Analysis of Skills Gap in the ICT Sector in Bangladesh

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List of Abbreviations

3D	Three-dimensional.
Ahsanullah	Ahsanullah University of Science and Technology
AI	Artificial intelligence
AIUB	American International University-Bangladesh
BACCO	Bangladesh Association of Call Center & Outsourcing
BASIS	Bangladesh Association of Software and Information Services
BCS	Bangladesh Computer Samity
BIDS	Bangladesh Institute of Development Studies
BPO	Business process outsourcing
BRACU	BRAC University
BUET	Bangladesh University of Engineering and Technology
CAGR	Compound annual growth rate
CUET	Chittagong University of Engineering and Technology
DU	Dhaka University
FTTX	Fiber to the x
GDP	Gross Domestic Product.
GIS	Geographic Information System
ICT	Information and Communications Technology
ICX	Inter connection Exchange
IIG	International Internet gateway Service),
IoT	Internet of Things
ISP	Internet service provider
ISPAB	Internet Service Providers Association of Bangladesh
IT	Information Technology
ITES	Information Technology Enabled Services
ITO	Information Technology Outsourcing
IUT	Islamic University of Technology
JU	Jahangirnagar University
KUET	Khulna University Of Engineering & Technology
NGO	Non-Governmental Organization
NSU	North South University
NTTN	Nationwide Telecommunication Transmission Network
PSTN	Public Switched Telephone Network
RPA	Robotic process automation
RUET	Rajshahi University of Engineering & Technology
TVET	Technical and Vocational Education and Training
VSAT	Very Small Aperture Terminal

Executive Summary

The development of human capital is an important prerequisite for the development of the ICT sector. With a demographic dividend in place, Bangladesh is in an advantageous position to exploit the potential of the IT industry. The sector employs roughly about 0.22 million IT professionals in 2020, which is expected to be doubled by 2025. To understand the IT labor market, existing skills, and skills gap, this study attempts to make an in-depth analysis of the skills gap in the sector. A survey of 146 firms and about 250 employees was conducted from December 2020 to March 2021 to understand the employment situation and skills gap in the ICT sector. We attempt to analyze the skills gap in a succinct manner to understand the dynamics of the labor market and future demand for skills in this sector that would be key for the growth and development of the ICT sector.

About 85% of the surveyed firms are involved in the software industry and 46% are involved with IT consultancy (Figure 2). About 33% of firms are involved with networking activities and 24% are engaged in internet service-providing activities. Only 14% are engaged in call center & BPO and the same proportion in hardware solutions. Survey results suggest that 60% are involved in website development and hosting, 52% in e-commerce, 47% in mobile applications, 42% in accounting and financial software development, 41% in education management systems, 36% in enterprise resource planning (ERP), 33% in POS/inventory management, 30% in graphics, about 25% are involved in hospital/insurance management system and a similar proportion in security and biometric system development. Less than 15% of the firms are involved in banking applications and e-governance applications indicating a decrease in demand for software from these sectors. Average sales revenue growth for 2018 was 6% and for 2019 was 10% for the ICT firms. However, during the Covid-19 pandemic, sales revenue in several quarters in 2020 has been declining though in total the revenue in 2020 would not have declined substantially. The domestic market share is on average 76% and the foreign market share is the rest 24%.

Labor market, employment and wage

Our survey data shows that in 2019, on average 18.23 percent of employees in IT firms are Software developers, 12.42 percent are Administrative and Managerial employees, 10.12 percent are App developers, and about 11 percent are Technicians. In the case of ISP (Internet Service Provider) firms, the average percentage of technicians is very high (39 percent). On average about 11.72 percent of employees in Call center & BPO (Business Process Outsourcing) firms are as call center agents and 31 percent are Web developers and Graphic and multimedia designers. Compare to male employees the average number of females is very low. Overall, the male-female ratio of employees is 80:20 and for some of the

occupations, such as applications developer, system administrator, website developers, the ratio is even lower. The average age of owner/director/shareholder is about 40 years and administrative managers are about 37 years for all types of firms.

Among permanent employees; Administrative and Managerial employees, Software developers (including mobile app. game developers, and Software Tester), and Quality Assurance Managers receive a relatively higher monthly salary (52, 59, and 46 thousand takas respectively). Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer, Applications developers/programmers, Database designers, administrators and Systems administrators, and Computer network professionals have an average monthly salary of around forty thousand to fifty thousand takas. The average monthly salary of contractual employees is relatively lower than permanent employees, with Systems administrators and Computer network professionals having the highest average monthly salary of 26 thousand.

Skills shortage and skills gap

Skills gaps are determined by three aspects: (i) shortage of job-specific skills; (ii) skill shortfalls arising from faults in education; and (iii) skills mismatch—oversupply or undersupply caused by skill shortfalls and skill shortage.

On average, the percentage of a filled post mostly varies from 90 to 100. However, in the case of Call centers and BPO firms on average only 67 percent of Software developers (including mobile app. and game developers, and Software Tester) posts are filled which is the lowest among the three firm types, suggesting unavailability of such employees in the call centers and BPO sectors. In general, there is no big shortage of professionals in the IT sector. Occupation-specific shortages are evident. Around less than 5% of posts remained unfilled in the cases of web developer and graphic designer, software developer, and applications developer. Only call centers & BPO firms face difficulties in fulfilling the required positions.

On the other hand, over 60% of the professionals are reported as skilled or high skilled in e-commerce, e-governance, BPO, data entry, website, graphic, multimedia, ERP, and IoT. For hardware assembling and repairing, about 50% of employees are skilled/high-skilled and a similar proportion is available for internet services. Around 50% of the unskilled or semi-skilled employee was reported in the areas of GIS, BPO, Multimedia, AI, IoT, and Robotics. For the hardware sector, over 50% are unskilled or semi-skilled in assembling, repairing, and manufacturing. About 50% in call centers and 67% in ISPs fall in this category. The results indicate that the IT industry lacks adequate skilled manpower for some emerging areas of activities, such as Robotics, AI, IoT, etc. It is observed that IoT professionals and Software Tester are not available in the market, and in all other occupations, they don't face difficulties to fill up vacancies for entry and intermediate level but reported difficulties to fill vacancies for

senior-level. The availability of IT employees with a lack of skills for about 20 to 30 percent indicates a certain level of mismatch in skills and job preferences. Employees also identified that there is a gap in their educational qualifications and programming language skills indicating the need for training in programming languages.

Training and training demand

Among IT-related specialized training, Data Science, RPA Developer, Network and Security, and programming language were considered highly important. In 2019, a relatively higher number of employees participated in training on the programming language, design, front-end development, software tester (QA), Software tester (QC), business, marketing, and management, indicating higher demand for these training programs. Our survey data shows that enterprises also arrange training on FTTX (Fiber to the x), Ethical hacking and 3D design, and BPO-related works. Given the potential, by 2025, 80% of firms projected the demand for game developers, data scientists, IoT professionals, mobile app developers, software developers, applications developers, the system administrators will increase substantially.

The increased market demand for skilled laborers in the ICT sector raises the demand for a skilled workforce with more advanced training rather than semi-skilled labor with basic training. To mitigate the problem, industry stakeholders propose to combine elementary and advanced courses in one particular discipline. It is also proposed to provide training on both elementary and advanced courses of only one particular discipline/subject; rather than providing the scope of receiving training on only one course. High importance is placed on an effective industry-academia linkage. It is also recommended that only short-term courses may not be sufficient, instead, SEIP may invest in creating a center of excellence in the University's respective departments to ensure a sustainable supply of IT human capital. A few specific recommendations are also made in this report to make the existing training programs more effective.

Chapter 1: Background

The government of Bangladesh articulated the "Digital Bangladesh" vision in 2009 as a key development strategy and accordingly started investing in necessary ICT infrastructures and formulating necessary policies. The digital Bangladesh vision is based on four pillars: connecting citizens, e-governance (e-governance is the complete digitization of the administrative and service wing of the government), human resource development, and development of the ICT industry (National ICT Policy, 2009). Bangladesh, being a country of 170 million people, has been currently enjoying a demographic dividend with over half of its population belonging to the working-age group (15-54 years), and is thus well poised to take the advantage of developing the ICT industry[1].

Accordingly, the government has formulated the National ICT Policy 2009, which was later revised in 2015 and recently updated the Policy in 2018. Apart from that, the government enacted National Telecommunication Act, 1999, National ICT Act, 2006, etc. The government also placed utmost importance on digital transformation in various plan documents, such as Five-Year plans, Perspective Plans 2021, and 2041. The Digital Bangladesh initiative is therefore a big push toward creating a digital economy that might lead to higher growth and productivity (Hossain et al., 2012; Shinkai and Hossain, 2011). This is consistent with the view that the development of the ICT sector can help leapfrog developing countries into a developed nations at a faster pace. Creating a big job market, generating revenues, and improving efficiencies in capital and scopes for ICT for development such as health, education, agriculture, manufacturing, and other service sectors, the sector could be the backbone of achieving higher growth trajectories. Considering the digital Bangladesh vision as a technology and service-oriented key development strategy, the importance of developing the ICT industry and the respective human capital should get utmost importance in the policy framework (Hossain, forthcoming).

The ICT sector can take advantage of the rapidly expanding offshore and outsourcing industry. The global ICT services export stands at US$586 billion, growing at a CAGR of 9% from 2005 to 2019 (Digital Economy Report, 2019). The global digital economy is worth $11.5 trillion, which amounts to 15.5 percent of global GDP and has grown at a rate 2.5% faster than global GDP in the last 15 years. The IT industry has benefitted greatly from the reduction in telecommunication costs over the past decade. A majority of IT services, such as software development and testing, and ITES, such as call center services and data entry, can be delivered from a remote location without a need for onsite physical presence. The offshore

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[1] Gartner, Inc, (2010) identified Bangladesh as one of the emerging top 30 outsourcing destinations.

service industry size at a global level ranged widely from US$101 to US$157 billion in 2008 and has increased to a whopping US$520.74 in 2019 and is forecasted to grow at a CAGR of 7.7% from 2020 to 2027 (Grand View Research, Inc., 2019). Demand in the industry continues to be led by the United States and Canada (51.1%), followed by Europe (30.6%) and Asia (16.2%). However, in Bangladesh, the performance of the ICT sector is not quite satisfactory. The exports of IT services is about US$1 billion, which is about 2% of total exports and less than 1% of GDP. The growth of revenue of the IT sector is about 15%, which is also not very encouraging (Hossain, 2022). Given the lower wage rate and demographic dividend, the ICT sector in Bangladesh has the potential to capture a certain share of the global offshore industry and contribute to the country's economic growth and development.

The development of human capital is an important prerequisite for the development of the ICT sector. With a demographic dividend in place, Bangladesh is in an advantageous position to exploit the potential of the IT industry. The sector employs roughly about 0.22 million IT professionals in 2020 (as per projections made in Hossain, 2016), of which 35000 belong to software industries, 30000 belong to freelance software services, and 50000 belong to IT jobs in different NGOs and other sectors. About 50000 IT professionals are now engaged in ISPs, 30000 in call centers, 20000 in other NTTN, PSTN, IIG, etc., and only 2500 in the hardware sector. The demand for the IT workforce will be doubled by 2025, as projected by Hossain (2016). To understand the IT labor market, existing skills, and skills gap, this study attempts to make an in-depth analysis of the skills gap in the sector. This is also important in the context of the 4th Industrial Revolution (4IR).

The Fourth Industrial Revolution (4IR) underscored the necessity of skilled human resources capable of embracing the digital transformation and automation in industrial development. This is obvious that the capacity to apply technologies required for the Fourth Industrial Revolution is limited due to inadequate supply of required human capital, shortage of quality institutions, and aligned infrastructures. Especially the ICT sector has to embrace the opportunities of the 4IR with the right mix of human capital. The shortfall of skills can only be addressed through the blended approach of both reskilling and up-skilling of the existing workforce for which implementation of relevant training programs emerges as a prerequisite.

A survey of 146 firms and about 250 employees was conducted from December 2020 to March 2021 to understand the employment situation in the ICT sector. We attempt to analyze the skills gap in a succinct manner to understand the dynamics of the labor market and future demand for skills in this sector that would be key for the growth and development of the ICT sector.

1.1 Study Objectives

The study intends to address the following objectives:

i) Exploring needs for human capital and skills in the ICT sector, especially in view of the Digital Bangladesh Vision;

ii) Identification of sector priorities, assess skills gap by occupations;

and analyze the sector-wise occupational composition of employment (including gender composition of employment);

iii) Assessment of occupation-wise training requirements by sector and trade;

iv) Identifying sector-wise training capacity including the skill training capacity for disabilities (public, private, NGO, and industry-driven training facilities); and

v) Recommendations and way forward for the growth and development of the human capital for the ICT sector.

1.2 An overview of the ICT sector

The rapid expansion of telecommunication and internet access over the last decade provides developing countries the leverage to deliver information technology services from a remote location. With the availability of low-wage skilled human capital and low-level technologies including computers and mobile phones, developing countries are better poised at capturing a substantial portion of the global outsourcing ITO and BPO businesses. Some developing countries, including Bangladesh, have the potential to gain from this industry due to the availability of trained and educated human capital and technologies in these countries, as the industry heavily relies on these easily accessible inputs.

With various policy supports[2] of the government toward private sector friendly approaches[3], the ICT sector in Bangladesh has been growing steadily over time. Internet users, mobile and fixed telephone users, tele density, and investment in ICTs have been expanding over time. The number of internet users and investments in the sector has increased to more than double over the last 10 years. Mobile phone penetration in Bangladesh is one of the highest in the developing world with a tele density of over 79 percent in 2015, which is now over 99% (it is about 55% if unique subscribers are considered). The internet penetration rate was estimated to be 12 percent in 2012, which has increased to 27.8 percent in 2015 with most people using mobile internet (Digital Bangladesh Report, 2015), Internet penetration in Bangladesh stood

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[2] The National ICT Policy, 2009 was formulated to facilitate the materializing of "Digital Bangladesh" which the government has pledged to build by 2021. Very recently, the government has approved the National ICT Policy , 2015.

[3] Bangladesh is now connected to second submarine cable network and several software IT parks are under construction.

at 43.1% as of January 2020 (Bangladesh National ICT Household Survey, 2018-2019). The use of international bandwidth has increased by 200 percent in 2011 with capacity being upgraded recently for international bandwidth of over 500 percent. These are the strengths of the development of the ICT service sector.

The ICT sector in Bangladesh comprises IT (software), ISP, Call centers, Telecommunications, and hardware sectors. Excluding telecommunications and hardware, the market size of the ICT sector is now about US$ 2 billion in Bangladesh, of which export earnings are about US$ 1 billion (BASIS, 2017). The industry sets a target of US$5 billion to be achieved by 2021.

The ICT sector currently comprises about 1800 software firms, 2000 Internet Service Provider firms, 282 licensed call centers (210 Call centers are members of the BACCO), 4 mobile phone operators, 37 IIG (International Internet gateway Service), 4 NTTNs (Nationwide Telecommunication Transmission Network) firms, 15 PSTN (Public Switched Telephone Network) operators, 65 VSAT, 26 Interconnection Exchange (ICX) Services and 2500 hardware sales and servicing centers (Hossain, 2016). According to industry insiders, the domestic market for ICT services has been expanding rapidly, and currently, the size is estimated to be about US$1 billion excluding the telecom sector.

1.3 Organization of the Report

The Report is organized as follows. Chapter 2 reviews the literature in regard to the labor market and employment in the ICT Sector. Chapter 3 describes the survey instruments, sampling method, and team mobilization. Chapter 4 elaborates on some basic characteristics of ICT firms. Chapter 5 discusses the labor market, employment, and wage in the ICT sector. Chapter 6 highlights the extent of formality in the IT labor market: contract type, leaves, and other benefits. Skills Shortage and Gap Analysis is given in Chapter 7. Chapter 8 discusses training and skills development programs. Chapter 9 highlights the future growth potentials and expected labor demand. In Chapter 10, findings from the employee survey are described and Chapter 11 concludes the report.

Chapter 2: Literature Review

The skill gap is defined as insufficiency in skill levels of the existing workforce to meet the productivity requirements of the firm and it is a primary determinant of firm-level training. Misidentification of skill gaps might result in reduced competitiveness. Thus, accurate identification of skill gaps is important for training investments. (McGuinness et al., 2016). The term skill mismatch can be described as different types of labor market friction, including vertical mismatch, skill gaps, skill shortages, the field of study (horizontal) mismatch, and skill obsolescence (McGuinness et al., 2017).

Literature on developed countries tried to analyze skill gaps and skill mismatches. By studying the wage effects of educational mismatch where the educational mismatch is a function of the distance between schooling and work, Robst (2007) found that human capital received in college is not completely general and cannot be simply transferred to other occupations. As a result, workers with educational mismatch face wage loss. The greater the degree of mismatch, the higher the wage loss. Given the same amount of schooling, mismatched workers have a lower wage than matched workers (Robst, 2008). Allen et al., (2007) found that, compared to the graduates in matching jobs, the graduates working jobs outside their field or working below their level can't utilize their full capacity, and those who are working above their level or outside their field face, more skill shortages. However, many graduates in "matching jobs" also report skill mismatches. The study also indicated that the countries with higher education strongly equipped for the labor market have the best education to job match and lowest skill mismatch.

Along with identifying the determinants and patterns of skills gap and mismatch, studies also show, how skill level varies across demographics. In Europe, the level of mismatch is significant and there are large variations by age group and sex (Sparreboom et al., 2017). The literature also suggested prioritizing studies targeting specific skills and sectors. Morris, et al. (2020) argued that policy focus to increase regional productivity cannot be limited to only space-neutral higher education and skill levels, they also have to acknowledge the characteristics of place-specific skills gaps and shortages.

However, very little study has been done in Bangladesh and other developing countries to capture the skill gaps and mismatches. A purposive survey conducted in 2016 revealed that there exists a gap of around 40% of the required IT professionals, and among the existing pool of IT workforce, 60% are skilled and the rest are semi or non-skilled (Hossain, 2016). In the case of developing countries, the evidence, effects, and possible policy responses to skill mismatch are unclear and the research on this issue is still at an early stage. Limited

availability of quality data results in underdeveloped literature on skills mismatch in the case of low- and middle-income countries. (McGuinness et al., 2017)

Given the potential of the IT sector, the government of Bangladesh has taken initiatives to develop software and the ITES industry and aims to support talented young individuals by providing STEM (science, technology, engineering, and mathematics) education (Journey Towards A Digital Bangladesh, 2011). However, due to the lack of studies on the labor market experience of the graduates and the relevance of tertiary education to job markets, the policy responses to skill gap and skill mismatch have been difficult to determine. And using education as a proxy for skill ignores the effects of training and on-the-job experiences for skill development (Cappelli, 2015), implying the necessity to do more research on this issue. Urgent rethinking is needed on the current relationship between institutional education and skill development as adaptability to different skills seems more important than skills learned in a classroom (Innovative Strategies in Higher Education for Accelerated Human Resource Development in South Asia, 2015).

In light of the recent development of the IT sector in Bangladesh, a few studies exist depicting the skill demand, gap, and shortage of this sector. According to Data Collection of Bangladesh IT/ITES Industry (2015), most software development and computer networking firms require prior experience while recruiting technical employees and industry certification is also preferred for job recruitment. Apart from educational qualifications, software firms prioritize technical and analytical skills. Weakness in technical skills and communication seems to be a significant concern for employers and the study also found that male employees dominate the computer networking sector.

Employees find it difficult to hire mid to higher-level skilled workers in the IT sector and it indicates failure in our schooling and training system (Sajjad Zohir, 2019) and this study suggested school system incorporate projects, business initiatives, and training and collaboration with other agencies working with local communities to introduce science and technology-oriented practice spaces. To ensure training at different levels, the present literature recommended that the government, universities, and ICT businesses work in cooperation (How Information and Communications Technology can Achieve the Sustainable Development Goals, 2015).

Chapter 3: Survey, Survey Instruments and Team Mobilization

The survey has been administered among the IT/ITES, ISPAB, and Call center firms in Bangladesh taking firms in their proportional involvement in respective associations, such as Bangladesh Association of Software and Information Service (BASIS), Bangladesh Computer Samity (BCS), Bangladesh Association of Call Center & Outsourcing (BACCO), and Internet Service Providers Association Bangladesh (ISPAB). The sample size has been distributed proportionately within different employer categories. As per available information from the five categories of firms, there are about 5439 IT/ITES firms in Bangladesh. So, the required sample size has been drawn based on standard sampling techniques used by the World Bank for enterprise survey purposes. We assume the precision level at 10% and 90% confidence levels in determining the samples. The minimum number of IT/ITES sample firms that have been determined is 115 IT/ITES firms. Considering some non-responses, finally, we decided to survey 150 IT/ITES firms for assessing their employees' skills gap.

According to the proportionate distribution of members of associations, the sample distribution by category of IT/ITES firm has been shown in Table 3.1 below.

Table 1: Table 3.1: Sample Distribution for the Employer Survey

Sl.	Association type	Number of ICT members	Proportions	Finally selected Samples
1	Bangladesh Association of Software and Information Services (BASIS) &	1,800	81	141
	Bangladesh Computer Samity (BCS)	2583		
2	Bangladesh Association of Call Center and Outsourcing (BACCO)	210	3.8	5
3	Internet Service Providers Association Bangladesh (ISPAB)	225 (General)	15.5	4
		621(Associated)		
Total		5439	100	150

Source: Respective associations, 2022
Note: Duplication of an employer will be avoided as many companies are registered in multiple industry associations.

Sample survey and Time-frame

The survey was conducted from December 2020 to March 2021 and it takes a bit longer time than expected due to the difficulties of the Covid-19 pandemic. The majority of the samples are taken from Dhaka and some firms were surveyed from Chattogram, Jessore, and Sylhet (Table 3.2). As Table 2 shows, the majority are IT firms (122) followed by ISP (15) and call center & BPO firms (9). Though there are overlapping in the activities of the firms, as some IT

firms are also involved as ISP or BPO service providers, and vice versa, the distribution in Table 3.2 is based on the major activities of the firms. In addition, we interviewed two employees from each of the surveyed firms covering all the relevant occupations.

Table 2: Table 3.2: Sampling distribution across location & enterprise type

| Location | Type of enterprise | | | | | | | |
| | IT Firm | | ISP Firm | | Call center & BPO | | Total | |
	%	N	%	N	%	N	%	N
Dhaka	64.4	94	8.9	13	4.8	7	78.1	114
Chattogram	9.6	14	0.7	1	0.7	1	11.0	16
Jashore	6.2	9	0.7	1	0.7	1	7.6	11
Sylhet	3.4	5	0	0	0	0	3.4	5
Total	83.6	122	10.3	15	6.2	9	100	146
Total Employee (2 from each firm)		244		30		18		292

The sampling distribution of employees across their occupations is reported in Table 3.2. The majority of the employees belong to the following occupation categories: software developer (28.42%), web developer (10.27%), system administrator (10.96%), IT & network (11.30%), administrative and managerial (9.93%), and technicians (7.19%). More or less the selected employees represent the dominant occupations of the industry.

Table 3: Table 3.3: Distribution of employees across occupations

Occupation in Broad Heading	Sub-Heading	N	%
Software developers (including mobile app. game developer, and Software Tester)	Software Tester (Quality Control)	4	1.37
	Software Tester	6	2.05
	Software developers	83	28.42
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	Data Scientist	11	3.77
Database designers and administrators	Database designers and administrators	11	3.77
Web developers and Graphic and multimedia designers	Graphic and multimedia designers	8	2.74
	Web developers	30	10.27
application developers/programmers	application developers	9	3.08
	Programmers	3	1.03
Systems administrators and Computer network professionals	System Administrator	32	10.96
	IT & Network	33	11.30
Technicians		21	7.19
		2	0.68
Administrative and Managerial		29	9.93

Working Owner/Director/Shareholder	8	2.74
Accountants, Financial and investment advisers	1	0.34
Others	2	0.68
Total	292	100.00

Instruments

A structured questionnaire was used to collect relevant information under the employer survey and employee survey. Both structured and semi-structured questions were incorporated in the questionnaires designed for both enterprise and employee surveys. The questions incorporated in the questionnaires were based on the objectives of the study. In addition, while designing the questionnaire, similar types of studies conducted in Bangladesh and outside Bangladesh were reviewed. The basic components of the questionnaires are as follows.

Enterprise questionnaire	Employee questionnaire
• Basic firm characteristics • Sales revenue and major activities • Production cost • Employment • Wage • Extent of formality • Occupation by qualification • Skill shortage and recruitment process • Training • Industry-academia linkages • Labor demand projection	• Personal information • Family information • Family employment and related information • Academic performance • Training • Need for training • Occupation history • Self-assessed skills and skill demand • Employee job satisfaction

Mobilization of Team

A total of 10 enumerators have been hired based on their skills and experience in various aspects of the survey implementation process and a thorough knowledge of the industry and country-specific context. A database of professional enumerators and supervisors of about 100 with five years and more experience mostly in industry surveys nationwide was reviewed for selection. An experienced supervisor has supervised the survey activities and field placement. In some cases, enumerators have to make an online appointment with the firm owners to complete the survey due to the Covid-19 pandemic.

Training and Quality Control Measures

A two-day-long training session has been arranged for the selected enumerators. The team leader and other researchers have conducted the training program. They were given adequate knowledge about the ICT industry as well a selection of the firms. Moreover, they were given instructions on how to collect various information from the employees and enterprises. After the training, a **field testing** of the questionnaire was done in two ICT firms in Dhaka.

Chapter 4: Some Basic Characteristics of ICT Firms

The majority of the surveyed firms are private limited companies (75%) and only 18% are individual proprietorship companies (Table 4.1). In terms of ownership, about 90% of the firms are owned by Bangladeshi and 1.37% by foreign nationals, and about 8% of firms belong to joint ownership.

Table 4: Table 4.1: Types of firms

Type	Percent
Individual/proprietorship company	17.93
Partnership company	2.07
Private limited company	75.17
Public listed company	4.14
Non-governmental organization	0.69
Total	**100**
Ownership	
Only Bangladeshi	90.41
Only Foreign	1.37
Both	8.22
Total	**100**

Over 80% of the surveyed firms are associated with the Bangladesh Association of Software and Information Services (BASIS), while about 20% are associated with Bangladesh Computer Samity (BCS) and a similar proportion of firms are associated with the Internet Service Provider Association of Bangladesh (ISPAB). A few firms are associated with other business associations. The percentages indicate that some firms are members of multiple associations (Figure 4.1).

Figure 1: Figure 4.1: Firms' membership with sector associations
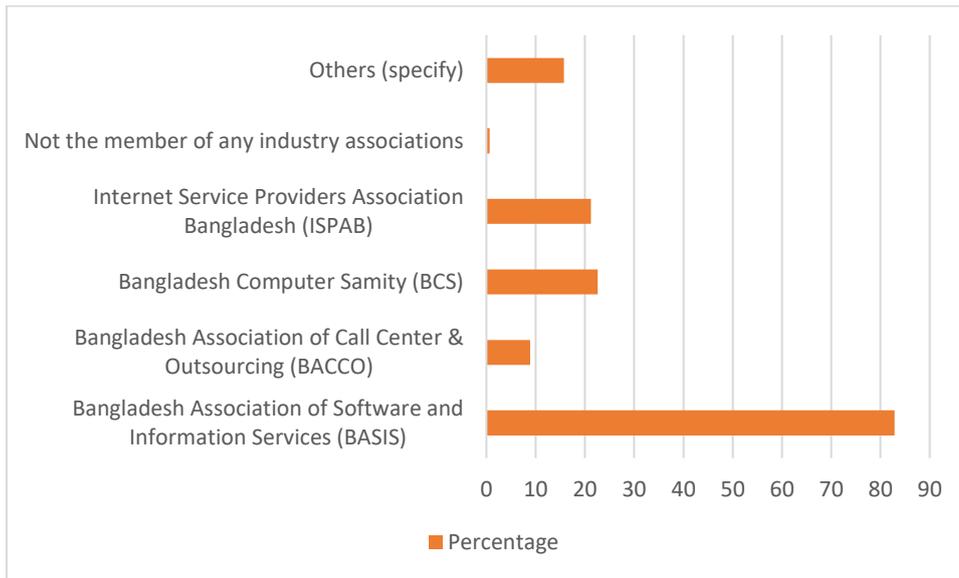
About 85% of the surveyed firms are involved in the software industry and 46% are involved with IT consultancy (Figure 4.2). About 33% of firms are involved with networking activities and 24% are engaged in internet service-providing activities. Only 14% are engaged in call center & BPO and the same proportion in hardware solutions.

Figure 2: Figure 4.1: Types of activities of the firms (multiple responses)
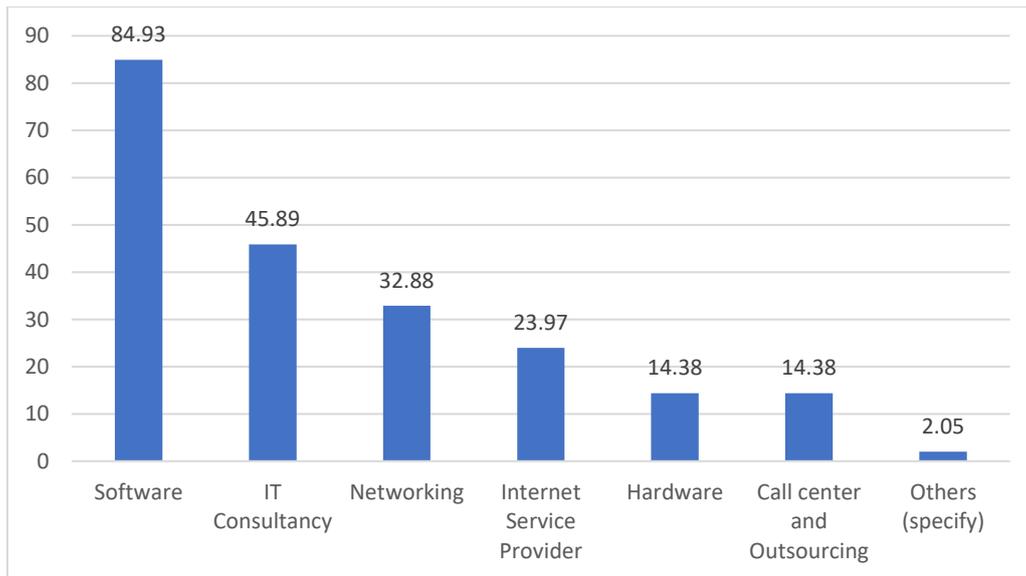
We further investigate the detailed activities of the software firms. Survey results suggest that 60% are involved in website development and hosting, 52% in e-commerce, 47% in mobile applications, 42% in accounting and financial software development, 41% in education management systems, 36% in enterprise resource planning (ERP), 33% in POS/inventory management, 30% in graphics, about 25% are involved in hospital/insurance management system and a similar proportion in security and biometric system development (Figure 4.3).

Less than 15% of the firms are involved in banking applications and e-governance applications indicating a decrease in demand for software from these sectors.

Figure 3: **Figure 4.2: Major activities of the software firms**
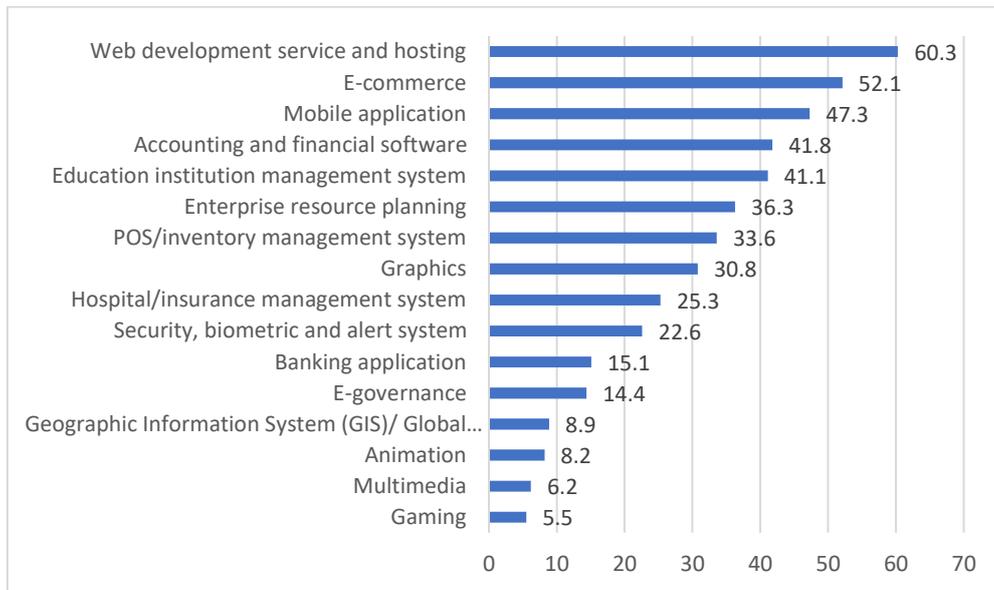
The financial performances of the firms before and during the Covid-19 pandemic were assessed through the firms' own assessment. As Figure 4.4 shows, during the Covid-19 pandemic, the ICT sector has been faring well, and even a higher percentage of firms (24% vs, 18%) have evaluated their financial performance at a very good level.

Figure 4: **Figure 4.3: Financial performances of the firms**
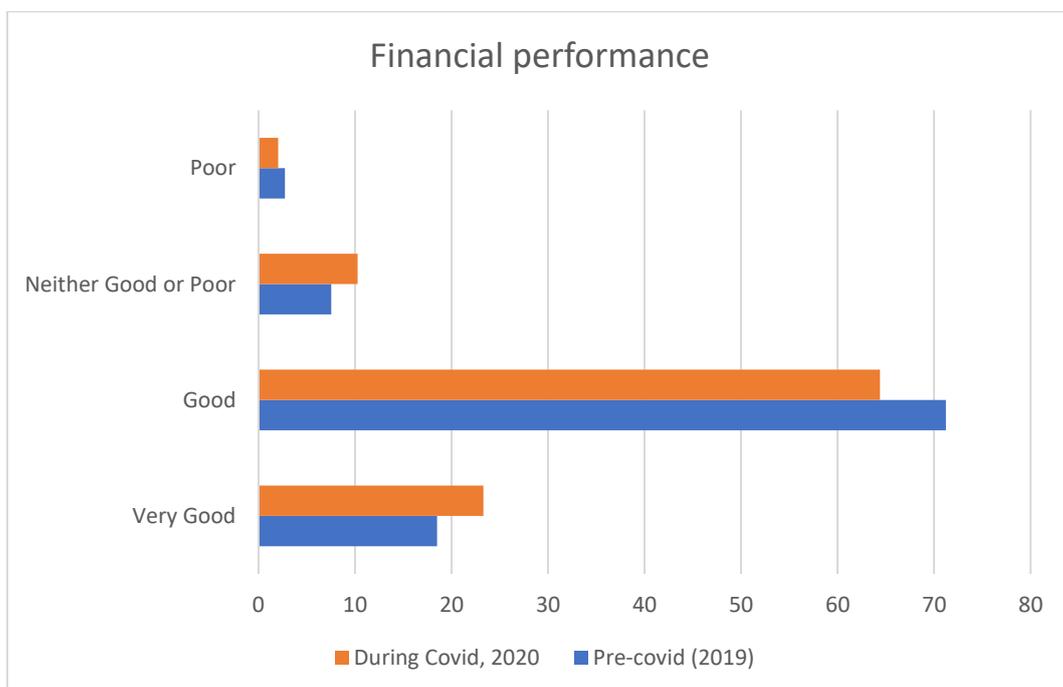
Sales Revenue and Market share

Average sales revenue growth for 2018 was 6% and for 2019 was 10% for the ICT firms (Table 4.2). However, during the Covid-19 pandemic, sales revenue in several quarters in 2020 has been declining though in total the revenue in 2020 would not have declined substantially. The domestic market share is on average 76% and the foreign market share is the rest 24%.

Table 5: **Table 4.2: Sales revenue and major products (mean)**

Panel A. Sales revenue during 2017-2019

	Total Sales revenue (In lac taka)	Average Total Sales revenue growth rate (%)	Percentage of sales in:	
			Domestic Market (%)	Foreign Market (%)
2017	753.08	--	76.07	21.87
2018	798.17	6.0	76.75	21.87
2019	876.77	9.8	76.12	22.95

Panel B. Sales revenue during Covid-19 pandemic

	Total Sales revenue (In lac taka)	Average Total Sales revenue growth rate (%)	Percentage of sales in:	
			Domestic Market (%)	Foreign Market (%)
Jan-March 2020	217.2	--	76.45	22.45
April-June 2020 (Lockdown)	223.27	2.8	74.71	22.55
July-Sept 2020	209.31	-6.3	75.78	22.85

Source: BIDS Survey, 2020

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Chapter 5: Labor Market, Employment and Wage

We have identified 10 key groups of professionals in the ICT sector. They are (i) Administrative and Managerial; (ii) Accountants, Financial and investment advisers; (iii) Software developers; Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer; (iv) Applications developers/programmers; (iv) Web developers and Graphic and multimedia designers; (vi) Database designers and administrators; (vii) Systems administrators and Computer network professionals. In addition, call center agents, quality assurance managers, and technicians are available in the industry. A detailed analysis of these occupations is given in this section.

Average number of employees across occupations

Table 5.1 shows the average percentage of employment across occupations and gender. Our survey data shows that in 2019, on average 18.23 percent of employees in IT firms are Software developers, 12.42 percent are Administrative and Managerial employees, 10.12 percent are App developers, and about 11 percent are Technicians. In the case of ISP (Internet Service Provider) firms, the average percentage of technicians is very high (39 percent). On average about 11.72 percent of employees in Call center & BPO (Business Process Outsourcing) firms are as call center agents and 31 percent are Web developers and Graphic and multimedia designers.

The average percentage of male and female employees for each occupation category suggests that the average number of male employees in a firm in the case of IT, ISP, and call centers are 62.31, 78.33, and 110.78, respectively. Compare to male employees the average number of females is very low. In a few occupations, women are seen to have a relatively high average percentage. 14.5 percent of Systems administrators and Computer network professionals in ISP firms are female, while the average percentage of females working as Web developers and Graphic and multimedia designers in call centers is about 18 percent. However, the average number of female employees in ISP firms is 6 and for call centers, it is 17.

Table 6: Table 5.1: Average Percentage of employment across occupation and gender, 2019

Occupation Name	IT Firm			ISP Firm			Call center & BPO		
	Average% of employees	Average% of Male	Average% of Female	Average% of employees	Average% of Male	Average% of Female	Average% of employees	Average% of Male	Average% of Female
Administrative and Managerial[1]	12.42	10.46	2.60	9.69	8.18	1.14	10.31	9.32	1.55
Working Owner/Director/ Shareholder	7.45	6.01	1.62	4.16	3.62	0.60	7.01	5.92	1.23
Unpaid Family workers	0.01	0.01	0.01	0	0.00	0.00	0.00	0.00	0.00
Accountants, Financial and investment advisers[2]	4.48	3.93	0.70	7.07	6.38	0.60	3.98	3.14	0.66
Software developers	18.23	15.76	2.57	4.53	4.41	0.00	2.33	1.85	0.17
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	2.76	2.58	0.18	0.75	0.71	0.05	0.46	0.23	0.13
Applications developers/programmers	10.12	9.83	0.66	2.21	2.19	0.00	0.27	0.12	0.08
Web developers and Graphic and multimedia designers	9.83	8.91	0.80	2.44	2.42	0.00	31.07	27.44	2.40
Database designers and administrators	4.31	3.85	0.43	1.47	1.20	0.21	0.36	0.36	0.04
Systems administrators and Computer network professionals	5.86	5.60	0.52	8.43	7.24	1.09	7.00	7.17	0.13
Technicians[3]	10.94	10.19	0.38	38.59	38.45	0.00	3.63	4.00	0.00
Clerical and Sales[4]	6.92	6.03	1.08	10.9	9.72	1.17	8.78	7.48	1.70
Call Center Agent	0.13	0.09	0.12	0	0.00	0.00	11.72	8.86	1.34
Quality Assurance Manager	0.06	0.06	0.00	0	0.00	0.00	3.74	3.46	0.42
Others[5]	6.45	5.52	1.26	9.77	7.98	2.62	9.33	7.28	3.54
Average number of employees	70.16			84.67			127.89		

Note: Administrative and Managerial include: Managing Directors and Chief Executives; Finance Managers; Human Resource Managers; Policy and Planning Managers; Business services and administration managers not elsewhere classified; Sales and Marketing Managers; Advertising and public relations managers; Information and Communications technology managers; Managers.

Accountants, Financial and investment advisers include: Include Accounting associate professionals;

Technicians include: ICT operations technicians; ICT user support technicians; Computer network and systems technicians; Web technicians and Broadcasting and audiovisual technicians; Electrical or Electronics or Telecommunications engineering technicians.

Clerical and Sales include: Administrative and executive secretaries; Typists and word processing operators; Data entry clerks; Accounting and bookkeeping clerks

Overall, the male-female ratio of employees is 80:20 and for some of the occupations, such as applications developer, system administrator, and website developers, the ratio is even

lower (Figure 5.1). However, in the case of unpaid family employees, call center agents, and quality assurance managers, the female ratio is about 40%.

Figure 5.1: Gender distribution across occupations
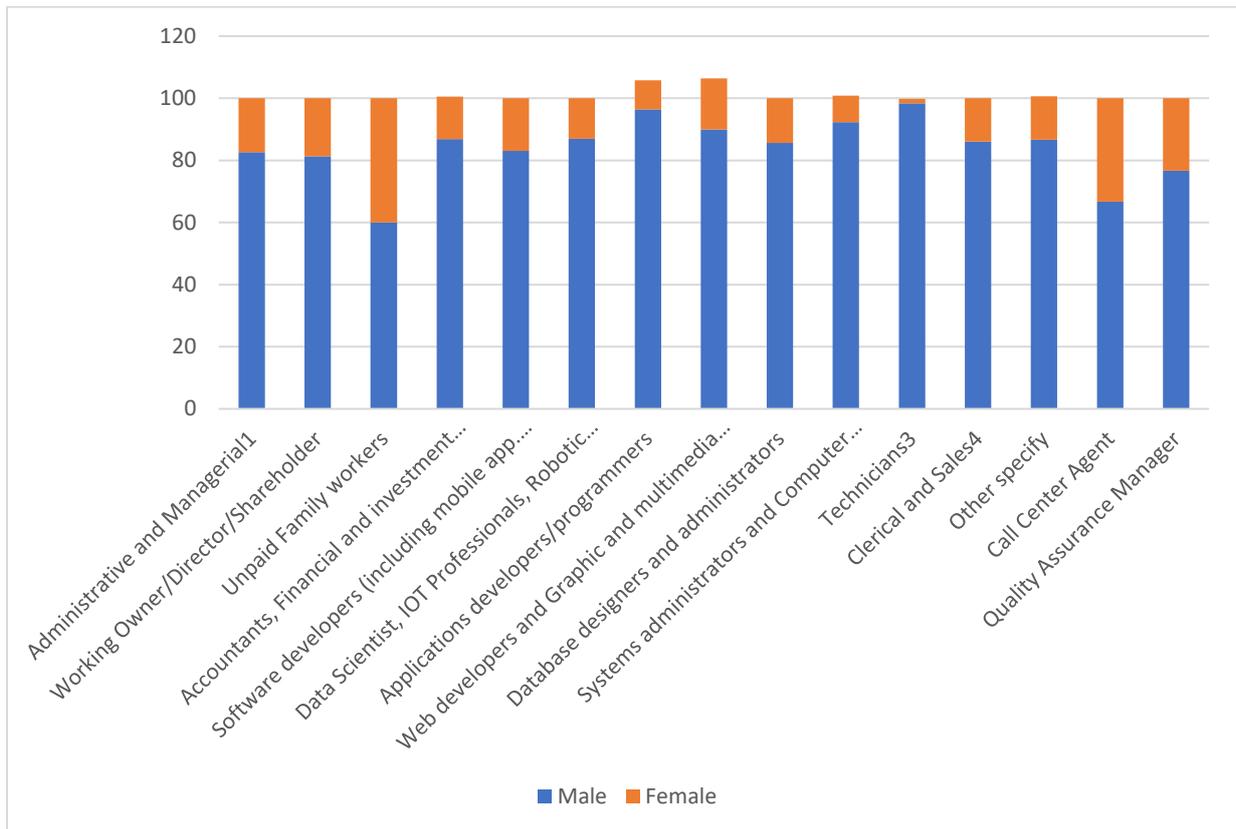
Average age of employees

As Table 5.2 shows, the average age of owner/director/shareholder is about 40 years and administrative managers are about 37 years for all types of firms. From table 7, we can see that on average most employees in the IT industry are at tricenarian with relatively younger employees working as technicians and call center agents. There are few exceptions such as working owners and employees working as accountants, financial advisers on average have a higher age. In the case of IT firms, the average age of a quality assurance manager is 38 years.

Table 7: Table 5.2: Average age of employees

Occupation Name	Average age of the workers		
	IT Firm	ISP Firm	Call center & BPO
Administrative and Managerial[1]	37	38	37
Working Owner/Director/Shareholder	44	44	42
Unpaid Family workers	31	--	--
Accountants, Financial and investment advisers[2]	35	37	35
Software developers (including mobile app. game developer, and Software Tester)	32	31	33
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	31	30	30
Applications developers/programmers	31	29	32
Web developers and Graphic and multimedia designers	30	31	30
Database designers and administrators	32	32	31
Systems administrators and Computer network professionals	33	35	31
Technicians[3]	29	31	29
Clerical and Sales[4]	30	29	29
Call Center Agent	28		26
Quality Assurance Manager	38		30
Others[5]	30	31	31

Average wage of professionals

Table 5.3 shows the average monthly salary per employee of different occupations across job types. Among permanent employees; Administrative and Managerial employees, Software developers (including mobile app. game developers, and Software Tester), and Quality Assurance Managers receive a relatively higher monthly salary (52, 59, and 46 thousand takas respectively). Data Scientists, IoT Professionals, Robotic Process Automation (RPA) Developers, Applications developers/programmers, Database designers, administrators, and Systems administrators and Computer network professionals have an average monthly salary of around forty thousand to fifty thousand takas. The average monthly salary of contractual employees is relatively lower than permanent employees, with Systems administrators and Computer network professionals having the highest average monthly salary of 26 thousand. Average per person monthly Convenience without salary data for permanent employees shows a different distribution with Working Owner/Director/Shareholder, Unpaid Family workers receiving high benefits (10, 8 thousand takas respectively).

From the last three columns of table 5.3, we can see an average monthly salary, wage, and honorarium experience an increase for all occupations from April to June of 2020, in comparison to the previous and following quarters. From July to August of 2020 the average

monthly salary value decreased a little for a few occupations and the others, it remained similar to the value from January to March of 2020.

Table 8: Table 5.3: Average per person monthly wage and honorarium across occupations

Table 5.3a: Average Per person monthly salary, wage, and honorarium (In lac taka)

Occupation Name	Permanent			Contractual		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Administrative and Managerial[1]	0.52	0.050	2.50			
Working Owner/Director/ Shareholder	1.33	0.096	45.00			
Unpaid Family workers						
Accountants, Financial and investment advisers[2]	0.36	0.056	3.00			
Software developers (including mobile app. game developer, and Software Tester)	0.59	0.050	18.00	0.14	0.08	0.25
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	0.46	0.053	1.20	0.08	0.08	0.08
Applications developers/programmers	0.5	0.067	11.05			
Web developers and Graphic and multimedia designers	0.37	0.037	2.04	0.25	0.25	0.25
Database designers and administrators	0.39	0.025	1.39	0.05	0.05	0.05
Systems administrators and Computer network professionals	0.44	0.025	4.50	0.26	0.26	0.26
Technicians[3]	0.22	0.020	0.69	0.12	0.12	0.12
Clerical and Sales[4]	0.24	0.012	0.85	0.1	0.10	0.10
Call Center Agent	0.09	0.013	0.14			
Quality Assurance Manager	0.46	0.045	1.29			
Others[5]	0.14	0.026	0.50	0.08	0.08	0.08

Table 5.3b Average Per person monthly Convenience without salary (Cash benefit/non-cash benefit/social security/ pension) (In lac taka)

Occupation Name	Permanent			Contractual		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Administrative and Managerial[1]	0.05	0.006	0.68			
Working Owner/Director/ Shareholder	0.1	0.002	1.95			
Unpaid Family workers	0.08	0.083	0.08			
Accountants, Financial and investment advisers[2]	0.03	0.003	0.25			
Software developers (including mobile app. game developer, and Software Tester)	0.04	0.004	0.98	0.01	0.01	0.01
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	0.05	0.005	0.52			
Applications developers/programmers	0.05	0.006	0.92			
Web developers and Graphic and multimedia designers	0.03	0.004	0.22			
Database designers and administrators	0.03	0.003	0.12	0.01	0.01	0.01
Systems administrators and Computer network professionals	0.04	0.001	0.38	0.03	0.03	0.03
Technicians[3]	0.02	0.002	0.42	0.06	0.06	0.06
Clerical and Sales[4]	0.02	0.001	0.42			
Call Center Agent	0.01	0.001	0.01			

Quality Assurance Manager	0.05	0.010	0.12			
Others[5]	0.01	0.002	0.09			

Table 9: Table 5.3c Average Per person monthly salary, wage and honorarium (In lac taka)

	January-March2020 (In lac taka)			April-June 2020 (In lac taka)			July-September 2020 (In lac taka)		
Occupation Name	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Administrative and Managerial[1]	0.52	0.03	1.88	0.61	0.05	3.78	0.51	0.03	1.96
Working Owner/Director/ Shareholder	1.11	0.10	6.67	1.37	0.11	10.80	1.11	0.10	6.67
Unpaid Family workers				0.42	0.33	0.50			
Accountants, Financial and investment advisers[2]	0.42	0.08	7.47	0.68	0.08	34.67	0.36	0.08	2.05
Software developers (including mobile app. game developer, and Software Tester)	0.55	0.05	18.00	0.79	0.03	21.90	0.55	0.03	18.00
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	0.46	0.10	1.40	0.56	0.08	2.88	0.46	0.08	1.40
Applications developers/programmers	0.49	0.05	11.05	0.61	0.05	14.73	0.49	0.05	11.05
Web developers and Graphic and multimedia designers	0.4	0.04	2.48	0.56	0.04	10.30	0.39	0.04	2.48
Database designers and administrators	0.41	0.10	1.81	0.48	0.10	1.95	0.41	0.10	1.80
Systems administrators and Computer network professionals	0.44	0.02	2.00	0.52	0.03	2.52	0.43	0.02	2.00
Technicians[3]	0.23	0.01	0.69	0.31	0.03	2.34	0.23	0.01	0.69
Clerical and Sales[4]	0.24	0.01	0.78	0.29	0.02	2.34	0.24	0.01	0.78
Call Center Agent	0.09	0.01	0.14	0.12	0.02	0.19	0.09	0.01	0.14
Quality Assurance Manager	0.28	0.12	0.50	0.3	0.16	0.50	0.28	0.12	0.50
Others[5]	0.15	0.01	0.50	0.18	0.02	0.60	0.15	0.01	0.50

Impact of Covid-19 on employment

Table 5.4 describes the average percentage of new recruitment and lay off across occupations. On average 26.38 percent of Software developers (including mobile app. game

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developers, and Software Tester) were recruited during the first quarter of the year 2020 (January – March), the percentage decreased in the second quarter (April – July) to 19.71 percent and continued to fall in the third quarter (August- September). On average 18.73 percent of Applications developers/programmers were recruited in the first quarter and the percentage is lower in the following two quarters. 13.39 percent, Web developers and Graphic and multimedia designers on average were newly recruited during the first quarter of the year and in the second quarter, the average percentage increased to 21 percent. The average recruitment percentage for technicians was 13.42 in the first quarter and the percentage increased during the third quarter (22.24 percent).

The layoff percentage of Software, Applications developers, and Web developers, Graphic and multimedia designers in the first quarter of 2020 are about 37, 10.39, and 18 percent respectively. The average percentage of laid-off employees for these occupations dropped from April to July, however, the average percentage increased in the third quarter for Software and Web developers.

Table 10: Table 5.4: Average percentage of new recruitment and lay off across occupations.

Occupation Name	COVID-19 Impact					
	Percentage of recruited employees			Percentage of laid off employees		
	Jan-March 2020	April-June 2020	July-September 2020	Jan-March 2020	April-June 2020	July-September 2020
Administrative and Managerial[1]	3.52	8.11	12.73	7.42	10.73	10.71
Working Owner/Director/Shareholder	0.00	1.05	0.00	0.00	0.00	0.00
Accountants, Financial and investment advisers[2]	0.35	2.41	8.10	7.14	5.44	8.77
Software developers (including mobile app. game developer, and Software Tester)	26.38	19.71	10.65	36.90	17.66	19.34
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	0.27	0.33	0.00	0.00	2.04	0.00
Applications developers/programmers	18.73	3.61	6.98	10.39	8.55	6.49
Web developers and Graphic and multimedia designers	13.39	21.05	10.45	17.91	9.38	12.37
Database designers and administrators	2.57	9.87	0.00	3.57	1.42	0.76

Occupation Name	COVID-19 Impact					
	Percentage of recruited employees			Percentage of laid off employees		
	Jan-March 2020	April-June 2020	July-September 2020	Jan-March 2020	April-June 2020	July-September 2020
Systems administrators and Computer network professionals	7.02	16.49	3.69	0.00	9.46	7.83
Technicians[3]	13.42	9.21	22.24	7.14	12.66	11.41
Clerical and Sales[4]	6.83	1.97	15.58	7.14	15.94	6.97
Call Center Agent	1.74	3.51	0.00	0.00	0.00	6.06
Quality Assurance Manager	0.17	0.00	2.78	0.00	0.00	3.03
Others[5]	5.62	2.67	6.81	2.38	6.73	6.26
Average number of recruited/laid off employee	2.15	1.23	1.26	0.67	3.26	0.85

Chapter 6: Extent of Formality in IT Labor Market: Contract Type, Leaves and Other Benefits

The survey results suggest that the ICT sector is highly a formal sector. As Table 6.1 shows, on average, nearly 100 percent of employees for all occupation category, is provided with a written employment contract.

Table 11: Table 6.1: Average percentage of employees with written contract across occupation

Occupation Name	The average percentage of employees with a written contract
Administrative and Managerial[1]	99.7
Working Owner/Director/Shareholder	100
Unpaid Family workers	100
Accountants, Financial and investment advisers[2]	99.4
Software developers (including mobile app. Game developer, and Software Tester)	100
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	100
Applications developers/programmers	100
Web developers and Graphic and multimedia designers	100
Database designers and administrators	100
Systems administrators and Computer network professionals	99.3
Technicians[3]	98.8
Clerical and Sales[4]	98.98
Call Center Agent	100
Quality Assurance Manager	100
Others	98.7

Table 6.2 shows the percentage of employees receiving benefits. Across all occupations, a bonus is provided to all employees. Only a small percentage (2 percent) of Administrative and Managerial employees, Working Owner/Director/Shareholder, Systems administrators and Computer network professionals, Technicians, and Clerical and Sales employees receive a pension. 14 percent of Database designers and administrative employees and 25 percent of Call Center agents and Quality Assurance managers receive life insurance. These professionals also show a similar percentage in receiving health insurance. 25 to 42 percent loan is provided to different IT professionals excluding Unpaid family workers and Quality Assurance Manager, these professionals also reported to not receiving a Provident fund. But Provident fund is available to other employees. 25 percent of call center agents receive provident funds.

Table 12: Table 6.2: Percentage of employees receiving benefits across occupations.

Occupation Name	1	2	3	4	5	6	7	
	Bonus	Pension	Life insurance	Health insurance	Loan facilities	Oth ers	Provident fund	Cases
Administrative and Managerial[1]	100	2	7	10	38	10	8	146
Working Owner/Director/ Shareholder	100	2	7	9	37	10	8	142
Unpaid Family workers	100	0	0	0	0	50	0	2
Accountants, Financial and investment advisers[2]	100	2	6	10	39	11	8	140
Software developers (including mobile app. Game developer, and Software Tester)	100	2	7	11	37	11	7	123
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	100	2	14	20	35	8	8	49
Applications developers/program mers	100	0	9	12	36	8	9	97
Web developers and Graphic and multimedia designers	100	0	8	11	42	11	9	118
Database designers and administrators	100	0	8	14	38	15	10	93
Systems administrators and Computer network professionals	100	2	8	11	36	11	9	122
Technicians[3]	100	2	6	10	37	10	10	105
Clerical and Sales	100	2	6	10	33	11	9	123
Call Center Agent	100	0	25	25	25	0	25	4
Quality Assurance Manager	100	0	25	25	0	0	0	4
Others	100	0	7	8	33	12	6	97

Table 6.3 shows that about 99 percent of IT enterprises provide their employees with Sick leave, weekly leave, and maternity leave with salary, respectively. Also, 100 percent of enterprises reported having the provision of 30-days' notice before leaving the job and a definite time frame limit in case of laying off employees.

Table 13: Table 6.3: Percentage of employees receiving different leaves with salary.

Type of leave	Percentage of enterprises with provision of these leave	
	With salary	Without salary
Sick leave	99.25	0.75
Weekly leave	98.5	1.5
Maternity leave	100	0
Laying off Employees		
	yes	No
If employees have the provision of 30-days' notice before leaving the job	100	0
In case of laying off employees, is there any definite time frame limit?	100	0

Chapter 7: Skills Shortage and Skill Gap Analysis

The analysis of the skills gap is not straightforward. There are various dimensions in identifying skills gaps in a sector. (Capelli, 2015) determines skills gap in terms of three aspects: (i) shortage of job-specific skills; (ii) skill shortfalls arising from faults in education; and (iii) skills mismatch—oversupply or undersupply caused by skill shortfalls and skill shortage.

A. Shortage of job-specific skills

From the data on, the percentage of filled posts in Table 7.1, we can see on the average percentage of a filled post mostly varies from 90 to 100. However, in the case of Call centers and BPO firms on average only 67 percent of Software developers (including mobile app. and game developers, and Software Tester) posts are filled which is the lowest among the three firm types, suggesting unavailability of such employees in call centers and BPO. The average percentage of filled posts for Data Scientists, IoT Professionals, Robotic Process Automation (RPA) Developers; Systems administrators, and Computer network professionals are also lower in call centers and BPO (83 and 88 percent respectively).

Table 14: Table 7.1: Filled in job-specific positions.

Occupation Name	Average Percentage of filled posts		
	IT Firm	ISP Firm	Call center & BPO
Administrative and Managerial[1]	99	95	94
Working Owner/Director/Shareholder	100	100	100
Unpaid Family workers	100	--	--
Accountants, Financial and investment advisers[2]	99	94	96
Software developers (including mobile app. game developer, and Software Tester)	94	98	--
Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer	97	100	83
Applications developers/programmers	94	100	--
Web developers and Graphic and multimedia designers	96	91	100
Database designers and administrators	99	100	100
Systems administrators and Computer network professionals	99	93	--
Technicians[3]	98	95	100
Clerical and Sales[4]	97	98	100
Call Center Agent	100		99
Quality Assurance Manager	100		97
Others[5]	99	96	100

The shortage of human capital (in terms of unfilled positions) for IT firms is relatively lower, as depicted in Table 3.3. Around less than 5% of posts remained unfilled in the cases of web developer and graphic designer, software developer, and applications developer. A more or less similar percentage of shortage is observed in the case of ISP firms. However, the shortage

is bigger for the call centers & BPO firms for the positions: Data scientist/analytics (17%), accounting and financial (6%), administrative and managerial (6%), and so on.

Activity-specific skill shortages
Skilled and high-skilled
Over 60% of the professionals are reported as skilled or high skilled in e-commerce, e-governance, BPO, data entry, website, graphic, multimedia, ERP, and IoT. For hardware assembling and repairing, about 50% of employees are skilled/high-skilled and a similar proportion is available for internet services (Figure 6). On the contrary, around 50% of the unskilled or semi-skilled employee was reported in the areas of GIS, BPO, Multimedia, AI, IoT, and Robotics. For the hardware sector, over 50% are unskilled or semi-skilled in assembling, repairing, and manufacturing. About 50% in call centers and 67% in ISPs fall in this category. The results indicate that the IT industry lacks adequate skilled manpower for some emerging areas of activities, such as Robotics, AI, IoT, etc.

Figure 5: Figure 7.1: Skills level across activities
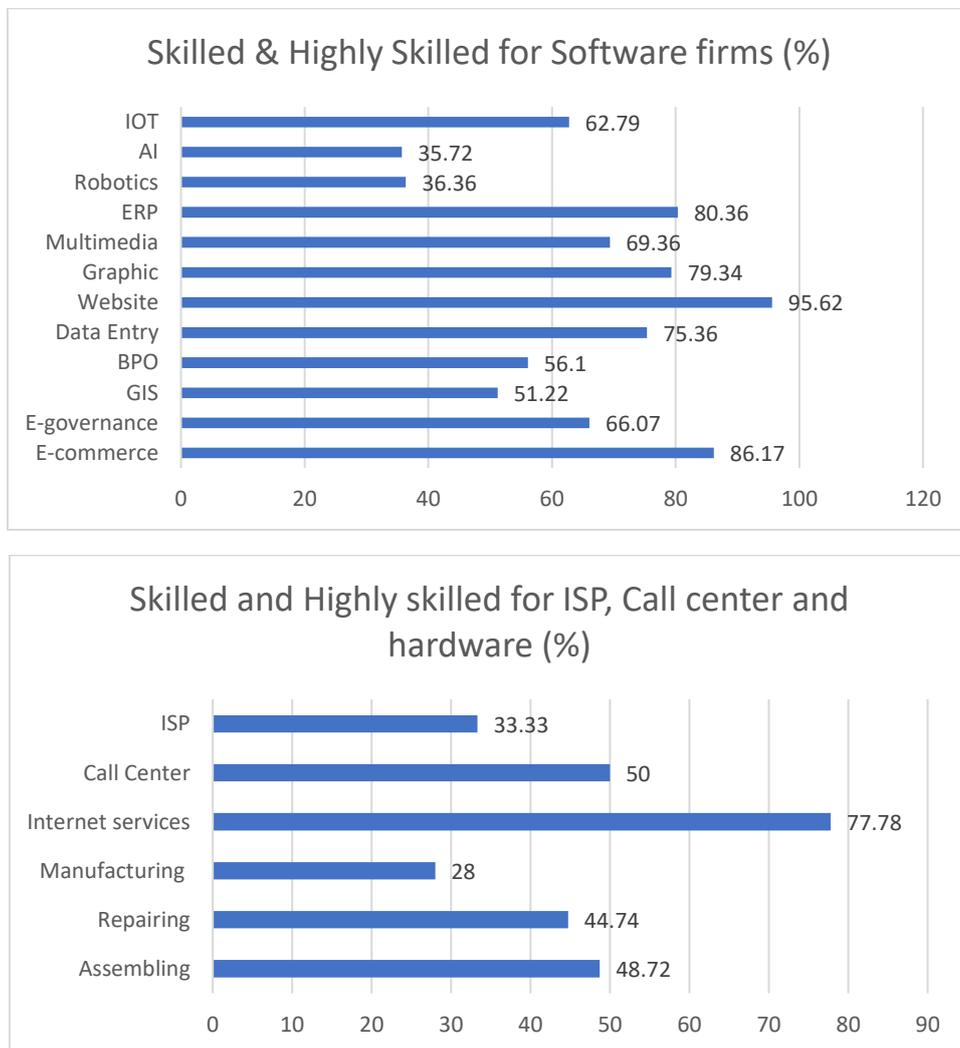
Average shortage in experiences

We have asked the firms to identify the gap between desired years of experience and what actually they got. The shortage of years of experience for entry, intermediate, and senior levels have been estimated and shown in Figure 7.2. It appears that there is a one-year gap in desired years of experience for the senior positions and mid-level positions, it is about 0.5 years. There is almost no shortage of desired years of experience for entry-level professionals. A detailed analysis of the shortage of experience is given in Table 7.2.

Table 15*:* **Table 7.2: Shortfall in experience across occupation level using Average years of Experience.**

Occupation Name and level		Desired Experience (Average Number of years)	Available Experience (Average Number of years)	The difference (shortfall) in Average Experience
Software Developer	Entry-level	1.55	1.46	0.09
	Intermediate or Experienced	3.23	3.10	0.13
	Senior-level or Supervisor	5.46	4.50	0.97
Mobile App Developer	Entry-level	1.84	1.66	0.18
	Intermediate or Experienced	3.16	2.84	0.32
	Senior-level or Supervisor	5.26	4.06	1.21
Game Developer	Entry-level	1.46	1.64	-0.18
	Intermediate or Experienced	3.06	2.80	0.26
	Senior-level or Supervisor	5.00	4.09	0.91
Applications developers/ programmers	Entry-level	1.75	1.73	0.02
	Intermediate or Experienced	3.81	3.58	0.23
	Senior-level or Supervisor	5.43	4.39	1.04
Web Dev. & Graphic & multimedia designers	Entry-level	1.60	1.58	0.02
	Intermediate or Experienced	3.31	3.14	0.17
	Senior-level or Supervisor	5.29	4.28	1.01
Database designers and administrators	Entry-level	2.11	1.94	0.17
	Intermediate or Experienced	4.09	3.58	0.51

Occupation Name and level		Desired Experience (Average Number of years)	Available Experience (Average Number of years)	The difference (shortfall) in Average Experience
	Senior-level or Supervisor	6.06	4.91	1.15
Systems administrators and Computer network professionals	Entry-level	2.39	2.22	0.17
	Intermediate or Experienced	4.50	3.75	0.75
	Senior-level or Supervisor	6.76	5.23	1.53
Data Scientist	Entry-level	2.38	2.12	0.25
	Intermediate or Experienced	3.95	3.62	0.33
	Senior-level or Supervisor	6.18	5.42	0.76
IoT Professionals	Entry-level	1.94	1.82	0.11
	Intermediate or Experienced	3.65	3.15	0.50
	Senior-level or Supervisor	5.67	4.80	0.87
Software Tester	Entry-level	1.98	1.86	0.12
	Intermediate or Experienced	4.12	3.16	0.96
	Senior-level or Supervisor	5.23	4.58	0.65
Robotic Process Automation (RPA) Developer	Entry-level	2.00	2.00	0.00
	Intermediate or Experienced	4.00	2.89	1.11
	Senior-level or Supervisor	7.00	5.13	1.88
BPO related work	Entry-level	1.33	1.50	-0.17
	Intermediate or Experienced	3.17	2.67	0.50
	Senior-level or Supervisor	3.50	2.50	1.00
Others	Entry-level	2.00	2.00	0.00
	Intermediate or Experienced	4.00	3.00	1.00

Figure 6: Figure 7.2: Shortage in desired years of experience
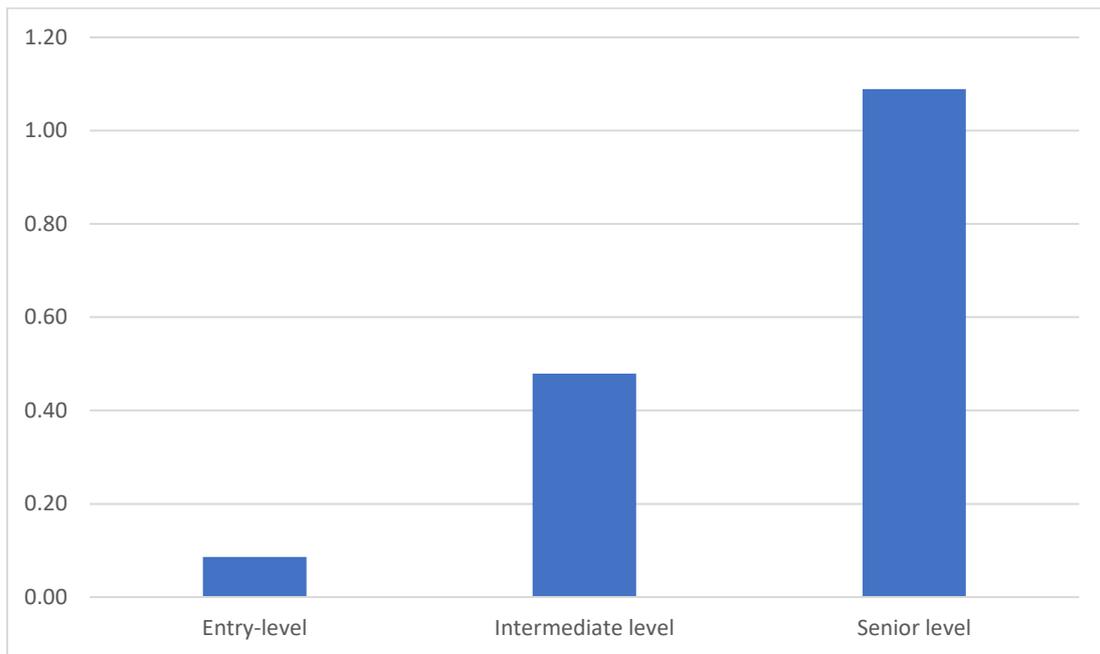
B. Shortfalls in skills

The employers assess the perceived shortfall in skills through a five-scale ranking. They rank the academic qualifications and programing language skills level for entry, mid-level, and senior-level professionals on a 1 (low) to 5 (high) scale. Average scores for the three categories are shown in Table 7.3. The results show that a skills gap exists between the average educational qualifications and the programming language skills among the employees. It can be observed that the average score for an entry-level is 3, while it is 3.5 for mid-level and about 4 for senior level. Overall, there is still a gap in senior levels too in terms of the desired level of academic education and proficiency in programming languages. As Table 7.3 suggests, senior-level Game developers, Data Scientists, and BPO-related employees are ranked highly for their available specialized qualifications with an average rank of 4.08 and 4 respectively while entry-level IoT Professionals have a relatively low average rank of 2.90. The average ranking of available language skills suggests entry-level Software Developers, Mobile App Developers, Game Developers, Web Dev. & Graphic & multimedia designers, Systems administrators, and Computer network professionals, and Data scientists, Robotic Process Automation (RPA) Developers, and BPO-related professionals have an average rank of less than 3. This in other words indicates that these professionals are not adequately prepared with their academic curriculum to enter the job market.

Data on the percentage of IT firm employers ranking the skill gap on a scale of 1 to 5, (1 to 5: very low to very high) shows that the highest percentage of IT enterprises (about 60%) identified the lowest skill gap at the entry-level employees across all occupation accept Game

developers. For mid or intermediate-level professionals, 30% of firms identified a very low skill gap while a similar 30% identified a moderate-level skills gap in this category. For the senior-level professionals, 30% identified a moderate skills gap, and 20% identified a high skills gap.

Table 16: Table 7.3: Gap in average qualifications

Occupations		Average qualification that you usually get (1 to 5 scale: 1 low to high 5)	Average prog. language skill that you usually get (1 to 5 scale: 1 low to high 5)	Average overall skills gap (1 to 5: low to high)
Software Developer	Entry-level	3.24	2.91	1.70
	Intermediate or Experienced	3.52	3.30	2.18
	Senior-level or Supervisor	3.76	3.43	2.62
Mobile App Developer	Entry-level	3.33	2.94	1.90
	Intermediate or Experienced	3.59	3.32	2.56
	Senior-level or Supervisor	3.68	3.36	2.94
Game Developer	Entry-level	3.08	2.62	2.31
	Intermediate or Experienced	3.31	3.31	2.88
	Senior-level or Supervisor	4.08	3.75	2.92
Applications developers/programmers	Entry-level	3.26	3.06	1.60
	Intermediate or Experienced	3.59	3.44	2.16
	Senior-level or Supervisor	3.81	3.46	2.63
Web Dev. & Graphic &	Entry-level	3.13	2.96	1.64

Occupations		Average qualification that you usually get (1 to 5 scale: 1 low to high 5)	Average prog. language skill that you usually get (1 to 5 scale: 1 low to high 5)	Average overall skills gap (1 to 5: low to high)
multimedia designers	Intermediate or Experienced	3.50	3.38	2.17
	Senior-level or Supervisor	3.73	3.53	2.46
Database designers and administrators	Entry-level	3.33	3.08	1.81
	Intermediate or Experienced	3.73	3.41	2.33
	Senior-level or Supervisor	3.85	3.50	2.73
Systems administrators and Computer network professionals	Entry-level	3.10	2.86	1.62
	Intermediate or Experienced	3.44	3.31	2.00
	Senior-level or Supervisor	3.80	3.54	2.54
Data Scientist	Entry-level	3.08	2.97	1.85
	Intermediate or Experienced	3.41	3.38	2.16
	Senior-level or Supervisor	4.00	3.82	2.73
IoT Professionals	Entry-level	2.90	3.10	1.55
	Intermediate or Experienced	3.46	3.62	2.12
	Senior-level or Supervisor	3.87	4.00	2.73

Occupations		Average qualification that you usually get (1 to 5 scale: 1 low to high 5)	Average prog. language skill that you usually get (1 to 5 scale: 1 low to high 5)	Average overall skills gap (1 to 5: low to high)
Software Tester	Entry-level	3.13	3.15	1.58
	Intermediate or Experienced	3.42	3.60	2.14
	Senior-level or Supervisor	3.90	4.03	2.58
Robotic Process Automation (RPA) Developer	Entry-level	2.89	2.78	1.67
	Intermediate or Experienced	3.56	3.44	2.67
	Senior-level or Supervisor	3.75	3.25	3.00
BPO related work	Entry-level	3.20	2.67	1.20
	Intermediate or Experienced	3.60	3.33	1.83
	Senior-level or Supervisor	4.00		2.00
Others	Entry-level	3.00	3.00	1.00
	Intermediate or Experienced	4.00	4.00	2.00
	Senior-level or Supervisor			

It is observed that there is a very high skills gap at the entry-level of game developer professionals and the same skills gap persists at all levels of this profession. About 40% of firms identified a moderate level skills gap among the senior-level professionals of applications developer (38%), system administrator (37%), and Data Scientist (39%). For mid-level professionals, a moderate level of skills gap has been identified by over 30% of firms for

applications developer (34%), web developer (32%), database designer (33%), system administrator (26%), and Data Scientist (37%) is RPA developer (44%). The high skills gap has been identified at the mid and senior levels by over 20% of firms for the mobile app. developers, game developers, database designers, data scientists, IoT professionals, software testers, and RPA developers (Table 7.4).

Table 17: Table 7.4: Average rank of Available Specialized Qualification, language skills and Percentage of enterprises rating (scale of 1 to 5: Low to High) overall skill gaps across different occupation level

		Rate overall skills gap (1 to 5: low to high), (% of Firms)				
		Very low	Low	Moderate	High	Very high
Software Developer	Entry-level	59	17	18	5	0
	Intermediate or Experienced	34	24	32	7	2
	Senior-level or Supervisor	18	25	38	18	2
Mobile App Developer	Entry-level	51	18	24	6	1
	Intermediate or Experienced	22	17	46	11	3
	Senior-level or Supervisor	2	30	43	21	4
Game Developer	Entry-level	15	38	46	0	0
	Intermediate or Experienced	6	38	25	25	6
	Senior-level or Supervisor	17	25	25	17	17
Applications developers/programmers	Entry-level	64	20	8	8	0
	Intermediate or Experienced	38	19	34	8	1
	Senior-level or Supervisor	15	28	38	18	1
Web Dev. & Graphic & multimedia designers	Entry-level	64	16	13	5	2
	Intermediate or Experienced	43	12	32	11	2
	Senior-level or Supervisor	22	28	33	16	1
Database designers and administrators	Entry-level	52	22	17	8	0
	Intermediate or Experienced	30	23	33	11	3
	Senior-level or Supervisor	17	24	33	21	5
Systems administrators and Computer network professionals	Entry-level	62	18	18	2	1
	Intermediate or Experienced	38	31	26	4	1
	Senior-level or Supervisor	18	29	37	15	1
Data Scientist	Entry-level	56	18	10	15	0
	Intermediate or Experienced	39	16	37	5	3
	Senior-level or Supervisor	27	6	39	21	6
IOT Professionals	Entry-level	65	20	10	5	0
	Intermediate or Experienced	44	20	20	12	4
	Senior-level or Supervisor	27	13	27	27	7
Software Tester	Entry-level	65	19	10	6	0
	Intermediate or Experienced	44	16	21	19	0
	Senior-level or Supervisor	29	19	19	29	3
Robotic Process Automation (RPA) Developer	Entry-level	56	22	22	0	0
	Intermediate or Experienced	22	11	44	22	0
	Senior-level or Supervisor	25	13	25	13	25
BPO related work	Entry-level	80	20	0	0	0
	Intermediate or Experienced	33	50	17	0	0
	Senior-level or Supervisor	0	100	0	0	0

Unavailability of required skills

In another attempt to understand the shortfall in required skills, we asked questions about the difficulties the firms face in recruiting required skilled human resources. Table 7.5 shows the percentage of firms rating the difficulties, from no difficulties to extreme difficulties in filling up vacancies across occupations. In the case of entry-level recruitment, over 70% of firms don't face any difficulties, but for mid to senior-level, about 40 or above percentage of firms face difficulties due to unavailability.

It is observed that IoT professionals and Software Tester are not available in the market, and in all other occupations, they don't face difficulties to fill up vacancies for entry and intermediate level but reported difficulties to fill vacancies for senior-level.

Table 18: Table 7.5: Percentage of firms rating the difficulties in filling up vacancies across occupation

Occupation		Percentage of firms rating the difficulties in filling up vacancies			Case
		No difficulties	Difficult	Extremely difficult	
Software Developer	Entry-level	74.79	23.53	1.68	119
	Intermediate or Experienced	64.29	25.89	9.82	112
	Senior-level or Supervisor	37.50	55.21	7.29	96
Mobile App Developer	Entry-level	71.21	27.27	1.52	66
	Intermediate or Experienced	55.56	38.10	6.35	63
	Senior-level or Supervisor	28.00	64.00	8.00	50
Game Developer	Entry-level	64.29	28.57	7.14	14
	Intermediate or Experienced	85.71	14.29	0.00	14
	Senior-level or Supervisor	18.18	63.64	18.18	11
Applications developers/ programmers	Entry-level	70.79	25.84	3.37	89
	Intermediate or Experienced	59.26	35.80	4.94	81
	Senior-level or Supervisor	29.17	62.50	8.33	72
Web Dev. & Graphic & multimedia designers	Entry-level	73.39	23.85	2.75	109
	Intermediate or Experienced	64.76	27.62	7.62	105
	Senior-level or Supervisor	39.58	54.17	6.25	96
Database designers and administrators	Entry-level	67.44	31.40	1.16	86
	Intermediate or Experienced	52.38	41.67	5.95	84
	Senior-level or Supervisor	28.99	62.32	8.70	69
Systems administrators and Computer network professionals	Entry-level	71.30	27.78	0.93	108
	Intermediate or Experienced	62.96	32.41	4.63	108
	Senior-level or Supervisor	34.07	63.74	2.20	91
Data Scientist	Entry-level	83.33	16.67	0.00	36

Occupation		Percentage of firms rating the difficulties in filling up vacancies			Case
		No difficulties	Difficult	Extremely difficult	
	Intermediate or Experienced	60.53	36.84	2.63	38
	Senior-level or Supervisor	40.63	43.75	15.63	32
IoT Professionals	Entry-level	54.17	37.50	8.33	24
	Intermediate or Experienced	53.85	38.46	7.69	26
	Senior-level or Supervisor	52.63	42.11	5.26	19
Software Tester	Entry-level	79.17	20.83	0.00	48
	Intermediate or Experienced	73.33	22.22	4.44	45
	Senior-level or Supervisor	54.55	33.33	12.12	33
BPO related work	Entry-level	57.14	14.29	28.57	7
	Intermediate or Experienced	57.14	0.00	42.86	7
	Senior-level or Supervisor	33.33	66.67	0.00	3
Others	Entry-level	100.00	0.00	0.00	2
	Intermediate or Experienced	33.33	66.67	0.00	3
	Senior-level or Supervisor	100.00	0.00	0.00	1
Total		57.80	36.91	5.29	1967

c. Skill Mismatch

As already stated, skill mismatch arises out of oversupply or undersupply of required skills. On average, high (and very high) skills gap exists among 5% of the entry-level professionals, 13% at mid-level, and 24% at senior-level (Figure 7.3). This analysis along with a very low shortage of job-specific professionals (below 5%) also points to the fact that a certain level of skill mismatch exists in the sector as the firms run at almost full employment with a certain level of skills gap.

Figure 7: Figure 7.3: Skills gap identified by the firms (%) from very low to very high

Skills gap
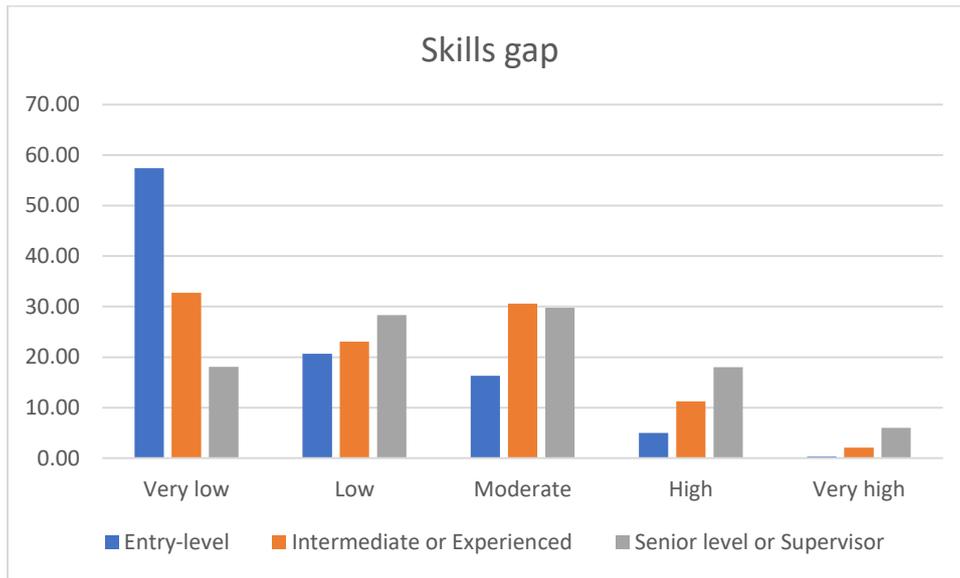
Source: BIDS Survey, 2020

Chapter 8:
Training and Skills Development Programs

The average number of training arranged in 2019 was about 2 for each category of professions by each firm and on average 16 persons participated in the training (Table 18). The highest average number of training arranged during 2019 was on Network and Security (4. 44). A relatively higher number of employees participated in training on the programming language (20.5), design (35), front end development (25), software tester (QA) (24), Software tester (QC) (40), business, marketing, and management (about 20), indicating higher demand for these training programs. Our survey data shows that enterprises also arrange training on FTTX (Fiber to the x), Ethical hacking and 3D design, and BPO-related works.

Table 19: Table 8.1: Average number of training arranged in 2019

Name of Training	Average no of employees received training	Average no of training arranged in 2019
Web Development	10.56	1.97
Mobile App Development	14.31	2.39
Game Development	11.00	1.67
Programming Language	14.58	2.27
Software Testing	20.50	1.81
Database	4.57	1.42
Network and Security	10.37	4.44
Design	35.33	1.89
Software Architecture	10.67	1.67
Data science	5.00	1.83
Internet of Things	21.00	2.25
Telecom Network	6.50	3.00
Software Development	12.11	1.83
Front End Development	25.17	1.83
RPA Developer	5.50	3.00
Software Tester (Quality Assurance)	24.11	2.43
Software Tester (Quality Control)	39.83	2.67
DBA	16.00	2.00
Business	28.78	3.11
Marketing	20.67	3.81
Management	18.00	2.00
Others	15.40	1.60

Table 8.2 shows the percentage of enterprises that expressed interest to spend on different training and the average scale of importance of such training on a scale of 1 to 5, (1 low to high 5) with an overall ranking of 3.39. Among IT-related specialized training, such as Data Science, RPA Developer, Network and Security, Programming Language were rated with high

importance and their average ranks are 4,4,3.8 and 3.7 respectively. Overall, 70% of the firms are willing to fund fully for arranging training for various professional categories. And the highest percentage of enterprises reported interest to spend fully on the training with 100 percent of firms showing interest in fully spending on RPA training.

Table 20: Table 8.2: Percentage of enterprises interested to convey different degrees of training expenses and average scale of importance of training

Name of Training	Percentage of enterprises that expressed interest to spend on training				Average scale of Importance of training on a scale of 1 to 5 (1:5, low to high)
	Fully	Partially	Not at all	N (number of enterprises)	
Web Development	69	23	8	39	3.45
Mobile App Development	71	14	14	14	3.08
Game Development	25	25	50	4	3.67
Programming Language	71	21	8	24	3.74
Software Testing	81	13	6	16	3.63
Database	77	15	8	13	3.39
Network and Security	68	32	0	19	3.84
Design	89	11	0	9	3.33
Software Architecture	67	0	33	3	3.67
Data science	43	29	29	7	4.00
Internet of Things	64	27	9	11	3.46
Telecom Network	50	50	0	4	3.00
Software Development	74	19	7	27	3.18
Front End Development	71	0	29	7	3.14
RPA Developer	100	0	0	2	4.00
Software Tester (Quality Assurance)	67	33	0	9	3.67
Software Tester (Quality Control)	57	14	29	7	2.86
DBA (Database Administrators organize)	80	20	0	5	2.40
Business	89	0	11	9	2.89
Marketing	95	5	0	19	3.79
Management	82	12	6	17	3.88
Others	50	50	0	4	2.50
Overall	**70.00**	**18.77**	**11.23**	**12.23**	**3.39**

Industry-Academia Linkage

One of the important aspects of skills mismatch is the lack of coordination between industry and academia which affects the quality of graduates. The industry-academia linkage depicts a very dismal scenario; less than 40% of firms have some sort of academic collaboration. Our survey shows that the linkage between the firms and TVET is very low, less than 5% of firms have linkages with TVET (Figure 8.1). On the other hand, more firms have linkage with other

institutes other than TVET. However, our survey reveals that any type of industry-academia linkage (TVET and non-TVET) is higher for the following areas; Software Developers, Application Developers, and Programmers, Web Development & Graphic & multimedia designers.
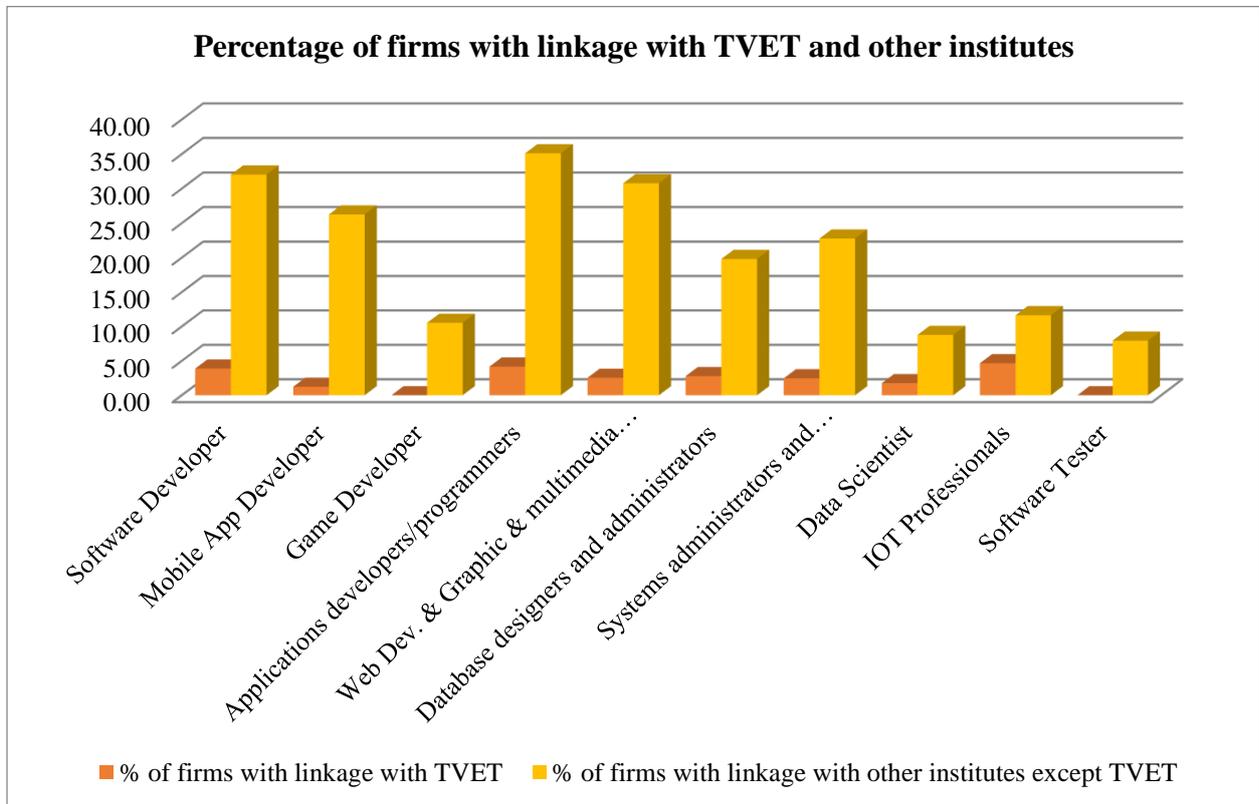
The firms which stated that they have industry-academia linkage with non-TVET institutes were asked to report the type of linkages they are having with non-TVET institutes (Figure 8.2). More than 60% of firms have the facility of internship as a form of industry-academia linkage for the following areas of specializations: Software Developer, Applications developers/programmers, Web Development and Graphic and multimedia designer, Data Scientist, IoT Professional, Software Tester. More than 75% of firms have an internship with respective academic institutions for Mobile Developers and Game Developers. Professional Training and Academic guidance is another type of industry-academia linkage as reported by a considerable proportion of firms across all the areas of specialization. The findings reveal that the current forms of linkages are weak in the sense that it has nothing to do with modernizing the curriculum or improving collaboration with academics.

Figure 9: Figure 8.2: Percentage of Firms with types of linkages with Non-TVET institutes

Percentage of firms with types of linkages with other instititutes (except TVET)
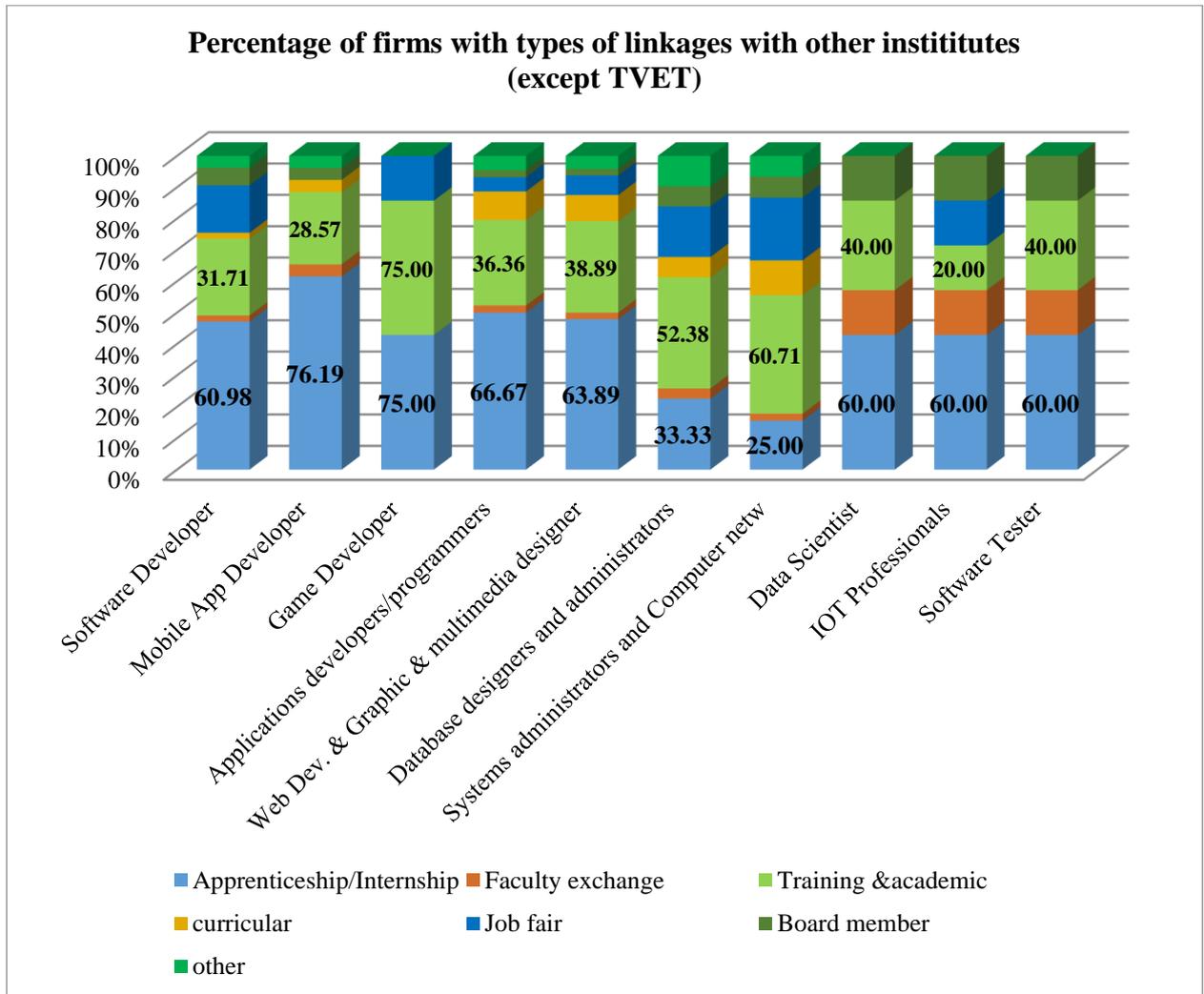
The surveyed firms were asked about their preferred institutes in the context of establishing industry-academia linkages. BUET came up as the most preferred institute in case of having industry-academia linkages across all the areas of specialization (Table 20). Dhaka University (DU) comes next in this regard and Chittagong University of Engineering and Technologies (CUET) is also preferred by a considerable proportion of firms.

Table 21: Table 8.3: Percentage of Firms with Preferred institutes of Industry-Academia Linkage

	Software Developer	Mobile App Developer	Game Developer	Applications developers/programmers	Web Dev. & Graphic & multimedia designer	Database designers and administrators	Systems administrators and Computer netw	Data Scientist	IoT Professionals	Software Tester
BUET	30.74	27.62	25.00	26.64	26.99	25.09	27.04	25.78	22.58	27.74
CUET	12.30	9.94	10.53	10.25	9.00	7.75	7.55	9.38	7.53	9.68
RUET	4.53	3.87	3.95	4.10	3.46	4.06	3.77	5.47	4.30	5.16
KUET	5.18	6.08	5.26	6.15	5.88	5.54	5.66	6.25	7.53	5.81
IUT	1.94	4.42	3.95	3.69	3.11	3.32	4.09	5.47	4.30	5.16
Ahsanullah	1.94	3.31	6.58	1.64	2.42	2.95	3.14	2.34	6.45	2.58
DU	17.48	14.36	10.53	16.80	17.30	15.87	16.35	14.84	15.05	16.13
JU	3.88	3.87	5.26	4.10	5.19	4.80	5.66	7.03	8.60	5.81
NSU	5.50	6.63	11.84	7.79	7.27	7.38	6.92	7.81	5.38	6.45
BRACU	8.09	8.84	5.26	10.66	9.34	11.44	10.06	7.03	8.60	10.97
AIUB	2.91	3.31	6.58	4.51	5.54	6.64	5.97	7.81	7.53	4.52
East West Uni	0.97	1.10	5.26	0.41	1.73	2.21	1.26	0.78	1.08	0.00
Chittagong	1.94	2.76	0.00	1.64	0.35	1.11	0.63	0.00	1.08	0.00
others	2.59	3.87	0.00	1.64	2.42	1.85	1.89	0.00	0.00	0.00

Chapter 9: Future Growth Potentials and Expected Labor Demand

All of our surveyed firms stated that they have a plan to expand the operations of their enterprises in the next ten years. As part of their expansion, the majority of the firms reported that they expect to recruit 51-100 more employees (25% of 145 firms), 101-200 employees (32.45% of 145 firms), and 201-500 employees (21.4% of 145 firms) in the next 5 to 10 years. Around 11% of firms stated they expect to recruit 26-50 more employees at their enterprises in the next five to ten years. However, around 9.7% of our surveyed firms expect to recruit more than 500 employees in the next 5 to ten years. Game developer (72%) and mobile app developer (54%) got the highest consideration followed by the database administrator (48%), system administrator (46%), and applications developer (45%). The expected motive of expansion of the entrepreneurs indicates a positive outlook of the industry. The expected number of employees in the next ten years (as perceived by firms) across different skills is provided in Table 9.1.

Table 22: **Table 9.1: Percentage of Firms with the expected number of employees in next ten years**

No of employees	Year	Software Developer	Mobile App Developer	Game Developer	Applications developers/programmers	Web Dev. & Graphic and multimedia designer	Database designers and administrators	Systems administrators and Computer network	Data Scientist	IoT Professionals	Software Tester
25 or below	2023	82.44	90.54	88.00	84.38	86.44	92.39	85.48	96.23	91.43	88.14
	2025	61.07	75.68	84.00	63.54	66.10	75.00	69.35	81.13	80.00	76.27
	2030	40.46	63.51	80.00	45.83	44.07	59.78	52.42	60.38	68.57	61.02
26-50	2023	10.69	2.70	12.00	10.42	7.63	5.43	8.87	1.89	5.71	10.17
	2025	24.43	14.86	8.00	23.96	22.03	17.39	19.35	15.09	11.43	15.25
	2030	31.30	18.92	8.00	29.17	31.36	26.09	24.19	30.19	14.29	20.34
51-100	2023	5.34	6.76	0.00	4.17	2.54	2.17	4.84	1.89	2.86	1.69
	2025	9.92	5.41	8.00	9.38	6.78	5.43	6.45	1.89	5.71	6.78
	2030	17.56	10.81	8.00	18.75	16.10	6.52	14.52	5.66	8.57	10.17
101-200	2023	1.53	0.00	0.00	1.04	1.69	0.00	0.81	0.00	0.00	0.00
	2025	4.58	4.05	0.00	3.13	2.54	2.17	4.84	1.89	2.86	1.69
	2030	6.87	4.05	4.00	3.13	4.24	4.35	8.06	1.89	5.71	6.78
201-500	2023	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00
	2025	0.00	0.00	0.00	0.00	1.69	0.00	0.00	0.00	0.00	0.00
	2030	3.05	1.35	0.00	3.13	2.54	2.17	0.00	0.00	0.00	0.00
>500	2023	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00
	2025	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00
	2030	0.76	1.35	0.00	0.00	1.69	1.09	0.81	1.89	2.86	1.69

Expected firm growth

Figure 9.1 shows the percentage of firms stating their expected growth in demand for different skills. Around 43% of firms expect to have "high growth" in demand for IoT professionals. More than 40% -45% of the firms reported moderate growth in Software Developer, Application Developer/Programmers, Web Development and Graphic and multimedia designer while 46%-50% of the firms reported that they expect to have "moderate growth" in the demand for Database designers and administrators, Systems administrators and Computer network. A substantial proportion of firms also stated "moderate growth" for Mobile App developers (4%) and Game developers (72%).

On the other hand, more than 20% of the firms reported having "very high growth" in Software Tester, IoT Professionals, Data Scientist, Systems administrators and Computer networks, Database designers and administrators, Web Development & Graphic & multimedia designer, and Software Developer.

Figure 10: **Figure 9.1: Percentage of Firms with expected growth in labor demand across different skill**

Percentage of firms with expected growth in labour demand across different skill

Skill	Moderate growth	High growth	Very High growth
Software Tester	37.29	35.59	27.12
IOT Professionals	34.29	42.86	22.86
Data Scientist	37.74	37.74	24.53
Systems administrators and Computer netw	45.97	27.42	26.61
Database designers and administrators	47.83	30.43	21.74
Web Dev. & Graphic & multimedia designer	41.53	31.36	27.12
Applications developers/programmers	44.79	39.58	15.63
Game Developer	72.00	16.00	12.00
Mobile App Developer	54.05	35.14	10.81
Software Developer	40.46	38.93	20.61

Expected demand for professionals by 2023

More than 80% of the firms are expected to increase the number of almost all professionals to 26 or less by 2023 (Figure 9.2). The following designations are considered: Software Developers, Mobile App Developer, Game Developer, Applications developers/programmers, Web Development and Graphic and multimedia designer, Database designers and administrators, Systems administrators and Computer network, Software Tester, Data Scientist, IoT Professionals.

Figure 11: **Figure 9.2: Percentage of Firms with expected number of employees by 2023**
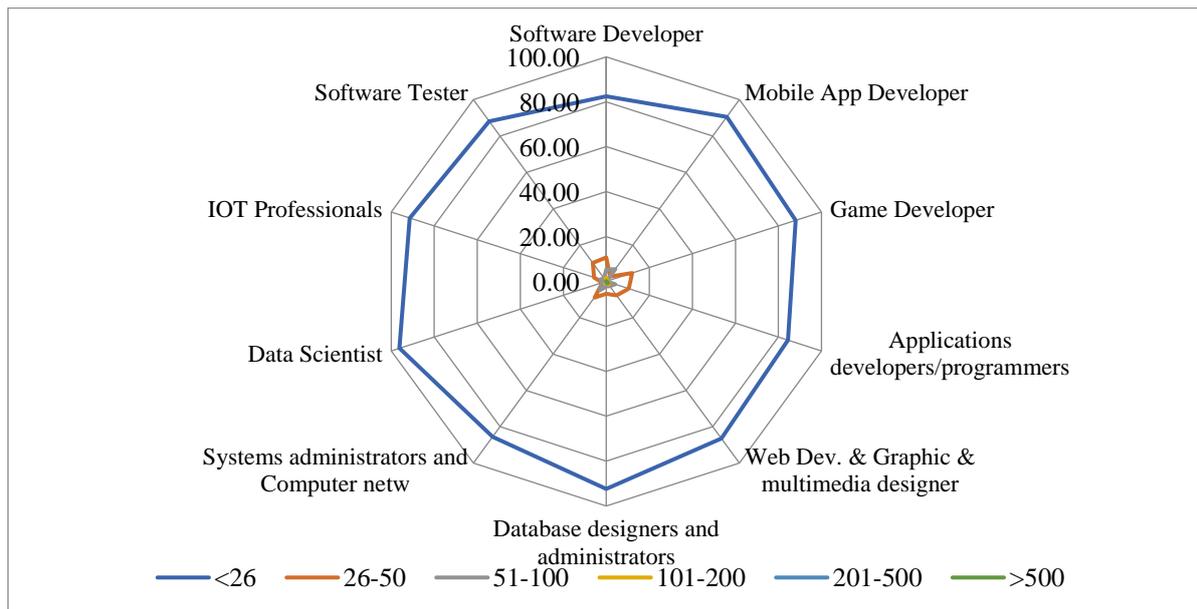
Expected demand for professionals by 2025

However, by 2025, 80% of firms projected the required number of game developers, data scientists, IoT professionals, and mobile app developers will be below 26 and the demand for software developers, applications developers, the system administrators will be between 26-50 (Figure 9.2). About 10% of firms projected the demand for certain professionals between 50-100 by 2025.

Figure 12: **Figure 9.3: Percentage of Firms with the expected number of employees by 2025**
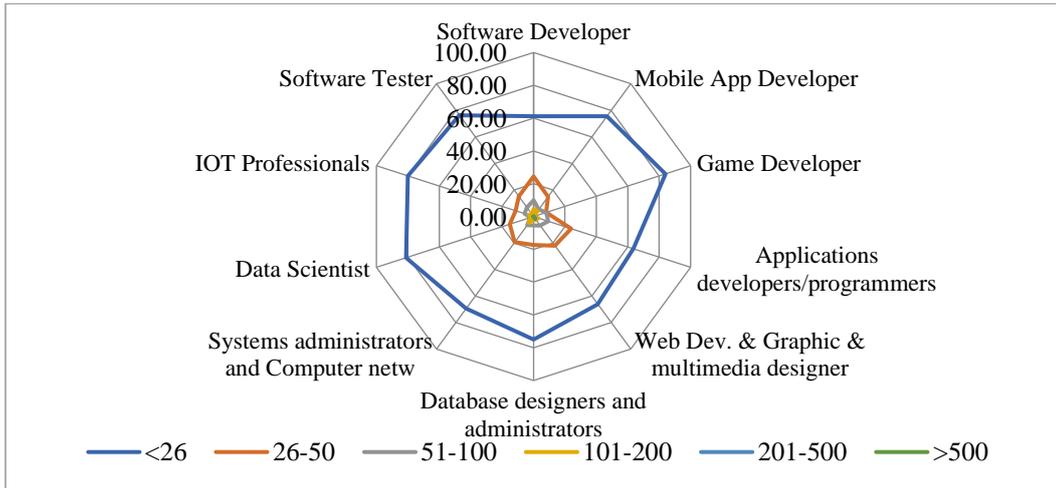
Expected demand for professionals by 2030

The expected demand for some professionals, such as game developers, IoT professionals, mobile app developers, database designers, and administrators will hover around 26 or below for about 60% of firms in 2030 indicating that the demand for these professionals will continue to persist. However, by 2030, the required number of professionals for certain categories, such as software developers, data scientists, web designers, and applications developers will increase by 26 to 50 for some firms. Even for some professional categories, about 10% or more firms anticipate that about 50 to 100 professionals will be required by 2030 for their firms.

Figure 13: **Figure 9.4: Percentage of Firms with expected number of employees by 2030**
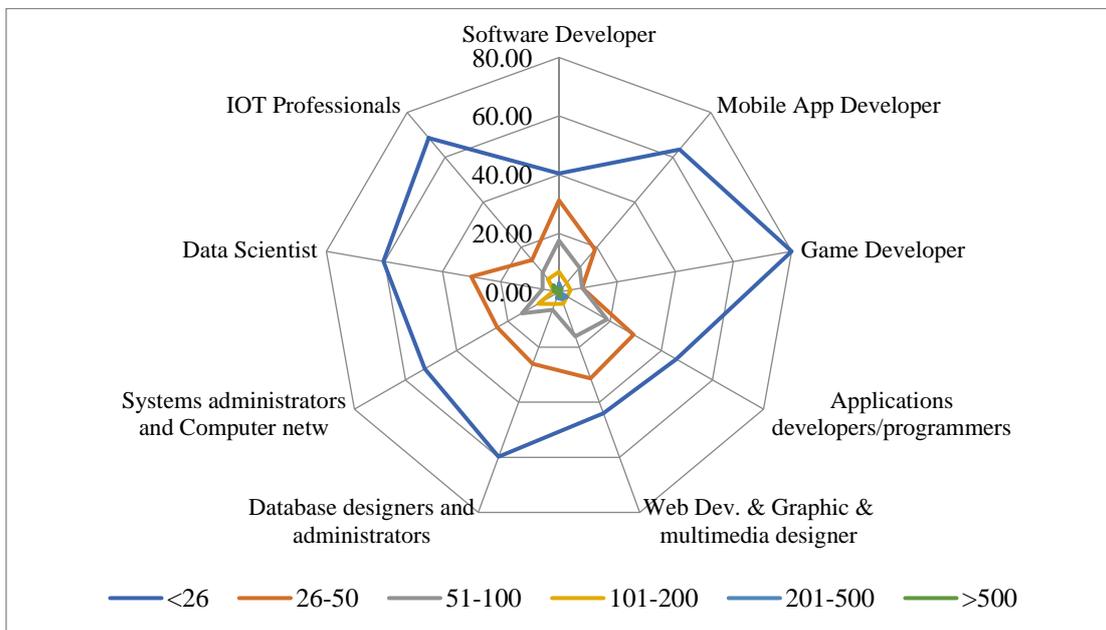
Preferred area and skills matching

Table 9.5 depicts the preferred area of specializations across different designations in terms of the percentage of firms stating the preferred area of specializations (arrayed in rows) across each of the designations (listed in columns)[4]. Software development is one of the demanding areas where specialization is required mostly for the designations of Software developers, Applications developers/programmers, Systems administrators, and Computer networks as stated by 74.6%, 14.7%, and 10.5% of the firms respectively. The need for this specialization is diverse as "software development" is also required for Mobile App Developer (6.9%), Data Scientist (3.6%), and IoT professionals (5.9%).

Specialization in "web development" is mostly needed for Web Development and Graphic & multimedia designer (72%) and Systems administrators and Computer networks (7.3%). "Mobile App Development" is primarily required for "Mobile App Developers" as reported by 71% of the firms. However, around 5% of the enterprises also prefer these specialties for Applications development.

Specialization in "Game development" is solely needed for the post of "game developer". However, when we observe it another way round, a "Game Developer" needs specialization in other areas apart from "Mobile App Development"; a Game App developer needs to have expertise on "Programming language" (stated by 12% of firms) as well as a specialization in Software Tester (quality control and Assurance), Database, Network & security, software architecture, Internet of things, Software development as stated by 4% of the firms.

"Programming language" came up as one of the most preferred skills needed for a number of different designations; around 59% of the firms stated that they prioritize expertise in "programming language" while recruiting "Applications developers/programmers". More than 10% of firms reported that "programming language" is preferred for Game developers, Systems administrators, and Computer networks, IoT Professionals.

The above results suggest that firms hire job-specific professionals according to their expertise though they are responsible for some other tasks that they are able to perform.

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[4] For any specific designation the numbers in each cell reflects the percentage of firms that stated their preferences for any particular area of specialization/skill. For instance, for the designation "Software Developer", around 74% of firms revealed that they prefer to have "employees with expertise in "Software Development" whereas 5% of the firms stated that they prefer to have employees with skills on "web development"

Figure 14: Figure 9.5: Percentage of firms with a preferred area of specialization across different skill

Specialization / Designations	Software Developer	Mobile App Developer	Game Developer	Applications developers/programmers	Web Development & Graphic & multimedia designer	Database designers and administrators	Systems administrators and Computer network	Data Scientist	IOT Professionals	Software Tester
Web development	5.38	2.74	0.00	2.11	72.03	4.40	7.26	0.00	0.00	1.72
Mobile app Development	0.77	71.23	4.00	5.26	0.85	0.00	0.81	0.00	0.00	0.00
Game development	1.54	2.74	60.00	0.00	0.85	0.00	0.00	0.00	0.00	0.00
Programming language	3.08	4.11	12.00	58.95	7.63	4.40	15.32	3.85	11.76	3.45
Software Tester (quality control and Assurance)	3.08	1.37	4.00	0.00	0.85	2.20	3.23	3.85	5.88	74.14
database	2.31	1.37	4.00	5.26	0.85	68.13	1.61	11.54	0.00	0.00
Network & security	0.77	1.37	4.00	1.05	1.69	2.20	33.87	0.00	2.94	5.17
design	0.77	4.11	0.00	2.11	7.63	6.59	3.23	1.92	8.82	0.00
software architecture	4.62	0.00	4.00	4.21	1.69	0.00	3.23	1.92	8.82	3.45
data science	0.00	0.00	0.00	0.00	0.85	8.79	8.06	61.54	2.94	6.90
Internet of things	3.08	4.11	4.00	5.26	1.69	0.00	3.23	7.69	44.12	1.72
Telecom Network	0.00	0.00	0.00	0.00	0.85	1.10	5.65	1.92	5.88	0.00
Software development	74.62	6.85	4.00	14.74	0.85	0.00	10.48	3.85	5.88	3.45
Front end development	0.00	0.00	0.00	1.05	0.00	0.00	0.81	0.00	2.94	0.00
business	0.00	0.00	0.00	0.00	0.00	0.00	0.81	1.92	0.00	0.00
marketing	0.00	0.00	0.00	0.00	0.00	1.10	0.00	0.00	0.00	0.00
management	0.00	0.00	0.00	0.00	0.00	1.10	0.81	0.00	0.00	0.00
others	0.00	0.00	0.00	0.00	0.85	0.00	0.81	0.00	0.00	0.00

Expected experience in next 5-10 years

Figure 9.6 shows the average years of experience expected by employers in the next 5-10 years. On average, average years of experience is between 8 to 9 years for Software Testers, System Administrators and Computer Networks, Data Scientists, Web Development & Graphic & multimedia designers. Average years of experience are expected to be between 7 to 8 years for the rest of the designated employees

Figure 15: Figure 9.6: Average years of experience expected by employers in next 5-10 years

Average years of experience expected by employers in next 5-10 years

Role	Value
Software Tester	8.57
IOT Professionals	7.15
Data Scientist	7.96
Systems administrators and Computer netw	8.34
Database designers and administrators	7.74
Web Dev. & Graphic & multimedia designer	8.26
Applications developers/programmers	7.86
Game Developer	7.36
Mobile App Developer	6.30
Software Developer	7.85
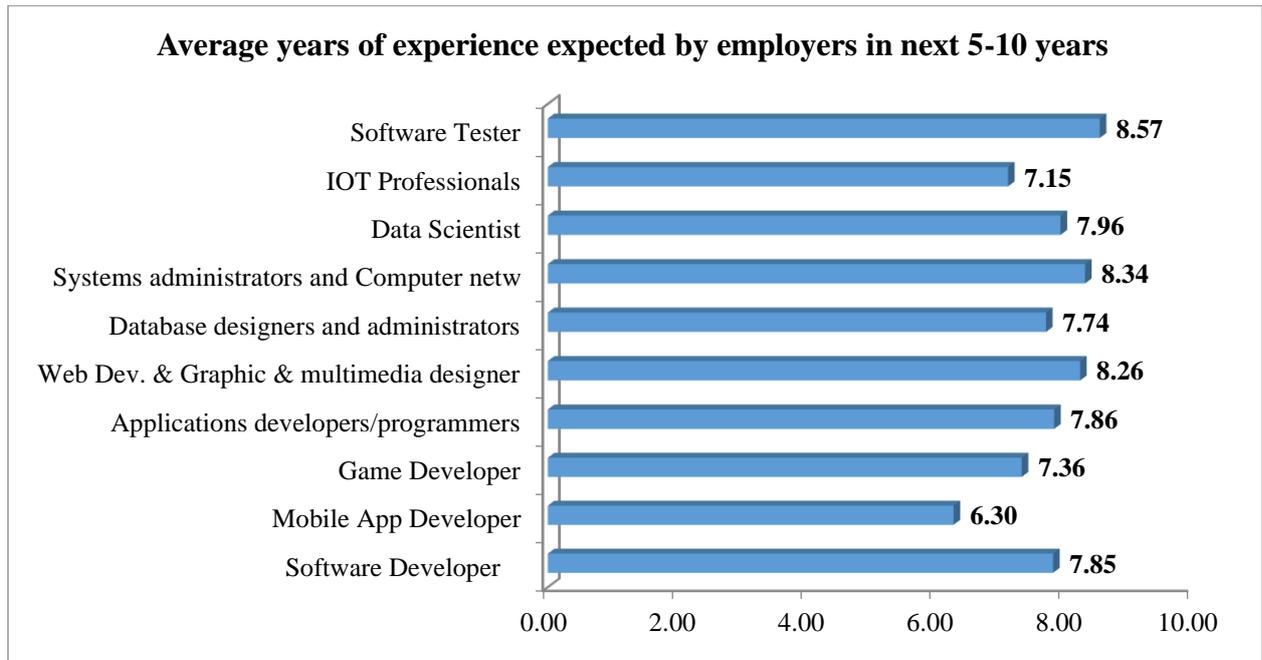
Chapter 10: Findings from Employee Survey

Around 292 employees were interviewed and all of them were asked about the need for further training for improvement of current work proficiency, future job progression/career prospects, and adaptation to technological change. The respondents expressed the extent of the requirement of further training on a scale between 1 to 5 (1=very low, 5=very high). The mean score turned out to be 4.29 when employees were asked if they need training to "improve their current work proficiency" (Table 10.1). The mean score came up to 4.35 and 4.49 when employees revealed their perception of the need for further training for future job progression/career prospects as well as for adaptation to technological change. Therefore, our findings show that the need for further training perceived by employees is "very high".

Table 23: Table 10.1: Level of Requirement of Further training (Scale 1 to 5: 1 very low, 5=very high)

	Mean	N
Need for further training to improve current work proficiency	4.29	292
Need for further training for future job progression/career prospect	4.35	292
Need for further training for table 1	4.49	292

We also asked the employees to assess their skills in using certain languages on a scale between 1 to 5 (1 very low, 5 very high). Then the employees expressed their perception about the need or relevance of those languages in terms of applying those languages in the workplace. We also asked the employees if there is any requirement for further training in those languages to apply them as per the need of the industry.

Employees were asked if they are willing to spend for receiving training in different areas and to what extent they are willing to bear the expenses. More than 60% of employees across all training categories reported that they are willing to bear partial expenses of the respective training (Figure 17). On the other hand, more than 20% of respondents reportedly stated that they will not bear the expenditure of training while less than 15% of employees stated that they will bear the full expenses on their own.

Figure 16: **Figure 10.1: Employees' willingness to bear training expenses**
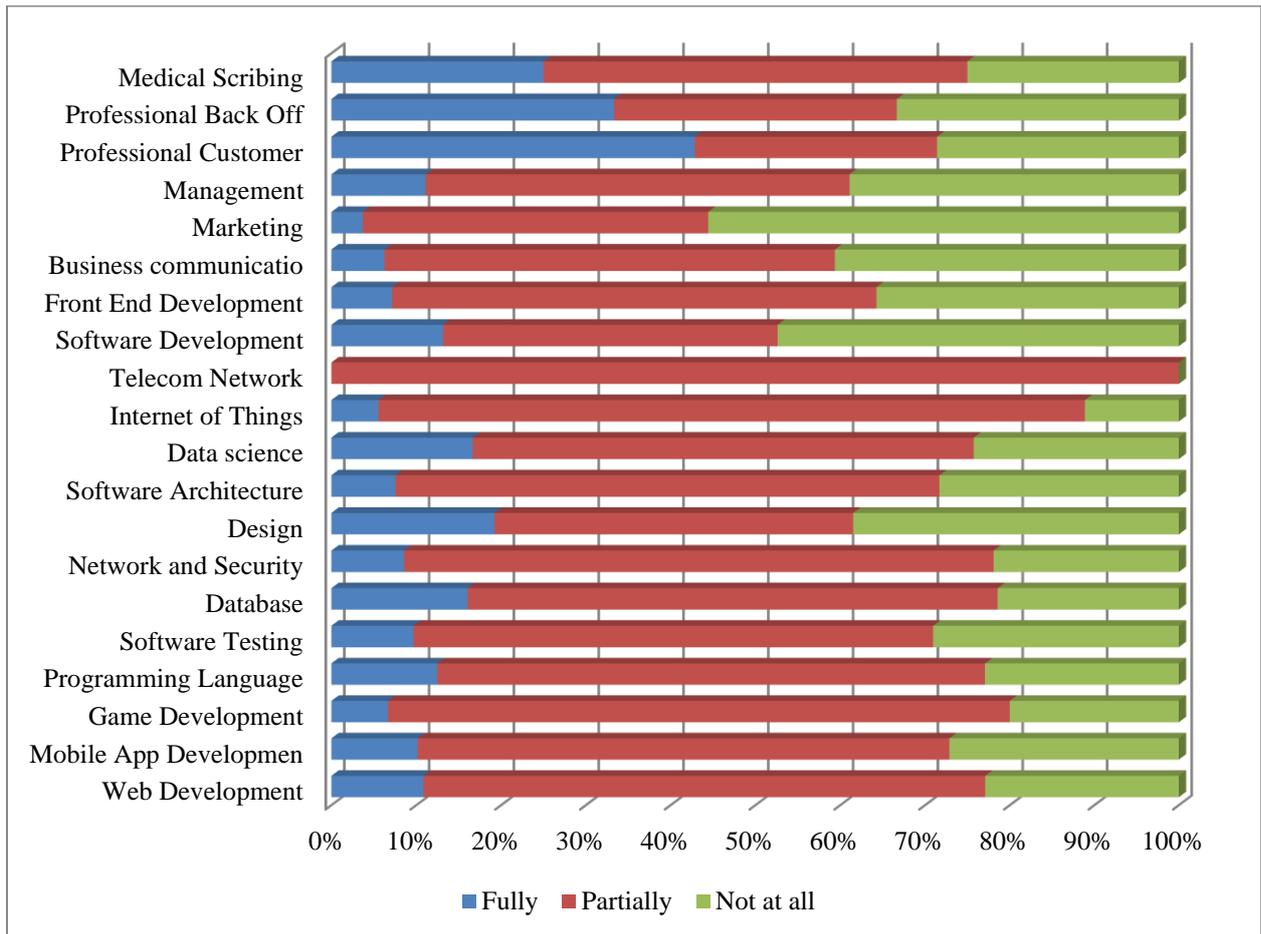
Employee's own assessment about the skills gap

Table 10.2 depicts the mean score of level of skill as assessed by employees; extent of relevance of those languages to current job and level of requirement of further training on those languages as perceived by employees. The majority of the employees have assessed their language skills more than average (mean score is over 3) and similarly, they found their job related to their proficiencies in the language (with a score over 3). And therefore, the need for training in those languages is low, below 3. We observe that only in a few languages the score for training need is 3 or above, such as for python, core python, and ethical hacking and cyber security. We may also consider training needs for some other specialties in languages based on a mean score above 2.5. These are database, Java, SQL/MySQL, Javascript, /Net, Ms SQL, XML, ASP, Laravel, Software Testing & Quality Assurance using Selenium, Oracle, UNIX/LINUX/Solaris, JSP, Laravel & Vue, Android App Dev. with Java SE, Automation Testing with Selenium, Professional Android Application Development, React, Kotilin, Video Editing with Adobe Premiere Pro Swift, Dart, CGI Perl, Cold Fusion, Machine Learning using R, and CCIE. While developing training programs for IT professionals in the future, emphasis should be given to the aforementioned languages and topics.

Table 24: **Table 10.2: Employee's assessment about own his skill, Perception regarding the need of these languages for their job and training needs on these languages**

(Scale 1 to 5: 1=very low, 5=very high)

Languages	Employee's assessment about his own skill		Employees' Perception regarding the relevance of skills with current job		Employees' Perception of training needs on these languages and applications	
	Mean Score	N	Mean Score	N	Mean Score	N
HTML	3.67	193	3.66	206	2.11	204
HTML and HTML5	3.47	145	3.48	170	2.21	170
Database	3.46	166	3.7	177	2.61	177
JAVA	3.42	215	3.61	222	2.51	222
C/ C++	3.33	214	3.54	220	2.32	221
PHP	3.32	189	3.73	192	2.39	191
SQL/MySQL	3.18	163	3.66	187	2.64	187
Javascript	3.18	189	3.68	195	2.58	195
/Net	3.18	147	3.32	161	2.52	163
MS SQL	3.15	173	3.55	188	2.54	188
CSS and CSS3	3.1	140	3.26	165	2.32	165
XML	3	107	2.99	133	2.52	134
Bootstrap 4.3	2.91	122	3.19	151	2.38	151
Operating	2.91	105	3.08	125	2.36	126
Photoshop for Web/App Developers	2.89	114	3.24	139	2.52	138
ASP	2.78	118	3.13	136	2.63	137
Javabeen	2.74	107	2.99	121	2.44	121
Laravel	2.71	133	3.25	148	2.53	148
Software Testing & Quality Assurance using Selenium	2.71	133	3.39	145	2.74	145
jQuery	2.7	123	3.06	153	2.43	152
Oracle	2.57	155	3.12	172	2.81	172
Laravel 6.0	2.52	103	2.91	124	2.46	125
MS Access/Fox pro	2.48	94	2.59	123	2.44	123
Python	2.47	165	3.35	177	3.17	176
UNIX/LINUS/Solaris	2.44	109	2.94	139	2.54	140
Core Python	2.42	151	3.31	161	3.16	163
JSP	2.42	103	2.74	114	2.54	114
CSS using SASS	2.41	87	2.67	118	2.35	118
Other programming	2.25	79	2.76	109	2.64	110
Laravel & Vue	2.23	92	2.9	115	2.62	116
Android App Dev. with Java SE	2.2	100	2.76	131	2.67	132

Languages	Employee's assessment about his own skill		Employees' Perception regarding the relevance of skills with current job		Employees' Perception of training needs on these languages and applications	
	Mean Score	N	Mean Score	N	Mean Score	N
Automation Testing with Selenium	2.05	88	2.72	121	2.78	121
UML	2.01	78	2.45	113	2.48	116
Professional Android Application Development	1.99	90	2.59	124	2.81	125
React	1.98	96	2.77	131	2.78	131
Kotilin	1.94	98	2.71	126	2.83	126
MS NT 2000,2006	1.79	79	2.27	112	2.44	114
Video Editing with Adobe Premiere pro	1.77	77	2.52	112	2.64	109
Ethical Hacking and Cyber Security	1.75	113	2.75	144	3.04	142
Swift	1.74	77	2.29	113	2.54	115
Android and IOS APP Development with Flutter	1.72	88	2.55	122	2.75	122
Dart	1.69	72	2.41	111	2.6	111
CGI Perl	1.62	66	2.18	98	2.64	98
Android Architecture Components with Kotlin	1.61	74	2.41	112	2.66	108
Cold Fusion	1.52	69	2.22	102	2.58	102
Machine Learning using R	1.43	77	2.37	107	2.74	100
Lotus notes	1.41	63	2.11	101	2.49	102
Power BI,	1.36	73	2.17	108	2.46	104
TableAU,	1.2	65	2.07	99	2.38	98
CCIE	1	1	5	1	5	1

Chapter 11: Findings from Focused Group Discussions

A few FGDs (focused group discussions) have been organized with participation from the Bangladesh Association of Software and Information Services (BASIS) and Bangladesh Computer Samity (BCS) representatives. The discussion focused on three major agendas; (i) sectoral aspects (ii)skill gap and skill shortage and (iii) COVID-19 and the ICT sector. Each of these three major agendas was discussed through specific sub-themes:

- Sectoral Aspects: Overall situation of the IT sector and its growth prospects; major problems of this sector; suggestions on Training and skills needs; progress of Digital Bangladesh; and internet connectivity.
- Skill Gap and Skill Shortage: Areas of Skill Gap and skill shortage in Software companies, Internet Service Providers, Hardware companies and Call Centers; main factors responsible for skill gap and skill shortage; the role of educational institutions and government in addressing the skill gap; skills need in IT industry considering COVID-19 or post- COVID-19
- COVID-19 and ICT sector: Impact of COVID-19 on ICT Sector of Bangladesh in terms of job creation or job loss; change in production activities; competency of ICT sector against the effects of COVID-19; and coping Strategies during COVID-19.

11.1   Discussion with BCS

Bangladesh Computer Samity (BCS) is a lead IT business and trade industry association in Bangladesh. Its involvement in the industry comprises distributors, dealers, resellers of computer and allied products, locally assembled computer vendors, software developers and exporters, internet service providers, ICT-based educational institutions and training houses, and other ICT-enabled services providers. Established in 1987 it is the oldest organization in the ICT industry. The objective of BCS is to expand the ICT sector and create new interest and awareness of ICT across Bangladesh.

11.1.1 Current Status of Hardware and Networking

Although the ICT production capacity of Bangladesh has not reached 100%, much progress has been made in the assembling sector. 30% of mobile assembling is done within the country now. Companies like Walton, Samsung, and Symphony are making mobiles, motherboards, laptops, etc. Keyboard, Mouse, UPS, IPS made in Bangladesh have already been made available in the market.

The future goal is to create a 1000-billion-dollar industry targeting the fourth industrial revolution (4IR) by focusing on AI, IoT, Robotics, and Big data. To reach such a target, BCS

is teaming up with faculty members from Dhaka University Robotics, Engineers from Amazon, etc.

In providing a network throughout the county there has been much progress. Currently, under the Info Sarker II project, 492 Upazila have access to broadband internet while under project Infor Sarker III, 3856 unions out of 4553 will be brought under broadband internet connectivity, starting with Union Parishads. At present, this service provides 200 MG bandwidth and local internet service providers with a category license can use this broadband line to provide internet connection.

BCS is focusing on increasing digital connectivity and promoting the use of digital devices. Local support has improved much; once 100% of the software was imported and now Bangladesh is exporting software. Six Bangladeshi initiatives were awarded the Alliance Global ICT excellence award by World Information Technology and Services (WITSA) at the World Congress of IT. Bangladesh is also the host of the next World Congress of IT of WITSA next year. Prism software used by Titas Gas Transmission & Distribution Company Ltd., is one of the highlights of the achievements of Bangladesh's ICT sector, proving there is no lack of policy efforts from the Government's side as Bangladesh is bidding for work on an international platform and getting various projects.

Currently, 80% of software used in Banking Sectors is local software, and 90% of the software in mobile financing is also locally produced like Nagad, Surecash, and Nexus Pay. The use of E-Nothi in Government organizations has boosted the demand for the ICT industry. BCS believes we have just only started to explore the potential of local demand and local markets.

Bangladesh has succeeded in producing ICT accessories. CAT5 and CAT9 cable lines are being manufactured; manufacturing of B2B and byproducts has become one of the priorities. There are 10000 enterprises and 2500 members that are associated with BCS with 60-70 thousand workers including both ICT and ISP but informally the number is even higher. Market penetration or new demand in this sector is 8-9%.

11.2 Problems faced by the ICT sector in Bangladesh

11.2.1 Shortage in Labor Supply

A survey done six-seven years back showed that 30% of the ICT devices in Union Tottho O Seba Kendro are damaged or need to be repaired. There is a shortage of skilled manpower to provide necessary support and maintain services to hardware (computer/internet/Wifi etc.) in various labs, and training centers throughout the country. Even existing facilities such as Sheikh Rasel IT Seba and Union Tottho O Seba Kendro suffer from the dearth of skilled manpower. Skilled professionals are required to run ICT labs at different schools and colleges, mobile usage, and provide internet connection. As members of BCS are more interested in

entrepreneurship, support for production is mostly needed. As a booming industry that has much potential in combining mobile and computer technologies, this sector needs skilled human capital.

11.2.2 Skill Shortage

The educational institutions only provide theoretical knowledge but do not provide practical orientation. It has become a common practice by IT firms to recruit fresh graduates and provide the necessary training to gather practical skills required to perform according to firms' needs. However, after receiving the training and gathering a decent experience with the required skills, the employees tend to move to other companies/firms for a higher payment. Therefore, the firms in this industry are incurring huge losses in order to groom up an inefficient, semi-skilled workforce as the firms are constantly competing to get skilled and efficient workers.

In the future market, the local ICT industry is facing hard competition from renowned international companies such as HP, and IBM. The future goal is to create a 1000-billion-dollar industry targeting the fourth industrial revolution (4IR) by focusing on AI, IoT, Robotics, and Big data. A skilled workforce has become a dire necessity in order to achieve this target. For example, the level of skill of the existing workforce can only facilitate assembling computer goods; producing these goods (such as laptops, and other accessories) is still a distant attempt to achieve. The lack of R&D facilities is one of the major reasons for this skill gap. Active Network Unit (ANU) used in networking and ANU manufacturing has a lot of demand but in Bangladesh no workforce with the required skill is available.

In hardware and networking, there is no skill shortage at the basic level but in the intermediate or standard level, there is a 70% skilled labor shortage, and in the advanced level the skill shortage is 80%. The basic salary in hardware is 15-20 thousand, which is low whereas the standard level salary is 35-50 thousand and the advanced level salary is 50 thousand and above.

BCS perceives that policymakers need to change their mindset for the overall development of the IT sector. BCS believes that its problems have been conveyed to policymakers many times but the suggestions have never been addressed with adequate attention. The government's new ICT policy includes all associations and they are all connected, but constant support from the government is needed for the development of this industry. BCS also felt the necessity of decentralization as currently it is more or so based on capital.

11.2.3 Connectivity

BCS emphasizes more on increasing the use of fixed broadband rather than mobile internet. While mobile internet has limited service but it is very popular due to the relatively high cost of broadband. Still compared to India, the quality of internet speed needs to be increased along

with low pricing. Quality of service is more of a concern than pricing as the demand for connection is more than the capacity. BCS asked the government to reduce internet prices so that the goals set by the Prime Minister can be achieved. For 4IR, internet price needs to be more affordable and cabling and hardware need more attention as they are completely different subsectors.

11.2.4 Training and Skills need

There is a need for comprehensive upgrading of the existing training both for freshers and graduates. Training institutes are available but they are commercial and provide very little practical knowledge. The ICT sector lacks quality senior workers. Most workers in this sector gain their practical knowledge from informal learning, such as learning from seniors by being an intern.

BCS proposes to train the available workers (hardware and maintenance) using its own syllabus focusing on hardware applications. They have already created their own training center, but financial support is required to make the center operational. BCS plans on having its own training center and they are currently working on a course outline. They can run 2-3 courses with 100 people in each seating with each batch having 3 days of classes per week. The courses will be run by experts from this industry and the duration may be 3, 6 months, or a year for an advanced level diploma and full course. They feel that any support from SEIP for the BCS training Center would be very supportive. They also place a request to SEIP to come up with an MoU like BASIS IT Institute so that they can smoothly run skills development training to this section of people, for which the unmet need for training is huge.

11.2.5 Effects of COVID-19

During COVID-19 hardware purchase has increased which will play an important role in national growth. Although the increase in sales was offset by a shortage of supply, the existing local stock has been sold out during this pandemic. In 3 months of Government holidays, 74000 new broadband connections have been made, 60% of which are out of metropolitan but the demand is way larger than the capacity, creating a supply shortage.

There was a 40% growth in the market but it was offset by a production crisis and supply shortage. However, no worker was fired; and an annual bonus was announced.

The firms are expecting another supply shortage as worldwide COVID-19 cases increased and many countries are going for lock-down. To cope with the current crisis, the industry is emphasizing product variation. The ongoing supply shortage is expected to be continued till June-July of 2021. Small manufacturers are mostly affected during this pandemic. COVID-19 helped eCommerce to grow and local applications such as Chaldal, and Evaly are doing better than foreign apps.

11.3 Future of the ICT sector in Bangladesh

The industry should focus on manufacturing ICT accessories, digital networking, and digital trading. New apps for remote workplaces and remote education are demanded during this pandemic. Although the developed world might focus on robotics for nursing such advanced technology is currently impossible for Bangladesh to apply. Bangladesh should aim on flourishing e-commerce, digital marketing, or e-trading. More training can help firms to survive as there is high competition in this market and those who lag behind face the risk of losing their business.

11.4 Discussion with BASIS

BASIS was established with the mission to develop the ambition, capacity, and sustainable growth of the BASIS member companies, and to lead and deliver the BASIS contribution to One Bangladesh. BASIS started its own training activities in 2007 to address the skill gap in the IT industry. Later in 2012, BASIS institutionalized its training activities and set up the **BASIS Institute of Technology & Management (BITM)** with the support of SEIP. BITM was established with a vision to be a world-class IT institute in Bangladesh for the purpose of enhancing the competitiveness of the IT Sector in Bangladesh by creating a pool of qualified IT professionals and quality certified IT companies.

11.5 Skill shortage and skill gap in the IT sector

Both skill shortages and skill gaps exist in the IT sector. Despite the ample availability of graduates every year, employers face difficulties to recruit fresh graduates as the skill level acquired by these graduates does not seem to meet the required demand expected by the employers. On the other hand, the skill gap becomes an obvious challenge when an employer finds that the newly recruited graduates do not have the ability to execute their assigned job (e.g. Game Development) despite the training provided by the employers after recruitment. Graphic Design and Android Programming are two areas where the companies are outsourcing foreign employees as the indigenous labor force do not have the advanced skill. SEIP training cannot serve the role of enhancing skill level as 90% of the training is very basic in nature and these trainings are designed to target fresh graduates only. On the other hand, there is an inadequacy of skilled professionals to work for AI, and big data analytics.

11.6 Improvement of Training financed by SEIP

The members of BASIS in FGD stated that the training provided by BASIS is effective enough in terms of capacity building of the trainees as well as useful in getting salaried employment as well as in freelancing and outsourcing. BASIS provided training to around 23,000 participants in the first phase of SEIP (2015-2018). BASIS estimates that 80% of trainees of

the first phase got a job at a different time interval after receiving the training. Another 7,000 trainees received training in the following year with the leftover funds from the first phase. 62% of trainees got a job within three months after completion of training. Half of these 62% of trainees (who got a job within three months after training)were employed directly in IT sectors while the rest half were employed in IT fields of different non-IT sectors(banks, industries, hospitals, etc).

The participant should at least have a diploma or be in the last year of graduation to get enrolled in SEIP training and no prior experience is needed. However, for participation in a course on web applications or mobile applications, the trainees must have prior academic training in CSE. Most of the courses excluding graphics design, web design, and digital marketing are only suitable for CSE (Computer Science and Engineering) students, and both public and private university CSE students can take these training. These trainings are provided on a part-time basis but require 3-4 hours on each day a week. Some of the suggestions made by the FGD participants regarding the improvement of SEIP training are highlighted in the concluding chapter.

11.7 Broadband Connectivity

Bangladesh is lagging far behind in terms of readiness index, knowledge index, and IT development index. Despite the growing demand for the internet, the cost of using the internet is still very high due to the high transmission costs. The price of bandwidth has been falling significantly, (the price of bandwidth has been reduced from per MBS 76000 taka to 300 takas in the last 12 years), still connections in remote areas are way costlier than in the capital city; about 7-10 times higher due to unchanged or increased transmission. Only 20% of the subscription cost comes from bandwidth price and the rest is for other operational expenses and transmission costs.

Connectivity is still far away from availability; people in rural/suburban areas are yet to get easy access to the internet despite the infrastructural development of optical fiber. Moreover, local users do not feel motivated to use the internet. The government can come forward to induce the demand by creating content such as online marketing and getting government services via internet.

11.8 Reporting of Export Data

Many studies are being carried out to accumulate data on exports but different platforms give different figures. Finance Ministry, Bangladesh bank, and associations need to work closely with the respective organizations, such as the Export Promotion Bureau and Bangladesh Bank to come up with a unified exports figure on export data on ICTs. It is important to know the overall exports of software and ITES service for assessing the performance of the industry.

11.9 Effect of COVID-19

BASIS states that the IT sector is not significantly affected by COVID-19; the initial shock from the pandemic led some firms to incur losses but overall growth in this sector is positive. The number of BASIS members now stands at around 1800 which is significantly higher than in the past. The overall scenario of the IT sector in the last decade shows that some firms have always been susceptible to losses and ran out of business due to the competitive performance of other companies, poor business plans especially the start-ups which failed to comprehend the actual nature of the market and failed to launch. During the pandemic, it was the startups that failed to operate and were shut down. However, these startups are recovering from losses now and are expected to incept the usual operation.

Export is expected to increase in the upcoming months; more than 1 billion exports can be achieved this year. Currently, 0.2 to 0.3 million IT professionals are working in Bangladesh but it is expected to be 1.2 million by the next few years. On average, around 22,000 fresh graduates with IT backgrounds are available per year.

11.10 Future of Bangladesh ICT Sector

Considering the agenda of Digital Bangladesh, there is ample scope for the IT sector to grow and flourish in upcoming years. A large segment of the industry and service sector (Education, Agriculture, Health, and Fintech) is yet to be digitalized with automation. For example, the present rate of automation in the RMG sector is only 1% and a large number of banks are yet to introduce core banking software. New technology such as Blockchain, AI, IoT has a high demand. Government can play a significant role in encouraging industries to adopt automation. For instance, the government can incentivize firms and companies by providing soft loans to introduce automation following ICT regulations. The whole process will be monitored with the help of BASIS and BASIS will certify the extent of automation of the firms and companies.

Considering huge demand for cloud computing, skills training on cloud computing has been considered as an essential component of government's endeavor towards "Digital Bangladesh". SEIP has introduced training program on "Cloud Service Management using Amazon Web Services" in collaboration with BASIS. On the other hand, Bangladesh Hi-Tech Park Authority (BHTPA) in collaboration with a local IT firm organized online training on Cloud Management involving Microsoft-certified professionals as the trainers[5]. Around 6000

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[5]http://www.bhtpa.gov.bd/sites/default/files/files/bhtpa.portal.gov.bd/notices/c9956724_343c_4d10_a557_1b13af8dfc13/2021-04-22-07-03-899532e2adc34d50e42b21dd38aecc5a.jpg

participants have been targeted in BHTPA's Cloud training program with a provision of receiving 'cloud credit' worth USD100 each upon successful completion of the training.

Chapter 12: Summary, Recommendations and Conclusions

In realizing the digital Bangladesh vision, the importance of developing the ICT industry is enormous. Given the prospect of demographic dividend and favorable policy diffusions, the ICT sector in Bangladesh has the potential to capture a certain share of the global offshore industry and contribute to the country's digital transformation and subsequently to economic growth and development. The ICT sector in Bangladesh comprises IT (software), ISP, Call centers, Telecommunications, and hardware sectors. Excluding telecommunications and hardware, export earnings are about US$1 billion including unreported freelancing activities. Given the potential of the sector with low wage rates and demographic dividends, this study assesses the labor market and skills gap in the ICT sector. Labor market outcomes and skills patterns would play an instrumental role in the further development of the ICT industry in Bangladesh.

Since human capital is the only important input for this industry, this study makes an attempt to understand the skills gap and labor market outcomes in the ICT sector. This study thus focuses mainly on the labor market, existing skills, and the skills gap in this sector. Analyzing the skills gap helps understand the dynamics of the labor market and future demand for skills in this sector from both employer and employee perspectives.

The survey sample included 146 IT/ITES, ISP, and call center & BPO firms for assessing their employees' skills gap. The survey was conducted from December 2020 to March 2021. The majority of the samples are taken from Dhaka and some firms were surveyed from Chittagong, Jessore, and Sylhet. The majority are IT firms (122) followed by ISP (15) and call center & BPO firms (9). About 90% of the firms are owned by Bangladeshi and 1.37% by foreign nationals and about 8% of firms belong to joint ownership. During the Covid pandemic, the ICT sector has been faring well, and even a higher percentage of firms (24% vs, 18%) have evaluated their financial performance at a very good level.

It is observed that the average sales revenue growth for 2018 was 6% and for 2019 was 10% for the ICT firms. However, during the Covid-19 pandemic, sales revenue in several quarters in 2020 has been declining though in total the revenue in 2020 would not have declined substantially. The domestic market share is on average 76% and the foreign market share is the rest 24%.

Overall, the male-female ratio of employees in the IT sector is 80:20. The average monthly salary of contractual employees is relatively lower than permanent employees. On average

nearly 100 percent of employees, are provided with a written employment contract. About 99 percent of IT enterprises provide their employees with Sick leave, weekly leave, and maternity leave with salary, respectively. On average, the percentage of a filled post mostly varies from 90 to 100. The shortage of skills (in terms of unfilled positions) for the IT firms is relatively lower, in particular less than or around 5% in the cases of web developers and graphic designers, software developers, and applications developers. A more or less similar extent of shortage is observed in the case of ISP firms.

The results indicate that the IT industry lacks adequate skilled manpower for some emerging areas of activities, such as Robotics, AI, IoT, Cloud computing etc. A good proportion (around or over 60%) of skilled and high skilled professionals are available for e-commerce, e-governance, BPO, data entry, website, graphic, multimedia, ERP, and IoT. However, there is lacking skilled manpower for other professional activities. For hardware assembling and repairing, about 50% of employees are skilled/high-skilled and a similar proportion is available for internet services. The skills gap in the programming language is higher than academic qualifications in all levels, however, the gap is minimum at the higher hierarchies. Overall, there exists a skill gap in senior levels too in terms of the desired level of academic education and proficiency in programming languages.

Cloud computing, one of the most significant transformations in Information Technology comes up as an emerging area in ICT revolution in Bangladesh. As the technology offers the possibility of using systems with state of the art computing capabilities, high availability, and scalability, cloud computing is deemed imperative for 4iR.

It is worthwhile to note that currently the businesses involving cloud computing in Bangladesh has a total annual turnover of USD13 million. Around 10,000 professionals are involved in the services based on cloud-computing and it is projected to grow by 20 to 25 per cent over the next 3-5 years[6]. However, compared to other developing countries; this figure of skilled workforce in Bangladesh in this area does not provide any aspirational scenario. According to NASSCOM (the apex body for Indian IT BPM [Business Process Management] Industry) , the Indian cloud computing market is currently valued at USD 2.2 billion and is expected to grow at 30 per cent (year-on-year) to reach USD 7.1 billion by 2022. Islam et al (2017) described the significance of "cloud computing" through five different case studies launched through five different programmes; "Publishing public exam results", "Computers for every school", "Schools for hill-district ", "Google service for education" and "Microsoft Office for education".

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[6] https://thefinancialexpress.com.bd/public/editorial/securing-a-niche-in-cloud-computing-market-1620403371

The survey results indicated that about 40% of the professionals are not adequately prepared with their academic curriculum to enter the job market as about 60% of IT enterprises identified the lowest skill gap among Entry-level employees across all occupations except Game developers. For the senior-level professionals, 30% identified a moderate skills gap and 20% identified a high skills gap. In the case of entry-level recruitment, over 70% of firms don't face any difficulties, but for mid to senior level, about 40 or above percent of firms face difficulties due to unavailability.

It is observed that IoT professionals and Software Tester are not readily available in the market. On average, high (and very high) skills gap exists at 5% among the entry-level professionals, 13% at mid-level, and 24% at the senior level. This analysis of shortfalls and shortages of skills points to the fact that a certain level of skills mismatch exists in the sector as the firms run at almost full employment with a certain level of the skills gap.

The average number of training arranged in 2019 was about 2 by each firm and on average 16 persons participated in the training Among IT-related specialized training, such as Data Science, RPA Developers, Network and Security, Programming Language were rated with high importance and the highest percentage of enterprises reported interest to spend fully on these training with 100 percent firm showing interest to fully spend on RPA training.

Our survey shows that the linkage between the firms and TVET is very low, less than 5% of firms have linkages with TVET. BUET came up as the most preferred institute in case of having industry-academia linkages across all the areas of specialization. The expected motive of expansion of the entrepreneurs found through survey analysis indicates a positive outlook of the industry. Around 292 employees were interviewed and all of them were asked about the need for further training for improvement of current work proficiency, future job progression/career prospects, and adaptation to technological change. The findings show that the need for further training perceived by employees is "very high".

In sum, the analysis suggests that there is a scope for improving skills in the ICT sector, particularly in emerging areas, such as robotics, IoT, game and mobile app development, artificial intelligence, and so on. A key area of intervention would be to engage academic institutions and TVET in mitigating the skills gap in this sector. Proper skill development strategies would help the ICT industry to explore untapped potentials and help the country to realize its Digital Bangladesh vision.

Fourth Industrial Revolution (4IR) and Skill Gap
The Fourth Industrial Revolution (4IR)—with the distinct feature of growing utilization of new technologies such as artificial intelligence, cloud computing, robotics, 3D printing, the Internet of Things, and advanced wireless technologies, has ushered the possibility of economic

disruption with uncertain socio-economic consequences for Bangladesh. The Fourth Industrial Revolution (4IR) is poised to unleash widespread industrial automation on a scale and complexity that will be unlike anything the country has experienced before (a2i, 2021). Bangladesh is moving fast in injecting digital operations into finance with the innovation of digital products which are not only fulfilling the financial needs but also creating new avenues to fulfill future economic needs (Mujeri & Azam, 2018). However, Bangladesh is well-positioned to develop skills for new occupations brought along with the 4IR if prudent and strategic policy measures are undertaken considering the existing skill gap in the ICT sector.

A study by a2i reports that around 5.5 million people, which is 47% of the workforce of the five sectors (RMG and Textile, Leather and Footwear, Hospitality and Tourism, Agro-Food, Furniture) will lose their jobs due to automation by 2041. Breaking down this number across the industries shows that 2.7M (60%) will lose their jobs in RMG & Textile sector, 1.5M (60%) in the Furniture sector, 600,000 (40%) in Agro-food processing; 100,000 (35%) in Leather & Footwear; and 600,000 (20%) in Tourism and Hospitality sectors, respectively. The findings of the study also highlight that nearly half of all the jobs will face the risk of automation, the most vulnerable group to be impacted negatively by 4IR are the less educated women workers, and deeper sector-based understanding and internal assessments will enable enterprises to benefit from automation.

It is imperative to focus on up-skilling and re-skilling the existing workforce in order to address the underlying risks and challenges. The study of a2i reveals that "the need to develop future trades like industrial robotics control, ready-to-assemble designer, computer-aided engineering, AR/VR application, cyber-security, data analytics, and digital marketing are the most evident skills across the sectors to meet the future need.

Recommendations

The increased market demand for skilled laborers in the ICT sector raises the demand for a skilled workforce with more advanced training rather than semi-skilled labor with basic training. To mitigate the problem, industry stakeholders propose to combine elementary and advanced courses in one particular discipline. It is also proposed to provide training on both elementary and advanced courses of only one particular discipline/subject; rather than providing the scope of receiving training on only one course. A few recommendations are made below to make the existing SEIP training programs more effective and target-oriented:

i.   **Flexibility in course intake:** The regulations for the trainees who participate in the training under SEIP do not have the provision to be enrolled in two courses of the same subject. Therefore, despite the interest to receive further training in advanced courses, the participants are restrained to do so which eventually results in the underutilization of theirpotential and skills. Even for some advanced courses, participation in earlier

courses is necessary. Therefore, it is felt that this issue needs to be resolved in a practical way so that participants can get the maximum benefit out of the training.

ii. **Financing the training:** Given the resource constraints of SEIP, the provision of facilitating advanced training to the participants who already received training at the elementary level might not be a viable solution. In that case, self-financed training on advanced courses can also be allowed where enrollment in training will be contingent upon payment of certain course fees. If a certain portion of the training costs are subsidized and the rest are carried by the participants, the trainees seem to be self-motivated and interested enough to develop their skills through these advanced training and the programs will be sustainable.

iii. **Branded certification:** One suggestion from BASIS is to promote branded certification such as Microsoft certified professionals, CISCO certified networking engineers, ADOBE certified graphic designers, etc. which will facilitate the branding of the IT sector of Bangladesh. The required training in this sector is already provided but this training needs to be certified by International brand companies through appearing in the examinations conducted and controlled by brand companies. However, appearing in brand-led examinations is really costly and SEIP can contribute to this procedure by providing the exam fee for those examinees who participate in the SEIP training.

iv. **Decentralization:** It is suggested to promote the decentralization of training facilities across the country instead of concentrating on the capital city only. BASIS already has a training center in Chittagong and planning to establish it in another region. BCS is planning to establish one training center targeting the hardware sector. The initiatives by SEIP in establishing training centers all over the country will definitely facilitate the process of capacity building for the skilled labor force by increasing the number of participants.

v. **SEIP may incentivize job replacement of female trainees:** Being a cross-cutting sector, around 1 million IT professionals are placed in various jobs in the country. Only 0.22 million IT professionals are working in the IT industry while the major portion is involved in IT services in the different non-IT sectors. Hence, the IT sector provides the opportunity to increase female employment in this sector. At present, female participation in the IT sector is 12-13% whereas female participation at the management level is only 2%-3%. SEIP may incentivize job replacement of female trainees (if currently employed in another sector) and encourage employers to recruit female trainees.

vi. **Courses on Computer Applications should be included in SEIP training:** The graduates from formal institutions are not largely aligned with the required skills in the industry. The academic training is mostly concentrated on theoretical knowledge instead of practical orientation. For example, students are not well-trained in programming and they lack the skills to produce creative and innovative ideas which eventually created difficulties in meeting the goals set by the employers. The CSE students should be primarily encouraged and groomed as programmers and adequate lab facilities and activities should be ensured. For example, in India, there is a comprehensive bachelor's and master's course in applications of software/programming named Masters in Computer Application (MCA) and Bachelor in Computer Applications. These types of courses are really helpful in getting a job immediately as the students are trained up with practical usage of computer applications. It is emphasized to initiate such courses in SEIP interventions. Even SEIP may collaborate and provide capacity-building support to some academic universities to upgrade their curriculum in line with industry needs. UGC may play a vital role in enhancing the industry-academia linkage in this sector.

Apart from the above recommendations on existing SEIP training programs, some other complementary issues need to be addressed to improve the required human capital for the ICT sector.

1. The lack of R&D facilities is one of the major reasons for the existing skills gap in the ICT sector. Active Network Unit (ANU) used in networking and ANU manufacturing has a lot of demand but in Bangladesh no workforce with the required skill is available. Necessary skills need to be developed to tap the potential of ANU.

2. The government needs to reduce internet prices further so that the digitalization goals set by the government can be achieved. For the 4IR, internet price needs to be more affordable and cabling and hardware need more attention in terms of policy support as they are completely different subsectors.

3. To develop the ICT hardware sector, it is important to train the available workers (hardware and maintenance) using its own syllabus focusing on hardware applications. The BCS has already created its own training center, but financial support is required to make the center operational. Any support from SEIP for the BCS training Center would be very supportive.

4. Bangladesh should aim on flourishing e-commerce, digital marketing, or e-trading. More training can help firms to survive as there is high competition in this market.

5. Graphic Design and Android Programming are two areas where the companies are outsourcing foreign employees as the indigenous labor force do not have the advanced skill. SEIP may design training programs for Graphic design and Android programming, and it also needs to design training programs for professionals involved with AI, big data analytics, robotics, gaming, IoT, etc.

Finally, the support from the policymakers and their understanding of the problems is critical to the development of the ICT sector and overall digitalization. Policymakers need to change their mindset toward the overall development of the IT sector including the development of human capital. It is often complained by the industry stakeholders that their suggestions have never been addressed with adequate attention. The government's new ICT policy includes all associations and they are all connected, but constant support from the government is needed for the development of this industry.

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Appendix-I: List of participants in FGDs

Discussion with members of Bangladesh Computer Shamity (BCS) on IT sector in Bangladesh

Date and time: January 5, 2021 11:00 AM, Dhaka

Name and designation of the participants are given below:

SI No.	Name	Designation
1	Md. Shahid-Ul-Munir	President
2	Md. Jabedur Rahman Shaheen	Vice President
3	Mohammed Monirul Islam	Secretary General
4	Md. Muzahid Al Beruni	Joint Secretary General
5	Kamruzzaman Bhuiyan	Treasurer
6	Mosharaf Hossain Sumon	Director
7	Md. Rashed Ali Bhuiyan	Director

Discussion with members of Bangladesh Association of Software and Information Services (BASIS) on IT sector in Bangladesh

Date and time: January 12, 2021 03:00 PM, Dhaka

Name and designation of the participants are given below:

SI No.	Name	Designation
1	Mr. Syed Almas Kabir	President
2	Ms. Farhana A. Rahman	Senior Vice President
3	Mr. Shoeb Ahmed Masud	Vice President (Admin)
4	Mr. Mushfiqur Rahman	Vice President (Finance)
5	Mr. Hashim Ahmed	Secretary

Appendix-II: Questionnaires

Name of the
enterprise...

Date of interview (First Visit):

				2	0		

  Day   Month   Year

Date of interview (Second Visit):

				2	0		

  Day   Month   Year

Name of **main** respondent: ....,
Gender: Male, 2 = Female, 3 = Other

Job Title position) ……………………………………………………….…

Respondent's phone number:

Name of **second** respondent (if any):
....,

Gender: 1= Male, 2 = Female, 3 = Other

Job Title (Position): …………………………………………………

Respondent's phone number:

SECTION A: BASIC CHARACTERISTICS OF THE FIRM

A1 Name of the company

……………………………………………………………………..

A2 Address of the company

………………………………..

…………………………………

Email…………………………..Phone……………………….

A3 Is this a branch or a main office?

1	Main Office
2	Branch Office

A4 Personal details of the interviewed person (if different from contact person)

   (Attach his/her visiting card)

1	Name	
2	Sex	
3	Position	
4	Telephone No. (Office)	
5	Telephone No. (Mobile)	

A5 What is the role of the interviewed person in the company?

Sl.	Position
1	CEO/President/Owner/General Manager/Director
2	Representative of Human Resource Department
3	Representative of Administration Department
97	Others (specify)

Note: For a workplace with fewer than 20 employees, the respondent should be the Owner/CEO/Manager. For larger companies, Human Resource should respond. If not available, ask the CEO/Owner/General Manager.

B1 What is the sex of the CEO/President/Owner?

1	Male
2	Female

B2 What is the age of the CEO/President/Owner? (Identify the numeric number)?

Age	

B4 The Company is a/an...

Sl.	Business Type
1	Individual/proprietorship company
2	Partnership company
3	Private limited company
4	Public listed company
5	Branch of a foreign company
6	Cooperative
7	Non-governmental organization
97	Others (specify)

B5 The Company is owned by…

1	Bangladeshi only	
2	Foreigner only (specify nationality)	
3	Both	

B6 What is the percentage of share in the company? (Specify the numeric percentage)

1	Local	
2	Foreign	

B7 Which industry association does your company belong to?

(Multiple answers)

1	Bangladesh Association of Software and Information Services (BASIS)
2	Bangladesh Association of Call Center & Outsourcing (BACCO)
3	Bangladesh Computer Samity (BCS)
4	Internet Service Providers Association Bangladesh (ISPAB)
5	Not the member of any industry associations
97	Others (specify)

B8 Which industry type does your company belong to?

   (Multiple answers)

1	Software	
2	Hardware	
3	Internet Service Provider	
4	IT Consultancy	
5	Networking	
6	Call center and Outsourcing	
97	Others (specify)	

B9 If software (i.e. B8=1), Please specify the major software development
   activity of your company? Showcard and read list). [Multiple answers]

1	E-commerce
2	E-governance
3	Geographic Information System (GIS)/ Global Pointing System (GPS)
4	Web development service and hosting
5	Graphics
6	Accounting and financial software
7	Enterprise resource planning
8	Banking application
9	Mobile application
10	Security, biometric and alert system
11	Hospital/insurance management system
12	POS/inventory management system
13	Education institution management system
14	Animation
15	Gaming
16	Multimedia
97	Others (specify)

B10 If hardware (i.e. B8=2), please specify the major hardware development activity of your company)

1	Assembling
2	Repairing
3	Manufacturing
97	Others (specify)

B11 If internet service provider (i.e. B8 = 3, 4 & 5), please specify the major internet service provider activity of your company?

1	Internet/Web
2	Networking
97	Others (specify)

B12 If call center and outsourcing (i.e., B8 = 6), please specify the major activity of your company?

1	Call center
2	Business process outsourcing
3	Data entry and processing
97	Others (specify)

B13 What are the major economic activities of your client company? (Multiple answers, Maximum 3)

SI	List of the Eeconomic Activities
1	Manufacturing
2	Mining and quarrying
3	Agriculture, forestry and fishing
4	Electricity, gas, steam and air conditioning supply
5	Water supply, sewerage, waste management and remediation activities
6	Construction
7	Wholesale and retail trade,
8	Transportation and storage
9	Accommodation and food service activities (Hotel and restaurants)
10	Information and communication
11	Financial and insurance activities
12	Real estate activities
13	Professional, scientific and technical activities
14	Administrative and support service activities
15	Public administration and defense, compulsory social security
16	Education, teaching
17	Human health and social work activities
18	Arts, entertainment and recreation
19	Other Service Activities
20	Activities of households as employers, undifferentiated goods and services Producing activities of households for own use
21	Activities of extraterritorial organizations and bodies

97	Others (specify)

B14 If manufacturing (i.e. B13 = 1), please specify the major manufacturing activity of your client company? (Showcard and read list. Multiple answers, Maximum 3)

Sl.	List of the Manufacturing Activities
1	Food products
2	Beverages
3	Tobacco products
4	Textiles
5	Wearing apparel (readymade garments)
6	Leather and related products
7	Wood and products of wood and cork, except furniture, articles of straw and plaiting materials
8	Paper and paper products
9	Printing and reproduction of recorded media
10	Coke - a refined petroleum products
11	Chemicals and chemical products
12	Pharmaceuticals, medical chemical and botanical products
13	Rubber and plastics products
14	Other non-metallic mineral products (glass, cements, bricks, etc.)
15	Basic metals (iron, steel, etc.)
16	Fabricated metal products, except machinery and equipment
17	Computer, electronic and optical products
18	Electrical equipment
19	Machinery and equipment (not elsewhere classified)
20	Motor vehicles, trailers, and semi-trailers
21	Other transport equipment
22	Furniture
23	Other manufacturing
24	Repair and installation of machinery and equipment
25	Recycling
97	Others (specify)

B15 Does this company have a registration number to the government?

1	Yes
2	No

B16 Which year did your company start business?

Year	

B17 Please specify the share of market revenue (Note: local share and export share should add up to 100%) (Specify the percentage)

1	Local
2	Export

B18 How do you describe the financial performance of your company in the last financial year?

1	Very Good
2	Good
3	Neither Good or Poor
4	Poor
5	Very Poor
8	Refuse

B19 How do you describe the prospects for your company in the coming three years (POST COVID)?

1	Very Good
2	Good
3	Neither Good or Poor
4	Poor
5	Very Poor
8	Refuse

SECTION: B.1 SALES REVENUE and MAJOR PRODUCTS

Sl.	**B.1.1**	Total Sales revenue (In lac taka)	Percentage of sales in:		Proportion of sales in three major products (%)						**B.1.8** Proportion of services Outsourced (%)
	Name of the main activities		Domestic Market (%)	Foreign Market (%)	Code	%	Code	%	Code	%	
	2017										
	2018										
	2019										
	Jan-Marc 2020										
	April-June 2020 (Lockdown)										
	July-Sept 2020										

CODES of MAJOR PRODUCTS:

	E-commerce	8	Internet Services	15	Database	22	Telecom Network
	E-gov.	9	Mobile app development	16	IoT (Internet of Things)	23	Software Development

	GIS	10	Game development	17	Others[7] (lump sum)	24	Front End Development
	BPO	11	Artificial intelligence	18	Programming Language	25	DBA
	Data entry	12	Augmented Reality Virtual (AR/VR)	19	Software Tester (quality and assurance)	26	Multimedia
	Web site	13	Web hosting	20	Network and Security	27	Data science
	Graphic	14	ERP	21	Software Architecture	28	Call center

SECTION: C.1 - PRODUCTION COST (JANUARY 1, 2019 – SEPTEMBER 31, 2020)

Sl.	C.1.1	C.1.2	C.1.3	C.1.4			
		In BDT (Lac)					
	Cost Categories	2017	2018	2019	January-March 2020	April-June 2020	July-September 2020
	Salary/wage payment (wages, salaries, bonuses, social payments)						
	Computer/Accessories/Server/Printer/Switcher						
	Software (Including operating systems and tools)						
	Internet/Bandwidth						
	Other ICT Hardware						
	Utility cost (gas, electricity, water etc.)						
	Office space rent						
	Others						
	Total annual cost						

SECTION C.2 - CAPITAL STOCK

Sl. No.	C.2.1	Book Value (year end in Lac Taka)			
	Type of machinery (10 most important)	2017	2018	2019	
1	Car/Vehicles				
2	Computer (indicate Used or New)/Server/Printer/Switcher				
3	Software (MS Office, windows, others)				
4	Other ICT Hardware and Equipment				
5	Buildings and other capital stocks				
6	Land				
7	Total capital stick				

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[7] All other items not listed above.

SECTION: D.1 - EMPLOYMENT

Sl.	D.1.1 Occupation Name	D.1.3	D.1.4	D.1.5			D.1.6	D.1.7	D.1.8	D.1.9	D.1.10	D.1.11	D.1.12	D.1.14	D.1.15	D.1.16	D.1.17	D.1.18	D.1.19	
		Number of employees			Total employee was in		Average age of the workers	% of required posts are now filled up	Type of workers (Numbers)				Number of hours worked per day, on average? (including overtime) (in hours)		How many workers you hired during the year?			How many workers left during the year?		
		2019			2018	2017			Permanent		Contractual				2017	2018	2019	2017	2018	2019
		Male	Female	Total	Total	Total		Full Time	Full Time	Part Time	Full Time	Part Time	Permanent	Contractual						
1	Administrative and Managerial[1]																			
2	Working Owner/Director/Shareholder																			
3	Unpaid Family workers																			
4	Accountants, Financial and investment advisers[2]																			
5	Software developers (including mobile app. game developer, and Software Tester)																			
6	Data Scientist, IoT Professionals,																			

	Robotic Process Automation (RPA) Developer																								
7	Applications developers/ programmers																								
8	Web developers and Graphic and multimedia designers																								
9	Database designers and administrators																								
10	Systems administrators and Computer network professionals																								
11	Technicians[3]																								
12	Clerical and Sales[4]																								
13	Other specify																								
14	Total Employees																								

1. Managing Directors and Chief Executives; Finance Managers; Human Resource Managers; Policy and Planning Managers; Business services and administration managers not elsewhere classified; Sales and Marketing Managers; Advertising and public relations managers; Information and Communications technology managers; Managers
2. Include Accounting associate professionals;
3. Technicians include: ICT operations technicians; ICT user support technicians; Computer network and systems technicians; Web technicians and Broadcasting and audio-visual technicians; Electrical or Electronics or Telecommunications engineering technicians.
4. Administrative and executive secretaries; Typists and word processing operators; Data entry clerks; Accounting and bookkeeping clerks

SECTION: COVD.D.1 – EMPLOYMENT (January–September, 2020)

Sl.	CD.D.1.1	CD.D.1.14	CD.D.1.15	CD.D.1.16	CD.D.1.17	CD.D.1.18	CD.D.1.19
		COVID-19 Impact					
		How many workers you hired during the quarter?			How many workers lost their job (fired) during the quarter?		
	Occupation Name	Jan-March 2020	April-June 2020	July-September 2020	Jan-March 2020	April-June 2020	July-September 2020
1	Administrative and Managerial[1]						
2	Working Owner/Director/Shareholder						
3	Unpaid Family workers						
4	Accountants, Financial and investment advisers[2]						
5	Software developers (including mobile app. game developer, and Software Tester)						
6	Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer						
7	Applications developers/programmers						
8	Web developers and Graphic and multimedia designers						
9	Database designers and administrators						
10	Systems administrators and Computer network professionals						
11	Technicians[3]						
12	Clerical and Sales[4]						
13	Other specify						
14	**Total Employees**						

SECTION: D.2 – WAGE AND EMPLOYMENT

Sl.	D.2.1						
		Total expenses from 1 January 2019 to 31 December 2019 on salary or wage (allowances, bonus, etc.)			Total salary, wage and honorarium (In lac taka)		
	BSCO Code (4 Digit)	Total salary, wage and honorarium (In lac taka)		Convenience without salary (Cash benefit/non-cash benefit/social security/ pension) (In lac taka)	January-March 2020	April-June 2020	July-September 2020

		Permanent	Contractual	Permanent	Contractual			
1	Administrative and Managerial[1]							
2	Working Owner/Director/Shareholder							
3	Unpaid Family workers							
4	Accountants, Financial and investment advisers[2]							
5	Software developers (including mobile app. game developer, and Software Tester)							
6	Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer							
7	Applications developers/programmers							
8	Web developers and Graphic and multimedia designers							
9	Database designers and administrators							
10	Systems administrators and Computer network professionals							
11	Technicians[3]							
12	Clerical and Sales[4]							
13	Other specify							
14	Total wage payments							

SECTION: E.1

EXTENT OF FORMALITY – CONTRACT TYPE, LEAVES AND OTHER BENEFITS

E.1 Leave type in your firm (Yes=1, No=2): 1. Sick: 1. Paid   2. Unpaid 2. Weekly: 1. Paid 2. Unpaid   3. Maternity: 1. Paid   2. Unpaid

E.2 In case of leaving the jobs, employees notify the employers 30 days in advan☐es=1, No=2

E3. In case of firing the employees, is there any minimum notice period; Y☐, No=2

Sl.	E.3.1 BSCO Code (4 Digit)	E.3.2 Proportion of employees having written contract (%)	E.3.3	E.3.4	E.3.5
			Which of the following benefits are provided to the employees? (at most 3 answers are allowed)		
			1 = Bonus; 2 = Pension; 3 = Life insurance; 4 = Health insurance; 5 = Loan Facilities; 6 = Others (Specify)		
1	Administrative and Managerial[1]				
2	Working Owner/Director/Shareholder				
3	Unpaid Family workers				
4	Accountants, Financial and investment advisers[2]				
5	Software developers (including mobile app. game developer, and Software Tester)				
6	Data Scientist, IoT Professionals, Robotic Process Automation (RPA) Developer				
7	Applications developers/programmers				
8	Web developers and Graphic and multimedia designers				
9	Database designers and administrators				
10	Systems administrators and Computer network professionals				
11	Technicians[3]				
12	Clerical and Sales[4]				
13	Other specify				
14	Total Employees				

SECTION: F.1.A. - OCCUPATION BY QUALIFICATION MATRIX (SKILL GAP)

SI.	F.1.1		F.1.2	F.1.3	F.1.4		F.1.5	F.1.6	F.1.7	F.1.8	F.1.9	F.1.10
			Desired qualifications by the enterprise				Available Qualification (Compared to desired qualification)			Rate overall skills gap (1 to 5: low to high)	Gross Salary Offered by the Firm	
			Preferred Area of specialization (at most 3) Code1*	Preferred Language Skill (at most 3) (Code*)	Average Experience (Number of years)	Preferred educational qualification (Code3)	Rank Specialized qualification that you usually get (1 to 5 scale: 1 low to high 5)	Rank language skill that you usually get (1 to 5 scale: 1 low to high 5)	Average Experience (Number of years)		Minimum (in thousand)	Maximum (in thousand)
	Example		1, 3, 5	1, 10, 20	2		4	4	1		20	40
1.1	Software Developer	Entry-level										
1.2		Intermediate or Experienced										
1.3		Senior level or Supervisor										
2.1	Mobile App Developer	Entry-level										
2.2		Intermediate or Experienced										
2.3		Senior level or Supervisor										
3.1	Game Developer	Entry-level										
3.2		Intermediate or Experienced										

3.3		Senior level or Supervisor										
4.1		Entry-level										
4.2	Applications developers/programmers	Intermediate or Experienced										
4.3		Senior level or Supervisor										
5.1		Entry-level										
5.2	Web Dev. & Graphic & multimedia designers	Intermediate or Experienced										
5.3		Senior level or Supervisor										
6.1		Entry-level										
6.2	Database designers and administrators	Intermediate or Experienced										
6.3		Senior level or Supervisor										
7.1		Entry-level										
7.2	Systems administrators and Computer network professionals	Intermediate or Experienced										
7.3		Senior level or Supervisor										
8.1		Entry-level										
8.2	Data Scientist	Intermediate or										

		Experienced										
8.3		Senior level or Supervisor										
9.1	IoT Professionals	Entry-level										
9.2		Intermediate or Experienced										
9.3		Senior level or Supervisor										
10.1	Software Tester	Entry-level										
10.2		Intermediate or Experienced										
10.3		Senior level or Supervisor										
11.1	Robotic Process Automation (RPA) Developer	Entry-level										
11.2		Intermediate or Experienced										
11.3		Senior level or Supervisor										

Code1: Area of Specialization (Training type: Broad Category)									
CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type		
1	Web Development	6	Database	11	Software Architecture	16	Front End Development	21	Software Tester (Quality Control)
2	Mobile App Development	7	Network and Security	12	Data science	17	Personal Development	22	DBA
3	Game Development	8	Design	13	Internet of Things	18	Business	23	Others
4	Programming Language	9	Marketing	14	Telecom Network	19	Others		
5	Software Testing	10	Management	15	Software Development	20	Software Tester (Quality Assurance)		

Code2: Language Skill (Training type : sub-category)											
CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type
1	C/ C++	10	Cold Fusion	19	Lotus notes	28	Bootstrap 4.3	37	Laravel & Vuejs	46	Video Editing with Adobe Premiere pro
2	JAVA	11	Other programming	20	XML	29	Laravel 6.0	38	Android App Dev. with Java SE	47	TableAU,
3	/Net	12	MONGODB	21	UML	30	HTML and HTML5	39	Professional Android Application Development	48	Power BI,
4	HTML	13	MS SQL : DQGS	22	Swift	31	CSS and CSS3	40	Android Architecture Components with Kotlin	49	Django
5	ASP	14	MS Access/Fox pro	23	Kotilin	32	Database	41	Android and IOS APP Developme	50	Machine Learning using R

								nt with Flutter		
6	PHP	15	Oracle	24	Javascript	33	jQuery	42	Core Python	51	Others
7	JSP	16	Operating	25	Dart	34	Photoshop for Web/App Developers	43	Software Testing & Quality Assurance using Selenium		
8	Javabeen	17	MS NT 2000,2006	26	React	35	SQL/MySQL	44	Automation Testing with Selenium		
9	CGI Perl	18	UNIX/LINUS/Solaris	27	Laravel	36	CSS using SASS	45	Ethical Hacking and Cyber Security		

Code3:

1	PhD	4	Diploma	7	Primary Education
2	Masters	5	TVET (vocational training)	8	No education
3	Bachelors	6	Secondary Education		

F1.B What is the skill level of your worker in different activity?

Level/ Section	E-commerce	E-gov.	GIS	BPO	Data entry	Web site	Graphic	Multimedia	ERP	Robotics	AI	IoT	Call center	Assembling *H	Reparing *H	Manufacturing* H	Internet Services
Highly skilled																	
Skilled																	
Semi-skilled																	

			Unskilled																

SECTION: G.1 - SKILL SHORTAGE AND RECRUITMENT PROCESS

Sl.			G.1.1	G.1.2		G.1.3	G.1.4	G.1.5	G.1.6 Number of unfilled vacancies at present (Numbers)	G.1.7 How frequently do you recruit? (no of days)	G.1.8 Time spent to fill the post (from advertisement to hiring)? (in days)	G.1.9 How much it costs (on average) to recruit for a single post? (in taka)
				Rate the level of difficulties in filling up the vacancies (1 to 10)								
				1 = No difficulties; 2 = Difficult 3= Extremely difficult	If G1.2>1, then state the reason (Code) (Maximum 3 reasons)							
1	Software Developer	Entry-level										
2		Intermediate or Experienced										
3		Senior level or Supervisor										
4	Mobile App Developer	Entry-level										
5		Intermediate or Experienced										
6		Senior level or Supervisor										
7	Game Developer	Entry-level										
8		Intermediate or Experienced										
9		Senior level or Supervisor										
10	Applications developers/programmers	Entry-level										
11		Intermediate or Experienced										
12		Senior level or Supervisor										
13		Entry-level										

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Sl.			G.1.1	G.1.2	G.1.3	G.1.4	G.1.5	G.1.6	G.1.7	G.1.8	G.1.9
				Rate the level of difficulties in filling up the vacancies (1 to 10)				Number of unfilled vacancies at present	How frequently do you recruit? (no of days)	Time spent to fill the post (from advertisement to hiring)? (in days)	How much it costs (on average) to recruit for a single post? (in taka)
				1 = No difficulties; 2 = Difficult 3= Extremely difficult	If G1.2>1, then state the reason (Code) (Maximum 3 reasons)			(Numbers)			
14	Web Dev. & Graphic & multimedia designers	Intermediate or Experienced									
15		Senior level or Supervisor									
16	Database designers and administrators	Entry-level									
17		Intermediate or Experienced									
18		Senior level or Supervisor									
19	Systems administrators and Computer network professionals	Entry-level									
20		Intermediate or Experienced									
21		Senior level or Supervisor									
22	Data Scientist	Entry-level									
23		Intermediate or Experienced									
24		Senior level or Supervisor									
25	IoT Professionals	Entry-level									
26		Intermediate or Experienced									
27		Senior level or Supervisor									
28	Software Tester	Entry-level									
29		Intermediate or Experienced									
30		Senior level or Supervisor									

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Code	Cause	Code	Cause	Code	Cause
1	Poor terms and conditions (e.g. pay) offered for post	5	Lack of work experience the company demands	9	Too much competition from other employers
2	Low number of applicants with the required skills	6	Lack of qualifications the company demands	10	Not enough people interested in doing this type of job
3	Low number of applicants with the required attitude, motivation or personality	7	Poor career progression/lack of prospects	11	Seasonal Work
4	Low number of applicants generally	8	Job entails shift work/unsociable hours	12	Others (Specify)……………………..

SECTION H.1 TYPE OF TRAINING

Which of the following types of training have you arranged or funded for employees of this enterprise over the last one year (2019)?

Sl.	H.1.1 Name of Training	H.1.2 No of persons received the training	H.1.3 How many times have you arranged this training last year?	H.1.4	H.1.5	H.1.6	H.1.7	H.1.8	Money amount spent by the enterprise for training (In lac taka)	Is the enterprise willing to fund these training? (1 = Fully, 2 = Partially 3 = Not at all)
				Language covered in the training (maximum 5) (Use the Code2 numbers given in **Section F**)						
1.	Web Development									
2.	Mobile App Development									
3.	Game Development									
4.	Programming Language									
5.	Software Testing									
6.	Database									
7.	Network and Security									
8.	Design									
9.	Marketing									
10.	Management									

SI.	Name of Training	H.1.1 No of persons received the training	H.1.2 How many times have you arranged this training last year?	H.1.3	H.1.4 Language covered in the training (maximum 5) (Use the Code2 numbers given in **Section F**)	H.1.5	H.1.6	H.1.7	H.1.8	Money amount spent by the enterprise for training (In lac taka)	Is the enterprise willing to fund these training? (1 = Fully, 2 = Partially 3 = Not at all)
11	Software Architecture										
12	Data science										
13	Internet of Things										
14	Telecom Network										
15	Software Development										
16	Front End Development										
17	Personal Development										
18	Business										
19	RPA Developer										
20	Software Tester (Quality Assurance)										
21	Software Tester (Quality Control)										
22	DBA										
23	Others										

SECTION H3: INDUSTRY-ACADEMIA LINKAGE

H.3.1	H.3.2	H.3.3	H.3.4	H.3.5	H.3.6	H.3.7	H.3.8
SI	BSCO code (4 digit)	Linkage with academic Institutions other than	Type of Linkage (code 1)	Name of the most preferred institutions for collaboration (code-2)			Does your training have linkages with TVET (Yes= 1, No = 2)
				1	2	3	

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		TVET (Yes= 1, No = 2)						
1	Software Developer							
2	Mobile App Developer							
3	Game Developer							
4	Applications developers/programmers							
5	Web Dev. & Graphic & multimedia designers							
6	Database designers and administrators							
7	Systems administrators and Computer network professionals							
8	Data Scientist							
9	IoT Professionals							
10	Software Tester							

Code1 : Type of linkage		Code-2 : Preferred Institutions					
1	Apprenticeship/Internship	1	BUET	7	University of Dhaka	13	
2	Faculty Exchange	2	CUET	8	Jahangirnagar University		
3	Training & Academic	3	RUET	9	North South University		
4	Curricular	4	KUET	10	BRAC University		
5	Job Fair	5	IUT (International University of Technology)	11	AIUB		
6	Board Member	6	Ahsanullah	12	East West University		

SECTION I.1: LABOR DEMAND PROJECTION FOR THE NEXT 10 YEARS (for existing occupations)

I.1.1 Do you have any plan to expand your business in next 5 to10 years? Yes=1, No=2. ☐

Sl.		I.1.1 BSCO Code (4 Digit)	Current number of employee (Refer to Table ***)	I.1.2 Expected Growth of the employee……… in next 5 to 10 years 0 = Negative growth; 1 = No growth (as usual); 2 = Moderate growth; 3 = High growth. 4 = Very high growth	I.1.3 Considering the current employment (I.1.2) level and your opinion in I.1.2 about job growth, what would be the projected number of jobs in each occupation for your enterprise? By 2023	I.1.4 By 2025	I.1.5 By 2030	I.1.6 Preferred Area of specialization (if current employment = 0) Code*	I.1.7 Experience (in number of years)
1	Software Developer								
2	Mobile App Developer								
3	Game Developer								
4	Applications developers/programmers								
5	Web Dev. & Graphic & multimedia designers								
6	Database designers and administrators								
7	Systems administrators and Computer network professionals								
8	Data Scientist								
9	IoT Professionals								

Sl.		I.1.1 BSCO Code (4 Digit)	Current number of employee (Refer to Table ***)	I.1.2 Expected Growth of the employee……… in next 5 to 10 years 0 = Negative growth; 1 = No growth (as usual); 2 = Moderate growth; 3 = High growth. 4 = Very high growth	I.1.3 Considering the current employment (**I.1.2**) level and your opinion in **I.1.2** about job growth, what would be the projected number of jobs in each occupation for your enterprise?	I.1.4	I.1.5	I.1.6 Preferred Area of specialization (if current employment = 0)	I.1.7
					By 2023	By 2025	By 2030	Code*	Experience (in number of years)
10	Software Tester								
11									
12									

Code: Area of Specialization (Training type: Broad Category)								
CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	
1	Web Development	6	Database	11	Software Architecture	16	Front End Development	
2	Mobile App Development	7	Network and Security	12	Data science	17	Personal Development	
3	Game Development	8	Design	13	Internet of Things	18	Business	
4	Programming Language	9	Marketing	14	Telecom Network	19	Others	
5	Software Tester (quality control and Assurance)	10	Management	15	Software Development			

SECTION J: ACCESS TO FINANCE AND OTHER ISSUES

J1. Over the period 2018-19, what % of amount was financed from these sources?

Source of funding	Working Capital (%)	Fixed Capital (%)	Amount (lac taka)	Year received	Interest rate (%)
Internal funds/retained earnings					
Borrowed from private commercial banks					
Borrowed from state owned banks and /or government agency					
Borrowed from family/friends					
Borrowed from non-bank financial institutions					
Borrowed from informal sources (e.g. money lender)					
Borrowed from NGOs					
Others (specify)					

J3. Gross profit and Market access of your company for last five years:

	Profit as % of revenue	No. of countries exported	
2019			
2018			
2017			
2016			
2015			

J4. Impact of COVID 19 Pandemic on Firm Growth in 2021 (rank them)

J4.1	J4.2	J4.3
Factor	**Rank (1=low to high=5)**	**If J4.2>2, cite your reasons**
Industry growth		1. 2.
Your business growth		
Labor shortage		

New skills development		
Finance constraint		
Future potential growth		
Stimulus (financial) needed		

Received:……………………………………….(date)

Checked by…………………………………… …

Bangladesh Institute of Development Studies (BIDS)
E-17 Agargaon, Sher-e-Bangla Nagar, Dhaka

Labor Market Study for SEIP
Employee Questionnaire

1. Name of the
   enterprise...

2. Date of interview (First Visit):

				2	0		
Day		Month				Year	

3. Date of interview (Second Visit):

				2	0		
Day		Month				Year	

4. Name of **employee**: ....

5. Employee ID

6. Gender: *Male, 2 = Female, 3 = Others,*   7. Age………………..Years

8. Job Title position) …………………………….……… 9. Employee's phone number::……..………………...…………………...………..

10. Marital status: 1. Currently married 2. Never married 3. Widowed 4. Divorced 5. Separated

SECTION-B: EDUCATIONAL QUALIFICATION

B1. What is your highest educational qualification?

Education code (Highest grade completed)			
0	No Class Passed	8	JSC (Class 8)
1	Class 1	9	Class 9
2	Class 2	10	SSC/ Equivalent
3	Class 3	11	HSC/ Equivalent
4	Class 4	12	Diploma
5	PSC (Class 5)	13	Bachelor degree
6	Class 6	14	Master's degree
7	Class 7	15	PhD

B2. When did you receive graduation certificate?

Year	Month

B3. Which university you have graduated from?

Code	University
1	BUET
2	Dhaka University
3	Jahangirnagar University
4	Jessore University of Science and Technology
5	Islamic University of Technology
6	Ahsanullah University of Science and Technology
7	BRAC University
8	Daffodil International University
9	East West University
97	Others (please specify)

B4. Which department did you graduate from?

Code	Department
1	Computer Science and Engineering (CSE)
2	Institute of Information Technology (IIT)
3	Engineering Department
4	Digital Media Technology
5	Cyber Security and Forensics
97	Others (please specify)

B5. What was the CGPA/Division in your graduate and undergraduate degree?

Sl.	Degree	CGPA (4 scale)
1.	Undergraduate (Bachelor)	
2.	Graduate (Masters)	

B6. Please rate the Quality of Education of your studied university on a 5 – point scale**.** *[5: very good to 1: very bad; read out response options]*

Sl.	Quality of Education	Very Good	Good	Neither Bad or Good	Bad	Very Bad
1.	Learning material (e.g. text book, ppt) developed by teachers	5	4	3	2	1
2.	Teachers' knowledge on work environment and IT/ITES industry	5	4	3	2	1
3.	Teachers' ability to explain the subject	5	4	3	2	1
4.	Class included practical work [we had a chance to	5	4	3	2	1

	apply/ practice the practical work in the classroom setting]					
5.	Transparent and consistent grading system	5	4	3	2	1
6.	Up to date technical equipment Professional advice and guidance provided by	5	4	3	2	1

	teaching staff					
7.	Partnerships/joint projects with local companies	5	4	3	2	1
8.	Research work in the IT sector	5	4	3	2	1
9.	Individual study advice in your field	5	4	3	2	1

B7. Please tell us the level of your satisfaction on the following statements on a 5-point scale.

[5: highly satisfied to 1: highly dissatisfied, 9 not applicable (read out response options).]

Sl.	Satisfaction Level	Highly Satisfied	Moderately Satisfied	Neither Satisfied or Dissatisfied	Moderately Dissatisfied	Highly Satisfied	N/A
1.	Knowledge acquired in the classrooms	5	4	3	2	1	9
2.	Skills gained in the laboratory/workshops	5	4	3	2	1	9
3.	Soft skills (e.g. communication, presentation, leadership, team work)	5	4	3	2	1	9
4.	Internship (on-the-job training)	5	4	3	2	1	9
5.	Reputation of the university Career Guidance which links employment opportunities	5	4	3	2	1	9

SECTION-C: VOCATIONAL TRAINING

C1. Have you taken any vocational training after graduation? 1. Yes 2. No

C2. Specify which training have you undertaken?

1	2	3	4	5	6	7	8	9	10
Sl.	Training Type (broad category)	How many times	Average duration (days)	When did you take (recent one in year)	Name the institution from which you undertook the recent training	Name three languages (sub-category) that you have learnt (Codes)			Rate the satisfaction level of your last training in 5 scale (1=least satisfied: 5=highly satisfied)
1	Web Development								
2	Mobile App Development								
3	Game Development								
4	Programming Language								
5	Software Testing								
6	Database								
7	Network and Security								
8	Design								
9	Marketing								
10	Management								
11	Software Architecture								
12	Data science								
13	Internet of Things								
14	Telecom Network								
15	Software Development								

16	Front End Development								
17	Personal Development								
18	Business communications								

C3. Future Need for training

1	2	3	4	5	6	7	8	9
SI	Training Type (broad category)	Rate the importance of specialization in a 5-scale (1=less important: 5=highly important)	Average duration expected (days)	Name three languages (sub-category) that you think important for this area of specialization (Codes)			Are you willing to pay for this training? 1=Yes 2=No	How much are you willing to pay for this course? (Tk.)
1	Web Development							
2	Mobile App Development							
3	Game Development							
4	Programming Language							
5	Software Testing							
6	Database							
7	Network and Security							
8	Design							
9	Marketing							
10	Management							
11	Software Architecture							
12	Data science							
13	Internet of Things							
14	Telecom Network							
15	Software Development							
16	Front End Development							
17	Personal Development							
18	Business communications							

CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type
									Training Codes: sub-category		
1	C/ C++	9	CGI Perl	17	MS NT 2000,2006	25	Dart	33	jQuery	41	Android and IOS APP Development with Flutter
2	JAVA	10	Cold Fusion	18	UNIX/LINUS /Solaris	26	React	34	Photoshop for Web/App Developers	42	Core Python
3	/Net	11	Other programming	19	Lotus notes	27	Laravel	35	SQL/MySQL	43	
4	HTML	12	Database	20	XML	28	Bootstrap 4.3	36	CSS using SASS	44	
5	ASP	13	MS SQL	21	UML	29	Laravel 6.0	37	Laravel & Vue	45	
6	PHP	14	MS Access/ Fox pro	22	Swift	30	HTML and HTML 5	38	Android App Dev. with Java SE	46	
7	JSP	15	Oracle	23	Kotilin	31	CSS and CSS3	39	Professional Android Application Development	47	
8	Javabeen	16	Operating	24	Javascript	32	JavaScript	40	Android Architecture Components with Kotlin	48	

SECTION-D: JOB PLACEMENT

D1. How long it took to get your first job after graduation? ....months

1	Through traditional media advertisement (newspaper, magazine, radio)
2	Through online job matching site (e.g. BDjobs.com)
3	Social media (e.g., Facebook, LinkedIn)
4	Through private employment agency
5	Through university career guidance office
6	Through job fair/campus recruitment arranged by Department/University
7	Job fair outside department/university
8	University Bulletin Board
9	Through informal network of family/relatives
10	Through informal network of friends
11	Through informal network other than family, relative and friends
12	Employer contacted you
13	Contacted employer directly

D2. Have you received any "on the job training" from your first job firm? 1. Yes 2. No

D3. If yes, what was its duration? ………………….days

D4. How useful were your university studies for the first work? Rate the following options on a 5-point scale

[5: Very useful to 1: Very useless; 9 not applicable]

Sl.	Satisfaction Level	Highly Satisfied	Moderately Satisfied	Neither Satisfied or Dissatisfied	Moderately Dissatisfied	Highly Satisfied	N/A
1.	Theoretical knowledge provided	5	4	3	2	1	9
2.	Practical knowledge provided	5	4	3	2	1	9
3.	How to interact with clients	5	4	3	2	1	9
4.	How to work with colleagues	5	4	3	2	1	9
5.	Internship/on-the-job training	5	4	3	2	1	9
6.	Overall						

D3. Did the education and skill you got prepared you to undertake the job?

1	Job requires higher level skill
2	Job requires lower level skill
3	Skill appropriate for job
4	Skills not applicable

D4. Why did you quit the last job?

[Do not read out the responses but allow the enumerator to select the most appropriate based on response.]

1.	Was not allowed to continue
2.	Enterprise closed
3.	Low salary, bad working conditions
4.	Moved to another geographical area
5.	End of contract
6.	Got married
7.	Was pregnant/ to start a family
8.	Became disabled
9.	Care work: looking after parents or family member
10.	(Re)joining education
11.	To do another job
12.	Other (specify)

D5. How many hours do you work in a week?

Total Working Hours	

D6. What is your starting gross monthly salary (in BDT) in this employment? [Including allowances and other benefits; IF ANYONE REFUSES TO ANSWER, THEN WRITE…9]

Amount in tk. (BDT)	

D7. Do you have mandatory and other benefits in this job?

Sl.	Benefits	Yes	No
1	Employee provident fund (EPF)/employees' trust fund (ETF)	1	2
2	Health insurance	1	2
3	Maternity leave	1	2
4	Overtime	1	2
5	Sick leave	1	2
6	Pension	1	2
7	Gratuity	1	2
97	Others (please specify)	1	2

SECTION-E: TRAINING NEED FOR JOB PROGRESSION

D1……..

		Rate (On a scale of 1 to 5) 1 ⟷ 5
1.	Do you think you need further training to improve your current work proficiency?	
2.	Do you think you need further training for future job progression/career prospect?	
3.	Do you think you need further training for adaptation to technological change?	
4.	To what extent do you think your job will be taken away by automation	

D2……..

1	2	3	4	5	6
SI	Basic	Level of Proficiency	Applicability to current job	Future need of training	Are you willing to pay for the course? Fully=1,Partially=2No=3
1.	C/ C++				
2.	JAVA				
3.	/Net				
4.	HTML				
5.	ASP				
6.	PHP				
7.	JSP				
8.	Javabeen				
9.	CGI Perl				
10.	Cold Fusion				
11.	Other programming				
12.	Database				
13.	MS SQL				
14.	MS Access/Fox pro				
15.	Oracle				
16.	Operating				
17.	MS NT 2000,2006				
18.	UNIX/LINUS/Solaris				
19.	Lotus notes				
20.	XML				
21.	UML				
22.	Swift				
23.	Kotilin				
24.	Javascript				
25.	Dart				
26.	React				
27.	Laravel				

1	2	3	4	5	6
SI	Basic	Level of Proficiency	Applicability to current job	Future need of training	Are you willing to pay for the course? Fully=1,Partially=2No=3
28.	Bootstrap 4.3				
29.	Laravel 6.0				
30.	**HTML and HTML5**				
31.	**CSS and CSS3**				
32.	**JavaScript**				
33.	**jQuery**				
34.	**Photoshop for Web/App Developers**				
35.	**SQL/MySQL**				
36.	CSS using SASS				
37.	Laravel & Vue				
38.	Android App Dev. with Java SE				
39.	Professional Android Application Development				
40.	Android Architecture Components with Kotlin				
41.	Android and IOS APP Development with Flutter				
42.	Core Python				
43.	Software Testing & Quality Assurance using Selenium				
44.	**Automation Testing with Selenium**				
45.	Ethical Hacking and Cyber Security				

1	2	3	4	5	6
SI	Basic	Level of Proficiency	Applicability to current job	Future need of training	Are you willing to pay for the course? Fully=1,Partially=2No=3
46.	Video Editing with Adobe Premiere pro				
47.	TableAU,				
48.	Power BI,				
49.	Python				
50.	Machine Learning using R				

D3……..

1	2	3	4	5	6	
Sl.No.	Write down the names of the three most important training (broad category) you need now or in near future? (Use Types of training code from the list given below)	Programming Language/Field (Code from sub-category)			Are you willing to pay for this?	
		[1]	[2]	[3]	Fully	1
					Partially	2
					Not at all	3
1						
2						
3						

Training type: Broad Category			
code	Training Type (broad category)	code	Training Type (broad category)
1	Web Development	10	Management
2	Mobile App Development	11	Software Architecture
3	Game Development	12	Data science
4	Programming Language	13	Internet of Things
5	Software Testing	14	Telecom Network
6	Database	15	Software Development
7	Network and Security	16	Front End Development
8	Design	17	Personal Development
9	Marketing	18	Business communications

CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type	CODE	Training Type
					Training type (sub-category)						
1	C/ C++	9	CGI Perl	17	MS NT 2000,2006	25	Dart	33	jQuery	41	Android and IOS APP Development with Flutter
2	JAVA	10	Cold Fusion	18	UNIX/LINUS/ Solaris	26	React	34	Photoshop for Web/App Developers	42	Core Python
3	/Net	11	Other programming	19	Lotus notes	27	Laravel	35	SQL/My SQL	43	
4	HTML	12	Database	20	XML	28	Bootstrap 4.3	36	CSS using SASS	44	
5	ASP	13	MS SQL	21	UML	29	Laravel 6.0	37	Laravel & Vue	45	
6	PHP	14	MS Access/ Fox pro	22	Swift	30	HTML and HTML 5	38	Android App Dev. with Java SE	46	
7	JSP	15	Oracle	23	Kotilin	31	CSS and CSS3	39	Professional Android Application Development	47	
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E. OCCUPATON HISTORY

E1. No. of previous jobs [   ]   **E2.** Total years of experience [   ]

E3. Years of experience in this industry

E4. Years of experience in this firm

1	2	3	4	5	6		7		8
		Occupation title (position)	BSCO code (4 digit)	Duration	This job is permanent or temporary?		Is it a full-time or a part-time employment?		Total monthly income (basic salary and other benefits) (taka)
					Permanent	1	Full time	1	
				In Years	Temporary	2	Part time	2	
1.	Current job position								
2.	Current job Previous position 1								
3.	Current job Previous position 2								
4.	Last job 1								
5.	Last job 2								
6.	Last job 3								
7.	First job								

E6.	Do you expect a promotion in the future?	Rank 1-10 1=Do not expect at all 5=Almost certain	

E7. Promotion policy (Yes=1, No=2): 1. Merit based   2. Seniority based 3. Others (Specify)………………… [   ]

F. EXTENT OF FORMALITY

		Questions	Codes		Answers
Contract	1.	Type of the contract of the employee	Written	1	
			Oral	2	
Leaves and other benefits	2.	How many weekly paid leave do you get?	One day	1	
			Two days	2	
			More than two days	3	
	3.	Which of the following paid leaves do you get?	Weekly holidays	Yes=1, No=2	
	4.		Sick leave	Yes=1, No=2	
	5.		Casual leave	Yes=1, No=2	
	6.		Maternity/Paternity leave	Yes=1, No=2	
	7.		Others, specify	Yes=1, No=2	
	8.	Which of the following unpaid leaves do you get?	Weekly holidays	Yes=1, No=2	
	9.		Sick leave	Yes=1, No=2	
	10.		Casual leave	Yes=1, No=2	
	11.		Maternity/Paternity leave	Yes=1, No=2	
	12.		Others, specify	Yes=1, No=2	
	13.	Which of the following benefits do you get?	Pension	Yes=1, No=2	
	14.		Life insurance	Yes=1, No=2	
	15.		Health insurance	Yes=1, No=2	
	16.		Loan	Yes=1, No=2	
	17.		Others, Specify	Yes=1, No=2	
Overtime	18.	Do you work overtime?	Yes	1	
			No	2	
	19.	Hourly wage compared to the regular wage (if the answer to the F 1.22 question is Yes)	Less	1	
			Same	2	
			Higher	3	
Laying off	20.	Does the enterprise inform you in advance before laying off?	Yes	1	
			No	2	

G. EMPLOYEE'S JOB SATISFACTION

	Questions	Scale	(on a scale of 1 to 10)
G.1	How satisfied you are with your current job?	1 5 1= Not satisfied, 5= Fully Satisfied	
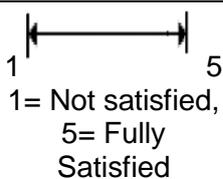
	Comments	Write responses below: Strongly disagree= 1; Slightly disagree= 2; Neutral= 3; Slightly agree= 4; Strongly agree= 5
G2	I feel I am paid adequately for the work I do.	
G3	I am satisfied with my job prospect/ promotion/ salary increase	
G4	My supervisor/boss is knowledgeable about my work	
G5	I am satisfied with my workplace safety / workplace environment	
G6	The benefits I receive are as good as what most other firms offer (competitive salary package)	
G7	My employers offer me training opportunities	
G8	My employers care for my career advancement	
G9	My work assignments are fully explained (ToR is followed)	
G10	My relationship with my colleagues is congenial	
G11	There are rewards/ appreciation for hard working	

H1. SELF ASSESSED SKILL & SKILL DEMAND

	Questions	Scale	(On a scale of 1 to 5)
H1.1	How do you assess your level of proficiency in performing your job? (1= No Proficiency, 10= Highly Proficient)		
H1.2	How do you think your formal education helps to perform your work proficiently? (1= Not at all, 10= Fully)		
H1.3	How helpful is your training in performing you work proficiently? (1= Not at all, 10= Fully)	1 ←————→ 5	
H1.4	Do you think your experience in this enterprise has increased your skill? (1= Not at all, 10= Fully)	1= Not satisfied 5= Fully Satisfied	
H1.5	How do you assess the market demand of your skill in the industry you are working? (1= No demand, 10= High demand)		
H1.6	If you want to leave this job now how difficult will it be to find a similar/ better job? (1= No difficulties, 10= Very difficult)		
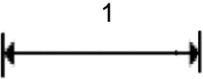
H2. ASSESSMENT OF SKILL & SKILL DEMAND BY EMPLOYER (To be filled in by the employer)
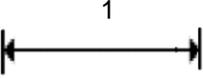
	Questions	Scale	(On a scale of 1 to 5)
H2.1	How do you assess the level of proficiency of this employee in performing his/her job? (1= No Proficiency, 10= Highly Proficient)		
H2.2	How do you think his/her formal education helps to perform his/her work proficiently? (1= Not at all, 10= Fully)		
H2.3	How helpful is his/her training in performing his/her work proficiently? (1= Not at all, 10= Fully)	1 ←————→ 5	
H2.4	Do you think his/her experience in this enterprise has increased his/her skill? (1= Not at all, 10= Fully)	1= Not satisfied 5= Fully Satisfied	
H2.5	How do you assess the market demand of the skill of your employee in the industry he/she is working? (1= No demand, 10= High demand)		
H2.6	If he/she wants to leave this job now how difficult will it be to find a similar/ better job? (1= No difficulties, 10= Very difficult)		