technical aspects and demo; job monitor backend and infrastructure; and job monitor core engine and live demo. The presentations and discussions during these two sessions are summarized in the following paragraphs.

A. Session 1

9. **Dr. Salim Araji** moderated the first session related to the Job Monitor Methodology and Algorithms.
10. **Ms. Sama Sleiman**, the Project Data Lead at ESCWA, elaborated on the representation and limitations of data coverage. **Ms. Sama Sleiman** went over data sources and online hubs, data coverage, shortages, representation and foreseen limitations. She provided examples on how data availability and coverage could affect the inferences made from the Job Monitor and how the robustness of the tool becomes limited to representative sectors and geographic areas.
11. With regards to data collection, **Ms. Sama Sleiman** mentioned that data was collected from online job hubs. Although several big job hubs did not allow the collection of their data, a few others allowed. She added that the frequency of hubs is disproportional depending on the size of hubs and that there is a discrepancy between postings among countries. She stressed that they aim at increasing both, the number of hubs being considered and the number of countries being covered.
12. As for data cleaning, **Ms. Sama Sleiman** stated that job descriptions were cleaned and sometimes translated. The industries were mapped to the ILO ISIC-V4.
13. When it comes to annotation, **Ms. Sama Sleiman** specified that EMSI's API has been used to extract hard skills, soft skills as well as certifications. She noted that the standardized skills are based on the UK and US market. **Ms. Sama Sleiman** claimed that the goal of this project is to adapt the extracted skills to the ESCWA region, suggest some improvements, and create ESCWA features extractors and add extra tags (i.e., years of experience, field, degree, gender inequality, disabilities and alignment with Agenda 2030). After providing an example of an annotated job description, **Ms. Sama Sleiman** mentioned that there are 66 annotators, open chat streams, mentors, and weekly meetings to make that the annotation process is being perfectly done. Each batch of job descriptions will be annotated 3 times by different annotators to analyse the discrepancies among annotations. The primary goal is to annotate 5000 job descriptions.
14. Discussions arose on the importance of the job monitor when it comes to benefiting universities, knowing that students search for jobs demanded outside their country. It was clarified that building this monitor will enable students in finding jobs that match their skill-set thus aiming at reducing brain drain.
15. Multiple attendees discussed some of the monitor's limitations caused by the differences in job postings frequencies, where some countries have higher job posting frequencies when compared to others. Attendees also raised the issue of the gap between the labour

market and university programs, knowing that universities are still relying on very old systems that might not be any more valid.

16. Discussants also stressed on the importance of communicating with target users, particularly policy makers.
17. They also underscored the importance of human intervention in the process of teaching and creating a good model/algorithm. The issue of the continuity of data collection was raised as well. It was made clear that the intention is to make it an automated process, i.e., a website that demonstrates the updated results daily.
18. **Mr. Jalal Abboud**, on behalf of **Dr. Wael Khreich**, presented a review of existing machine learning and natural language processing approaches for extracting (and normalizing) skills from job descriptions. He then focussed on the most appropriate techniques for the project.
19. **Mr. Maxim Hermez**, who also presented on behalf of **Dr. Wael Khreich**, discussed the techniques for mapping job titles to the skills extracted from the collected data in the aim of monitoring trends at the skill, occupation, and sector level.
20. Participants highlighted the importance of identifying the skills that are advancing versus those that are falling behind. They also made sure that the clustering and grouping of data will not lead to a loss of sense of the raw data.
21. **Ms. Kelly Ryan Bailey** from EMSI presented EMSI's approach for skills extraction and classification. She introduced EMSI's skills and EMSI's open skills libraries as well as showed why EMSI decided to create a data-driven common language of skills in the aim of more effectively connecting jobseekers, educators and employers in a fast changing and ever more complex labour market. **Ms. Kelly Ryan Bailey** demonstrated how EMSI constructed and maintained the active database of over 30,000 unique skills terms and outlined some of the technologies that have been built to help leverage this new language of skills. She particularly focused on EMSI's skill extraction technologies that are supporting UN-ESCWA's project.
22. Regarding the accuracy of EMSI's extractor, it was noted that the re-annotation process will feed into the stream of assessing as well as improving the accuracy of the extractor. In fact, it was mentioned that after annotating a certain batch of jobs, results indicate that 75 percent of EMSI's tags were correctly tagged, whereas 17 percent of the tags were missed and 7 percent were wrong. However, ESCWA aims at increasing the testing sample.
23. Discussions also tackled the importance of hiring many annotators in the purpose of boosting the accuracy of the system.

B. Session 2

24. Session 2 was moderated by **Dr. Nawar Al-Awa**, Regional Adviser at ESCWA.
25. **Mr. Belkacem Ayachi**, Lead Developer at ESCWA, discussed, on behalf of **Mr. Darshan Gadkari**, some technical aspects of the job monitor, particularly its backend and infrastructure. He went over the overall infrastructure, the module, APIs, virtual machines, clouds services and security. Then, **Mr. Belkacem Ayachi** presented the analytics dashboard. Throughout this live demo, he explained the process from end to end: the data collection, processing, machine learning and the different pieces of the infrastructure that make up the ESCWA Future of Work Job Monitor.
26. Concerning ESCWA's job monitor, **Mr. Belkacem Ayachi** demonstrated that it encompasses 4 main sessions that illustrate the following: (i) an analysis of job postings and industry composition at ESCWA member state level; (ii) a regional analysis of job postings, hard skills, and soft skills at industry level; (iii) a regional analysis of job postings, hiring industries, hard skills, and soft skills at job title level; and (iv) a regional analysis of job market at job title level.
27. In the subsequent discussions, presenters explained that the API will be publicly accessible once the project reaches the production stage. They however mentioned that not all data will be public and that this might be limited by the number of requests.
28. They also emphasized that although the number of announcements might be a false indicator for job needs, at this level, we are not differentiating between high and low job turnovers.
29. The discussions that followed revolved around the importance of hosting all the tools in the cloud, while archiving and storing data locally on servers. Regarding the analysis engine, discussants pointed out that the offline analysis must happen regularly, while the online analysis engine which will be answering online queries must occur on demand.

C. Closing Session

30. **Dr. Salim Araji** reiterated that this projects aims at increasing employment for youth(through extracting years of experience), females(through analysing text) and disabled as they have the highest unemployment rates in the Arab region. He highlighted that the project also aims at making sure that the Arab region skills are in line with the sustainable development goals (SDGs) and monitoring to what extent the region is approaching the attainment of Agenda 2030.He also reemphasized that the monitor aims at

enhancing the targets of SDG 8 as well as advancing the employment conditions of Arab citizens.

31. **Dr. Salim Araji** thanked all participants, particularly the partners in the project: ILO that is helping in terms of data analysis and critical thinking and EMSI that is providing ESCWA with its technology so that ESCWA would build on it and be able to monitor the skills, jobs and industries in the Arab region. **Dr. Salim Araji** stressed on the importance of staying in touch with all participants to be able to improve the job monitor based on their expertise.

III. ORGANIZATION OF WORK

A. VENUE AND DATE

32. The meeting was held online through Microsoft Teams platform on 21 December, 2020.

B. OPENING

33. **Dr. Mehrinaz El-Awadi**, the Gender Justice, Population and Inclusive Development Cluster Leader, welcomed to the Virtual Expert Group Meeting distinguished experts who participated to share their knowledge and experience. **Dr. Mehrinaz El-Awadi** also expressed her sincere appreciation and gratitude to EMSI for all their support. She emphasized on ESCWA's unique role in helping member states reach a targeted level of development in line with SDG goals by 2030. She moreover stressed on the important role that the Fourth Industrial Revolution will play as well as its serious impact on how the future of work will look like. **Dr. Mehrinaz El-Awadi** hence made clear the idea of ESCWA's project to establish a job monitor that is expected to help Arab States prepare for the 4th Industrial Revolution while factoring in the number of jobs needed between now and the attainment of Agenda 2030. She mentioned that the meeting is held to discuss the first draft of the methodological framework used to build the monitor in the aim of strengthening the methodology and finalizing a solid Arab job monitor. **Dr. Mehrinaz El-Awadi** concluded by extending her appreciation for the invaluable support of all ESCWA staff members and wished everyone a very successful and fruitful meeting.

34. **Dr. Salim Araji**, the Project Coordinator, gave an overview of the Future of Work Project. He went over the scope of the project, project outputs, and the overall progress. **Dr. Salim Araji** stressed on the importance of the ESCWA job monitor in revealing newly demanded job skills; providing valuable information as regards gender inequalities, disabilities, alignment with Agenda 2030; helping ESCWA member states reduce labor market

mismatches etc. **Dr. Salim Araji** continued by listing stakeholders that could take advantage of this job monitor, such as policy makers, the private sector, UN agencies, academia and civil society organizations. **Dr. Salim Araji** concluded by presenting the road map of the project: data collection, cleaning, machine learning, processing information, the analytics server and finally, the web application.

C. PARTICIPANTS

35. The meeting was attended by 36 participants, including experts who are engaged in the labor market policies and the future of work, as well as experts in data science, machine learning and artificial intelligence, big data experts and web developers. The list of participants is contained in Annex I of this report.

D. AGENDA

36. The meeting agenda is summarized and set forth below:

| Time (Beirut) | Description |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15:00-15:10 | Dr. Mehrinaz El-Awadi, Cluster lead of Gender Justice, Population and Sustainable Development. |
| 15:10-15:20 | Opening Remarks Overview of Future of Work Project, Dr. Salim Araji, Project Coordinator. Coordinator. This presentation will focus on the scope of the project, project outputs, and the overall progress. |
| Session 1 | |
| 15:20-15:40 | ESCWA Job Monitor Methodology and Algorithms Moderator: Dr. Salim Araji, Project Coordinator, ESCWA Data coverage: representation and limitations, Ms. Sama Sleiman, Project Data Lead, ESCWA This presentation will go over data sources and online hubs, data |

coverage, shortages, representatively and foreseen limitations.

The presentation will give examples on how data availability and

coverage can affect the inferences made from the Job Monitor

and how the robustness of the tool becomes limited to representative sectors and geographic areas.

Discussion

Job Monitor Methodology on Skill Extraction Prof. Wael

Khreich, Project AI Lead, American University of Beirut/

ESCWA

This presentation will provide a review of existing machine learning and natural language processing approaches for extracting (and normalizing) skills from job descriptions, then

focus on the most appropriate techniques for the project. It will

also present techniques for mapping job titles to the skills extracted from our collected data, to be able to monitor trends

at the skill, occupation, and sector level.

Discussion

EMSI Approach for Skills extraction and classification

In this session EMSI will introduce EMSI's Skills and EMSI's open skills library. The presentation will show why EMSI embarked on this ambitious project to create a data-driven common language of skills to more effectively connect jobseekers, educators and employers in a fast changing and ever more complex labour market. The presentation will show how EMSI constructed and maintained the active database of

over 30,000 unique skills terms and will outline some of the technologies that have been built to help leverage this new language of skills, with a particular focus on EMSI's

15:40-16:00

16:00-16:30

| | |
|--|-------------------------------------------------------------------------------------------------------|
| | <p>skill extraction technologies that are supporting UN-ESCWA's project.</p> <p>Discussion</p> |
|--|-------------------------------------------------------------------------------------------------------|

| Session 2 | |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16:30 -16:50 | <p>Job Monitor Technical Aspects and Demo Moderator: Dr. Nawar Al-Awa, Regional Adviser, ESCWA</p> <p>Job Monitor backend and infrastructure, Mr. Darshan Gadkari, data scientist and developer, ESCWA This presentation will talk about the overall infrastructure, the module, APIs, Virtual machines, Clouds services and security.</p> <p>Discussion</p> |
| 16:50-17:10 | <p>Job Monitor core engine and live demo, Mr. Belkacem Ayachi, data scientist, ESCWA: This presentation will go through the analytics dashboard, explaining the process from end to end: the data collection, processing, machine learning and the different pieces of the infrastructure that make up the ESCWA Future of Work Job Monitor.</p> <p>Discussion</p> |
| 17:10-17:30 | |
| 17:30 - 18:00 | Closing session and Future steps |

Annex

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