Toward a better analysis and exploration of the Saudi labor market using data visualization techniques

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Abstract

The acceleration rate of data growth and the emergence of new data types (such as images, tweets, etc.) have made it necessary to create more methods to visualize, present, and analyze data for a better understanding. Therefore, data visualization techniques have been expanded to include new and complex techniques corresponding to the exponential rate of data growth. This paper aims to investigate the use of data visualization to explore and gain insights into the labor market in Saudi Arabia. Varied visualization techniques were used such as (map, scatterplots, theme river, etc) to give the best representation of the data. This visualization of labor market data in Saudi Arabia enables us to gain critical insights into the following four aspects: women's status in the labor market of Saudi Arabia, foreign workers' effect on Saudis' employment rate, economic activities in the labor market in Saudi Arabia, and a discussion of the important factors that affect labor market distribution in Saudi Arabia (including administrative areas, age groups, and educational levels). This paper also provides related works and suggestions for future improvement.

1 Introduction

Middle Eastern countries have historically relied on foreign workers to provide goods and services for their economy. The Gulf Cooperation Council (GCC) area, according to the International Labor Organization (ILO), hosts 10% of the world's foreign employees and has the greatest number of non-nationals in the workforce (over 70%). By the end of 2019, more than three-quarters of the 13.4 million people working in Saudi Arabia were foreigners, creating the world's third-largest foreign population. In the remainder of the Gulf, the percentage of non-nationals employed is considerably greater. For example, in Kuwait and Oman, it approaches 80%, while in Qatar, it reaches over 95% [6].

Following the COVID-19 pandemic and the economic slowdown that it caused, numerous foreign workers are returning to their home countries, leaving a large gap that skilled Saudi workers can easily fill, as the country is already implementing the Saudization Program of Vision 2030, which requires expatriate workers to be gradually replaced by local workers. The Saudization Program of Vision 2030 also focuses on women and their presence in the labor market, as new rules have been implemented to provide women at various educational levels with many jobs in various fields to solve the increasing unemployment problem among women.

Additionally, the Saudi government is providing open government data for public use in accordance with Saudi Vision 2030's goals. This is because the availability of data is crucial for

researchers and entrepreneurs, software developers, economists, etc., and one of the ways in which to benefit from this data is data visualization through which the data can be mined and explored [5]. Data visualization of complex and large data aids decision-makers in making executive strategic decisions [15]. In addition, data visualization makes data easy to understand, allowing insights to be extracted more easily [12] On the other hand, data visualization is challenging, as there are different visualization techniques, different types of data, and different users.

In this paper, we use open government data related to the labor market in Saudi Arabia, as detailed in the data acquisition section. Our research aims to:

- Obtain insights into the current state of the labor market in Saudi Arabia using data visualization techniques.

- Labor market in Saudi is a concerning topic by many socioeconomics researchers as seen in the related work. Therefore, we want to contribute to this field by giving a better representation of the subject through using visualization technique.

- Explore the effect of using interactive information visualization techniques that can be used with similar datasets with appropriate adaption.

This paper also presents the labor market of Saudi Arabia based on the following four core aspects:

- Saudi women and their position in the labor market

- Foreign workers and their impact on the Saudi labor market and the changes needed to increase the Saudization rate

- Economic activities in Saudi Arabia and their role in the labor market

- The most important factors affecting the distribution of employment among Saudi persons.

The remaining of our paper is organized as follows: Section 2 discusses works related to the Saudi labor market and the most important factors affecting it depending on the classification of Saudi gender equality and foreigners' impacts. Section 3 describes the methodology used in this report to address the extracted insights, while the results and the discussion thereof are presented in Section 4. Finally, a conclusion and plans for future work are provided in Section 5.

2   Related work

Providing solid and up-to-date statistics for the labor market plays a critical part in labor market research, decision-making support, the conveyance of work issues to the overall population, and the informing of the population about market improvements [16]. Therefore, many research papers discuss the labor market from different perspectives, and in this paper, we present labor market research related to Saudi Arabia per the following categories:

Unemployment causes and solutions

An estimation of financial expenses of unemployment in Saudi Arabia using different approaches provided by [11] and their result is 851.5 billion SAR annually (227.09 USD billion or 29.97% of the gross domestic product [GDP]). In their paper, they also emphasize the social effects of unemployment and suggest a program for true and full employment, namely the job guarantee

(JG) program, which provides a public policy for job creation for Saudi youth in different sectors. Notably, this program only costs one-fifth of the cost of unemployment.

Recently, young people have turned toward self-employment instead of working in the private or public sectors (the simplest example is the increase in food trucks), mostly due to unemployment. AlObaid [3] studies who the target group for this field is, whether in terms of age, gender, or educational level, by using the dataset of the Labor Force Direct Survey (LFDS) and a sample of 1100 participants who became self-employed by 2017. They find that the self-employed tend to be young males (from 20 to 35 years) with a preference for working in the telecommunication sector, a high school certificate, and monthly earnings of between 7001 and, 10000 SR. Their findings also show that the most cited reason for 90% of males being self-employed is a preference for being their own boss. For 89% of females, however, the most motivating reason is the opportunity to earn more money. The limitation of this study is that it excludes individuals who attended a private pre-school.

One of the most important foundations for the success and revolution of the Saudi market is guiding young people at an early age to determine their labor market trends. Thus, in our research, we address this important point by focusing on this category in terms of education or training. Yusuf and Albanawi [17] emphasize the training and education sector's efforts to help young people keep up with the demands of the Saudi labor market. The results of the questionnaire distributed to the contributors (to a sample of 350 professionals working in Saudi Arabia's education sector) show that the Saudi education system is effective in supporting the local population's labor market needs, with some suggestions to add solutions to solve the unemployment problem, particularly for women. However, the absence of women's engagement in the Saudi labor market is a limitation of this study due to the cultural and social structure of that period of time where the study conducted.

Saudization and the impact of foreign workers

In [7], a comparison is conducted between the Saudi and non-Saudi unemployment and employment rates in both the public and private sectors. In this paper, the authors find that Saudi workers are dominant in the public sector and earn higher wages and greater benefits. On the other hand, there are more foreign workers in the private sector, but they earn lower wages and barely any benefits. Additionally, employed foreigners have a more consistent and balanced gender ratio, with the number of employed male Saudis being double that of females. The paper also discusses the current solutions that are subject to the balance in the citizens' employment rate in both sectors, such as Saudization, the Hafiz Program, the Nitaqat Program, etc., and suggests some enhancements and advancements for these solutions to make them more effective, in addition to emphasizing the enforcement of gender equality policies. Contrarily, Hertog [10] discusses whether Saudis are aware of Saudi Human Resource Development Fund programs such as the Hafiz Program. The results thereof are presented in Figure 1.

A report that King Faisal Center for Research and Islamic Studies (KFCRIS) published [9], similarly to what [7] finds, inspects the gap between workers' rights and costs in the public and private sectors among Saudi and foreign workers. The report provides solutions that are used in other GCC countries for solving the same problem in Saudi Arabia. For instance, applying a fee-subsidy system, as in Kuwait, and changing sponsorship policies, as in the United Arab Emirates and Bahrain, or giving foreigners a residency status not attached to a particular employment status could eventually result in closing the cost and right gap and enforcing Saudization in the private sector.

Similarly, [1] discusses the impact of foreign workers on the labor market in Saudi Arabia
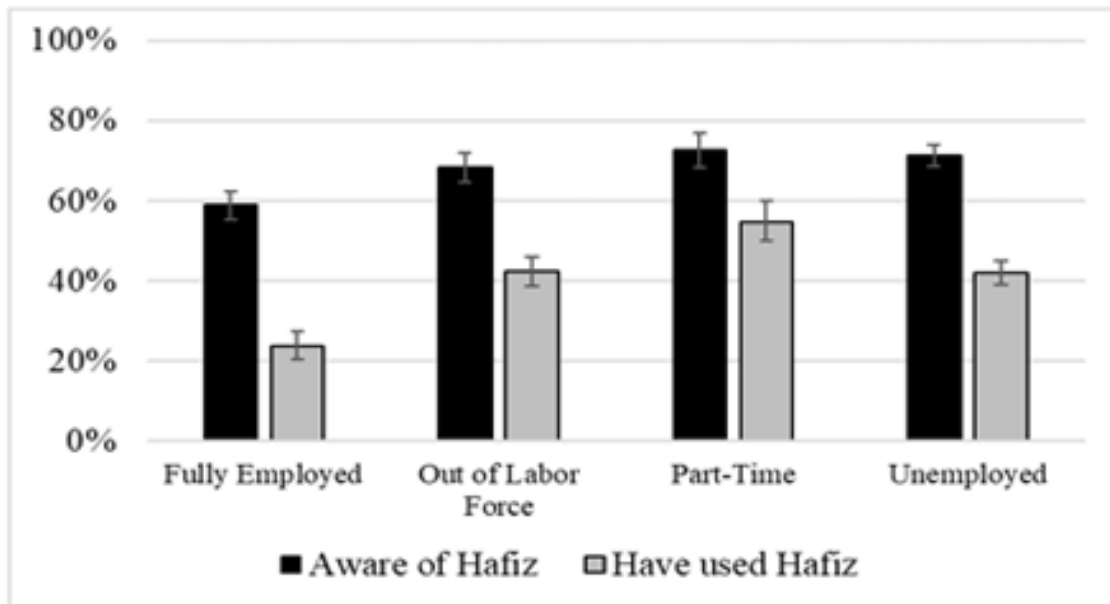
Figure 1: Awareness of the Hafiz Program

by conducting a structural analysis of the foreign workforce. This analysis includes the need to consider the "value of labor power" in addressing the truth of foreigners' division of the workforce in GCC nations in general and in Saudi Arabia specifically. That is, businesses control foreign workers through the sponsorship system (Iqama and Kafala), which results in prejudicial practices to guarantee that work expenses are minimal, limiting them from improving their ways of life or moving to other sponsors. Moreover, they disregard skillful workers yet keep away from workers who could accrue significant expenses (e.g., Saudis, particularly females).

In [6] they examined how one policy, such as Saudi Arabia's Nitaqat Program, affects the outcomes of exporting enterprises and non-oil companies, which form part of the economy's most productive sector. According to the researchers, Saudi workers' higher salaries are not offset by higher worker productivity, and their estimations indicate a drop-in output per worker. Firms also appear to have expanded their hiring of low-paid, low-skilled Saudi workers to meet their quotas. Therefore, a long-term study could provide additional information about the methods that companies should use for their hiring, which is a limitation of this research since it is focused on the short to medium term.

Female participation in the labor force

The study in [13] indicates that the unemployment rate of females is higher than that of males, despite their educational level. For instance, 68 % of females with academic degrees or higher are unemployed compared to 21 % of males. Their paper emphasizes the exigency of policies that prevent gender discrimination, providing more job opportunities for educated women and boosting their engagement in the economy. According to the results of [4], Saudi Arabia has

sufficient accomplishments in education enrollment at all levels, and it has achieved gender equality in education. Notably, the paper finds that females excel in global and local assessments. On the other hand, the results show inequality in employment and wages between women and men that requires the rescaling of payment policies to be based on achievements rather than the employee's gender. The paper goes on to recommend not restricting job opportunities for women to specific domains. Women's engagement in the Saudi labor market may not require them to go to work but rather to communicate online, especially with the advancement of electronic communication and its widespread availability throughout Saudi Arabia. Therefore, [4] investigated Saudi women's attitudes, social and economic traits, and empowerment in the online labor market. The paper shows that marriage is the most important social element influencing women's empowerment in the online labor market. Furthermore, it shows that high-income women are the most likely to work online since this provides them with an optimal and effective atmosphere in which to strive and succeed. Firm demand for female labor has been explored in Saudi Arabia, where gender segregation is the norm and employing both men and women is costly. These researchers seek ways to enhance the involvement of Saudi women in the labor market, which had previously been low. However, due to the presence of the Nitaqat Program, female Saudi employment has been increased by persuading businesses to integrate women into their workforces. Now, more women in general, more women with lower skill levels, and more married women are likely to join the labor force. However, the study's limitation is that the data used (GOSI) do not include non-Saudi workers, who comprise a significant portion of the private sector workforce [14].

The Impact of The Covid-19 Pandemic on the Saudi Labor Market

More recently, attention is being paid to the COVID-19 pandemic and its impact on certain aspects. Similarly, [2] aims to examine the effects of COVID-19 on the Saudi labor market. Specifically, people are becoming unemployed or working for lower earnings because of lockdowns and firm closures, resulting in a unique type of career shock in the worldwide employment market. Furthermore, this event has caused a negative feedback loop among workers, encouraging them to learn a new skill set to take advantage of this rare opportunity. This has necessitated a re-alignment of and robust engagement between labor markets and educational institutions. Data are gathered in [2],through a survey of 234 public and private sector employers to learn about their perspectives on the new skill set necessary in the changing business climate during and after pandemics. It is suggested, therefore, that Saudi Arabian institutions can innovate in this area by studying and adapting shifting market needs into their curricula. By doing so, they can not only contribute to the reconstruction of the domestic labor market with Saudi citizens; they can also support the country's Saudization policy.

3   Methodology

To achieve the purpose of visualizing the data and getting helpful insights, the visualization process is done in four stages, as seen in Figure 2. Each stage is explained as follows:

Data Acquisition The General Authority of Statistics (GASTAT) is the source of all data used in this paper[1]. The data consist of three datasets, namely the labor market of Saudi Arabia statistics from 2017 to 2021 (Q2), the administrative area of Saudi Arabia and its population in 2019, and the number of establishments involved in each economic activity in Saudi Arabia in 2019

Understanding and Exploration of The Data

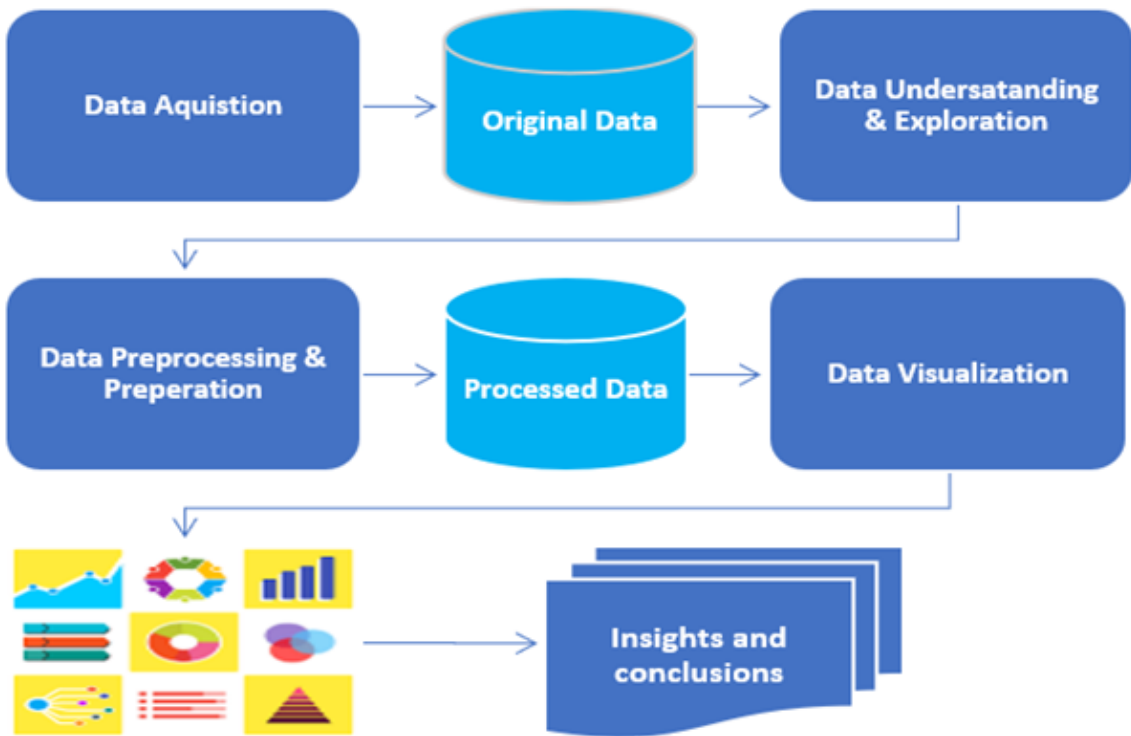---

[1] https://www.stats.gov.sa/en

Figure 2: Frame Work for the Visualization Process

In this step, we attempt to understand and explore the available data from the three datasets mentioned in the previous step to select the required data. Subsequently, the selected data are: The total number of employed and unemployed persons (Saudi and non-Saudi, both genders); the total number of employed persons by gender, nationality, sector (governmental, private), administrative region, age group, and educational level; the main groups of occupations (technicians, associate professionals, managers, etc.); the main groups of economic activities (e.g., agriculture, forestry, fishing, manufacturing, etc.). Aside from the labor market data, we require additional data, such as the population of each administrative area in Saudi Arabia (2019) and the number of establishments involved in each economic activity in Saudi Arabia (2019).

Data Preprocessing and Visualization

Following the above, the data are prepared to be presented by using suitable visualization techniques. Specifically, we use Tableau [2] to create the presentations of the data, and the preparation process includes joining related tables from the three datasets by using a common column in each table. For example, we join the labor market data and the population data with an administrative area column. This also includes removing unwanted columns or rows that do not serve the visualization, provide faulty insights, or are not required in this context.

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[2]https://www.tableau.com

4   Results and discussion

The results are discussed and analyzed in terms of four different aspects: women's status in the labor market of Saudi Arabia, the effect of foreign workers on Saudis' employment rate, economic activities and the labor market in Saudi Arabia, and important factors that affect the labor market in Saudi Arabia. Another important relation to investigate is the relation between gender and types of occupation.

Women's Status in The Labor Market of Saudi Arabia

To obtain insights into the current status of female employment in the Saudi labor market, we analyze the relations between gender and the employment rate, as well as the relationship between gender and educational level.

Enforcing Gender Equality to Increase the Female Employment Rate Although the number of male Saudi employees was still more than double the number of female Saudi employees between 2017 and 2021, as shown in Figure 3,there was a noticeable increase in the number of female employees after 2019 that continued until the end of the second quarter of 2021. This noticeable increase may have been due to the job opportunities that certain regulations have provided for females, such as requiring saleswomen in every store that sells women's commodities. Furthermore, new fields that are different from what women were accustomed to and that were limited to males are now available for women.

Allowing women to drive has also given them the opportunity to commute easily and cheaply, which has resulted in them accepting or considering jobs that they could not accept before due to transport problems. Another factor that affects the female employment rate is Saudi's restrictive culture [8].

• The Relationship Between Gender and Educational Level (2021 Q2)
Through an examination of the employment rate in 2021 (Q2) of Saudi persons based on their gender and educational level, as shown in Figure 4, we notice that there is no significant difference between the percentage of employed male Saudis and the percentage of employed female Saudis with the same educational level. However, the unemployment rate of female Saudis is much higher than that of males, especially those with a bachelor's degree, followed by those with an upper secondary education (those with a diploma or something similar obtained after high school).

• The Relationship Between Gender and Occupation (2021 Q2)
As shown in Figure 5. The number of male Saudis is higher in all types of occupations than the number of female Saudis. On the other hand, the number of employed women is higher in both clerical support and professional work than in any other occupation.

The Effect of Foreign Workers on Saudi's Employment Rate

Foreign workers are part of the Saudi labor market, so we intend here to explore their effects on Saudi's employment rate. We also discuss the efficiency of the measures that the Saudi government has taken to increase the employment rate. Notably, the least number of employed women is in jobs that are of Saudi Arabia. These jobs include crafts, fishery, and plant and machine operation.

• The Effect of Certain Rules and Measures that the Saudi Government Has Implemented to Increase the Employment Rate Among Saudi Persons in the Private Sector
By looking at Figure 6, we can see a significant difference between the number of employed Saudi persons and the number of foreigners in the private sector from 2017 to 2021 (Q2). This major difference could be due to many reasons, including that mostly Saudis prefer government jobs because they provide higher salaries and better benefits, and private sector employers prefer foreigners who
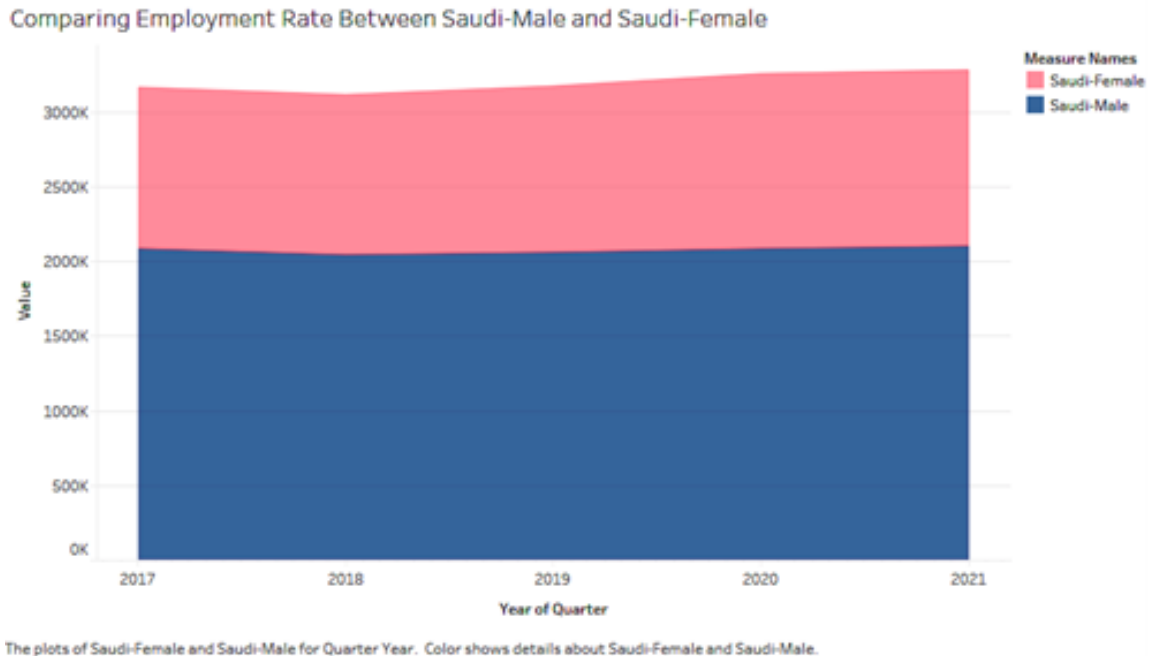
Figure 3: The Employment Rate Based on Gender

may be satisfied with lower wages and more working hours. Nevertheless, there was a large decrease in the number of employed foreigners after 2017, which might have been as a result of certain rules and measures that the Saudi government implemented to ensure the employment of Saudi persons in the private sector, such as Saudization, the Nitaqat Program, etc.

• The Relationship Between the Total Employment Rate of Foreigners and the Employment Rate of Saudi Persons

To better understand the effect of foreign workers on the Saudi labor market, we can look at the number of foreign employees in general from 2017 to 2021 (Q2), as shown in Figure 7. Saudi labor market indicators are the employment rate, unemployment rate, labor force participation rate, and share of working-age people not in the labor force, as shown in Figure 8. In the previous section, the employment rate of Saudi workers compared to that of foreigners in the private sector and in general is discussed. The unemployment rate of non-Saudis can be explained as follows: Many foreigners come to Saudi for work, but if they do not have a sponsor after a certain period of being in Saudi Arabia, they will be deported; thus, there is a very low unemployment rate among them. Likewise, the share of working-age people not in the labor force can be explained as follows: There are specific age groups that are granted a working visa in Saudi Arabia.

Economic Activities and The Labor Market in Saudi Arabia

The diversity of economic activities in Saudi Arabia can be the result of diversities in job opportunities. Therefore, in this section, we shed light on the most promising economic activities and the employment rate of Saudi persons in these activities.
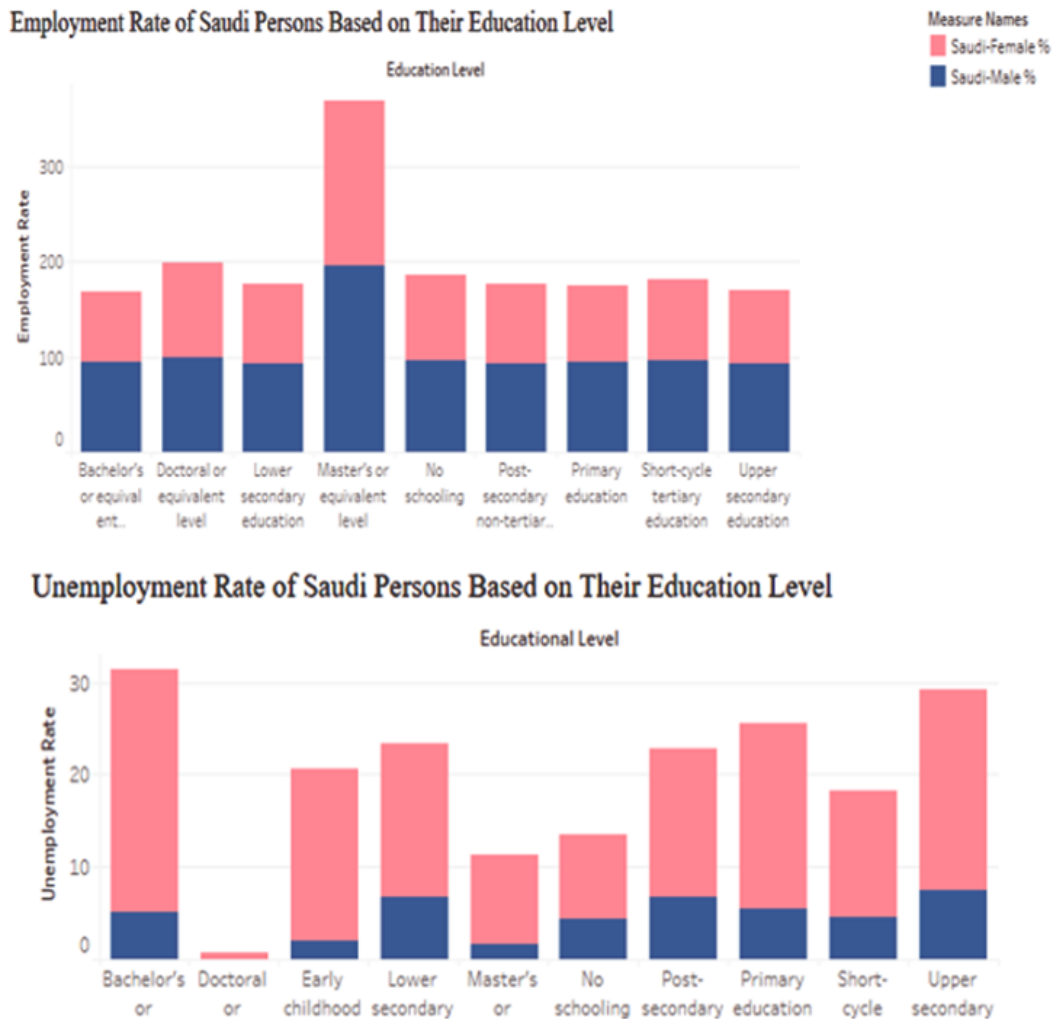
Figure 4: Education Level Based on Gender

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The Most Promising Economic Activities in the Labor Market of Saudi Arabia

Creating new jobs is much easier if new markets are created first. According to the GATA's data, there are many economic activities other than oil and mining in Saudi Arabia, and the number of establishments varies from one economic activity to another. As seen in Figure 9, there are activities with high revenue, many establishments, and the highest total number of employees,
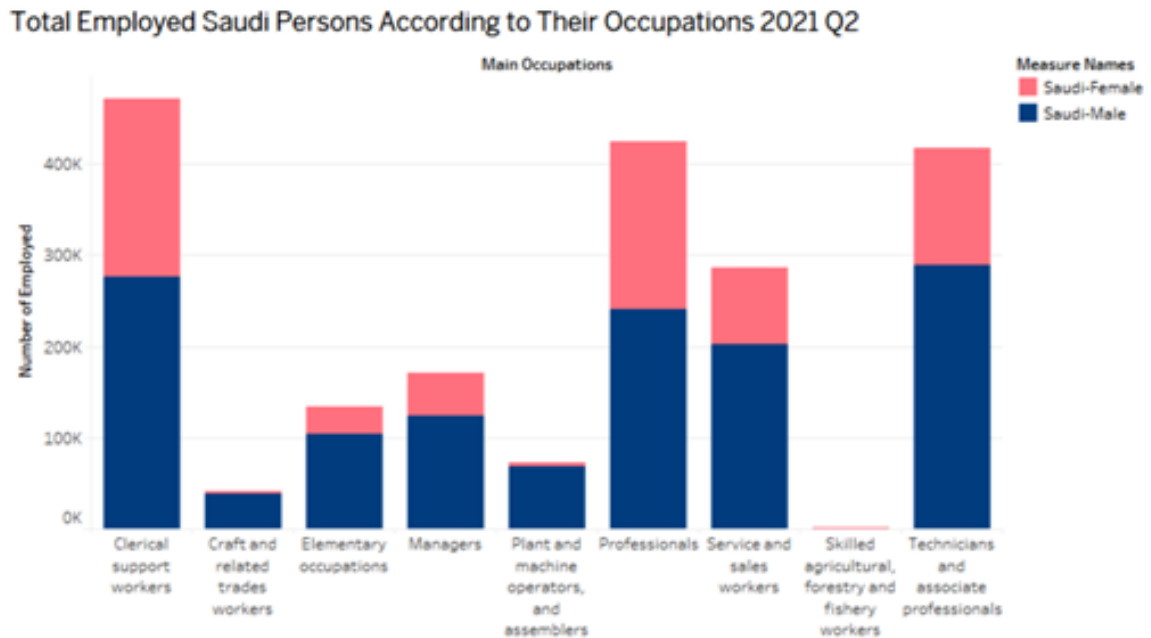
Figure 5: Total Employment Rate Based on Occupation and Gender

such as wholesale and retail trade, but there are also activities with a high number of employees but few establishments and low revenue, such as construction, health care, and social work.

On the other hand, there are activities with high revenue and many establishments but a very low total number of employees, such as manufacturing. Therefore, decision makers should consider these economic activities with high revenue and many establishments as opportunities to increase not only the employment rate (by creating new establishments) but also improve the overall economy. Similarly, these economic activities with low revenue should be evaluated to address the problems and opportunities that they entail, if any.

• The Increasing Employment Rate of Saudi Persons in Certain Economic Activities
Another approach to economic activities in Saudi Arabia can also be considered, namely examining the employment rate of Saudi persons in each activity who are subject to the rules and regulations of social insurance. For instance, the question of why some activities have a high number of foreign employees compared to Saudis, such as administrative and support services, accommodation, and food services, should be answered. Moreover, in some activities, such as agriculture, forestry, fishing, the arts, entertainment, and recreation, there is a very low number of Saudi employees, but there are activities in which there is an equal number of female and male employees, such as education, human health, and social work, as seen in Figure 10. Notably, there are numerous factors that affect the variance in employment distribution among economic activities based on gender, such as social and cultural taboos in Saudi society and the physical requirements of some activities that are

Total Saudi and Foreign Persons in Private Sectors 2017-2021 Q2

The plots of Total-Foreign Private and Total-Saudi Private for Year Year. Color shows details about Total-Foreign Private and Total-Saudi Private.
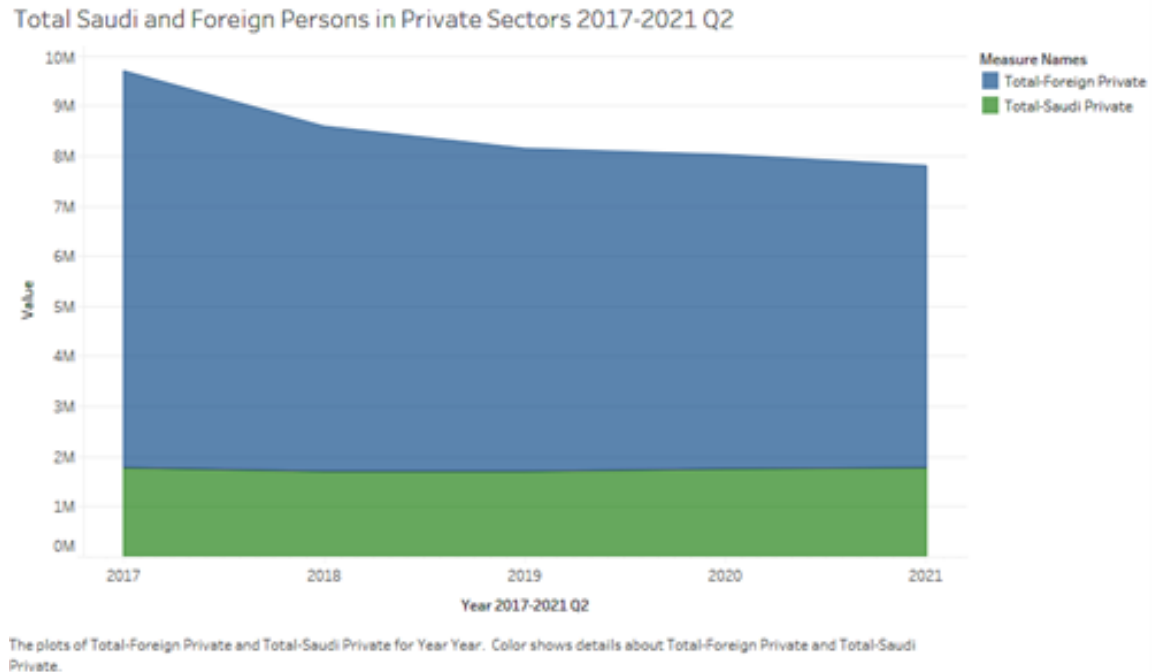
Figure 6: Comparing Total Employment Based on Nationality in Private Sector

perhaps unsuitable for certain genders. Similarly, there are factors that affect the distribution of the number of employees in economic activities based on nationality, such as Saudis favoring some jobs over others.

Important Factors That Affect the Labor Market In Saudi Arabia

There are other factors affecting the distribution of job opportunities among Saudi persons, including administrative areas, age, and educational level. We analyze these factors as follows:

- Administrative Region

There seems to be a relationship between the population and the total number of employed people in a certain administrative region. (Note: Population data are based on data from 2019.) We look at the labor market in Saudi Arabia from different perspectives to get an overview of the factors that affect the number of Saudi persons employed and their distribution in different regions, as seen in Figure 11. Mainly affected by the population of each administrative region and the political state of the region, as in Riyadh, the capital of Saudi Arabia, the economic state, as in Mecca, which contains the most important seaport and is the destination of Islamic pilgrimages.

- Age Group

There also seems to be a relationship between age group and the total number of employed persons in that age group (according to data from 2021 Q2). That is, the employment rate is generally affected by age groups, as some groups have a higher rate of employment than others. As seen in Figure 12, people aged 15–64 (the working-age population), people aged 15–24 (those just entering the labor market following education), and people aged 25–54 (those in the prime of their working lives) have
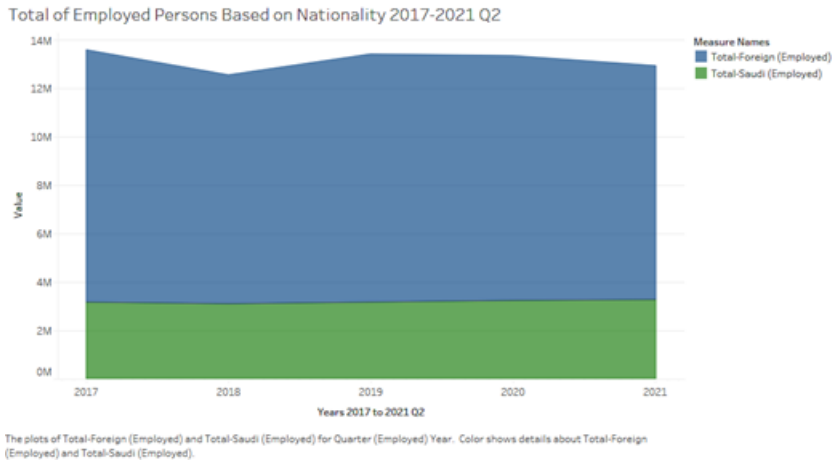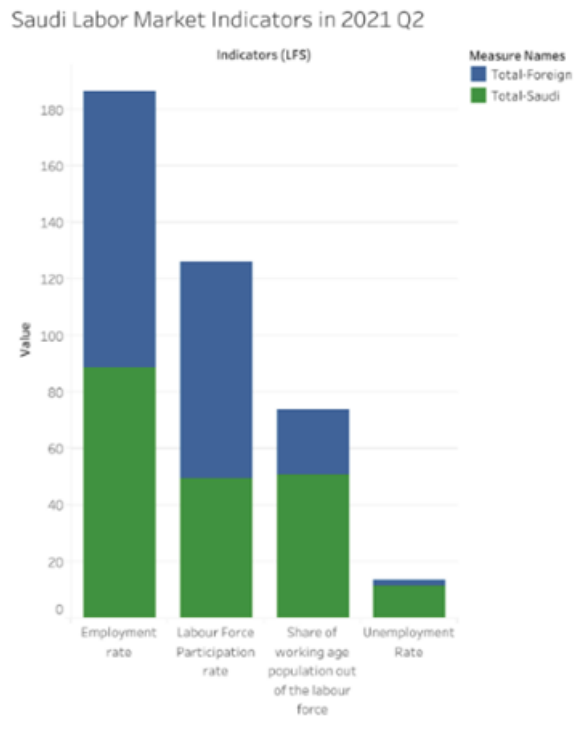
Total of Employed Persons Based on Nationality 2017-2021 Q2

The plots of Total-Foreign (Employed) and Total-Saudi (Employed) for Quarter (Employed) Year. Color shows details about Total-Foreign (Employed) and Total-Saudi (Employed).

Figure 7: Total Employment based on Nationality

Figure 8: Saudi Labor Market Indicators
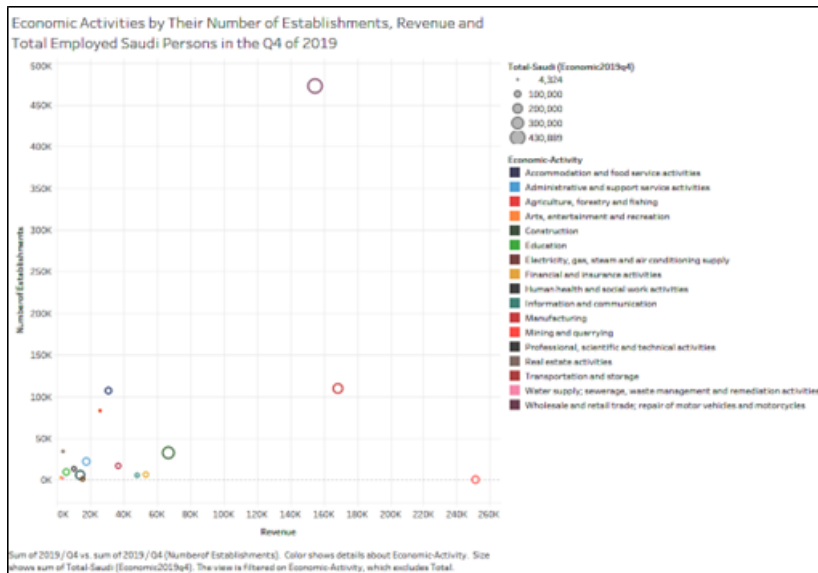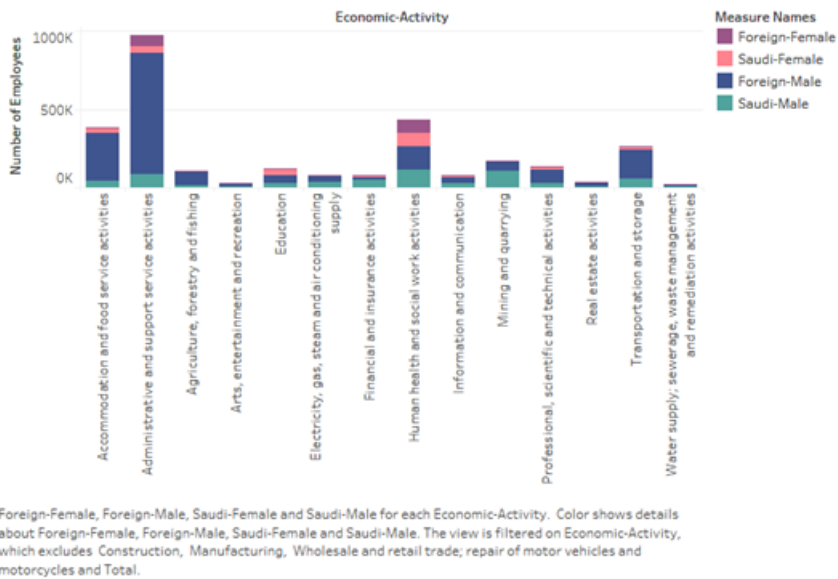
Figure 9: Economic Activities

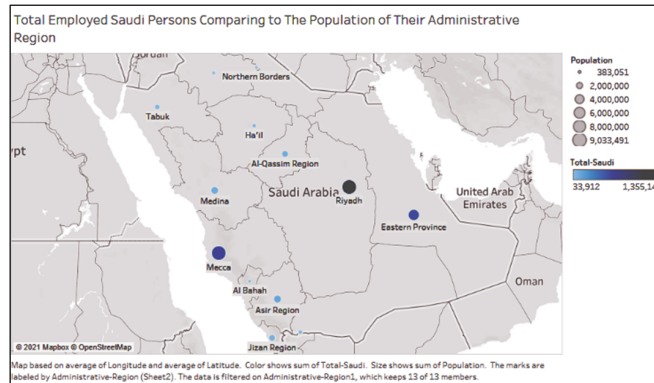Figure 10: Total Number of Employees in Economic Activities

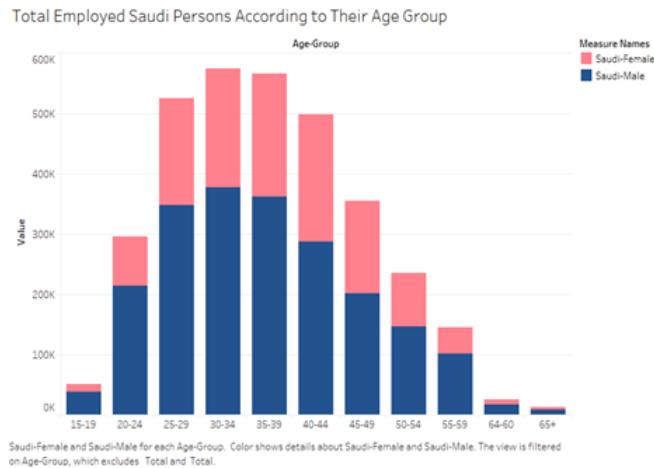Figure 11: Distribution of Employees in Saudi Arabia

Figure 12: Total Employment Rate Based on Gender and Age Group

higher rates of employment than other groups, such as people aged 55–64 (those passing the peak of their career and approaching retirement). If we look at the data from another perspective, we can see the relationship between age group and gender. That is, Saudi males have a higher employment rate, regardless of their age group.

• Educational Level

We can also see that there is a relationship between educational level and the total number of employed persons. (Note: This is subject to the rules and regulations of the Civil Service, 2021 Q2.) As can be noticed in Figure 13, educational level affects the employment rate in general, regardless of gender. Hence, there are no unemployed people with a Ph.D., and the unemployment rate of people with a master's is less than for people with a bachelor's degree. Consequently, there is a correlation between the educational level and employment rate of Saudi persons.
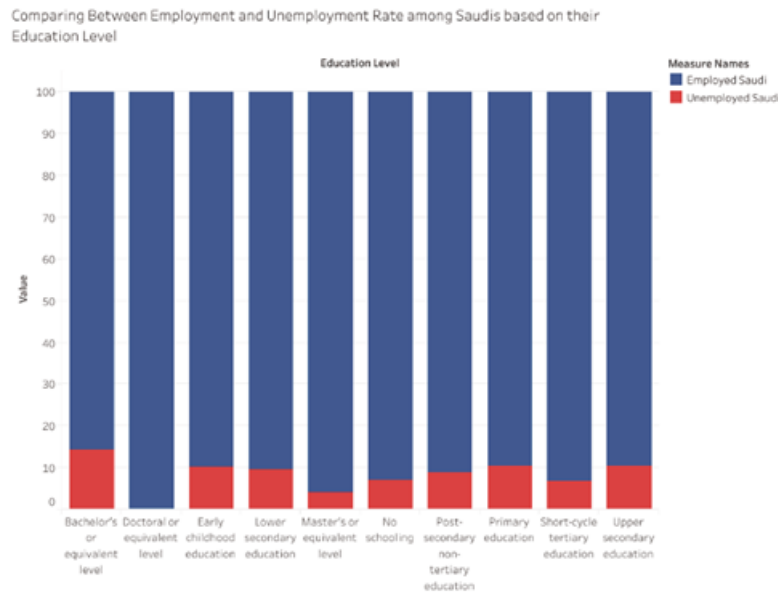
Figure 13: Employment Rate Based on Educational Level

5   Conclusion and future work

In conclusion, we notice that the better understanding that data visualization provides aids in the presentation of information in a clear, accurate, and appealing manner. The way in which information is presented is critical to how it will be perceived, and this may be the deciding factor in revealing new insights that could aid in decision-making. Therefore, we use data visualization as a decision support tool in our research. From 2017 to the second quarter of 2021, we find that there are noticeable differences in the Saudi labor market. In terms of foreign employment, we find that it is still somewhat high, but it has decreased significantly, while the rate of Saudi workers has increased. We also find that although the rate of unemployed female Saudis remains high, there has been a noticeable increase in the number of employed females in some fields, and it is likely that their reluctance to work in some jobs is because they feel that these jobs do not align with the nature of Saudi women and the traditions of Saudi society. Nevertheless, all of these changes are due to several factors, including the Saudization Program of Vision 2030 and the government's decisions to increase the Saudization rate. Additionally, the COVID-19 pandemic has led to a reduction in foreign workers as a result of the economic recession caused by the pandemic and the support that the government has provided to the private sector and their Saudi employees during the pandemic.

For future work, we intend to discover a more interactive visualization-based approach that can be used for a variety of data types and that can make selecting or searching through data easier. It would also help to get more detailed data about certain aspects, which could enhance the obtained results and provide more helpful insights on the topic.

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