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Exploring Industrial Demand Trend's in Pakistan Software Industry Using Online Job Portal Data

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Abstract: With the increasing number of internet users, many organizations prefer jobs advertisement via online job portals. Using online job portals data for forecasting industrial demand and trends is becoming popular. Software Industry plays a vital role in economy of developing countries like Pakistan. In this article Pakistan software industry is explored to draw statistical conclusions related to industrial demand for specific job roles, programming languages, gender, age and qualification etc. by data analysis of jobs advertisement. This is done by extracting and analyzing jobs advertised on Pakistan most popular job portal Rozee.pk. The results give an overview of current demand in Pakistan software industry, and are beneficial to student counseling organizations, job applicants, researchers, professionals working in software industry and Government in planning and decision making.

Keywords: Job Portals; Online data; Industrial Demand; Software Industry;

I. INTRODUCTION

The living style of people along with functioning of the organizations has been revolutionized during the last few decades. Internet evolves according to the global changes and challenges [1]. Now people rely on internet for all kinds of information, news, event etc. The working of many companies offering a variety of online services depends on Internet [2]. The number of individuals using internet is becoming almost equal to total population of the world [3]. Internet facilitates applicants for find jobs and application processing via online job portals. Online job portals are a collection of vacancies from multiple companies and profiles of various applicants. It serves as an effective medium for posting and searching job, applying against various posts advertised and selection of applicants in this electronic era [4].

In US the jobs posted online sees more activity then those printed in newspapers [5]. As a number of search methods are being used job seekers, therefore employers often use various job posting and hiring approaches [6]. Everyone in three of the job applicants reported using the Internet regularly in Glasgow [7]. There exists a positive relationship between job quality parameters and variety of job search methods on internet [8].

The revolution of technologies specifically internet has resulted into immense impact on information management and dissemination. The use of online job portals to facilitate services of knowledge management system is the topic under consideration of researchers. Educational institutions focused on web development led to the development of online job portals, which provides more elaborated and refined information to job applicants. This had produced an amplified urge in the applicants to pursue qualifications and skills demanded by industry [9-11]. Online job portals are adopted by large number of individuals for matching skills required by job [12]. Due to the emergence of online job portals the ways for searching jobs have been revolutionized. Many aspects of job search have been transformed due to the availability of online job portals [13].

The utilization of internet for online job searching has been increased. It is highly predictable that use of internet data for analysis and forecasting will grow. The online job portals are among the tools preferred for job matching. Using online data also leads to new prospects of collecting, processing and analyzing online data to capture the hidden facts and trends related to labor market demand with respect to required skills, working environments etc. [14].

There has been a rapid development in the field of Information Technology in Pakistan. Fast changing trends, skills & technologies in current challenging, competitive and globalized organizations has influenced the job trends and working environments throughout the World [1]. The basic problem faced by the Pakistan Software Industry and by the numerous industries is production of graduates with outdated skills. Therefore, there exists a vital need to groom and train fresh graduates according to demands of the market [15, 16]. Career portals are major source for collecting data online to forecast the demands of the rapidly changing IT industry [17]. It can be done by either performing data analysis,

sentiment analysis [2], data collection and specification of data by data cleaning and processing, empirical analysis [18] or data mining [16] etc.

There is no proper medium for posting job openings in Pakistan particularly software industry. Only a number of job opening are advertised using printed media, social media groups and official websites. As the number of job opening posted on these platforms is not sufficient by which one can analysis industrial trends in Pakistan software industry. Due to this lack of data availability the facts and stats are still hidden for Pakistan software industry. As no research for Pakistan software industry is conducted to reveal these facts due to non-availability of data. This research tried to revel industrial demand statistics for Pakistan software industry by utilizing jobs data available on one of Pakistan most frequently used online job portal by employer's and applicants. Rozee.pk is a centralized online job portal in Pakistan that has a huge number of registered software organizations which posted a number job opening on daily basis. The analysis of extracted data from online job portals discloses the facts and figures for jobs related to software industry in Pakistan.

II. RELATED WORK

The online data sources have been increasingly used for exploring jobs trends and market analysis [3, 19]. Kurekova et al. [12] discussed several advantages and disadvantages accompanied with processing of online data depending upon which sources and methodology used. Online voluntary surveys and jobs posted on online job portals or company websites are two data sources used to perform analysis. A number of results can be concluded on the basis of collected data. The data collected from online job portals is feasible to analyses as compared to print media (newspapers) advertisements in a timely and cost-efficient manner [4, 20, 21].

Sebastiani [22] focused on data, text classifications based on categories of predefined roles and occupations. The collection of data from the online job portals and data sources proves beneficial in overcoming the gaps reflecting numerous trait of the labor market [23]. The balance between the curriculum designed and industrial demands is necessary. The census has been conducted in the universities of Australia to figure out that whether the course offered to the student are according to industrial demands or not. Language choice, paradigm choice, tools used to support teaching and reasons given by academics for making these choices were covered in the census conducted. The instructors need to be aware of the changing global needs and wants. The research has been carried out in order to enlighten that instructors are responsible for designing introductory programming courses that are intended to meet languages demanded by the industry [15].

Number of adds analyzed and methodologies used for online job portal data source differ from those of print media data. The online job portals data source has been recently introduced by researchers, previous studies perform analysis on job data printed in newspapers [24-26]. Online job portal data is also used in Estonia to study market trends and occupational mobility [27]. A study extended the research on online data usage by looking at the relationship between data analyst analyzing online job portal data and job skills. The findings servers as a valuable input to student's career counseling organizations [20]. Huang et al. [28] study different categories of skills by using online job advertisements data. The data form online and print media is combined to identify "Skills cluster" for librarians to outline required skills in US [29].

The need is to adopt programing courses and skills that meet the demands of the software industry. For example, the unemployment rate recorded in 2006 for the graduates from the institution of higher education in Malaysia was about 70% due to outdated skills and changed industrial trends [30]. The data available on social media provides beneficial information for forecasting. Xie, et al. [31] witnessed unexpected outcomes in relation to the social order, choices, likes and dislikes including disease occurrences through real time Twitter data accessible on mega scale. Therefore, social media proves as being a vital medium for conducting surveys to highlights and forecast gaps in the labor market demand. A research proposed sentiment analysis and online opinion mining for online Job Search Company in Brazil. The techniques utilized in the extraction and evaluation of sentiments was generally conveyed in textual data. It entails a database of client comments about services that were analyzed. The results highlighted that customer satisfaction assessment is enriched by the use of sentiment analysis [2].

The surveys are often conducted on the basis of selected aspects of the industrial demands. This may include wages, age limit, sex, qualification, skills, work experience, employer assessment etc. The gathering of data sets provides a clear view of software labor market demand from the aspect of a specific country. It is also represented by the supply side perspective of a country [32]. Salary.com and Pay scale are commercial websites that work with data set for limited data analysis which doesn't possess deep research oriented focus. Glassdoor and Vault websites look ahead to assimilate information about employers and working environments with salary information. The information from these websites had been used for analysis in several researches [12, 33, 34].

Gender based study has been conducted by crawling data from one of the largest job portals in china by Kuhn and Shen [35]. Maurer-Fazio and Lei [36, 37] also used online job portals data to analyze perception of Chinese industrial trends. Many research studies extracted and analyzed data from online job portal named "Profesia.sk" to disclose demand and supply in Slovakia.

Monster.com is one of the World's best website having Google PageRank 8 with Alexa global rank 1258. It is basically consulted for Internet recruitment. It has been employed in various researches for the study of online job opportunities availability and information. A study was conducted by Capiluppi and Baravalle [38] to explore the demand of IT personnel in UK. The comparison with the level of the desired skills implanted by universities in graduates was accomplished by the creation of 'web spider'. These facts are revealed by analyzing data from

Monster.com website. The jobs advertisements data from Monster.com is analyzed from employer's perspective to understand facts related to human resource [39]. Currently Monster.com is operating in more than 40 countries. Monster India is playing vital role in Indian industry by hosting a large pool of more than 200 million applicants and organizations. The analysis of jobs posted online is conducted by Monster India since 2009. The results represent employers and jobs activities throughout India [40].

European Union (EU), EURES website is a potential source data of online job advertisements from all countries which serves as a guide to policy makers in national level decision making [41]. Moreover, the job portals involved in data analysis are mostly owned by private organizations [27, 35, 38, 39, 42]. Basic function of web mining takes into account searching and extracting prospective valuable models and hidden information from web based documents and activities. It is a combination of orthodox data mining with web. It plays a constructive role in numerous ways i.e. mining search engines, developing search engines, refining and increasing quality and effectiveness of search engines, determination of authority pages along with classification of web documents, web record/log mining, intellectual investigations and Meta Web data warehouse establishment [16, 43]. It has been tried to address the various issues in designing system for large scale categorization of jobs [44].

The aim of this paper is to use of online job portals data to understand industrial demand trends for Pakistan software industry. This study plays a vital role in highlighting the rising industrial trends. It helps applicants to find out which jobs roles have rising demands in the market? Further questions this study is going to answer includes which programming skills are more desired, gender preference for the jobs, desired minimum qualification, location, age limit and salaries relevant to any job posted online particularly in Pakistan software industry.

III. RESEARCH METHODOLOGY

The online job portal used for industrial demand trend analysis by this research is Rozee.pk. Rozee.pk is among most frequently used and popular online job portal for software and development jobs in Pakistan software industry. It provides services to the job seekers and employers by providing them a platform for job searching and hiring, respectively. This research paper focus on presenting the current statistics by analyzing the jobs advertised on Rooze.pk based on different factors. These factors include job roles, programming languages, gender, qualification, location, age limit, salaries etc. The data collected from the jobs posted on rooze.pk is in raw form as there is no defined pattern for posting a job, especially job title and job description. The proposed methodology for conducting this research includes the stages of data extraction, data preprocessing, data analysis & results. Figure 1 gives a visual representation of the research methodology and steps performed.

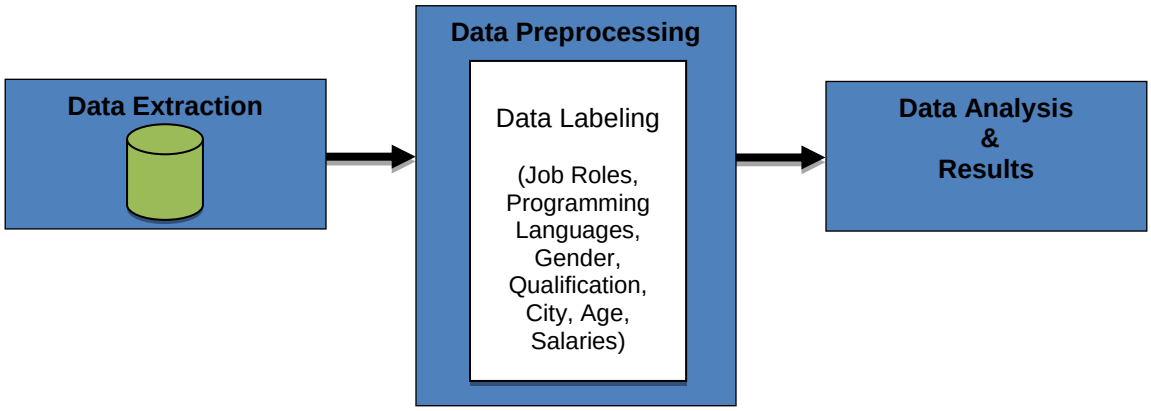

Figure 1: Proposed Research Model

A. *Data extraction*

The raw data is collected by using a standalone Google chrome extension "Web Scrapper". It provides the functionality to navigate and extract data from various websites whether they are HTML or JavaScript enabled. It also provides the functionality to download the extracted data in CSV format. All the data and job details available on Rozee.pk under the category of software and web development jobs is extracted and downloaded as CSV file. All available 492 job advertisements are extracted and further processed.

B. *Data Preprocessing*

The extracted data is further processed before used for analysis and results. Some the Job advertisements are fully defined whereas the other has missing information i.e. salary, location, description etc. Due to this missing data the data extracted is termed as raw data. The raw data is then preprocessed to remove inconsistency, redundancy and anomalies for utilizing data efficiently and effectively. The data collected is further categorized according to Job Roles, Programming Languages, Gender, Qualification, City, Age and Salaries. To get better results the raw data is further processed as it has no proper defined job titles and job

descriptions. The labeling is done by focusing and analyzing job title and specifications / requirements of the jobs mentioned in job description.

C. Data Analysis

Quantitative analysis is performed on categorized data to uncover results and trends in Pakistan software industry. These results form a basis for suggesting conclusions, and supports decision-making for student counseling organizations. In this study frequency distribution is used along with comparison to report the current statistics for selected categories i.e. Job Roles, Programming Languages, Gender, Qualification, City, Age and Salaries.

IV. RESULTS

The results of data analysis reports facts related to Job Roles, Programming Languages, Gender, Qualification, City, Age and Salaries. The results are discussed below.

A. Job Roles

The total number of jobs posted against each role and percentage of jobs distribution by job roles is shown in Figure 2 and Figure 3 respectively. The results reviled that the most demanding job roles are web developer 39%, software developer 29%, android developer 8%, IOS developer 5%, game developer 3% and graphics designer 3%. The all other roles i.e. database expert, project manager, SEO expert, software architect etc. are less demanded. These results give a clear picture to student in order to make decisions related carrier in particular job roles.

B. Programming Languages

Large numbers of individuals are adopting software industry on daily basis but the question regarding choice programming language to adopt still open due to unique nature of software industry [45, 46]. In addition to job role it is also important to know about the demanding programming language by industry. The choice of programming language is the core to jobs roles like Software development, web development etc. The most demanding programming languages in Pakistan software industry are shown in Figure 4. The highly demanded Programming languages are PHP 30%, ASP.NET 17%, JAVA 16%, JAVA SCRIPT 13% and C 7% in comparison to other programming languages.

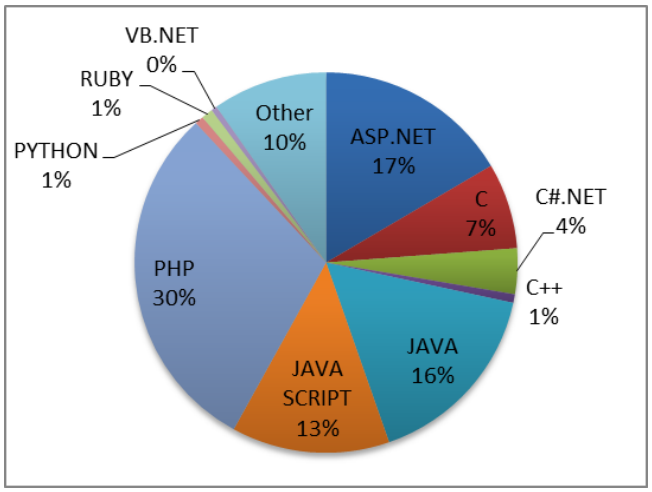

Figure 2: Pie Chart of Industrial Demand by Programing Languages

C. Salaries Comparison by Job Roles

Every job has designated salaries depending upon the qualification, skills and services required. Most of the individuals are attracted to job roles with higher salaries packages. The Figure 5 gives a detailed comparison of salary ranges (minimum and maximum) for specific job roles. The results revile that the most highly paid Job roles include Information security professionals with salary range from Rs. 250000 - 500000 and Software Architect with salary range from Rs. 100000 – 300000. The results of salaries comparison seem interesting as these two highly paid job roles are not much demanded by software industry as discussed above in industrial demand by job roles.

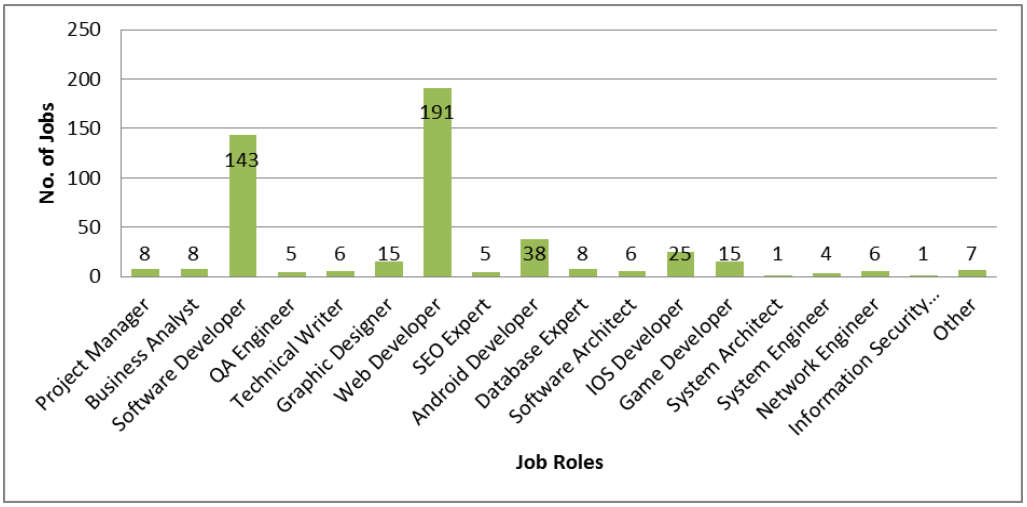

Figure 3: Bar Chart for Industrial Demand by Job Roles

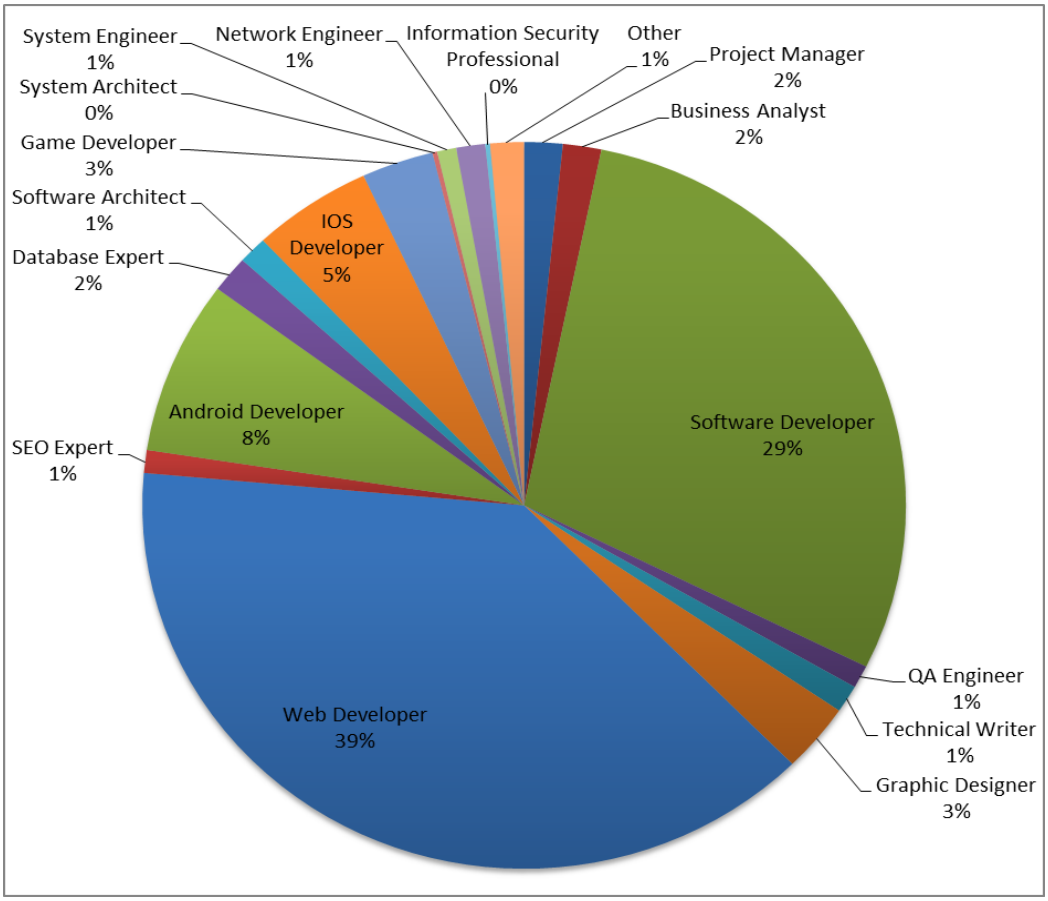

Figure 4: Pie Chart for Industrial Demand by Job Roles

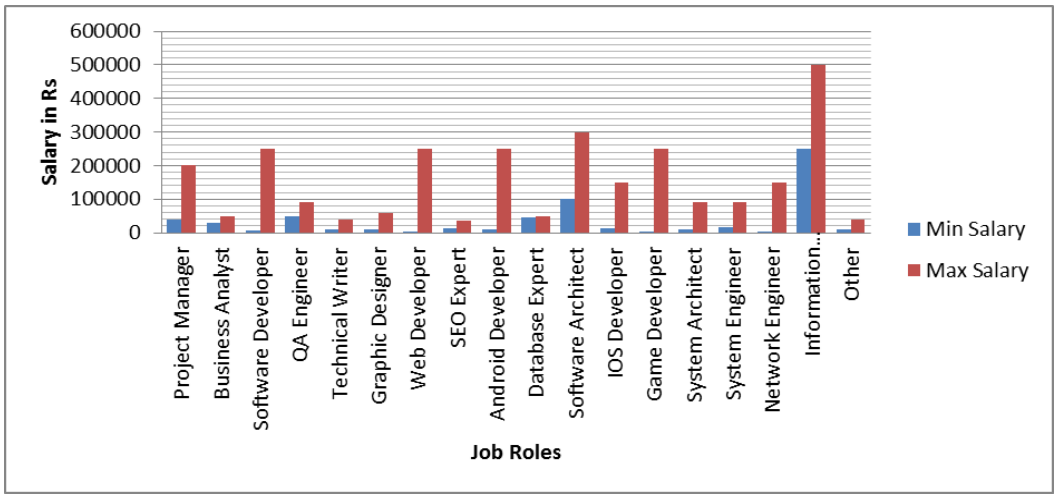

Figure 5: Column Chart for Salaries Compassion in Industry by Job Role

D. Gender Preferences

Kuhn and Shen [35] studied online job portal data to determine gender discrimination in china. Gender preference is given importance depending upon culture and nature of job. The results reported that Out of 492 jobs 420 (85%) has not mentioned any gender preference, 63 (13%) preferred male and only 9 (2%) prefers female. On the basis of the results depicted in the graphs of Figure 6, it is concluded that only 15% jobs advertised on Rooze.pk are gender specific. As against majority of jobs in Pakistan software industry

both male and female can apply, this shows that there is no gender discrimination.

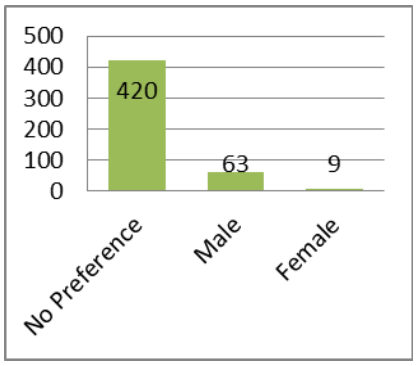

Figure 6: Bar Chart for Job Preference based on gender

E. Age and Qualification

The results related to age of applicants are depicted in Figure 7. The results highlight that the minimum age limit is 18 years and maximum age limit is 50 years for the jobs posted on Rooze.pk. The results for Qualification of applicants required for jobs posted on Rozee.pk are represented in Figure 8. Out of 492 jobs advertised on Rooze.pk 411 (84%) demanded bachelor's, 31 (6%) required Masters, 31 (6%) mentioned Intermediate/A-level, 3 (1%) stated Matriculation/O-level and 16 (3%) other qualifications. So, by seeing the results we can say that there are greater job opportunities for the application with bachelor's qualification.

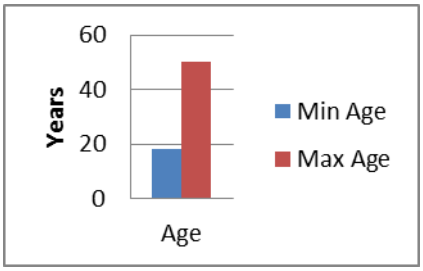

Figure 7: Column Chart for Age Preference in industry

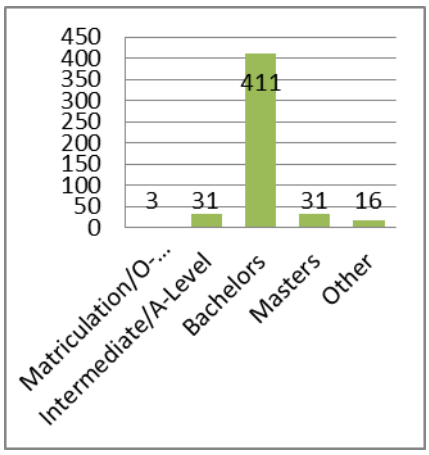

Figure 8: Bar Chart for Qualifications Demand by industry

F. Jobs by City

Figure 9 represents the number of jobs posted on Rozee.pk grouped according to the cities. The results give an overview about software industry spread over different cities of Pakistan. It is evident form the results that major portion of software organizations are established in Lahore (39%), Karachi (28%) and Islamabad (15%). The other represent the job posts which doesn't specify any city or virtual in nature. The geographic heat map of job distribution across cities of Pakistan is shown in Figure 10.

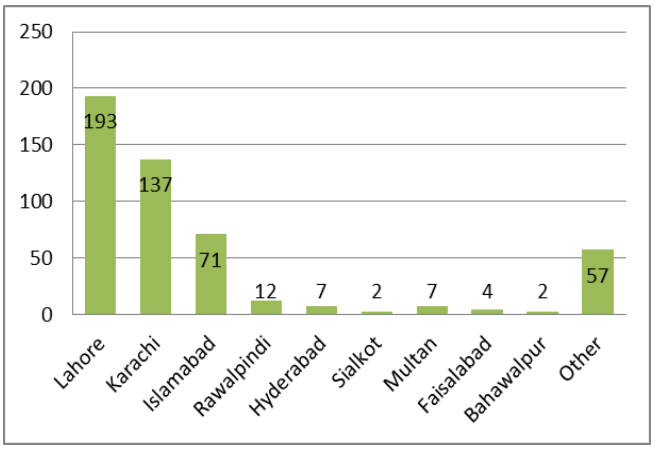

Figure 9: Bar Chart for Jobs Distribution by Cities

Figure 10: Geographical heat map of Jobs Distribution by Cities

V. CONCLUSION

Currently, there exists no research particularly focused to find jobs demand for Pakistan software Industry. It is crucial to know about the current demand which helps student counselors, job seekers, employers, professional working in software industry and Government agencies in decision making. By analyzing the collected jobs data, a number of conclusions have been made. Firstly, it is concluded that the job roles of web developer 39%, Software developer 29% are most demanded in software industry of Pakistan. Secondly, PHP, JAVA SCRIPT, ASP.NET and JAVA are most popular programming languages. Thirdly, the pay packages of Information security professional and software Architects are higher as compared to other job roles. Fourthly, there is no gender discrimination against majority of jobs, the age ranges from 18 – 50 years, whereas bachelors' qualification is preferred. Lastly, the majority of jobs posted on Rozee.pk are from Lahore, Karachi and Islamabad. This shows the spread of software organizations is focused in three big cities of Pakistan. The results highlight the current demand of Pakistan's software industry. This study assists students in preferring and adopting job roles, qualifications, programing courses and skills that meet the demands of the software industry.

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