Skills Set Required for Web Developers in Pakistan

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Abstract- **As the pool of potential employees for businesses throughout the world grows, the world is transforming into a global village. Pakistan is currently the 4th fastest-growing freelancing market in the world having growth rate 47%. The web development sector is essential to the economies of developing countries like Pakistan. In this study, the web development in Pakistan is surveyed to get statistical conclusions about the demand for particular job roles and skills set, required in the context of Pakistani web industry. This is accomplished by extracting and examining job listings from the most well-known job portals in Pakistan such as rozee.pk, mustakbil.com, and indeed. The study findings provide the present demand in the Pakistani web sector for web developers. For instance, expertise in Git, Firebug, Adobe photoshop, Adobe Illustrator, Figma, WordPress, Shopify, Magento, OOP, MVC, AJAX, SEO, MySql, MongoDB, are at highest rank. The conducted study will be beneficial for student counselling groups, job seekers, researchers, industry professionals, academic curriculum developers, government planners, and decision-makers.**

Index Terms—**Conventional Web Development, Digitized Remote Workstations, Freelancers, Global Village**.

I.   INTRODUCTION

The knowledge and skills required for the IT career, including programmers, testers, and IT managers, have been extensively researched and analysed. The findings of those studies help us not only to understand how IT trends are changing but also to prepare IT personnel for their future jobs. But little research has been done on the web developer, a position that may be just emerging. The prevalence of related jobs like web designer and webmaster, as well as role overlap in some businesses, make it difficult to define the work of a web developer [1].

The software sector in Pakistan is expanding, and is the third country in the world for creating independent contractors [2]. In developing nations like Pakistan, the web industry has a substantial economic impact [2]. In order to analyze job advertisements and get statistical conclusions about the industrial need for particular job roles, programming languages, talents, and other factors, the Pakistani web business is surveyed for this study. The study completion is achieved by extracting and analyzing job listings from the most popular job portals in Pakistan. The results provide a summary of the present demand in the Pakistani web sector, which helps student counselling groups, job seekers, researchers, industry experts, curriculum developers, the government planners, and decisions makers.

The whole world uses computers to complete daily chores, but only a are fully aware of how they function. The demand for the computer experts is greater than ever, and it grows yearly. In the context of U.S. Bureau of Labor Statistics, "demand for web developers will be driven by the growing use of mobile devices and e-commerce" [3], adding that their "occupation is predicted to rise 13 percent from 2018 to 2028, significantly more swiftly than the average for all professions."

Thousands of opportunities to build a secure future in the web development industry will arise as a result of the growth of digitalized remote workstations, which will require a qualified web developer on every team. Whether you want to build a profession in information technology, add some computational languages to your résumé, or simply want to build your own website [3]. The United States, United Kingdom, Germany, India, Brazil, and Mexico were all included in the global research study carried out by the research company Evans Data. It discovered that most web developers and designers are rising a whopping 25 percent or more a year. More than one in three even experience growth of 50% or higher [3].

Web professionals claim that they are doing more responsibilities than ever, and that meeting customer demand is their top priority. It originates mainly from young, expanding small firms in the United States. The combination of financial acumen, cutting-edge, complicated technical know-how, and creative abilities required to serve these firms is specific to the responsibilities of web developers and designers [3].

One of their top priorities is keeping such abilities current in order to remain competitive. They work in a sector that is constantly advancing into the next new thing, and their clients

constantly strive to remain at the cutting edge of innovation [9]. Web development as we know it is obsolete. Or rather, the traditional route no longer exists to become a skilled web developer in great demand. The methods used for web development five years ago are very different from what is needed today. The field of web design and development is one that is always evolving, changing drastically every few years or so. The have a safe and a bright career, it is necessary to remain up to date with the most recent trends and advancements [4].

II. RESEARCH PROBLEM

The skills set required for the IT career, involving programmers, testers, and IT managers, have been widely researched and analysed [1], however, currently there is no primary research focused at determining the skills needed for the Pakistani web development industry. Knowing the demand at any given time aids in decision-making for government organizations, job seekers, employers, and experts in the software sector.

III. RESEARCH QUESTION

A research question (RQ) is created for the study. The intended research question is covered in the discussion that follows.

RQ1: what skills are currently in demand for web development in Pakistan?

IV. OBJECTIVES

The research study aims to learn what expertise are presently in demand by Pakistan's software industry. The findings provide a summary of the skills currently required in the Pakistani web sector. The conducted research will help student counselling groups, job seekers, researchers, industry experts, curriculum developers, government officials' planners, and decision makers.

V. BACKGROUND AND LITERATURE REVIEW

The studies that were discovered aimed to look into the expertise of web developers. Pakistan has surpassed other nations, notably India, is at highest rank in the web freelancing among Asian countries. In the same period former year, the US ranked highest among the fastest-expanding freelancing marketplaces with 78% growth rate [5]. Skills in the programming languages such as Java and Java scripts, databases are the technical prerequisites for web developers. We anticipate that the findings of these publications will aid in our understanding of the expertise required for web development. The existing works performed in the same context is discusses in upcoming sub-sections.

A. US IT JOB SURVEY

On Dice.com, a job search for positions with "Web Developer" in the job title was conducted. The search was conducted on all 50 states' worth of job listings. The job postings were gathered continuously between August and September 2014. The study comprised 1,204 locations in all.

Based on the number of occupations that genuinely required one or more specified abilities (N = 1,204), percentages of sought skills were computed. The necessary technical abilities were noted and totalled. Whether a talent was sought because it was necessary or because it was just favoured, it was recorded. These data sets showed that 25% of web developers are

independent and self-taught. Photoshop and JavaScript libraries are necessary [6]. Table I, summarized the study finding.

TABLE I: Skills Areas Required (N=1024)

Category	N	%
Application Server	81	6.7%
Database Server	476	39.5%
Web Severs	156	7.8%
Operating System	301	25.0%
Programming Languages	668	55.5%
Client - Side Scripting	1028	85.4%
Server-Side Scripting	743	61.7%
Java Script Libraries	728	60.5%
Database Technologies	630	52.3%
Application Server	81	6.7%
Database Server	476	39.5%
Web Severs	156	7.8%
Operating System	301	25.0%
Programming Languages	668	55.5%
Client - Side Scripting	1028	85.4%

The percentage and quantity for each category where at least one of the skills was requested or necessary are summarized in Table I. Client-side scripting was the most needed or requested talent (85.4% asked for one or more scripting languages). More than 50% of the advertising required one or more of the following skills: server-side scripting (61.7%), JavaScript libraries (60.5%), programming languages (55.5%), and database technologies (52.3%) [6].

According to the high ratings for specialist abilities like JavaScript combined with JavaScript libraries (60.5%) and CSS, the field of web development today appears to have become exceedingly specialized. Requests for graphics editors like Photoshop demonstrate the overlap between the jobs of web developer and webpage art designer in some businesses [6].

B. PAKISTAN SOFTWARE INDUSTRY JOB SURVEY

Surveys are frequently carried out depending on certain characteristics of industrial demands. This could relate to salaries, age restrictions, sex preferences, educational requirements, occupational skills, employer evaluations, etc. The collection of Rozee.pk data sets offers a clear picture of the demand for software on the labour market from the perspective of a particular nation. The supply side perspective of a nation is another representation of it [2, 7].

Figure 1 shows the industrial demand of Job roles. The most in-demand employment positions in Pakistan's software business are web developer (39%), software developer (29%). Second, the most widely used programming languages are PHP, JAVA SCRIPT, ASP.NET, and JAVA [2]. Since the aforementioned research is conducted across all software careers, web development in particular does not receive much attention in their work.

C. SUMMARY OF RELATED WORK

The summary of related work is represented in Table II. The related work shows research has been conducted in the context of various careers, however less evidence is available regarding the web development sector in Pakistan.
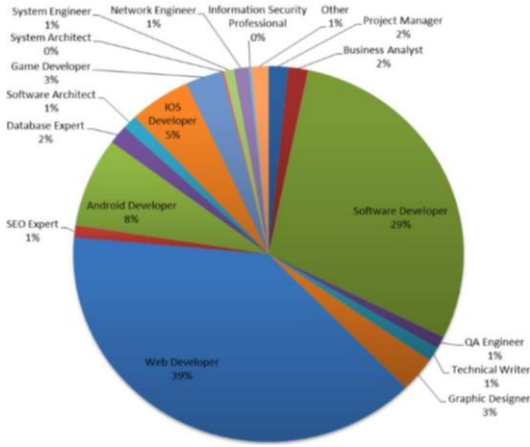
FIGURE 1.   Industrial Demand of Job Roles

TABLE II: SUMMARY OF RELATED WORK

Title	Year	Objective	Method	Reference
Web Developer Knowledge and Skills	2014	What are the skills required for web development in the US?	Online Search of job portal Dice.com	[6]
Exploring Industrial Demand Trends In Pakistan	2017	What are the software industrial demand trends of jobs in Pakistan?	Online Search of job portal Rozee.pk	[2, 7]
A Study of Knowledge and Skills Required for Web Developers	2013	Intended to look for knowledge and skills for webdevelopers.	Online survey of job advertisements JobKorea.com	[1]
Peering Through Glassdoor.com	2004	Assimilate information about employers and working environments with salary information.	Online survey of job on Glassdoor.com and Salary.com	[2, 8, 9]
Web Design and Development Curriculum Framework	2020	Web Design and Development Curriculum Framework	Vora survey using interviews andweb surveys.	[10]

III.   RESEARCH METHODOLOGY

We conducted a market analysis of the most recent job postings made by Pakistani software companies. Job portals chosen from the top 100 well-known Pakistani job sites, including rozee.pk, mustakbil.com, and indeed. The selected job portals are among the most used and well-liked online job sites for software and development positions in the Pakistani software industry. By giving them a platform for job searching and hiring, it offers services to both employers and job seekers. Primarily, we collected information about web developers' experience, education, talents, and career level as shown in recent job adverts. Languages, tools, practices, educational levels, job levels, etc.

will all be categorized in the data that was extracted. It will be decided after analyzing classified data. The actions we will take for this research are stated in subsections. The steps of data extraction, data pre-processing, data analysis, and outcomes are all part of the technique that is suggested for carrying out this study. The stages used in the study approach are discussed in sub-sections.

A. IDENTIFY THE DATA SOURCES
The success of a company in the modern world depends heavily on its online presence. The foundation of that presence is a well-designed website. Although it may seem impossible to create the ideal website, there are many companies that specialize in web building that can help [10].

We have put up the following list of the best web development businesses in Pakistan to aid in the search. We have noted a handful of job portals that are most frequently used in recent publications. These job portals listed below were planned to extract the data mustakbil.com

   a)   Indeed
   b)   Career Jet
   c)   Pakistan Jobs Bank
   d)   Bayrozgar
   e)   Talent Hunters
   f)   Jobs
   g)   Right Jobs

B. DATA EXTRACTION

Data is collected from the aforementioned websites using a specially developed data crawler and a standalone "Web Scraper" extension for Google Chrome. Both approaches rely on pre-determined parameters that must be entered at the start of the search and which change from site to portal. When raw data is extracted, we manually separate and extract the necessary data sets to carry out the research. Several of the frequent criteria used to search for jobs are listed below.

   a)   Company Info (Name, Location)
   b)   Company Size (Large, Medium, Small)
   c)   Type of Business (Local, Export)
   d)   Company Type (Private, Partnership, Public, Proprietorship)
   e)   Company Certifications
   f)   Career level
   g)   Experience
   h)   Skills
   i)   Education
   j)   Tools
   k)   Salary

C. CODING AND SYNTHESIS

Data extraction is followed by additional processing before being used for analysis and output. Some job postings are completely stated, whilst others exclude details like salary, education, location, and description. The extracted data is referred to as raw data because of this missing data. To use data

effectively and efficiently, the raw data is then pre-processed to reduce anomalies, redundancy, and inconsistency. Further categorization of the data is done using terms like Tools, Programming Languages, Practices, Skills, Qualification, Experience, etc. The raw data is further processed to provide better results because it lacks properly specified job titles and descriptions. The labelling given below is completed by concentrating on and examining the job description's job title and specifications.

    a)   Language (php, java, C#)
    b)   Tools (Git, Visual studio)
    c)   Practices (Agile, Devops)
    d)   Code basics (WordPress, Wix)
    e)   Frameworks (Laravel, codeigniter)
    f)   Experience (Expert, Beginner,)
    g)   Others (communication, language,)
    h)   Tags (new categories)

IV. DATA COLLECTION

Due to the constraints on the data we needed, we were only able to collect 151 job adverts from three employment portals in the end. We wanted job postings that listed the bare minimum of the necessary tools, languages, and technologies. Unfortunately, not all of the nine portals we chose provided us with that information, therefore we were forced to cut several job portals from the study. Below is a list of the job portals that provided the information we needed.

    a)   Rozee.pk
    b)   Mustaqbil.com
    c)   Indeed

We received 151 jobs from the aforementioned job sites up till October 25th, 2022. We received a total of 41 jobs from Mustaqbil.com, 64 jobs from Rozee.pk, and 46 jobs from Indeed.com. In 2022, all of the extracted positions were posted. The data sets provided by the above-mentioned job portals is presented in Table III.

TABLE III
DATA SETS FROM SELECTED JOB PORTALS

Location	Experience	Education
Salary	Tools	Languages
Libraries	Code Base	Database
Frameworks	Code Practices	PM and SE Practices

V. RESULTS ANALYSIS

The first part of the study covers general job and company information, including firm size, business type, target market, company category, job type, compensation, career level, and education. The second portion of the analysis focuses on industry-specific data. The second section is titled "Skills Required," and it lists all the qualifications and tools needed for a job that has been posted on any of the employment sites.

A. GENERAL INFORMATION OF JOB AND COMPANIES ANALYSIS

As previously noted, this section discusses a general study of jobs and businesses. For ease of understanding, we have divided this material into two parts: General Company Details and General Job Details.

B. GENERAL COMPANY DETAILS

Following some study, we were able to find out some publicly available information about each firm or organization that listed openings on several job boards, including the size, industry, target market, and company category. Let's examine each of these qualities individually.

One man to 1,000 employees makes up the range of company sizes, which we divide into four categories: 0-10, 11-49, 50-100, and 101-Larger. Companies who declined to disclose their size range or did not want it made public are labelled as Not Mentioned. According to the statistics in the Table IV, most companies fall into categories 1 and 2, while only a small minority have a higher concentration in Pakistan.

Pakistan, a developing nation, and the fourth-largest producer of independent contractors, has a huge number of businesses that export labor as well as work. Different companies' work markets are defined by their business types. Other companies work internationally, some only regionally, some work in both, and some haven't specified their business types. Table IV demonstrates that most of the Pakistani IT companies' software is both domestically produced and exported.

We discovered numerous companies that were registered in Pakistan and others that were established in other countries but had employees and branches in Pakistan because the survey was focused on the country's software market. We refer to it as the target market for businesses, which can be either national or international depending on who owns them. 80 percent of Pakistani enterprises have foreign operations.

There are numerous types of software companies. Some are IT companies that handle all IT work and support, while others are service providers who outsource their work to third parties and brand it under their name. We also have two other categories. Some businesses only work as web developers, while others are software and website development organizations. As seen in Table IV, most of the businesses we discovered identify as IT companies.

TABLE IV
GENERAL INFORMATION OF JOB AND COMPANIES

Portals	No. of jobs
Mustakbil.com	41
Rozee.pk	64
Indeed.com	46
Company size slab	**No. of Companies**
0-10	51
11-49	57
50-100	18
101-Larger	10
Not mentioned	15
Business Type	**No. of Companies**
Export	41
Export & Local	95
Local	14

Not Mentioned	1
Target Market	**No. of Companies**
National	131
International	20
Job Type	**No. of Jobs**
Full Time	140
Part Time	3
Contract	8
Salary Slab	**No. of Jobs**
0-20,000 PKR	8
21,000-49,000 PKR	39
50,000-100,000 PKR	38
101,000-More PKR	11
Not Mentioned	55
Education	**No. of Jobs**
BS	110
Certification	6
High School	8
Not Mentioned	27
Company Category	**No. of Companies**
IT	128
Services	3
Software & Web Development	14
Career Level Slab	**No. of Jobs**
0-1 Years	43
0-3 Years	57
3-5 Years	30
5-More Years	2
Not Mentioned	19

C. GENERAL JOB DETAILS

Jobs advertised on various employment boards include certain generic details, which are shown in Table V. Included in this data are Job Type, Salary, Career Level, and Education. Let's talk about each one separately.

Pakistan has an 80% youth population, however there are far less jobs available than there are job applicants. To create higher-quality work in greater quantities, many businesses perform day and night shifts. Job seekers now had the option of working full-time, part-time, or on a contract. Due to the full-time nature of development, most of the positions were listed. Few were contract-based and part-time.

One of the highest paying and lowest paying jobs at the same time is web development. As web developers, freelancers make between a few dollars at the minimum salary to thousands of euros. Based on salaries listed in job advertisements, which ranged from 5,000 to 101,000-More PKR, we created 5 salary slabs. For better comprehension and symmetry of the data gathered, we converted all the currencies we discovered on job advertisements into Pakistani Rupees (PKR). Most positions gave salaries between 21,000 and 49,000 Pakistani rupees.

For recruitment purposes, practically all businesses back then demanded college degrees from applicants (some still do!). Earning a degree and landing a job was the situation. However, something has changed since then. Candidates can now obtain the pertinent and necessary abilities for the organization through a variety of sources (Certification Programs, Training, Self-Learning, etc.). Employers are providing jobs for people without requiring a typical college degree considering this. But regrettably, our educational system is weaker than that of other countries, and we continue to rely heavily on degrees to pursue any vocation. The most common educational requirement for positions as a web developer is a BS or Bachelors, which requires 14 years of education.

D. SKILLS ANALYSIS

For every firm, relevant skills and expertise are, in fact, more crucial than any college degree. This part covers a wide range of topics related to web development, including knowledge of various tools, libraries, languages, frameworks, coding standards, databases, and platforms.

Git, Docker, and Jira are widely sought-after tools for creating effective websites. Git was a requirement from most recruiters because it is a platform for sharing open-source code. As a result, there are less disputes when several people collaborate on the same project. Knowing how to use tools like Firebase, Postman, and Chrome Inspector, some of the most popular in the online business, is a big advantage for any web development job.

To save designers' time and complete the task quickly, it is strongly suggested that developers become familiar with design tools. Many developers create websites from PSD designs. The most popular design tools are Photoshop and Illustrator.

One of the highest paying occupations today in Pakistan and the global market is react js. Basic innovations like the in-demand library Jquery didn't come with any restrictions. A developer's knowledge of modern libraries like Vue Js, Memcached, Redis, and ROR makes them stand out on a CV like stars.

Because of their user-friendly and time-saving code bases, WordPress, Wix, and Shopify account for about 60% of the web market. Magento is a newcomer, but it's sweeping the market. Web development advances in days, not months or years, so being familiar with new technologies is not a negative thing. Keeping your skills current is also a valuable skill. Table V summarizes the skills set required for web developers in Pakistan.

TABLE V
SKILLS SET REQUIRED FOR WEB DEVELOPERS IN PAKISTAN

Web Tools	No. of Jobs	Design Tools	No. ofJobs
Git	25	Adobe	9
Docker	3	XD	4
Jira	4	Figma	4
MS suite	2	Adobe	9
Firebug	5	InDesign	2
Chrome Inspector	5	Adobe Suite	2
BitBucket	3	Canva	1
Conflience	1	Adobe	1
Sharepoint	1	Adobe Flash	1
Codeship	1	**Code Base**	**No. ofJobs**
New Relic	1	Wordpress	57
NPM	1	Shopify	14

Laravel Listeners	1	Wix	6
Microsoft Visual Studio	1	Joomla	6
TFS	1	Magento	10
SSH	1	WooCommerce	6
Postman	2	Elementor	1
Kibana	2	OpenCart	2
Code Practices	**No. of**	**Other Skills**	**No. ofJobs**
OOP	22	SEO	13
MVC	18	AJAX	23
Netlify	1	QueryCore	1
CircleCI	1	ECommerce	10
Database / Data Formats	**No. of Jobs**	Blockchain	1
Mysql	65	Videography	1
PostgreSQL	3	LMS	2
MongoDB	12	Anime	2
JSON	6	Plugin	1
SQLite	1	Domains DNS	1
CSV	1	WHM	1

VI. CONCLUSION AND FUTURE WORK

It is essential that this huge knowledge gap within the sector be addressed because recent studies suggest there is a significant and growing skills shortage across the digital sphere. Training in a growing field is the best method to guarantee your employment for the foreseeable future as more traditional jobs disappear. Because of the shortage of digital skills that more than 75% of UK firms are experiencing, a career in web development may be both rewarding and versatile. This is the perfect time to think about a career in web development because firms with a global presence need experienced digital experts. One can start preparing for future school exams, whether they just graduated or want to retrain in a field that will be in demand in the future. Figure 2 provides the summarized view of skills demand for web development in Pakistan. In the future the same study can be conducted to get the skills set in other software development domain for instance, requirement engineering, software design, software testing, software quality engineering etc.
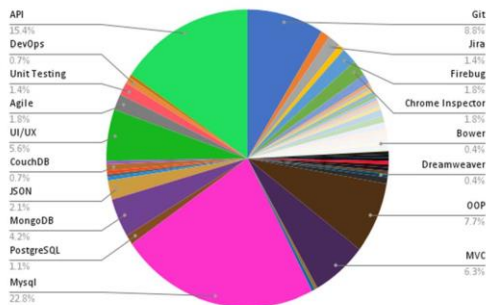

FIGURE 2.   Industrial Demand for Web Development

CONFLICT OF INTEREST

The Authors declare that they have no conflicts of interest to report regarding the present study.

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