

P@SHA
Pakistan Software Houses Association for IT & ITES

ICJ

KIC
Kobe Institute of Computing

Pakistan IT Skills Survey Report 2021

Acknowledgements

This study was conducted by a team led by Ms. Kimie Tanabe, Economist at Economic Development Department, International Center of Japan (IDCJ) with members: Dr. Sun Yi, Lecturer, Graduate School of Information Technology, Kobe Institute of Computing, Mr. Noaman Saeed, consultant, and Mr. Ali Abidi, research assistant. Ms. Kimie Tanabe and Dr. Sun Yi designed the survey instrument. This report was prepared under the supervision of Ms. Kimie Tanabe, and authored by Mr. Noaman (principal author), Ms. Kimie Tanabe and Dr. Sun Yi with support from Mr. Ali Abidi who conducted data cleaning and analysis. Mr. Talha Bin Afzal led this survey project from P@SHA, while curating the design of the survey form and its strategy, apart from the complete roll out, outreach and data collection from the member companies of P@SHA.



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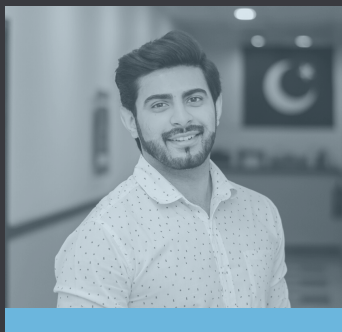
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Chairman's Message

P@SHA has been connected to multiple international organizations and counter-part organizations of several other countries over the years. P@SHA is also a member of Asia-Pacific ICT Alliance (APICTA) and Asian-Oceanian Computing Industry Organization (ASOCIO). P@SHA is the sole representative body of the IT and ITES sector of Pakistan, and on their behalf we interact with them on different strategic initiatives.



Considering the global shortage of IT skilled human resources, there is an anticipated shortage of young talent in Japan which has led to the exploration in different countries to import the talent based on the quality of skill-set. Therefore, P@SHA in collaboration with International Development Center of Japan (IDCJ) conducted this survey to evaluate and analyze the quality of skill-set of IT and ITES resources primarily working in three domains; software engineering, data sciences and cloud development. It was pivotal to uncover these specific domains in which Japanese firms are primarily looking for resources. The survey presented decent insights of the skilled resources of Pakistan which could convince International firms including Japanese companies to look towards Pakistan as the next market to hire resources.

P@SHA categorically advocated for the establishment of the offices of Japanese companies, based on our objective to provide preliminary support to Japanese organizations looking forward to opening office here and creating partnerships and joint ventures with the companies in Pakistan. One of the interesting findings was that Pakistani resources are reluctant to learn Japanese language to move to Japan for opportunities. It is concerning for the Japanese firms as Japanese is the pre-dominant language in Japan and very few people are able to speak English. Hence, on the basis of such findings, it became a more convincing argument to look for the option of opening up an office in Pakistan for the development of technology and other back-office services while having multi-linguistic leads and managers to run the teams here.

I am pleased to share this report with our members as well as others. This report gives comprehensive insights into different aspects of the survey and its methodology. This report also highlights the current standing of resources working in the aforementioned specific domains of technology.

Barkan Saeed

Chairman (2020 - 2021)

Pakistan Software Houses Association

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Executive Summary

From the very outset, this exercise was designed as an “exploratory study”, jointly conducted by P@ASHA and IDCJ, to gauge the ability levels in the major functional areas of IT sector landscape in Pakistan. The idea was to find status of skills being employed in the sector as well as to pinpoint areas where capacity development is needed.

The challenge of categorizing these functional areas having complex subcategories into distinct areas of specialization, resulted in identification of three broad categories, i.e., a) Software development 2) Data sciences and 3) Cloud management services.

The authors designed this study to be a purely quantitative endeavor specifically focused on the “employees”, as units of measurement, belonging to firms registered with P@SHA. The entire survey design revolved around a carefully crafted questionnaire containing queries that would provide frequencies against various variables of interest including demographics, certification levels and expertise areas in 3 identified areas ranked against a scale of 1 to 7 that gauged competence level (Skill level) in functions for each category. A small inferential analysis including of some regress-able variables is also attempted to fine-tune findings in the end to draw some conclusions. Various qualitative techniques, such as interviews with key stakeholders and industry leaders and focus group discussions with employees belonging to various categories were omitted due to shortage of time making it a completely number-based exercise.

Basic demographic data from the sample revealed that a majority of human resource in the IT sector comprises of males, almost 92%, offering a great opportunity for females to join the sector as there is a significant gap that can be filled. The overall, education level is good with at least 67% of the respondents being Graduates and 31% having Masters’ degree pointing out towards the fact that the workforce is well educated in this field. The workforce is also young, with 88% of the employees being of 41 years of age and less. 41% of them have up to 6 years of work experience, while 24% has up to 13 years of work experience. 24% of respondents belonged to firms having 0-50 employees while 32% belonged to firms having 1001 and above employees. Rest of the companies with 100 to 400 employees fell in between these 2 extremes. Employment status of 90% of the employees was permanent. 90% of the respondents worked 8 to 10 hours per day and 5 days per week. In terms of wages, cloud services employees were the highest paid having salaries in the range of Pak rupees 251k and 350k, pointing out towards the short supply of Cloud related HR in Pakistan. Software development employees were paid within the range of 150K meaning that they were slightly less paid pointing out towards a higher supply of employees in the market.

As far as type of certifications attempted is concerned, show a mixed picture. Cloud respondents had 39.5% employees who attended at least 5 trainings while at work pointing out towards a fact that they were the most trained of them all. Data sciences and software development people were the least trained with 36.8% and 44.4% of respondents who never attended a single IT training of any sorts.

No. Of IT Trainings Attended At Work	Cloud Services		Data Sciences		Software Development		Total	
	No.	%	No.	%	No.	%	No.	%
None	11	28.9	28	36.8	122	44.4	161	41%
1	0	0.0	13	17.1	20	7.3	33	8%
2	7	18.4	7	9.2	52	18.9	66	17%
3	5	13.2	7	9.2	18	6.5	30	8%
4	0	0.0	4	5.3	8	2.9	12	3%
5	15	39.5	17	22.4	55	20.0	87	22%
Total	38	100	76	100	275	100	389	100%

As far as certifications are concerned. Data Science employees had 22% and Software development employees had 20% respondents who claimed that they had some sort of certification. Although most of the people admitted that they have done certifications, but when asked specifically about type of certifications, the missing values were overwhelming, whereby very few people from each category could identify the exact type of certification as asked in the questionnaire. 44% of employees from software development area did not have a single certification.

The following table summarizes the percentages showing **missing values** i.e. those employees who did not have any of the specifically asked certifications, for each of the 3 categories, and we can see that this number is significant and provides a great opportunity to get them trained.

Category	AWS	CISCO	Oracle Master DBA	Oracle Java	MSft	Google	Category wise Average
Cloud Services	61%	76%	97%	100%	63%	87%	81%
Data Sciences	84%	95%	93%	99%	86%	96%	92%
Software Development	88%	95%	97%	96%	83%	96%	93%
Specialty wise Average	78%	89%	96%	98%	77%	93%	

The percentage of all participants having any type of certifications is provided in detail later in the report.

Regarding AWS certification, respondents from cloud management area had 61% people who were not AWS certified, whereas Data Sciences and Software design people had 84% and 88% missing values, meaning respondents from these areas hardly have these types of certifications. An even lower number of employees from the 3 areas attempted certifications in CISCO, with only 5% of Data sciences and software development employees attempting those. Cloud services still had a higher percentage with 24% respondents attempting it. The most alarming situation was with Oracle master DBA and Oracle JAVA certifications where hardly anyone from all 3 areas had any significant percentage of respondents who tried to get these certifications.

Microsoft certification and Google certifications had slightly improved numbers, but they too are far below normal. Of all the 3 areas, respondents from Cloud services were having the most certifications in all categories with the least number of missing values at 81%, whereas software and data science employees had the highest missing values with 92% and 93% respectively.

Oracle JAVA was the least attempted certification along with Oracle master DBA. Microsoft being the most widely attempted certification. So, the need is to facilitate the IT industry employees to get them certified in Oracle and Google related certifications to future-proof the current HR of the IT sector in Pakistan.

A new dimension of soft skills was introduced to give depth to analysis and to identify the effect of some exogenous soft factors that might have some effect on the overall outcome. Major traits of soft skills like empathy, leadership, numeracy skills, workplace adaptability, teamwork etc. were identified and scores were elicited against these. The results were exciting as elaborated in the inferential analysis, where a strong correlation was found between this construct and other variables, most importantly the Skill level one.

The most crucial element of this report pertained to finding skill levels against certain specific operational areas of each of the three categories. The joint effect of these operational area was named as the “Skill level” construct and was later used to good effect in our inferential analysis. To simplify reporting of the numbers, these skill areas were divided into 7 skill levels which were further categorized into 3 major categories for ease of analysis.

From the analysis (as elaborated in the text of report), it was found out that 42.1% respondents of Software development category fell in the “Expert level” skills’ category, while 38.7% fell in the “operational category”. Similarly, 42% employees from the Data Sciences category fell in the “Expert level knowledge” while 43% belonged to the “Operational level category”. For the Cloud management sciences, 44% of employees had “operational level knowledge”, and 34% were “Experts”. Overall the percentage of human resource belonging to all 3 major categories, having expert level knowledge, stood at 39.4%.

It points out towards the fact that skill level for all 9 identified Skill level competencies in 3 areas show almost the same trend as most employees fall in higher skill category, with data science employees having the highest skill levels amongst their identified 9 skills with more employees at expert level. It can be safely deduced that a significant %age of employees working in the identified categories of interest is having a high skill level and is primed for training interventions. A slight hand holding in terms of certifications will further boost their operational effectiveness making them increasingly acceptable to international markets. The following table depicts the overall picture of ability in 3 major skill areas as a consolidation of averages of all skills to give an overall picture.

Skill Levels (1 - 7)	Broad Skills Categorization	Software Development	Data Sciences	Cloud Management	Overall Average
Have Basic Tech Knowledge	Elementary level knowledge	19.2%	13.0%	21.3%	17.8%
Able to design a tech solution in case instructions are available					
Able to work independently, create functional requirements	Operational level knowledge	38.7%	43.0%	44.0%	41.9%
Able to create tech solutions based on non-functional requirements: pass adv tech exams					
Have contributed to open source projects: a recognized in a local community	Expert level knowledge	42.1%	42.0%	34.0%	39.4%
Have contributed to a commercial product service: recognized at industry level					
Have a strong profile: following on International Communities like Stack Overflow, GitHub etc.					

For inferential statistics, correlations were run to find relationships between various variables. It was evident from analysis that IT certification, soft skills, total experience and average monthly salary are found to have significant correlations with the overall cumulative “Skill level” construct for all levels of respondents and therefore are suitable to be analyzed through regression models presented in the next section. IT certification is 18%, soft skills; 39%, experience in IT sector; 11% and salary at 16% are significantly correlated with the overall “Skill level” of the employee.

Regression models of positively correlated constructs clearly found that the Skill

level of the employee is strongly affected by soft skills. Soft skills, IT certification and experience are found to be positively and significantly contributing to the performance of the employee. If soft skills increase, the Skill level of the employee significantly increases by 98%. Similarly, IT Certification affects the Skill level of the employee by 32%. It was also found that with the increase in the IT certification the Skill level also increases. If a person does not have IT related certifications, it is more likely that, he will be less efficient compared to others having more IT certifications. The sign of the variables confirms that, if a person has no or less IT certifications, he/she will perform 23% poorer in his output compared to the person having more IT certifications.

Age is found to be insignificant in the model. Experience caters to about 13% increase in the Skill level of the employee. The variable, work hours behave insignificantly i.e. it is not contributing to the Skill level of the employee.

Similarly, it was found out that higher the communication skills, higher will be the Skill level of the employee i.e. Skill level increases by 50%, by increasing the communication skills. Lastly, numeracy skills also make up a positive effect in the Skill level by 45% and is also significant, i.e. if the numeracy skills of the employee increases, his Skill level will significantly increase by 45%. This also allows us to conclude that, without having soft skills training especially the communication and numeracy skills, IT certifications alone are not enough to raise the overall Skill level of the employees which is the discerning goal.

Finally, to get a slightly deeper understanding regarding interaction of various variables, a dummy variable analysis was also conducted to validate findings from various iterations of regression models.

It was found out that those engineers who do not have IT certifications have lower level of skills as compared to those who have completed IT certification. Similarly, it is interesting to note that soft skills like communication and numeracy skills possessed by an engineer related to any of the 3 major categories like software development, cloud management and data sciences, tend to have positive and significant effect on the overall skill level. The variable, experience in years, is also positively correlated and significantly effects the level of skills of engineers.

The dummy variables for occupation variable clearly shows that it is insignificant and allows us to conclude that skill level is not related to the type of occupation.

Despite having a very small sample representation in the overall sample, the gender variable was also factored in. The results show that when compared to males, females have low level of skills, however this result is not a true representation of the facts on ground. Since participation of females in this sector is dependent on many factors which require detailed investigation.

The questionnaire designed for this exercise did not have queries to deeply analyze the environmental effect, societal constraints, access to IT opportunities

etc. for us to conclude anything concrete and as a result the findings for this variable exhibited an insignificant result with the given data set. Education i.e. was also found to be insignificant and is not related to the skill level of the engineer.

Conclusion

After detailed iterations and testing we can safely conclude that variables having significant effect on the overall skills of IT engineers belonging to our 3 areas of specialization i.e. Software Eng. Cloud Eng. or Data Sciences are IT certifications, soft skills mainly communication and numeracy skills, income and experience of the engineer and is consistent with our regression model above.



Background

The Japanese enterprises and investors are interested in exploring Pakistan's IT & ITeS market, which necessitated a baseline understanding of the existing basic skill set of the human resources in the existing IT landscape of Pakistan. P@SHA, in partnership with the International Development Center of Japan (IDCJ, a quasi-governmental and leading think tank specializing in the field of international development and cooperation), conducted a survey to develop this understanding by sharing different insights, connecting to different stakeholders, and conducting surveys.

Context

P@SHA has been the sole representative and registered trade body of the IT and ITeS sector of Pakistan. P@SHA has been conducting different research activities including surveys all over Pakistan in the past several years to assess the different needs of the IT industry in Pakistan and especially its members. This survey report is an extension of similar research activities which P@SHA undertakes from time to time to facilitate its valued members for the betterment of the industry.

Objective

The objective of this particular “exploratory” survey is to assess the level of existing skills in the workforce of the IT companies in Pakistan relevant to work requirements of the Japanese IT market.

Operational Context

The operational context of this survey revolved around identifying existing skill levels of human resource in the Pakistani IT sector. The main idea was to gather information about the demographics and technical skill levels prevailing in the IT industry of Pakistan in the following specific areas of interest.

AREA 1: Software Development (Architecture Design and Design Patterns, Quality Assurance and Testing, Software requirements and definition)

AREA 2: Data Sciences (Data Mining, Architecture Design, Warehousing and Business Intelligence, Analytics)

AREA 3: Cloud Management Services (System Analysis, Architecture Design & Development/Construction, Cloud Database, Application Implementation, System Monitoring, Networks Systems Implementation)

Target Audience

The target audience for this survey were the employees of all the registered member companies with P@SHA, existing and potential, and covered 2 levels of employees based on seniority level, i.e. Specialists/Engineers level (Junior level) and Mid to Senior management level, working in the above mentioned 3 areas of all the organizations to whom the questionnaire was sent.



Expected Outcome

The outcome of this survey intends to achieve the following outcomes.



·Find the state of existing skill levels prevalent in the 3 identified areas of the Pakistani IT sector



·Pinpoint skill gaps in those 3 identified areas



Create a basis for finding future training needs and a detailed capacity-building plan to be executed later in phase two of this exercise

Structure of the Report

This report has sections that describe the sampling methodology, sampling frame and associated techniques to arrive at the sample size and the subsequent percentages of responses received as result of that questionnaire administration philosophy.

In the findings' section, the demographics details of respondents belonging to each of the 3 areas of interest are preformed to create a broader picture of various characteristics prevalent in each category.

The next section will draw comparisons on the certifications and training scenarios prevalent in each category. Various trends that appeared out of the data will be delved upon.

The following section will try to gauge the level of Soft skills prevalent in the IT sector. Basing it on studies it is expected that they will have a marked effect on the Skill level construct of this study adding depth to the analysis.

Section after that will identify the “Skill levels” within each of the 3 categories and rate it on a grading scale of 1-7 and the number of people falling in each scale belonging to 2 seniority levels of employees. In the end, the efficiencies for all 3 areas were clubbed to form a single construct which was then used as an analysis baseline as dependent variable and tested against various independent variables.

The last section has inferential analysis based on relationships between dependent and independent variables to find any existing correlations between categories based on regression analysis. The report will conclude with some of the cumulative findings and some insights derived out of the data analysis performed in sections.

Survey Tool - Questionnaire

Given the fact that this first survey was intended to be of an “exploratory nature”, the survey tool was designed keeping that very dimension in mind. It consists of 3 distinct sections.

The first section has demographic information of respondents. Information related to age, gender, salaries, time, and experience spent in the IT industry etc. The Second part of the questionnaire includes information related to types of technical and IT related certifications and trainings that the respondents have undertaken during their job tenures. It also touches a bit upon soft skills training status of the respondents belonging to the 3 categories of skills.

The third and most important section of the questionnaire pertains to collecting data of those exact set of skills and their levels within those 3 major category areas i.e. Software development, Cloud management services and Data sciences. The level of ability for each set of 9 skill areas was ranked on a grading scale from 1 to 7 depending on expertise level within that area. Respondents ranked themselves based on their exact skill level in a specialty within the larger category. This supplied the basis for calculating the overall Skill level of the respondents in their respective areas.

A variety of question structures were used while asking for data. That included, multiple choice questions to open ended questions to capture data in a variety of ways depending on the type of variable of interest.



Methodology

Research Methodology Narrative

Due to time limitation, data from the questionnaire could not be triangulated and confirmed from other multiple channels like focus group discussions, key informant interviews from industry leaders etc., making this a purely quantitative exercise. Also, a prototyping session could not take place to find any changes or tweaks in question structures based on the feedback of respondents, that could be incorporated.

Sampling Methodology

For this “exploratory survey”, a broader sampling method was recommended by the authors, owing to the challenge faced in obtaining the exact population size due to fragmented data available with most of the IT related organizations.

There are hardly any exact industry wide employment figures in the IT sector of Pakistan. Estimates put the overall employment in the IT industry tentatively around 65 -75,000 employees and according to the Ministry of Information Technology and Telecom - MoITT, it is expected to grow by 20% each year adding 18 to 20,00 thousand jobs 2019 and onwards. As per one of the industry experts,

“In 2004 we were a 4,000 strong professional community. 14 years later in 2018 we are somewhere in the 60,000 – 75,000 employee range. That is a 15-20 times growth in employment. All this based on a small informal sample of the industry. The numbers are likely to be higher for an industry wide study.”

Author, Jawwad Farid is a 26-year veteran of the technology industry in Pakistan. He is the CEO of Alchemy Technologies, a Fellow Society of Actuaries, and a Columbia Business School alumnus.

By this analogy, the exact number of employees in the IT sector in Pakistan can be safely assumed to be around 135,000 to 140,000 mark by year 2021 considering all anomalies and industry estimates as projected by the growth rate figures.

Sampling Frames

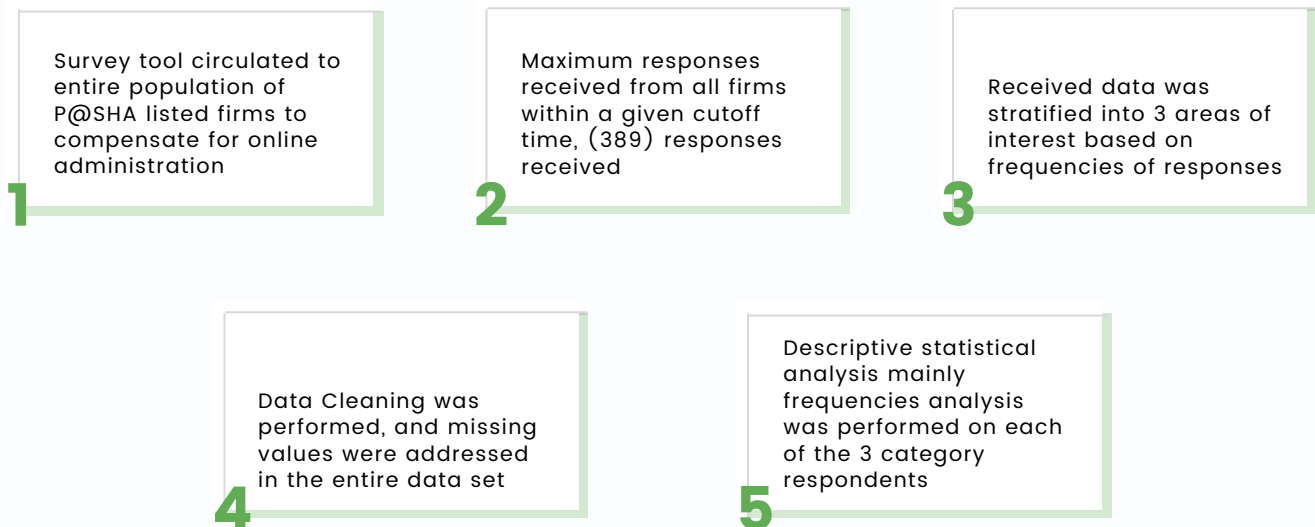
For the sake of this survey, the sampling frame was extracted from the lists of members whose data is kept by P@SHA. This list had around 348 active members having different core businesses. It was expected that a significant number of those businesses will be involved in the 3 areas of interest for this study, i.e. data sciences, cloud management services and software development. Most of them are medium to large sized companies where the expected number of employees is expected to be around 50,000. This number is according to the data obtained

in 2018 and as such will be considered tentative, since most companies might have reduced or increased their workforce during the time between 2018 and 2020.

There was another list of 325 member companies who have applied for memberships and whose contact addresses were available with P@SHA but are not yet fully active members. These are mostly small companies (50 to 100) employees and the total number of employees in all these firms is around 22,000.

These lists might not contain all the companies in Pakistan and as such the total number of IT employees will fall short of the overall population figure, but the sample size for a large enough population (in this case P@SHA's list), will still be representative of the overall populations while remaining statistically significant.

Graphical Representation of the Sampling Route



Unit of Measurement

Since this survey is targeted at identifying skills of the employees belonging to IT related firms registered at P@SHA, the “employees” will be the unit of measurement for this survey.

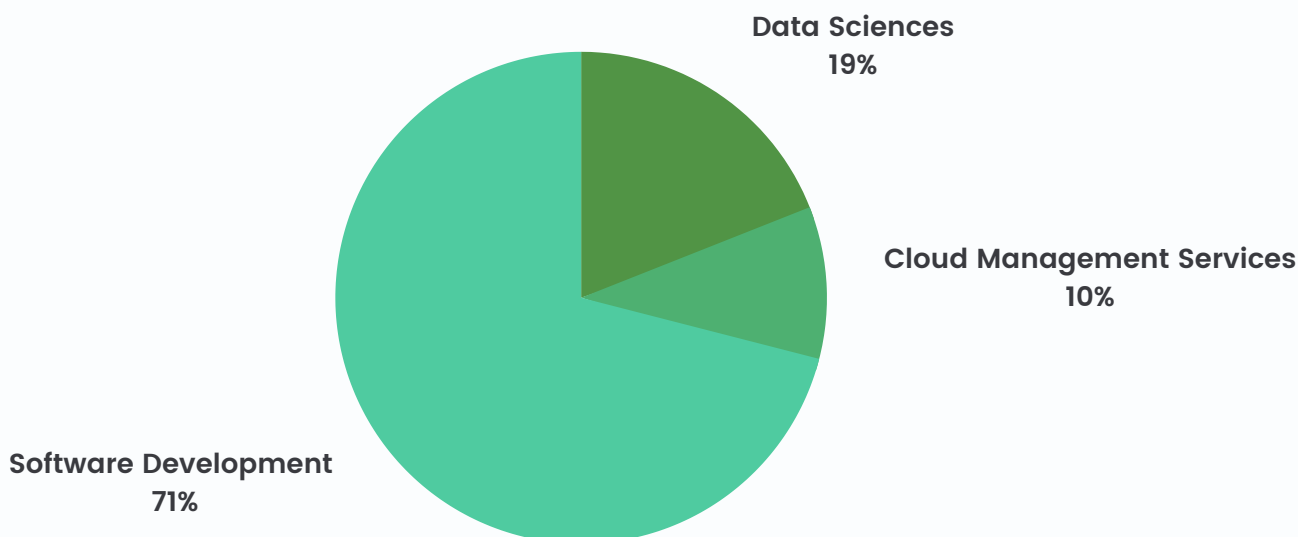
Sample size calculations

Owing to a max of 20-30% response rate for online administered questionnaires, P@SHA, administered the survey questionnaire to all of the approximately 673 companies (containing both active and prospective members), on its roster having a total of approximately 72,000 employees to cover up for a weaker response rate.

Considering a confidence level of 95% and a margin of error (confidence interval) of 5, the statistically significant sample size for a population of 72,000 employees comes out to be 382. If we assume the entire expected population size of employment as 140,000 by the 20% growth analogy the sample size for this population size comes to 383.

To achieve this number, as an initial strategy, “non-random” sampling was preferred due to non-availability of category wise, “stratified data” for 3 special areas of interest. The questionnaire was administered to the entire population of P@SHA registered firms to maximize responses. Once an adequate number of responses was received that surpassed the sample size figure of 383, stratification of that data was undertaken to identify the exact number of responses for each of the 3 areas of interest, i.e. data sciences, cloud management services and software development.

Categorywise Breakup of Responses



The sample size obtained using P@SHA lists was found to be statistically significant and can thus be considered as representative of the entire population size. Further deep diving does show some skewness in data in terms of categories with a larger part of the responses falling in the software development category having 275 responses. cloud management having 38 and data sciences having 76 responses. While skewed, number of responses of both the later ones is above 30 so going by the central limit theorem strategy they are still statistically significant, and their analysis can still supply meaningful insights.



Findings

As shown in the graphics previously, it was established that most respondents came from companies whose core area of interest was software development. This also points out towards the fact that large number of IT human resource belongs to this field. Some of the demographical insights between these 3 categories are discussed in detail in the following sections.

Inter Category Demographics Analysis

Demographic variables like age, gender, years of experience, salary etc. supply a basic insight into the dynamics of each category and helps in identifying a larger picture of its operational dynamics. The factors identified in this data points out towards the general direction and factors that might have an influence on the performance or competence prevalent in that category.

A tabulation of all inter categorical demographic variables are shown in this table for comparison. Highest percentages of values against each label are shaded and highlighted within each category.

Gender	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Male	352	90.5%	36	94.7	67	88.2	249	90.5
Female	37	9.5%	2	5.3	9	11.8	26	9.5
Total	389	100.0%	38	100	76	100	275	100
Education Level	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
High School Certificate	5	1.3%	0	0	0	0	5	1.8
Bachelor Degree	267	68.6%	26	68.4	47	61.8	194	70.5
Master Degree	110	28.3%	12	31.6	26	34.2	72	26.2
PhD	5	1.3%	0	0.0	2	2.6	3	1.1
Other	2	0.5%	0	0.0	1	1.3	1	0.4
Total	389	100.0%	38	100	76	100	275	100
Age Range (Years)	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
21-30	223	57.3%	19	50.0	45	59.2	159	57.8
31-40	125	32.1%	12	31.6	25	32.9	88	32.0
41-50	35	9.0%	5	13.2	5	6.6	25	9.1
51-60	6	1.5%	2	5.3	1	1.3	3	1.1
Total	389	100.0%	38	100	76	100	275	100

Experience in IT Industry (Years)	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
1-6	231	1	18	47.4	50	65.8	163	59.3
7-12	101	0	11	28.9	13	17.1	77	28.0
13-18	45	0	5	13.2	11	14.5	29	10.5
19-24	10	0	3	7.9	1	1.3	6	2.2
25-30	2	0	1	2.6	1	1.3	0.0	0.0
Total	389	1	38	100	76	100	275	100
Org. Employee Number	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
0-50	86	22.1%	15	39.5	7	9.2	64	23.3
51-100	61	15.7%	4	10.5	5	6.6	52	18.9
101-200	78	20.1%	7	18.4	7	9.2	64	23.3
201-500	21	5.4%	2	5.3	6	7.9	13	4.7
501-1000	38	9.8%	5	13.2	2	2.6	31	11.3
More than 1001	105	27.0%	5	13.2	49	64.5	51	18.5
Total	389	100.0%	38	100	76	100	275	100
Organization Location	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Islamabad	191	49%	20	52.6	53	69.7	118	42.9
Karachi	144	37%	13	34.2	18	23.7	113	41.1
Lahore	48	12%	5	13.2	3	3.9	40	14.5
Bahawalpur	4	1%	0	0	2	1.3	2	0.0
Faisalabad	1	0%	0	0	0	0	1	0.4
Peshawar	1	0%	0	0	0	0	1	0.4
Total	389	100.0%	38	100	76	99	275	99
Employment Status	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Permanent	367	94.3%	34	89.5	73	96.1	260	94.5
Freelancer	4	1.0%	2	5.3	0	0	2	0.7
Probation Period	9	2.3%	2	5.3	3	3.9	4	1.5
Contractual	9	2.3%	0	0.0	0	0	9	3.3
Total	389	100.0%	38	100	76	100	275	100

No. of hrs at work/day	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
1	1	0.3%	0	0.0	1	1.3	0	0
2	1	0.0%	0	0	0	0	0	0
3	1	0.3%	1	2.6	0	0	0	0
4	1	0.3%	0	0.0	0	0	1	0.4
5	4	1.0%	0	0.0	1	1.3	3	1.1
6	6	1.5%	0	0.0	0	0.0	6	2.2
7	9	2.3%	2	5.3	1	1.3	6	2.2
8	188	48.3%	15	39.5	34	44.7	139	50.5
9	89	22.9%	9	23.7	12	15.8	68	24.7
10	67	17.2%	9	23.7	23	30.3	35	12.7
11	6	1.5%	0	0.0	3	3.9	3	1.1
12	14	3.6%	2	5.3	1	1.3	11	4.0
13	2	0.5%	0	0	0	0	2	0.7
14	1	0.3%	0	0	0	0	1	0.4
15	0	0.0%	0	0	0	0	0	0
Total	389	100.0%	38	100	76	100	275	100
No. of days at work/week	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
1	2	0.5%	0	0	0	0	2	0.7
2	1	0.3%	1	2.6	0	0	0	0
3	0	0.0%	0	0	0	0	0	0
4	3	0.8%	0	0.0	1	1.3	2	0.7
5	325	83.5%	33	86.8	65	85.5	227	82.5
6	41	10.5%	3	7.9	5	6.6	33	12.0
7	17	4.4%	1	2.6	5	6.6	11	4.0
Total	389	100.0%	38	100	76	100	275	100
Job Title	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
CloudServ. Spec/Eng	15	3.9%	15	39.5	0	0	0	0
CloudServ. Sr. Mngr	23	5.9%	23	60.5	0	0	0	0
DataSc. Spec/Eng	37	9.5%	0	0	37	48.7	0	0

Job Title (Cont.)	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
DataSc. Sr. Mngr	39	10.0%	0	0	39	51.3	0	0
Soft Dev Spec /Engr	141	36.2%	0	0	0	0	141	51.3
Soft Dev Sr. Mngr	134	34.4%	0	0	0	0	134	48.7
Total	389	100.0%	38	100	76	100	275	100

Monthly Avg. Salary	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
40K - 80K	81	20.8%	4	10.5	13	17.1	64	23.3
81K - 150K	145	37.3%	11	28.9	27	35.5	107	38.9
151K - 250K	96	24.7%	10	26.3	13	17.1	73	26.5
251K - 350K	67	17.2%	13	34.2	23	30.3	31	11.3
Total	389	100.0%	38	100	76	100	275	100

Insights

A look at this demographic data covering a diverse set of variables, provides interesting insights. They are explained as follows:

Regarding **gender dispersion**, almost 92% of the entire category average consists of male employees, with cloud services employing the highest percentage, 94.7% of males. A significant employment opportunity exists for females to enter this field and make a positive contribution. This survey did not go into details to investigate other factors that limit their participation including low supply of female graduates from educational institutions, societal pressures, competence levels etc.

In general, the entire sample size showed **good education level** with almost 67% employees having at least a bachelor's degree and another 31% having master's degree. Cloud computing category had the highest percentage, with almost 70% of sampled employees having bachelor's degrees, while employees from data sciences category had the highest %age of master's degree holders with 34% having the degree. Almost 88% of the entire workforce is 41 years or less, pointing out towards a very educated workforce.

Data science had the **youngest category of employees** with 59% within the age bracket of 21-30 years of age, followed by data science people at 57.8%, while cloud computing having the oldest with only 50% of the employees falling in that

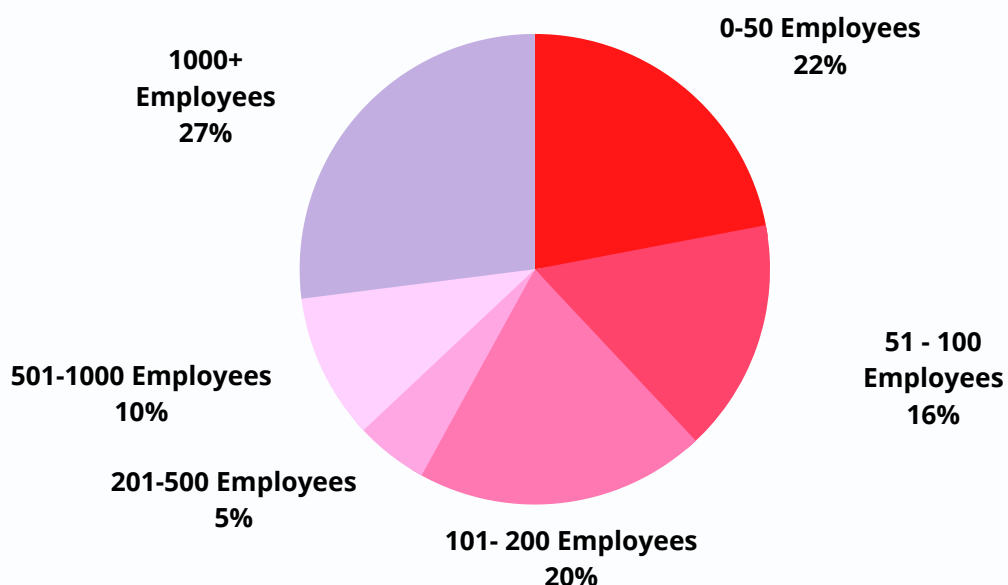
bracket. These differences while there, are rather insignificant, pointing out towards the fact that it is a younger generation contributing to these sectors with an overall category average of 56%. Whereas the average for the age bracket 31-40 years is also a significant 32%. So, we can safely say that 88% of the human resource in the IT sector is of the age bracket of 41 years and less.

41% of the entire sample had up to 6 years of **IT experience**, while almost 24% had up to 13 years of experience. This points out towards the late pick up of the IT sector, whereby it became vibrant in only the last decade and a half. The IT sector itself is now picking up pace with increased avenues opening for fresh graduates offering a variety of fields from within the sector to choose from. Software development area had the most experienced human resource having 59.3% people having up to 6 years of experience and 28% of people with up to 13 years of experience.

Sizes of companies that participated was quite diverse. The challenge of getting them to fill the questionnaire was quite significant. The outreach and follow up was carried multiple of times to elicit a response out of them and to ensure that companies from different core expertise areas and sizes participate in the exercise.

Category wise, the organizations that responded for cloud services were mostly small sized companies with up to 50 employees. The situation with Data science respondents is quite the opposite with 64% of them belonging to large category with 1001 employees or more. 46% of Software development companies that responded belonged to small and medium category with having up to 200 employees or less. The size of the participating companies is evident from this figure.

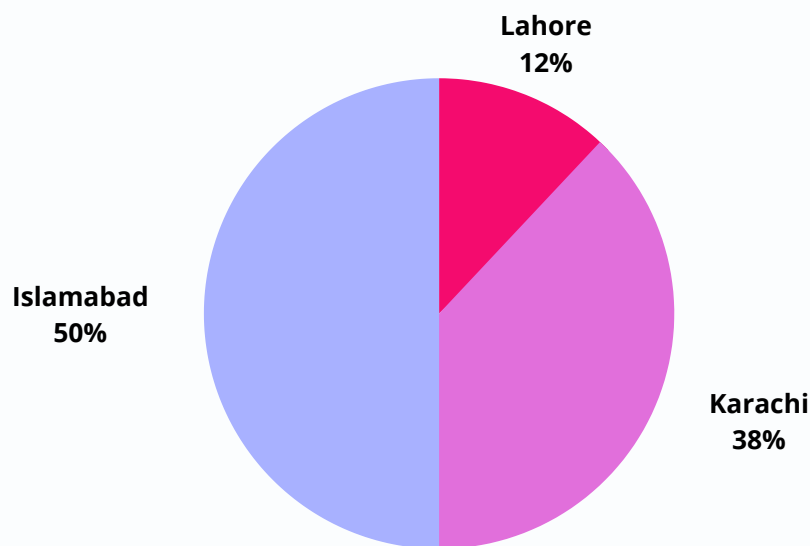
Size of Companies - Employees wise



Overall, the response from large companies was very encouraging with 32% responding to the survey activities. Small companies were a close second with 24% participation rate. If time permitted, the sample size would have increased enough to ensure a larger participation from middle sized firms. Bit for all practical purposes, this was a good representative mix.

As understood, favorite **location** for these companies was Islamabad, with most of the offices belonging to all 3 categories situated there. 70% of data science companies, followed by 53% of cloud companies and 43% of software companies were situated in Islamabad. Karachi and Lahore being the next two most favorite locations. Following figure explains the location of majority of sample companies.

Location



Employment status for 90% and above respondents was identified as “Permanent”. As far as **working hours** and **days worked per week** is concerned, a significant majority of employees belonging to all categories worked 8 hours a day. But a relatively significant number also worked for 10 hours a day pointing out towards the fact long hours and even after office hours sittings are quite common in this field. Cumulatively, at least 90% of the respondents from all the 3 categories work for up to 10 hours a day. Similarly, up to 87% of the people from all categories work for 5 days per week with minor variations in 3 categories.

In terms of **wages**, cloud management people overall had a higher percentage of people with salaries in the range of 251K to 350K with cumulative %age in the range of 55%. This points out towards lack of cloud management related expertise in the industry followed by the data sciences people next in line. Software development category had majority of people in the 150K PKR category with a significant number in lower salary brackets, pointing out towards excess supply of resources in this category. One counterargument that can be put forward to explain this phenomenon can be the significant percentage of this category in the overall sample size. But after discussing it various industry experts this finding was validated.

Inter-Category Certifications' Analysis

Following is the comparison of certifications that respondents in all 3 categories have acquired in different specialties.

IT Certification	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Yes	193	49.6%	29	76.3	36	47.4	128	46.5
No	196	50.4%	9	23.7	40	52.6	147	53.5
Total	389	100%	38	100	76	100	275	100
AWS Certification	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Foundation Level	22	5.7%	6	15.8	3	3.9	13	4.7
Associate Level	16	4.1%	8	21.1	4	5.3	4	1.5
Professional Level	11	2.8%	1	2.6	2	2.6	8	2.9
Have Certificate, Unsure about the level	10	2.6%	0	0.0	3	3.9	7	2.5
Sub total people having certifications	59	15.2%	15	39.5	12	15.8	32	11.6
Missing Values	330	84.8%	23	60.5	64	84.2	243	88.4
Total	389	100.0%	38	100	76	100	275	100
CISCO Certification	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Entry Level	9	2.3%	2	5.3	0	0	7	2.5
Associate Level	11	2.8%	5	13.2	3	4	3	1.1
Professional Level	4	1.0%	2	5.3	0	0	2	0.7
Have Certificate, Unsure about the level	2	0.5%	0	0.0	1	1	1	0.4
Sub total people having certifications	26	6.7%	9	23.7	4	5	13	4.7
Missing Values	363	93.3%	29	76.3	72	94.7	262	95.3
Total	389	100.0%	38	100	76	100	275	100

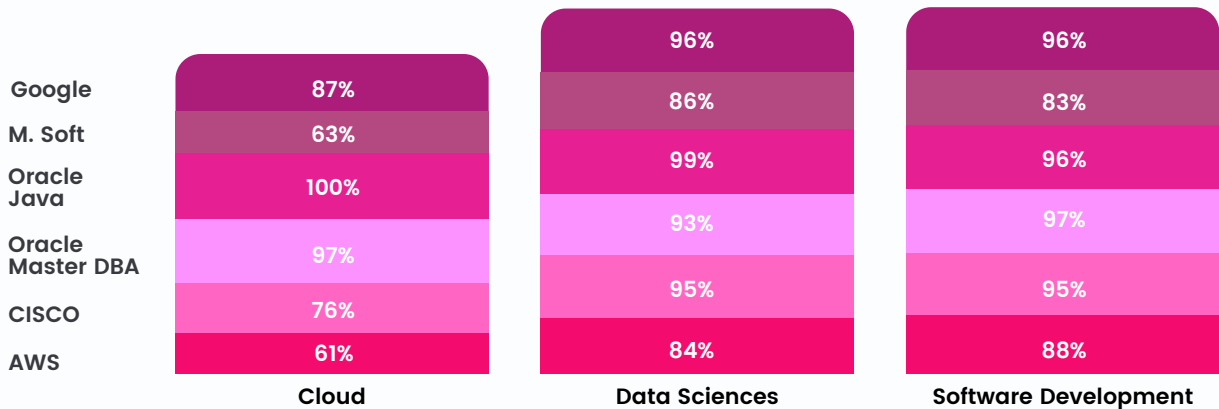
Oracle Master DBA	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Bronze	2	0.5%	0	0	1	1.3	1	0.4
Silver	1	0.3	0	0	0	0	1	0.4
Gold	2	0.5%	0	0	0	0	2	0.7
Have Certificate, Unsure about the level	10	2.6%	1	2.6	4	5.3	5	1.8
Sub total people having certifications	15	3.9%	1	2.6	5	7	9	3.3
Missing Values	374	96.1%	37	97.4	71	93.4	266	96.7
Total	389	100.0%	38	100	76	100	275	100
Oracle JAVA	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Bronze	1	0.3%	0	0	0	0	1	0.4
Silver	0	0.0%	0	0	0	0	0	0
Gold	4	1.0%	0	0	0	0	4	1.5
Have Certificate, Unsure about the level	8	2.1%	0	0	1	1.3	7	2.5
Sub total people having certifications	13	3.3%	0	0	1	1.3	12	4
Missing Values	376	96.7%	38	100.0	75	98.7	263	95.6
Total	389	100.0%	38	100	76	100	275	100
Microsoft Certification	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Foundation Level	31	8.0%	8	21.1	4	5.3	19	6.9
Associate Level	21	5.4%	4	10.5	5	6.6	12	4.4
Professional Level	13	3.3%	1	2.6	1	1.3	11	4.0
Have Certificate, Unsure about the level	6	1.5%	1	2.6	1	1.3	4	1.5
Sub total people having certifications	71	18.3%	14	36.8	11	14.5	46	16.7
Missing Values	318	81.7%	24	63.2	65	85.5	229	83.3
Total	389	100.0%	38	100	76	100	275	100

Google Cloud Certification	Overall Total		Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%	No.	%
Associate Level	14	4%	4	10.5	2	2.6	8	2.9
Professional Level	5	1%	1	2.6	0	0	4	1.5
Have Certificate, Unsure about the level	1	0%	0	0.0	1	1.3	0	0
Sub total people having certifications	20	5%	5	13.2	3	3.9	12	4.4
Missing Values	369	94.9%	33	86.8	73	96.1	263	95.6
Total	389	100.0%	38	100	76	100	275	100

As we can see from the above table many respondents have not attempted to get certified in many of the specialties as is evident from many missing values against each specialty.

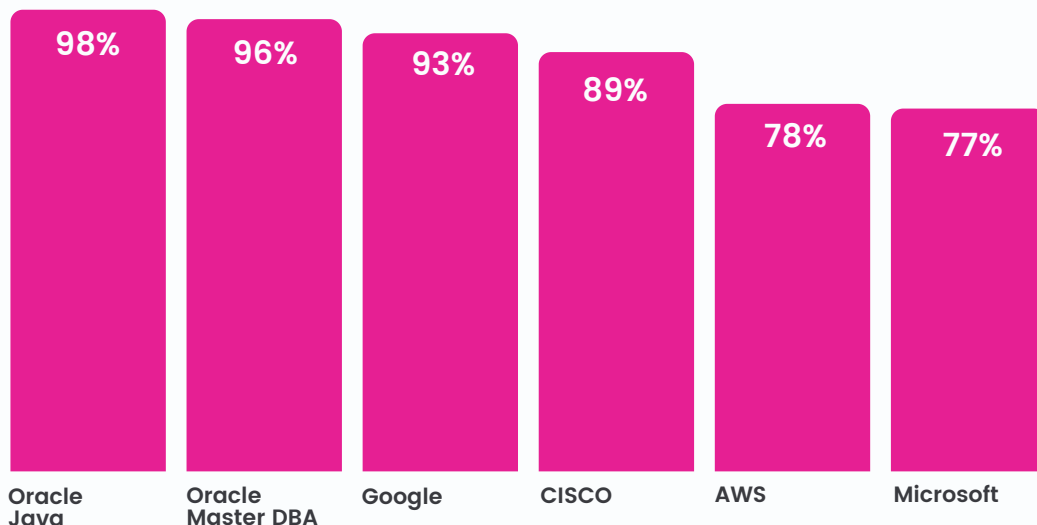
Cloud services respondents claim to have attained the highest percentage of certifications. Almost 76% of them have a certificate of one type or another. Less than half of all the respondents from Data sciences and Software development side do not have certifications in these specialties.

Category-wise Missing Values



Specialty wise analysis reveals that a massive gap in all the mentioned certifications exists for almost all categories. In term of 3 categories, cloud services respondents seem to have the highest percentage of all these certifications. But the small sample size for cloud respondents (36) is not a strong reflection of this and it can be safely assumed that they too require a lot of support in getting their human resources certified in these categories. Respondents from other 2 categories have an even higher requirement to get certifications in these crucial technical areas.

Certifications Highly Needed Across Categories



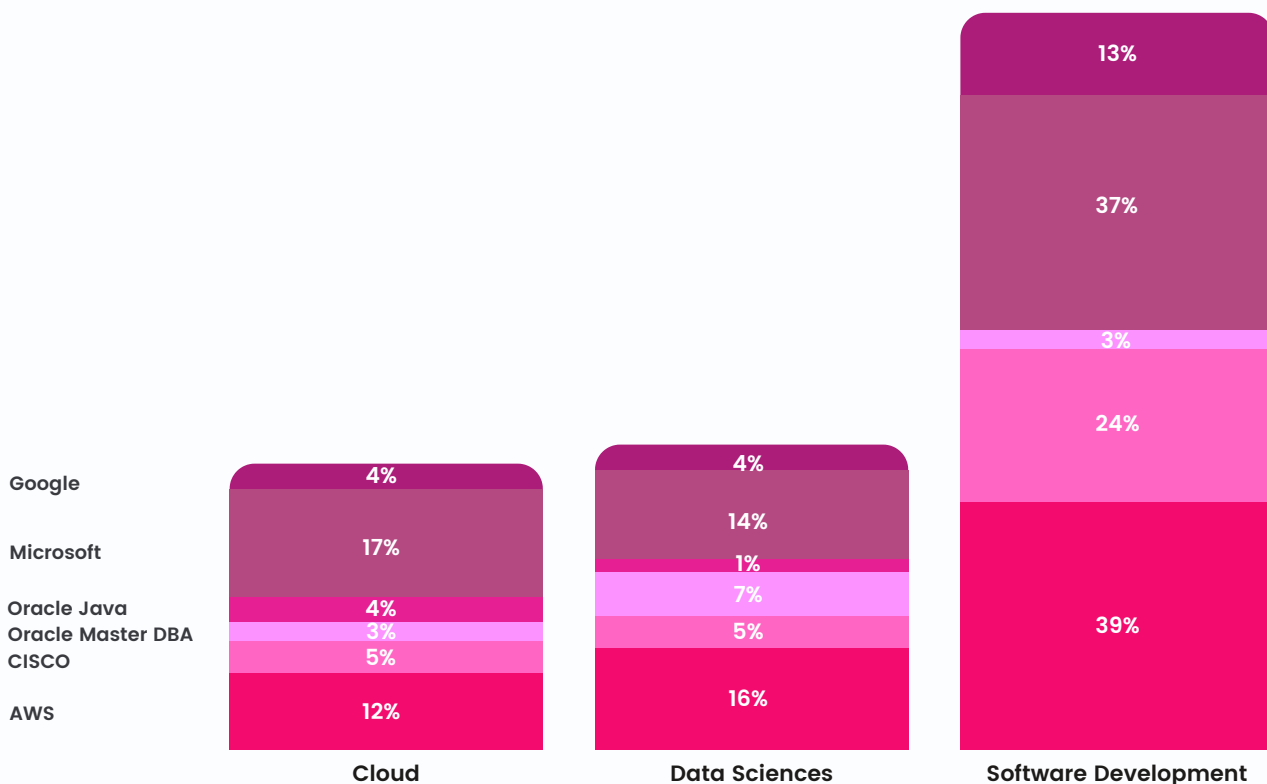
In terms of hierarchy analysis of the type of certification that is missed the most, its Oracle JAVA, where the highest number of missing values indicate the largest opportunity to provide trainings followed by Oracle DBA, Google, and others. This situation can also be depicted in tabular form as follows.

Categories	AWS	CISCO	Oracle Master DBA	Oracle JAVA	Microsoft	Google	Category wise Average
Cloud Services	61%	76%	97%	100%	63%	87%	81%
Data Sciences	84%	95%	93%	99%	86%	96%	92%
Software Dev.	88%	95%	97%	96%	83%	96%	93%
Special wise Average	78%	89%	96%	98%	77%	93%	

The %ages above show “missing values”, pointing out towards the absence of these certification in the respective categories and the need to provide them the opportunity to get them certified resulting in professional value addition.

We can also portray that graphically showing the most preferred certifications across 3 functional categories in which the flip side of the above table can be depicted as shown in the following graph.

Category-wise Most Favored Certifications



It validates the missing values shown in figure 10.3 above. For example, in software development functional area, Oracle Master DB is favored by most as it has the highest percentage of attempting at 17% followed by Microsoft at 12%. Similarly, for Cloud, since Oracle Java (Yellow series) is not a relevant certification, it shows a 0%. The most favored certification for Data Sciences area is Microsoft certification.

In all 3 functional areas, AWS is the most preferred certification, followed by Microsoft. This fact validates the missing value findings shared above and points toward the fact that there is a need for other certifications such as Oracle Java, Oracle Master DB, CISCO and Google and should be promoted for skill enrichment.

Inter-Category Soft Skills Analysis

It was deemed important that another dimension be introduced in this survey which caters to the soft skills of employees to provide some depth in the analysis. Studies show that these have a very close relation to the employee performance which we are also interested to know in terms of Skill level gains for each of the 3 areas of specializations.

These skills were ranked based on a “Excellent” to “poor” scale. Since this was not a third-party evaluation, the respondents ranked themselves on scales. As a result, most of the responses fell in the category of either very good or excellent, a cumulative sum for these 2 scales was taken as it represented most responses.

Soft Skill Category	Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%
Team Work						
Fair	3	7.9	5	6.6	22	8.0
Very Good	18	47.4	41	53.9	139	50.5
Excellent	17	44.7	30	39.5	114	41.5
Total	38	100.0	76	100.0	275	100.0
Workplace Ethics						
Poor	0	0	0	0	2	0.7
Fair	1	2.6	2	2.6	22	8.0
Very Good	14	36.8	38	50	125	45.5
Excellent	23	60.5	36	47.4	126	45.8
Total	38	100.0	76	100	275	100

Workplace Empathy	No.	%	No.	%	No.	%
Poor	0	0	0	0	2	0.7
Fair	4	10.5	8	10.5	29	10.5
Very Good	12	31.6	37	48.7	125	45.5
Excellent	22	57.9	31	40.8	119	43.3
Total	38	100.0	76	100.0	275	100.0
Workplace Adapatability	No.	%	No.	%	No.	%
Poor	0	0	0	0	1	0.4
Fair	1	2.6	9	11.8	26	9.5
Very Good	23	60.5	39	51.3	144	52.4
Excellent	14	36.8	28	36.8	104	37.8
Total	38	100.0	76	100	275	100
Communication Skills Verbal, Written	No.	%	No.	%	No.	%
Poor	0	0	1	1.3	1	0.4
Fair	6	15.8	17	22.4	61	22.2
Very Good	21	55.3	29	38.2	132	48.0
Excellent	11	28.9	29	38.2	81	29.5
Total	38	100.0	76	100	275	100
Numeracy Skills Excel Analysis	No.	%	No.	%	No.	%
Poor	1	2.6	0	0	6	2.2
Fair	10	26.3	10	13.2	90	32.7
Very Good	19	50.0	41	53.9	127	46.2
Excellent	8	21.1	25	32.9	52	18.9
Total	38	100.0	76	100	275	100
Leadership Skills	No.	%	No.	%	No.	%
Poor	0	0	2	2.6	5	1.8
Fair	6	15.8	14	18.4	59	21.5
Very Good	22	57.9	37	48.7	136	49.5

Excellent	10	26.3	23	30.3	75	27.3
Total	38	100.0	76	100.0	275	100.0

These cumulative responses were then averaged out for each soft skill in “category average” giving the overall situation of that skill across the 3 areas and are depicted in the table below:

Soft Skill Category	Cloud Services	Data Sciences	Software Development	Category Average
	Cumulative sum % (Very Good & Excellent Scales)			
Numeracy Skills (Excel Analysis)	71.1	86.8	65.1	74.3
Comm. Skills Verbal, Written	84.2	76.3	77.5	79.3
Leadership Skills	84.2	78.9	76.7	80.0
Workplace Empathy	89.5	89.5	88.7	89.2
Workplace Adaptability	97.4	88.2	90.2	91.9
Teamwork	92.1	93.4	92.0	92.5
Workplace Ethics	97.4	97.4	91.3	95.3

“Numeracy skills” especially in Excel analytics, that are deemed most important to perform day to day functions requires improvement across all 3 areas. These are analytical skills other than skills present in the area specialties. Next weaker segment is the “Communication skills” where most respondents thought they require improvement. “Ethics” came out to be the strongest of all soft skills in all categories across all 3 areas, while “teamwork” was a close second.

The most significant role they play reflects in term of the effect they have on Skill level construct. This will be established in detail in the following section 11, where the relationships will be highlighted against various dependent and independent variables.

Inter-category Skills Analysis

At the end of the questionnaire, 9 skills in each of the 3 categories, i.e. Software development, data sciences and Cloud management systems were rated against identified skill levels ranging from 1 to 7 having increasing level of expertise, to measure gaps in each category, which can then be targeted for capacity building efforts.

Skill Level Definitions

To further simplify this grading, the 7 grades of skills are combined in 3 broad categories. These categories are created keeping in mind the **Competency Dictionary Handbook - iCD**, according to which skills levels 1-4 are more associated with contents of technology/methodology related knowledge and are categorized as possessing the highest skill level related to independent task accomplishment.

For ease of understanding, skill levels 1-4 are subdivided into “Elementary knowledge” for starters and rises up to “Operational knowledge” necessary for independent task accomplishment without supervision as mentioned in the competency handbook

Skill levels 5 and above are not evaluated by skill possession alone but evaluated as the degree or extent of social contribution as a professional and is categorized as having “Expert level knowledge”.



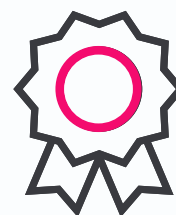
Elementary level Knowledge

Clubbing Skill
Levels 1 & 2



Operational Level Knowledge

Clubbing Skill
Levels 3 & 4



Expert Level Knowledge

Clubbing Skill
Levels 5,6 & 7

Soft Skill Category	Skill Levels (1-7)	Broad Categorization
1	Have basic tech knowledge	Elementary level Knowledge
2	Able to design a tech solution in case instructions are available	
3	Able to work independently create functional requirements	Operational Level Knowledge
4	Able to create tech solutions based on non functional requirements - pass advance tech exams	
5	Have contributed to open source project - a recognized developer in a local community	Expert Level Knowledge
6	Have contributed to a commercial product service - recognized at industry level	
7	Have a strong profile - following on International Communities like Stack Overflow, GitHub etc	

Owing to the scattered nature of responses, a sum of percentages (cumulative) is taken for 3 broad categories mentioned above for each of the 9 skills. That provided with a comparative analysis in percentages that helped in showing, which of the 3 broad categories has the most skills contained in them.

Cloud Management Skills

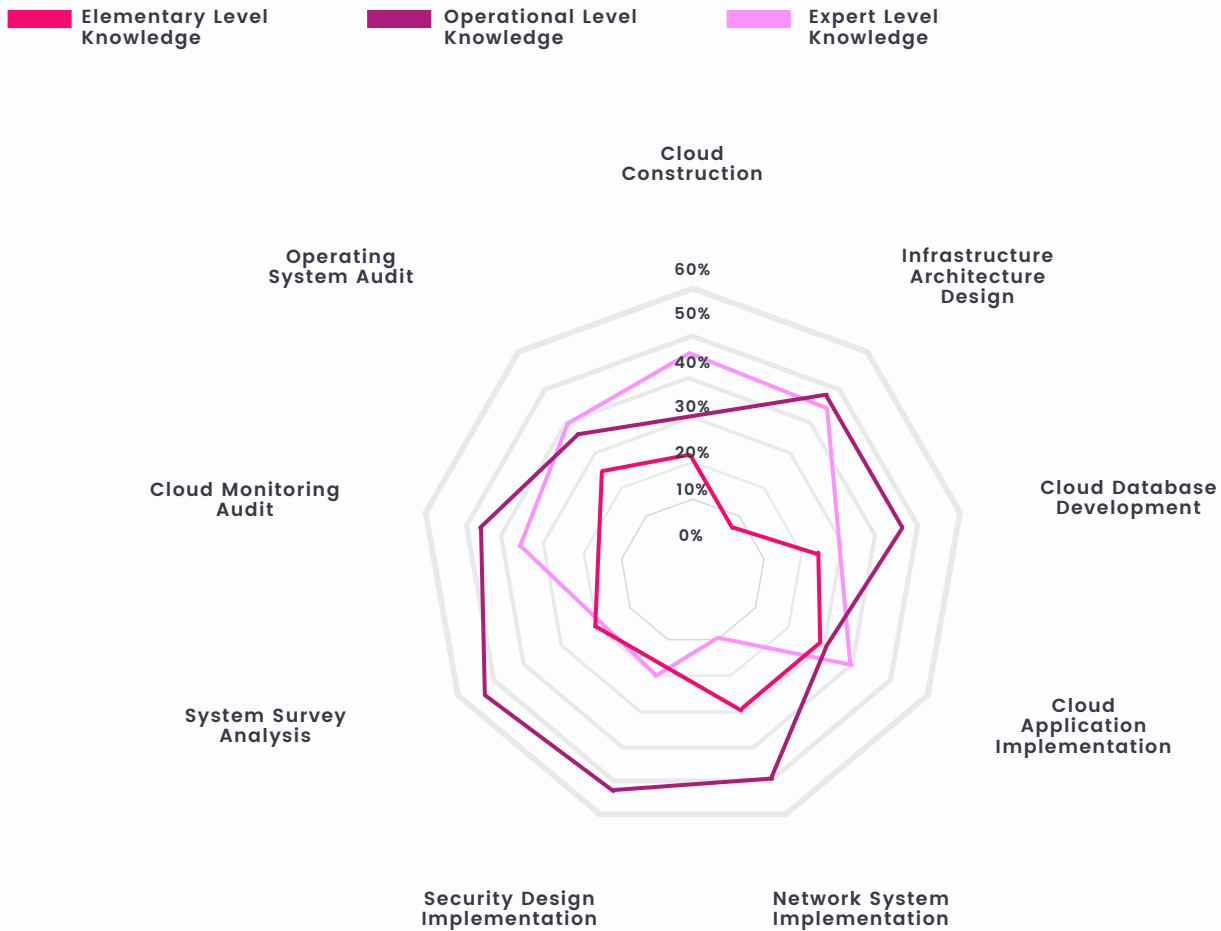
Cloud Service Management and Operations entails all the activities that an organization does to plan, design, deliver, operate, and control the IT and cloud services that it offers to customers. Cloud computing industry in Pakistan is under development, but it is predicted that soon the IT industry will lead the country's economy. The present skill situation is showed by the numbers in the following table:

Sr. No.	Cloud Management (9 Skills)		Cloud Construction	Infra-structure Arch.	Cloud Database Development	Cloud Application	Network System Implementation	Security Design Implementation	System Survey Analysis	Cloud Monitoring	Operating System Audit	Avg.
	Skill Levels (1-7)	Broad Categorization	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%
1	Have basic tech knowledge	Elementary Level Knowledge	21%	8%	24%	29%	29%	18%	21%	18%	24%	21%
2	Able to design a tech solution in case instructions are available											
3	Able to work independently create functional requirements	Operational Level Knowledge	34%	47%	45%	32%	50%	53%	55%	47%	37%	44%
4	Able to create tech solutions based on non functional requirements - pass advance tech exams											
5	Have contributed to open source project - a recognized developer in a local community	Professional	45%	45%	32%	40%	21%	29%	24%	34%	40%	34%
6	Have contributed to a commercial product service -recognized at industry level											
7	Have a strong profile - following on international Communities like Stack Overflow, GitHub etc											

It is very clear from this tabulation that the overall skill and knowledge level for this category is good, with a major component of human resource, 44%, falling in “operational level knowledge”, with a healthy proportion lying in the expert level category 34%. Majority of ability belongs to the security design systems, systems survey analysis and network systems implementation skills. From the demographic data analysis in the previous section, table 10.1, it was established that professionals belonging to this category of skills drew higher salaries. Since their overall number is low resulting in low market supply, their demand increases that also jacks up their market rates.

We can represent the analysis of each of the 9 skill categories for cloud management area graphically against level of knowledge in the following radar chart.

Analysis of 9 Skill Categories Vs. Knowledge Level For Cloud Management Area



Data Science Programming Skills

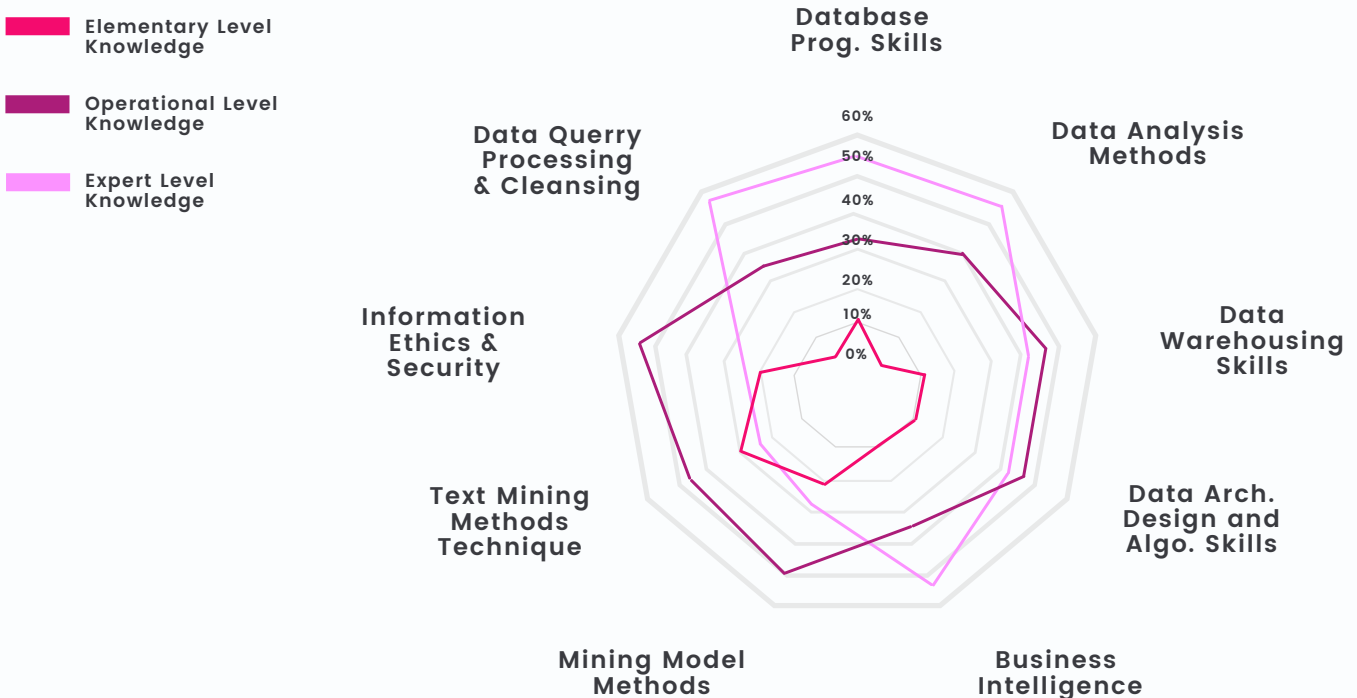
Database programming category, has a major chunk of its HR having “operational level skills”, at 43%, with a healthy proportion lying in the “expert level category” at a close 42%. All this points out towards the fact that this operational area has an equally impressive array of well qualified employees.

Information ethics and security related skills are at the highest with 54% of the respondents having “Operational level knowledge”. Data Query processing and cleansing skill has the highest number of people in the “Expert category” with 55% of people who are experts in the very crucial Database programming skills. Business intelligence category too has a good number of people in the expert category with 53% people belonging to this category.

Sr. No.	Data Sciences (9 Skills)		Database Prog. Skills	Data Analysis Methods	Data Warehousing Skills	Data Arch. Design and Algo. Skills	Business Intelligence	Mining Model Methods	Text Mining Methods Technique	Information Ethics & Security	Data Query Processing & Cleansing	Avg.
	Skill Levels (1-7)	Broad Categorization	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%
1	Have basic tech knowledge	Elementary Level Knowledge		4%								
2	Able to design a tech solution in case instructions are available		11%		11%	9%	9%	21%	29%	20%	7%	13%
3	Able to work independently create functional requirements	Operational Level Knowledge		41%								
4	Able to create tech solutions based on non functional requirements - pass advance tech exams		33%		46%	47%	37%	50%	46%	54%	34%	43%
5	Have contributed to open source project - a recognized developer in a local community	Expert Level Knowledge		54%								
6	Have contributed to a commercial product service -recognized at industry level		55%		42%	42%	53%	28%	24%	25%	58%	42%
7	Have a strong profile - following on International Communities like Stack Overflow,GitHub etc											

We can represent the analysis of each of the 9 skill categories for data sciences area graphically against level of knowledge in the following radar chart.

Analysis of 9 Skill Categories Vs. Knowledge Level For Data Sciences Area



Software Development Skills

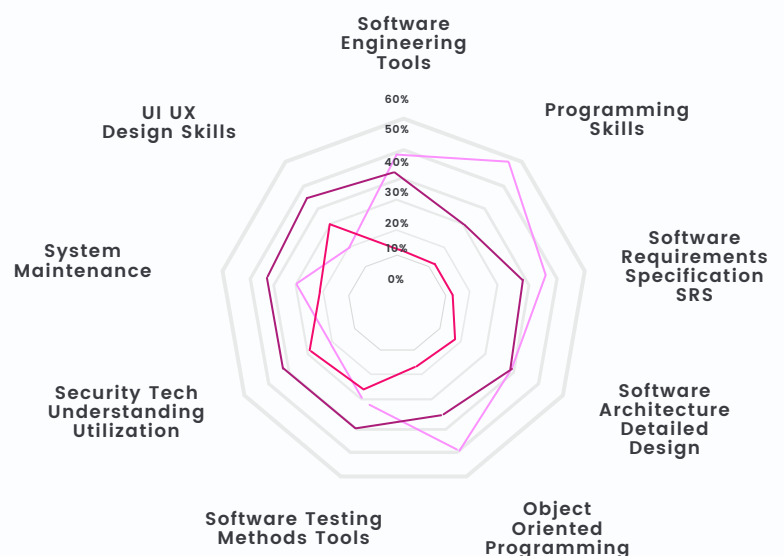
“Software development skills” category does not show any different picture and almost similar trends in terms of ability percentage amongst skill levels. This is the most capable functional area out of all 3 with 42.1% people in the “Expert level” category. Programming skills and object-oriented programming being the areas having the most experts with 56% and 51% respectively.

Sr. No.	Software Development		Software Engineering Tools	Programming Skills	Software Requirements Specification SRS	Software Architecture Detailed Design	Object Oriented Programming	Software Testing Methods Tools	Security Tech Understanding Utilization	System Maintenance	UI UX Design Skills	Avg.
	Skill Levels (1-7)	Broad Categorization	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%	Cum%
1	Have basic tech knowledge	Elementary Level Knowledge	14%	13%	14%	16%	16%	24%	27%	23%	29%	19.6%
2	Able to design a tech solution in case instructions are available											
3	Able to work independently create functional requirements	Operational Level Knowledge	40%	31%	39%	42%	34%	39%	41%	38%	44%	38.7%
4	Able to create tech solutions based on non functional requirements - pass advance tech exams											
5	Have contributed to open source project - a recognized developer in a local community	Expert Level Knowledge	46%	56%	47%	42%	51%	38%	33%	39%	28%	42.1
6	Have contributed to a commercial product service -recognized at industry level											
7	Have a strong profile - following on international Communities like Stack Overflow, GitHub etc											

This category also turned out to be the most populated category in Pakistan having the most respondents nationwide. This seems to be a popular destination for all IT graduates. This thing is reflected in slightly depressed salary numbers, pointing out to be oversupply of graduates versus available jobs in the markets. We can represent the analysis of each of the 9 skill categories for software development area graphically against level of knowledge in the following radar chart.

Analysis of 9 Skill Categories Vs. Knowledge Level For Software Development Area

- Elementary Level Knowledge
- Operational Level Knowledge
- Expert Level Knowledge





Inferential Statistics

This section presents the inferential analysis using correlation and regression statistics. Before proceeding to the correlations and regression analysis a short background of the variables for the analysis is explained here.

The current study intends to identify the level of skills of the engineers from IT industry. The level of skills is an important indicator related to worker's Skill level.¹ In this exercise, the variable "skill level" is constructed by calculating averages of the level of skills an engineer has in the three areas i.e. software development, data science and cloud management. It is categorized by the 7 levels.

The variable skill level is taken as "dependent variable" and variables which include salary level, years of experience in IT industry, education level, age, gender, IT certification, access to soft skill trainings and work related technical trainings are taken as "independent variables".

Sr. No.	Variables	Description
1	Skill Level (Dependent)	A continuous variable; calculating averages of the level of skills
2	Salary (Independent)	A discrete random variable measured on the scale of 7 points i.e. 1. 40K - 80K 2. 81K - 150K 3. 151K - 250K 4. 251K - 350K 5. 351K and Above
3	Experience	A continuous variable measured in numbers of completed years of experience
4	Education Level (independent)	A discrete random variable measured on the scale of 6 points i.e. 1. High School Certificate, 2. TEVT Diploma, 3. Bachelor's Degree, 4. Master's Degree, 5. PhD 6. Other
5	Age (Independent)	A continuous variable measured in numbers of completed years of age
6	Gender (Independent)	A discrete random variable measured as 1. Male 2. Female
7	IT Certifications (Independent)	An ordered categorical variable for each type of IT certification
8	Technical Trainings (Independent)	A continuous variable measured as number of trainings completed
9	Soft Skills (Independent)	An ordered categorical variable measured on the scale of 5 points i.e. 1. very poor 2. Poor 3. Good 4. Very Good 5. Excellent

¹: According to JC Pickens in *Beyond productivity: How leading companies achieve superior performance by leveraging their human capital* GG Dess, JC Pickens - 1999 - American Management Associates, the organizational performance of the worker can be raised by enhancing the human capital, i.e. generally consist of the individual's capabilities, knowledge, the level of skills and experience of the company's employees and managers, as well as the capacity to increase knowledge, skills, and experience through individual learning.

Correlation Analysis

Based on the discussion in the previous section, for identifying the key relationships among variables of interest of the study such as Skill level, IT certification, soft skills, total experience, average monthly salary, age and education, correlation is performed and the variables with positive results are presented in the table below.

Variables	Skill Level	IT Certification	Soft Skills	Total Experience	Avg. Monthly Salary
Skill Level	1				
IT Certification	0.1817*	1			
Soft Skills	0.3903*	0.1513*	1		
Total Experience	0.1126*	0.0695*	0.0933*	1	
Avg. Monthly Salary	0.167*	0.1762*	0.089*	0.0299*	1
Age	0.09	---	---	---	---
Education	0.09	---	---	---	---

*Correlation signification @ 5%

It is evident that IT certification, soft skills, total experience, average monthly salary are found to have significant correlations with the Skill level construct for all levels of respondents and therefore are suitable to be analyzed through regression models presented in the next section. IT certification is 18%, soft skills 39%, experience 11% and salary is 16% significantly correlated with the skill level of the employee.

Regression Analysis

Francis Galton coined the term "regression" in the 19th century to describe a certain phenomenon. Regression analysis is a type of inferential statistics where the researcher wants to analyze the effect of several independent variables upon the variable of interest. The objective of the regression analysis is to find out how the average value of the dependent variable (or regressand) varies with the given value of the independent variable (or regressor).

The method underlying the regression analysis and the method being employed here as well, is known as the method of Ordinary Least Squares (OLS).

The principle of least squares implies; “minimizing the sum of the squares of the differences between the observed dependent variable (values of the variable being observed) in a given dataset and those predicted by the linear function of the independent variable”.²

For a regression model of a linear form (in which the powers of the variables and the parameters equals=1), OLS method can be applied. Based on the correlations in the previous section, regression model in its general form can be depicted as below.

$$\text{Skill Level} = f(\text{IT Certification, Soft Skills, Experience, Salary, Age, Education}) \dots\dots\dots 1$$

From the above equation 1, a linear regression model in terms of variables and parameters () for the current regression model can be written as follows.

$$SK = \beta_1 + \beta_2 \text{ITCERT} + \beta_3 \text{SS} + \beta_4 \text{EXP} + \beta_6 \text{SAL} + \beta_7 \text{AGE} + \beta_8 \text{EDU} + \epsilon_i \dots\dots\dots 2$$

Where;

- SK = Skill Level
- ITCERT = IT Certification Index
- SS = Soft Skills Index
- EXP = Level of Experience in IT
- SAL = Salary
- EDU = Education

ϵ_i = Error term and $\beta_1 \dots \beta_8$ are the regression coefficients.

The equation 2 is our linear regression model and can be estimated through the method of ordinary least squares, which estimates the values of the coefficients introduced in the model (Eq.2).

These parameters reveal the effect of independent variables on skill level. Technically, it can be interpreted as any x unit change in independent variables causing β_i (where i =1 to 8) units change in the dependent variables with either a positive or a negative. It is pertinent to mention here that, the significance of the coefficients of the variables i.e. the magnitude of change in dependent variable can be observed by a T-test and p-values written next to the coefficient. If the value of T-test is greater than 2, with p-value less than 0.05 the coefficient/magnitude of change is significant in the direction of the sign, as it appears in the regression model.

Lastly, the significance of the regression models can be observed by looking at the F-value, which should be greater than 10 to show statistical significance. The coefficient of determination i.e. R^2 , should be greater than or equal to 13 for any primary data to be statistically sound. This explains the level of variation of the independent variables causing change in the dependent variables.³

2: Gujrati, N.D (2003). Basic Econometrics (4th Edition) McGraw-Hill/Irwin, ISBN- 0-07-112342-3. Chap.#2-3.

3: Gujrati, N.D (2003). Basic Econometrics (4th Edition) McGraw-Hill/Irwin, ISBN- 0-07-112342-3. Chap.#2-3.

Methodology

The methodology followed in this analysis is “Deductive” in nature, i.e. we move from general model to the specific model by iterating various variables against each other and identifying various significance levels, by passing them through the check of correlations and OLS method.

In the following regression models 1,2,3 and 4 we iterated and checked the effects of various variables against each other and tested their significance levels. In the last model # 5, we managed to isolate those selected variables which we found to have the most significant effect on our dependent variable, i.e. the skill level. The regression tables are presented in the tables below.

Regression Table 1

Variables	Coefficient	T - Test	P - Value	R ²	F - Value
Soft Skill Index	0.986	7.84	0.000	17	21.02 (.000)
IT Certification Index	0.324	2.22	0.000		
Age	0.011	1.32	0.188		
Experience	0.13	1.94	0.054		

Insight: The above table demonstrates the regression model 1 i.e. the Skill level of the employee is strongly affected by soft skills i.e. if soft skills increases the Skill level of the employee significantly increases by 98%. Similarly, IT Certification affects the Skill level of the employee by 32% with significant p value i.e. less than 0.05. This implies with the increase in the IT certification the Skill level also increases. Age is insignificant in the model. Experience caters to about 13% increase in the Skill level of the employee with significant p value.

Regression Table 2

Variables	Coefficient	T - Test	P - Value	R ²	F - Value
Soft Skill Index	0.998	7.96	0.000	16	27.40 (.000)
IT Certification Index	0.332	2.28	0.023		
Experience	0.14	1.95	0.051		

Insight: In the above table, the regression model 2 for soft skills, IT certification & experience are performed. The three variables are positively and significantly contributing to the performance of the employee as evident from the table.

Regression Table 3

Variables	Coefficient	T - Test	P - Value	R ²	F - Value
Soft Skill Index	0.996	7.92	0.000	17	17.58 (.000)
IT Certification Index	0.327	2.24	0.025		
Experience	0.054	0.61	0.543		
Work Hours	-0.068	-1.56	0.119		
Salary	0.134	1.79	0.073		

Insight: In the table above, the two important variables are incorporated i.e. work-hours and salary. The variable work hours behave insignificantly i.e. it is not contributing to the Skill level of the employee. Similarly, the variable experience in the previous model 2 has shown significant effect on the Skill level, however, after inclusion of the work hours in the model 3, it becomes insignificant in the current model 3. This result points out that the inclusion of workhours raised the problem of multicollinearity a & b among the two variables and become insignificant i.e. the two variables are highly collinear with each other that is why their effects turned to be insignificant. However, in the previous model 2 it is evident that experience is significantly contributing up to 14% with 0.05 p-value.

Regression Table 4

Variables	Coefficient	T - Test	P - Value	R ²	F - Value
Soft Skill Index	1.004	8.07	0.000	17	27.81(.000)
Income Variable	0.147	2.46	0.014		
IT Certification	-0.233	-0.195	0.052		

Insight: In this regression model above, the sign of the IT certification has become negative and it is also significant. Whereas in the previous models 1, 2 and 3, this sign was positive. This result is interesting since it points out that if a person only has soft skills and has good salary (excluding the experience, work hours' and IT

certification variables), it is more likely that, he will be less efficient compared to others having more IT certifications, experience and work hours. The sign of the variables confirms that, if a person has no or less IT certifications, he/she will perform 23% poorer in his output compared to the person having more IT certifications.

The regression model 5 below solved the mystery of the negative sign by decomposing the soft skill index into communication skills and numeracy skills.

Regression Table 5

Variables	Coefficient	T - Test	P - Value	R ²	F - Value
Income	0.177	2.91	0.004	13	20.53 (.000)
IT Certification	0.464	3.145	0.002		
Communication Skills	0.506	6.2	0.000		
Numeracy Skills	0.455	5.63	0.000		

Insight: The two new variables from within the soft skill index i.e. communication skills and numeracy skills are now introduced in the model. Here, it is important to mention that having IT certifications along with communication skills and numeracy skills, can enhance the skill level of the employee significantly. This model confirms that the sign of the IT certification is now positive (compared to model 4) and has significant value as well.

It is more likely that 46% of the performance is increased if IT certifications of an engineer increases. Similarly, higher the communication skills, higher will be the skill level of the employee i.e. 50% increase in the Skill level by improving the communication skills.

Lastly, numeracy skills also constitute a positive effect and enhances Skill level by 45% and is also significant, i.e. if the numeracy skills of the employee increases, his Skill level will significantly increase by 45%. This also allows us to conclude that, without having soft skills trainings, (especially the communication and numeracy skills), IT certifications alone will not be enough to raise the overall Skill level of the employees in their respective areas of specialization.

The regression model 6 below, tries to capture the effect of gender, education, and occupation on skill level along with IT certification, income, and soft skills. The occupation variable is recoded into 3 dummy variables representing three main categories i.e. software engineering, cloud management, and data sciences.

The education variable was also recoded into a dummy for engineers with master's degree. The variable gender is also recoded to dummy for female engineers. The results are shown in the table below.

Regression Table 6

Variables	Coefficient	T - Test	P - Value	R ²	F - Value
IT Certification	1.173	2.291	0.02		
Income	0.180	2.794	0.02		
Communication Skills	0.388	4.451	0.00		
Numeracy Skills	0.319	3.677	0.00		
Experience	0.019	1.802	0.07		
Software Eng. Dummy	0.019	0.122	0.90	15%	9.04 (0.00)
Cloud Eng. Dummy	-0.422	-1.783	0.75		
Data Scientist Dummy	-0.026	-0.164	0.87		
Gender (1 = Female)	-0.172	-0.830	0.40		
Education (1 = Female)	0.034	0.243	0.808		

Insight: In the above model, the variable IT certification (1 = Completed IT Certification) is significant, but with a negative sign. This points out that those engineers who do not have IT certifications have lower level of skills by .270 points compared to those who have completed IT certification.

It is interesting to note that soft skills like communication and numeracy skills possessed by an engineer related to any of the categories like software, cloud or data sciences, tend to have positive and significant effect on the overall skill level.

The variable, experience in years, is also positively correlated and significantly effects the level of skills of engineers, i.e. one-year increase in years of experience leads to 1.9% increase in the overall level of skills.

The dummy variables of occupation clearly show that the variables are insignificant and allow us to conclude that skill level is not related to the type of occupation as depicted by our 3 main categories, i.e. Software Eng. Cloud Eng. or Data Sciences.

Gender variable was also factored in despite having a very small sample representation in the overall sample. The results show that when compared to males, females have low level of skills, however this result is not a true representation of the facts on ground. Since participation of females in this sector is dependent on so many factors which require detailed investigation. The questionnaire designed for this exercise did not have queries to deeply analyze the environmental effect, societal constraints, access to IT opportunities etc. for us to conclude anything concrete and as a result the findings for this variable exhibited an insignificant result with the given data set. Education i.e. was also found to be insignificant and is not related to the skill level of the engineer.

Conclusion

After detailed iterations and testing we can safely conclude that variables having significant effect on the overall skills of IT engineers belonging to our 3 areas of specialization i.e. Software Eng. Cloud Eng. or Data Sciences are IT certifications, soft skills mainly communication and numeracy skills, income and experience of the engineer and is consistent with our regression model 5 above.



Annexures

Survey Questionnaire

Demographics

- Male Female

Education Level

- High School Certificate TVET Diploma
 Bachelor's Degree Master's Degree
 PhD Other

Age (In Numbers)

Years of Experience in the IT Industry (In Numbers)

No. of Employees in your Firm (Approx.)

- 0 - 50
 51 - 100
 101 - 200
 201 - 500
 500 - 1000
 1000 and above

City of Company's Location

- Islamabad Karachi Lahore Peshawar
 Faisalabad Hyderabad Bahawalpur Sialkot
 Quetta Multan Sukkur Other

Your Employment Status

- Permanent
- Contract Based
- Freelancer
- Other: _____

How many hours per day do you usually work? (In Numbers)

How many days per week do you usually work? (In Numbers)

Do you have any IT related certificate?

- Yes
- No

AWS Certification

- Foundational Level
- Associate Level
- Professional Level
- I have the certificate, but I'm not sure about its level

Cisco Certification

- Entry Level
- Associate Level
- Professional Level
- Expert Level
- Architect Level
- I have the certificate, but I'm not sure about its level

Oracle Master DBA

- Bronze Level
- Silver Level
- Gold Level
- I have the certificate, but I'm not sure about its level

Oracle Certified Java Programmer

- Bronze Level
- Silver Level
- Gold Level
- I have the certificate, but I'm not sure about its level

Microsoft Certification

- Foundational Level
- Associate Level
- Expert Level
- I have the certificate, but I'm not sure about its level

Google Cloud Certification

- Associate Level
- Professional Level
- I have the certificate, but I'm not sure about its level

What is your job title in your organization?

- Specialist/Engineer level - Software development
- Specialist/Engineer level - Data Sciences
- Specialist/Engineer level - Cloud Development
- Mid/Senior Managerial level - Software Development

- Mid/Senior Managerial level - Data Sciences
- Mid/Senior Managerial level - Cloud Development

Your Average Monthly Gross Salary in PKR

- 40K - 80K
- 81K - 150K
- 151K - 250K
- 251K - 350K
- 351K and Above

Number of "IT" trainings attended at work?

- None
- 1
- 2
- 3
- 4
- 5 and above

How do you rate yourself on following Soft Skills?

	Very Poor	Poor	Fair	Very Good	Excellent
Team Work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workplace Ethics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workplace Empathy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workplace Adaptability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication Skills (Verbal/Written)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Numeracy Skills (Excel/Analytics)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leadership Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The number of non-technical / soft skills trainings that you have attended at work?

- None 1
 2 3
 4 5 and above

Please mark your skill level, based on the following 7 scale categories, where you fit.

- 0 - No experience
 1 - Have basic tech knowledge
 2 - Able to design a tech solution, if instructions are available
 3 - Able to work independently & create functional requirements
 4 - Able to create tech solutions based on non-functional requirements & pass adv. tech exams
 5 - Have contributed to open-source project & a recognized developer in a local community
 6 - Have contributed to a commercial product/service and recognized at industry level
 7 - Have a strong profile & following on International Communities like Stack Overflow/GitHub etc.

SOFTWARE DEVELOPMENT

Please rate yourself in the following skills against the scales

	1	2	3	4	5	6	7
Software Engineering Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Programming Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Software Requirements Specification (SRS)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Software Architecture & Detailed Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4	5	6	7
Object Oriented Programming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Software Testing Methods & Tools	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security Tech, Understanding & Utilization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
System Maintenance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
UX/UI Design Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please mark your skill level, based on the following 7 scale categories, where you fit.

- 0 - No experience
- 1 - Have basic tech knowledge
- 2 - Able to design a tech solution, if instructions are available
- 3 - Able to work independently & create functional requirements
- 4 - Able to create tech solutions based on non-functional requirements & pass adv. tech exams
- 5 - Have contributed to open-source project & a recognized developer in a local community
- 6 - Have contributed to a commercial product/service and recognized at industry level
- 7 - Have a strong profile & following on International Communities like Stack Overflow/GitHub etc.

Please rate yourself in the following skills against the scales

	1	2	3	4	5	6	7
Database Programming Skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1	2	3	4	5	6	7
Data Analysis Methods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data Warehouse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data Architecture Design & Algorithm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Business Intelligence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mining Model Methods & Tech	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Text Mining Methods & Technologies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information Ethics, Security & Personal information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data Query, Processing & Cleansing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please mark your skill level, based on the following 7 scale categories, where you fit.

- 0 - No experience
- 1 - Have basic tech knowledge
- 2 - Able to design a tech solution, if instructions are available
- 3 - Able to work independently & create functional requirements
- 4 - Able to create tech solutions based on non-functional requirements & pass adv. tech exams
- 5 - Have contributed to open-source project & a recognized developer in a local community
- 6 - Have contributed to a commercial product/service and recognized at industry level
- 7 - Have a strong profile & following on International Communities like Stack Overflow/GitHub etc.

Please rate yourself in the following skills against the scales

	1	2	3	4	5	6	7
Cloud Construction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Infrastructure Architecture Design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud Database Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud Application Implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud Construction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network System Implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Security Design & Implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
System Survey & Analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cloud Monitoring & Audit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Operating System & Middleware	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Detailed Tabulation of Soft Skills

Soft Skill Category	Cloud Services		Data Sciences		Software Development	
	No.	%	No.	%	No.	%
Team Work	No.	%	No.	%	No.	%
Fair	3	7.9	5	6.6	22	8.0
Very Good	18	47.4	41	53.9	139	50.5
Excellent	17	44.7	30	39.5	114	41.5
Total	38	100.0	76	100.0	275	100.0
Workplace Ethics	No.	%	No.	%	No.	%
Poor	0	0	0	0	2	0.7
Fair	1	2.6	2	2.6	22	8.0
Very Good	14	36.8	38	50	125	45.5
Excellent	23	60.5	36	47.4	126	45.8
Total	38	100.0	76	100	275	100
Workplace Empathy	No.	%	No.	%	No.	%
Poor	0	0	0	0	2	0.7
Fair	4	10.5	8	10.5	29	10.5
Very Good	12	31.6	37	48.7	125	45.5
Excellent	22	57.9	31	40.8	119	43.3
Total	38	100.0	76	100.0	275	100.0
Workplace Adapatability	No.	%	No.	%	No.	%
Poor	0	0	0	0	1	0.4
Fair	1	2.6	9	11.8	26	9.5
Very Good	23	60.5	39	51.3	144	52.4
Excellent	14	36.8	28	36.8	104	37.8
Total	38	100.0	76	100	275	100.0
Communication Skills Verbal, Written	No.	%	No.	%	No.	%
Poor	0	0	1	1.3	1	0.4
Fair	6	15.8	17	22.4	61	22.2

Very Good	21	55.3	29	38.2	132	48.0
Excellent	11	28.9	29	38.2	81	29.5
Total	38	100.0	76	100	275	100.0
Numeracy Skills Excel Analysis	No.	%	No.	%	No.	%
Poor	1	2.6	0	0	6	2.2
Fair	10	26.3	10	13.2	90	32.7
Very Good	19	50.0	41	53.9	127	46.2
Excellent	8	21.1	25	32.9	52	18.9
Total	38	100.0	76	100	275	100.0
Leadership Skills	No.	%	No.	%	No.	%
Poor	0	0	2	2.6	5	1.8
Fair	6	15.8	14	18.4	59	21.5
Very Good	22	57.9	37	48.7	136	49.5
Excellent	10	26.3	23	30.3	75	27.3
Total	38	100.0	76	100.0	275	100.0

Detailed Tabulation of Competency Grading

Sr. No.	Cloud Management (9 Skills)		Cloud Construction		Infra-structure Arch.		Cloud Database Development		Cloud Application		Network System Implementation		Security Design Implementation		System Survey Analysis		Cloud Monitoring		Operating System Audit	
	Skill Levels (1-7)	Broad Categorization	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Have basic tech knowledge	Elementary Level Knowledge	4	10.5	1	2.6	2	5.3	4	10.5	2	5.3	2	5.3	2	5.3	4	10.5	6	15.8
2	Able to design a tech solution in case instructions are available		4	10.5	2	5.3	7	18.4	7	18.4	9	23.7	5	13	6	16	3	8	3	8
Cumulative %			21%		8%		24%		29%		29%		18%		21%		18%		24%	
3	Able to work independently create functional requirements	Operational Level Knowledge	6	15.8	12	31.6	13	34.2	5	13.2	10	26.3	15	39.5	11	28.9	11	28.9	5	13.2
4	Able to create tech solutions based on non functional requirements - pass advance tech exams		7	18.4	6	15.8	4	10.5	7	18.4	9	23.7	5	13.2	10	26.3	7	18.4	9	23.7
Cumulative %			34%		47%		45%		32%		50%		53%		55%		47%		37%	
5	Have contributed to open source project - a recognized developer in a local community	Professional	7	18.4	6	15.8	3	7.9	5	13.2	3	7.9	4	10.5	3	7.9	5	13.2	8.0	21.1
6	Have contributed to a commercial product service - recognized at industry level		5	13.2	5	13.2	4	10.5	4	10.5	1	2.6	4	10.5	5	13.2	3	7.9	4	10.5
7	Have a strong profile - following on International Communities like Stack Overflow, GitHub etc		5	13.2	6	15.8	5	13.2	6	15.8	4	10.5	3	7.9	1	2.6	5	13.2	3	7.9
Cumulative %			45%		45%		32%		40%		21%		29%		24%		34%		40%	
Total			38.00	100.0	38	100.0	38	100.0	38	100.0	38	100.0	38	100.0	38	100.0	38	100.0	38	100.0

Sr. No.	Data Sciences (9 Skills)		Database Prog. Skills		Data Analysis Methods		Data Warehousing Skills		Data Arch. Design and Algo. Skills		Business Intelligence		Mining Model Methods		Text Mining Methods Technique		Information Ethics & Security		Data Query Processing and Cleansing	
	Skill Levels (1-7)	Broad Categorization	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Have basic tech knowledge	Elementary Level Knowledge	2	2.6	3	3.9	1	1.3	4	5.3	3	3.9	9	11.8	11	14.5	9	11.8	2	2.6
2	Able to design a tech solution in case instructions are available		6	7.9	0	0	7	9.2	3	3.9	4	5.3	7	9.2	11	14.5	6	7.9	3	3.9
Cumulative %			11%		4%		11%		9%		9%		21%		29%		20%		7%	
3	Able to work independently create functional requirements	Operational Level Knowledge	11	14.5	14	18.4	19	25.0	19	25.0	15	19.7	20	26.3	17	22.4	18	23.7	11	14.5
4	Able to create tech solutions based on non functional requirements - pass advance tech exams		14	18.4	17	22.4	16	21.1	17	22.4	13	17.1	18	23.7	18	23.7	23	30.3	15	19.7
Cumulative %			33%		41%		46%		47%		37%		50%		46%		54%		34%	
5	Have contributed to open source project - a recognized developer in a local community	Expert Level Knowledge	15	19.7	13	17.1	10	13.2	9	11.8	9	11.8	9	11.8	7	9.2	11	14.5	7	9.2
6	Have contributed to a commercial product service -recognized at industry level		21	27.6	20	26.3	16	21.1	15	19.7	18	23.7	7	9.2	6	7.9	3	3.9	21	27.6
7	Have a strong profile - following on International Communities like Stack Overflow,GitHub etc		6	7.9	8	10.5	6	7.9	8	10.5	13	17.1	5	6.6	5	6.6	5	6.6	16	21.1
Cumulative %			55%		54%		42%		42%		53%		28%		24%		25%		58%	
Sb Total			75	98.684	75	98.7	75	98.7	75	98.7	75	98.7	75	98.7	75	98.7	75	98.7	75	98.7
Missing Values			1	1.3	1	1.3	1	1.3	1	1.3	1	1.3	1	1.3	1	1.3	1	1.3	1	1.3
Total			76	100	76	100	76	100	76	100	76	100	76	100	76	100	76	100	76	100

Sr. No.	Software Development		Software Engineering Tools		Programming Skills		Software Requirements Specification SRS		Software Architecture Detailed Design		Object Oriented Programming		Software Testing Methods Tools		Security Tech Understanding Utilization		System Maintenance		UI UX Design Skills	
	Skill Levels (1-7)	Broad Categorization	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1	Have basic tech knowledge	Elementary Level Knowledge	16	5.8	19	6.9	15	5.5	19	6.9	28	10.2	22	8.0	30	10.9	24	8.7	42	15.3
2	Able to design a tech solution in case instructions are available		23	8.4	16	5.8	23	8.4	26	9.5	15	5.5	44	16.0	43	15.6	40	14.5	37	13.5
Cumulative %			14%		13%		14%		16%		16%		24%		27%		23%		29%	
3	Able to work independently create functional requirements	Operational Level Knowledge	34	12.4	24	8.7	39	14.2	47	17.1	25	9.1	42	15.3	47	17.1	35	12.7	46	16.7
4	Able to create tech solutions based on non functional requirements - pass advance tech exams		75	27.3	62	22.5	69	25.1	67	24.4	67	24.4	64	23.3	65	23.6	68	24.7	74	26.9
Cumulative %			40%		31%		39%		42%		34%		39%		41%		38%		44%	
5	Have contributed to open source project - a recognized developer in a local community	Expert Level Knowledge	45	16.4	53	19.3	60	21.8	61	22.2	57	20.7	54	19.6	57	20.7	56	20.4	30	10.9
6	Have contributed to a commercial product service -recognized at industry level		58	21.1	74	26.9	46	16.7	37	13.5	56	20.4	33	12.0	23	8.4	35	12.7	31	11.3
7	Have a strong profile - following on International Communities like Stack Overflow,GitHub etc		24	8.7	27	9.8	23	8.4	18	6.5	27	9.8	16	5.8	10	3.6	17	6.2	15	5.5
Cumulative %			46%		56%		47%		42%		51%		38%		33%		39%		28%	
Total			275	100	275	100	275	100	275	100	275	100	275	100	275	100	275	100	275	100

Overall Correlations Tables

Variables	Skill Level	Gender	Education	Age	Experience	Hrs./ Day	Soft Skill
Gender	-0.063	1					
Education	0.0946	0.0145	1				
Age	0.0999*	-0.0494	-0.0257	1			
Experience	0.1126*	0.0067	-0.0168	0.8970*	1		
Hours Per Day	-0.0038	-0.0917	-0.0227	0.0026	0.015	1	
Soft Skills	0.3903*	-0.004	-0.0627	0.0828	0.0933	0.1036*	1
Avg. Monthly Salary	0.1670*	-0.1858*	0.2794*	0.0233	0.0299	0.1688*	0.089

Female Correlations

		Skill level Index	Education Level	Age CAT	Total Exp in IT Industry in years	Monthly Avg Salary	Soft Skill Index
Skill Level Index	Pearson Correlation	1	-.064	-.042	.097	.159	.361*
	Sig. (2-tailed)		.707	.803	.567	.349	.028
	N	37	37	37	37	37	37
Education Level	Pearson Correlation	-.064	1	.337*	.165	.227	-.223
	Sig. (2-tailed)	.707		.041*	.329	.177	.185
	N	37	37	37	37	37	37
Age CAT	Pearson Correlation	-.042	.337*	1	.838**	.671**	.153
	Sig. (2-tailed)	.803	.041		.000	.000	.365
	N	37	37	37	37	37	37
Total Experience in IT Industry in years	Pearson Correlation	.097	.165	.838**	1	.716**	.205
	Sig. (2-tailed)	.567	.329	.000		.000	.224
	N	37	37	37	37	37	37
Monthly Avg Salary	Pearson Correlation	.159	.227	.671**	.716**	1	.210
	Sig. (2-tailed)	.349	.177	.000	.000		.213
	N	37	37	37	37	37	37

Soft Skill Index	Pearson Correlation	.361*	-.223	.153	.205	.210	1
	Sig. (2-tailed)	.028	.185	.365	.224	.213*	
	N	37	37	37	37	37	37

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

a. Gender = Female

Male Correlations

		Skill level Index	Education Level	Age CAT	Total Exp in IT Industry in years	Monthly Avg Salary	Soft Skill Index
Skill Level Index	Pearson Correlation	1	.107*	.125*	.019	.158**	.395**
	Sig. (2-tailed)		.045	.019	.039	.003	.000
	N	352	352	352	352	352	352
Education Level	Pearson Correlation	.107*	1	.489**	.414**	.291**	-.048
	Sig. (2-tailed)	.045		.000	.000	.000	.364
	N	352	352	352	352	352	352
Age CAT	Pearson Correlation	.125*	.489**	1	.866**	.538**	-.002
	Sig. (2-tailed)	.019	.000		.000	.000	.975
	N	352	352	352	352	352	352
Total Experience in IT Industry in years	Pearson Correlation	.110	.414**	.866**	1	.597**	.006
	Sig. (2-tailed)	.039	.000	.000		.000	.915
	N	352	352	352	352	352	352
Monthly Avg Salary	Pearson Correlation	.158**	.291**	.538**	.597**	1	.079
	Sig. (2-tailed)	.003	.000	.000	.000		.141
	N	352	352	352	352	352	352
Soft Skill Index	Pearson Correlation	.395**	-.048	-.002	.006	.079	1
	Sig. (2-tailed)	.000	.364	.975	.915	.141	
	N	352	352	352	352	352	352

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

a. Gender = Male

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