ANALYZING THE EVOLUTION OF IN-DEMAND SKILLS IN THE SAUDI JOB MARKET USING MACHINE LEARNING

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1.1 Introduction to the Research

In the fast paced world economy, countries are changing profoundly in terms of labor market activities. This is especially true for The Kingdom of Saudi Arabia, which is undergoing significant change through its Vision 2030, focusing on diversifying the economy, cutting down oil reliance, and channeling resources into technology, innovation, and human capital. Consequently, the Saudi labor market's skills requirements are perpetually shifting, and education attaining labor market relevance has emerged as a critical national goal.

Traditional practices of analyzing labor markets by means of fixed surveys and manual coding no longer pass muster in an increasingly real-time and technology-disruption-impacted environment. Today's employers expect workers to be more technologically competent, flexible, and responsive. Policymakers, schools, businesses, and even job hunters must track the changing needs of the necessary skills.

This research tries to explore how the most sought-after skills in the Saudi job market changed during the recent years. It uses machine learning software power to examine massive datasets from job sites, i.e., LinkedIn, Bayt.com, GulfTalent. By doing this, the research constructs a complete, metrics-driven image of trends behind labor demand in fields such as information and communication technology, healthcare, engineering, finance and public sector.

Delivery of Intervention in Higher Education Studies One of the primary motivations for this study in higher education is the increasing misalignment of qualifications by higher education graduates and employer needs. Because of the incompatibility between what was provided by the curriculum in schools and the requirements of the labour market, most Saudi graduates lament that they cannot find jobs not because they are not well educated, but because they lack the skill set required to integrate into the local labor market. Thus, with the advance of time coming with new and lost skills acts as a vehicle that bridges this gap and provides evidence-based advice to academic planners, vocational training providers, and national employment policy..

Unstructured job posting text is open to being analyzed with machine learning models like natural language processing (NLP) and clustering that allow automated extraction and categorization of job skills. Compared to conventional survey-based competency evolution analysis, these models impose accuracy and ongoing accuracy. Machine learning also detects latent patterns and relationships uninvestigated in manual approaches.

This research also points to the socio-technical perspective of labor changes in Saudi Arabia. The pace of digitalization is creating new jobs and skills, particularly in data science, cybersecurity, artificial intelligence and cloud computing, while making other, conventional jobs obsolete. These young people are also discovering new professions, as net talent needs are leading, not only technological change, but also social change, as systems shift to attract, train and retain talent.

Another key characteristic this research examines is the distribution of skill demand across gender and geographic lines. The government of Saudi Arabia aims to achieve Vision 2030 through enhancing women's employment and empowering underdeveloped regions. It is significant to examine the distribution of skill demand patterns across groups and areas which is key input to craft labor policies that ensure greater opportunity on an equal basis across the Kingdom.

Overall, the study presents a timely and reflective examination of the ways that high-demand skills are evolving within the Saudi labor market. The study illustrates various mechanisms through which machine learning methodologies have the capability to improve labor market intelligence and inform more evidence-based decision-making within education, workforce development, and economic development. Through this transdisciplinary effort, the study contributes to making real the national objective of developing an educated, competitive workforce responsive to the challenge and opportunity represented by the 21st century.

1.2 Problem Background

The Saudi Arabian job market is undergoing a sea change, fuelled in part by national efforts, international economic trends, and technological changes. There have been numerous policy reforms in the last few years that have included strategic plans such as Vision 2030, the Human Capability Development Program and others, all of which have collectively changed the socio-economic landscape at the national level. Re-calibrating what skills are worth something and in demand across sectors is underway.

In a nation such as Saudi Arabia, job seekers have hitherto relied on qualifications to offer a first-step access to the employment market, hoping that education would open up career prospects in the public and private sectors. But it has become an old-fashioned model in today's employment market, where employment is shifting at an increasing pace and employers are relating working expertise, IT competence and curricula flexibility to educational qualifications only.

Disconnect between educational learning and required employment has caused increasing numbers of graduates to become unemployed even in possession of qualifications. Meanwhile, numerous companies are complaining that they cannot fill some of their core positions because of a lack of suitable candidates holding the exact desired skillsets necessary. This served to highlight one of the areas where new data-driven insight to the form of developing skill needs is needed most.

Compounding this is the sudden technology change that is redefining work descriptions, producing new jobs, and replacing others. Rapidly emerging are data analysis, cloud computing, artificial intelligence, and cybersecurity careers, while repetitive and manual careers are disappearing. Without constant observation and analysis of these trends, schools, policymakers, and workers can get left behind.

Even though one can get job data on the Internet, there is no systematic research that monitors how certain skills come into or out of vogue over time. Research carried out in academia is narrow in focus and does not help in projecting contemporary trends in the labor market. Such a limitation bars it from contributing something substantial towards shaping educational output, workforce training, and national manpower policy

This research attempts to bridge this gap by using machine learning methods to examine job advertisements and make effective inferences on how marketable skills vary between industries in Saudi Arabia. Through this, it seeks to provide a dynamic fact-based perspective that connects the education sector to the employment sector.

1.3 Problem Statement

As Saudi Arabia is leading its national transformation according to Vision 2030, the labor market is transforming into a digitally enabled, knowledge-based economy. Nevertheless, in spite of thousands of job openings available on digital platforms, one can observe the lack of systematic, analytical methods of monitoring and forecasting the development of in-demand skills across sectors. The difficulty is not just in the fast speed at which the job roles are changing but also in the fact that traditional labour market analysis cannot measure live real-time skill developments with data-driven and scalable approaches.

Increasingly, the increasing imbalance between employers' actual needs and the qualifications of job applicants has contributed to raising the need for knowledge

about how necessary skills shift with time. Significant numbers of graduates are being kept out of employment or remain underemployed because the training schemes are equated to the demands of the labor market with delay. Meanwhile, the employers document shortages in primary areas of expansion including technology, finance, and engineering.

Classical models of workforce planning are generally not taking the strength of present data analysis to bear. Traditional workforce planning models are static, cyclic, and predominantly manual-based data collection. Education, economic, and policy planners are thereby challenged to make effective adaptive programs in response to labor market requirements.

Missing is an automated, scalable, and smart platform capable of scanning persistently for job postings and inferring helpful things about skill needs in a local setting. A creative solution to fill the gap between university output and market demand based on advanced machine learning methods must be designed for Saudi Arabia.

This study fills this void by using machine learning techniques on Saudi Arabian online labor market data to determine the development of in-demand skills over time. The long-term goal is to improve national labor market information and enable more informed, data-driven education planning and workforce planning

1.4 Research Objectives

The main objective of this study is to examine the acquisition of desirable skills in the Saudi Arabian job market through the application of machine learning methods. In line with this overall objective, the study aims to attain the following particular :objectives

1- To obtain and preprocess authentic job market data from leading online job search websites like LinkedIn and Bayt.com, handling job advertisements pertaining to .different parts of Saudi Arabia

2- To use machine learning algorithms—such as natural language processing (NLP)— .to extract and classify job skills from unstructured job advertisement text

3- To detect patterns and trends in demand for certain skills over time, distinguishing .between emerging, stable, and declining skills by sectors and regions

4- To analyze the match between available academic output and real demands of the Saudi labor market, especially in rapidly changing sectors such as technology and .finance

5- To offer strategic recommendations and inputs to policymakers, educators, and training institutions to close the skill gap and prepare future graduates with in-demand .skills in the market

6- To facilitate a replicable, data-driven method for frequent monitoring of labor markets using machine learning that can be applied to other domains or future updates.

1.5 Gap Analysis

Even with greater focus on trends in Saudi labor markets—especially within the context of Vision 2030—there is still to be a perceived gap between skills with which candidates are offered for employment and those sought by employers. There have been numerous reports pointing out that the majority of graduates go into employment lacking the hands-on, technical, or digital skills required for success in today's labor market. Since schools go on producing quality professionals, the compatibility of academic product with real industry demands is still tenuous or obsolete.

Current evidence regarding Saudi Arabian labor market demands has been mainly rooted in static surveys, periodic government reports, or broad economic metrics. Even though these indicators present useful macro-level information, they are often not adequate to account for up-to-date changes in skill demands—most significantly, in high-paced sectors like information technology, artificial intelligence, cybersecurity, and data analytics.

Furthermore, few prior studies used machine learning methods to extract and study labor data from actual job postings across various websites. This is a large blind spot in the labor market intelligence, where most academic and institutional analyses are unable to leverage the vast amount of online, real-world labor data now at their disposal.

Another under-explored aspect in earlier research is the temporal dynamic of skill demand—how the saliency of particular skills increases or declines. This trend is critical to understand in terms of future policy-making, academic restructuring, and workforce planning.

Moreover, most local studies have a tendency to emphasize national-level data with inadequate sensitivity to regional or sectoral variations.

Consequently, the inferred outcomes are typically too aggregated to provide input to targeted interventions.

The value added of this research in this paper is to fill such gaps by means of machine learning-driven real-time tracking of Saudi employment market trends. Specifically, it aims at monitoring changes of on-the-rise in-demand skills, organizing unstructured job descriptions data, and providing actionable insights to facilitate decision-making by education, policy, and labor authorities**.**

1.6 Scope of the Study

This research is centered around the examination of high-demand skill emergence in the Saudi labor market using machine learning methods. The focus is specifically chosen to span domains of interest, enabling precise but overall insights into trends within the labor market.

The study is mainly derived from the Kingdom's online job portals, including LinkedIn, Bayt.com, and GulfTalent, which show recent job openings in the Kingdom's different sectors. The database contains job postings that were submitted within a specific time frame to enable temporal analysis of skill demand.

The territorial coverage is within Saudi Arabia, focusing on the key economic areas of Riyadh, Jeddah, and the Eastern Province. However, regional variations in the skills needed where data are available are also taken into account.

The research examines a variety of critical sectors, notably information technology, engineering, healthcare, finance, and public administration. These sectors have been identified on the basis of Vision 2030's strategic priority to them and their active presence in the online labor market.

Technically, the project uses natural language processing (NLP) and machine learning algorithmic methods to extract and categorize skills from unparsed job postings. It has no interest in salary predictions, job openings forecasts, or individual career guidance because these are beyond the given scope

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In addition, the study does not include offline employment adverts or government records of employment since emphasis ought to be on online, instantaneous signals in the labor market. Although this restricts coverage to digitally presented jobs, it enables scalability as well as relevance within a contemporary data-driven labor market.

In general, the research aims to offer strategic knowledge that can be used to inform curriculum design, vocational training curricula, and national-level labor policies, respectively, regarding current and emerging trends in skill demand.