Labour Market Observatory in Vietnam Universities
LAB-MOVIE

REPORT ON
THE RESULTS OF WP2 SURVEY WITH ENTERPRISES IN ICT SECTOR

NGUYEN TAT THANH UNIVERSITY

Team members:
Dr. Nguyen Tuan Anh
Mr. Nguyen Phuong Thong
Mrs. Duong Thi Kim Xoa
Mr. Tran Binh Hau
Mr. Le Quang Khanh

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1. Overview of ICT Sector

In general, the Information and Communication Technology Sector (ICT) is continuing to have a strong development, increasingly asserting its role and position on the development of the country. In 2020, the Covid-19 pandemic outbreak and its unpredictable development on a global scale affected all socio-economic aspects of countries around the world, including Vietnam. Nevertheless, the sector still achieved many remarkable results, maintaining an average increase of revenue at 7.5% over the period 2016-2020 with the employment of more than one million people in more than 60,000 enterprises. The following overview of the ICT sector is based on data reported in the annual Whitebooks of Viet Nam ICT and annual summary reports on ICT released by the Ministry of Information and Telecommunication as well as data reported in related official news sites. It shows the overall picture of the current situation and trends in ICT in Vietnam in general and Ho Chi Minh City in particular.

1.1. Driving activities in ICT sector

IT industry

The IT industry is being evaluated as one of the key industries for Vietnam. There are about one million employees working in the IT industry. Vietnam has long been considered to be an ideal destination for the leading technology companies in the world to look for a place to develop products.

The IT (including electronics) industry continues to be one of the fastest growing economic sectors in the country, always maintaining a double-digit growth rate in the past 5 years. By the end of 2020, the total revenue of the IT industry reached 124.6 billion USD (compared with 112.5 billion USD in 2020), in which, the electronics and hardware industry accounted for 111 billion USD and the software industry accounted for 5.4 billion USD. The remained revenue was shared by the digital content industry (0.9 billion USD) and the IT services (7.3 billion USD).

The IT industry is characterised with tremendous export value. It was globally ranked the 2nd in mobile export with an export revenue of 35.5 billion USD, occupying 14.2% of the world market share at the growth rate of 14.1% compared to that of 2019. It was also ranked the 8th in computer export, occupying 2.4% of the world market; ranked the 10th in electronic circuit export, occupying 1.8% of the world market; ranked the 8th in printer export, occupying 4.4% of the world market share; ranked the 6th in software services; ranked the 7th in video game export.

The software industry as a part of the IT industry can be considered as one of the main activities for IT labour. The majority of the software workforce are programmers of varying ages and usually concentrated in the regions of Ho Chi Minh City and Hanoi. In 2020, the average income of software workers was reported to reach 9,419 USD person/year and continue to be the highest average income in the IT industry, almost doubling the average lowest income of the workers working in the electronics hardware industry.

On the other hand, the hardware and electronics industry can be considered as one of the main revenue generator and employer of the IT industry. By the end of 2020, the total number of employees working in this field was the largest with a total of 842,458 people, accounting for approximately of 78% of the total number of employees in the IT industry. It revenue in 2020 continued rising to reach 111 billion USS, accounting for 89% of the revenue generated by the IT industry. However, the recent growth rate of hardware and electronics industry shows signs of slowing down in both revenue and in the number of employee if compared with the previous years.

The second largest revenue generator of the IT industry is the IT services. In 2020 it had a turnover of 7.3 billion USD, up to 12% compared to 2019. However, the average annual income of IT services workers is the bottom group, only higher than those in hardware and electronic industry but significantly lower than those in the software and digital content industry. In 2020, the number of employees in IT services in 2020 was 55,361 people, accounting for 5% of the total number of employees in the IT industry.

The smallest revenue generator for the IT industry is the digital content industry. In 2020, it continued showing the contrasting directions of development. Compared with 2019, its revenue continued rising to reach 0.9 billion USD while the number of employee continued falling to the lowest number of the 5-year period of 34,377.

Telecommunication industry

The telecommunication industry consists mainly of fixed-line telephone service, mobile service, internet service.

In 2020, Vietnam's fixed telephone number continued its reducing trend to 3.2 million subscribers. The market share of subscribers of landline telephone services in Vietnam is provided by 3 major operators VNPT, Viettel, SPT. In particular, VNPT accounts occupied the highest market share of 63% and ranking second is Viettel with 33%. The trend of using mobile phones has brought landline phones into a state of decline and gradually replaced.

On the other, the market share of mobile services provided by operators is also very competitive. According to the statistics of 2020, the number of mobile phones operating in the country was approximately 130 million subscribers with 4 major mobile telecommunications service providers including Viettel, VNPT, Mobilephone, Vietmamobile. In recent years, it is recognized the mobile market has begun to show signs of saturation, service providers have begun to reduce investment in development of new subscribers and increase quality of service, infrastructure and added value instead. By the end of 2020, the market share of subscribers of operators providing cellular mobile services also has a lot of changes. Viettel was still one of the pioneering providers and hold a huge market share with 52%, followed by VNPT with 24% and MobileFone with 18%. Furthermore, the number of mobile subscribers generating traffic including regular calls phones and data packages is always on the rise. However, there is an interesting trend of development in mobile subscribers. While

the number of mobile subscribers generated traffic is stable, the number of mobile subscribers generated only voice traffic, messages is reduced and the number of mobile subscribers generated data traffic is increased.

Regarding the internet service, in 2019, Internet activity in Vietnam increased sharply with 64 million Internet users and up to 28% compared to 2017. It is shown that Vietnamese users spend an average of 6 hours 42 minutes a day participating in Internet-related activities. Among 64 million internet users in Vietnam, the number of users accessing via mobile devices is 61.73 million (accounting for 96% of internet users). And among the 138 million registered mobile phone subscribers, 45% have subscribed to 3G & 4G.

According to the data of 2020, in term of market share for internet service, the fixed broadband service is dominated by Viettel, VNOT, FPT and SCTV with Viettel and VNPT being the largest player of 39% each. For the mobile broadband service, the market is dominated by Viettel at 56% with VNPT and MobileFone tracing at 19% and 18% correspondingly.

Regarding telecommunication equipment manufacturing, Vietnamese mobile phone operators have invested in the research and manufacturing of telecommunications equipment for specific networks, and currently produces over 70% of the range of telecommunications equipment. The target of producing 100% of the range and becoming the 4th largest exporter in the world is well within their reach.

1.2. Key regions to develop IT and Telecommunication industry in Vietnam

The distribution of ICT enterprises and revenue by locality (province / city) shows that the concentration is always mainly located in the big provinces / cities with high economic conditions and developed infrastructure. Bac Ninh and Thai Nguyen have always been the leading provinces in IT revenue in recent years due to investment from large enterprises from foreign countries such as Samsung. The following table shows the order of the top 20 localities in IT revenue

Table 1. List of top 20 provinces leading in ICT revenue

Rank	Province/City	Rank	Province/City
1	Bac Ninh	11	Ninh Binh
2	Thai Nguyen	12	Hung Yen
3	Hanoi city	13	Long An
4	Ho Chi Minh city	14	Phu Tho
5	Bac Giang	15	Ha Nam
6	Vinh Phuc	16	Hoa Binh
7	Hai Phong	17	An Giang

8	Da Nang	18	Can Tho
9	Quang Ninh	19	Binh Duong
10	Hai Duong	20	Nghe An

Examining the location of ICT enterprises, they are mainly concentrated in big cities like Hanoi City, Ho Chi Minh City and Da Nang. Large cities have a high population, so there will be many technological needs to be met. This will be the basis for attracting ICT businesses that have large scale investment strategies. It is reported in Table 2.

Table 2. List of 20 provinces leading in numbers of ICT enterprises

Rank	Province/City	Rank	Province/City
1	Ha Noi	11	Binh Duong
2	Ho Chi Minh	12	Hai Phong
3	Da Nang	13	Hai Duong
4	Bac Ninh	14	Binh Dinh
5	Lam Dong	15	Bac Giang
6	Tay Ninh	16	Lang Son
7	Đong Nai	17	Can Tho
8	Thua Thien – Hue	18	Ninh Thuan
9	Ba Ria – Vung Tau	19	Kien Giang
10	Binh Thuan	20	Quang Ninh

Table 3. Provinces leading in labour forces in IT.

Rank	Province/City	Rank	Province/City
1	Bac Ninh	11	Hoa Binh
2	Hanoi	12	Phu Tho
3	Ho Chi Minh	13	Ha Nam
4	Thai Nguyen	14	Lam Đong
5	Bac Giang	15	Quang Nam
6	Vinh Phuc	16	Thua Thien – Hue
7	Đa Nang	17	Nghe An
8	Hai Phong	18	Long An

9	Hung Yen	19	Can Tho
10	Ninh Binh	20	Quang Ninh

1.3. The development of enterprises and human resources in ICT

IT Industry

The number of enterprises registered to operate in the field of information technology has increased sharply each year, from 24,502 enterprises in 2016 to 44,597 enterprises in 2020. All business sectors showing increases over the years, even nearly doubling in the number of businesses registered within just 5 years from 2016-2020.

Table 4. Table of statistics on the number of enterprises registered to operate in IT Industry (2021 ICT White Book)

Indicator	2016	2017	2018	2019	2020
Total number of enterprises operating in the field of information technology - electronics and telecommunications	24,502	28,424	38,861	42,136	44,597
Hardware and electronics enterprises	3,404	4,001	4,730	5,365	5,929
Software enterprises	7,433	8,883	11,496	12,423	13,544
Digital content enterprises	2,700	3,202	3,561	3,982	4,188
IT services enterprises (except for trade, distribution)	10,965	12,338	19,074	20,366	20,936

The increase in the number of enterprises in the industry group also led to a sharp increase in the number of employees in the field of IT. The total number of employees in the country in 2015 was 721,594 increasing to 973,692 in 2018. At the same time, the data shows that the number of employees in each field of hardware, electronics, software, digital content and IT services has also increased steadily over the years.

Table 5. Labour in the IT Industry by year (2021 ICT White book)

Indicator	2016	2017	2018	2019	2020
Total number of employees	780,926	922,521	973,692	1,005,206	1,081,268

Number of hardware, electronics industry workers	568,288	678,917	717,955	760,097	842,458
Number of software industry workers	97,387	112,004	127,366	143,149	149,072
Number of digital content industry workers	46,647	55,908	51,952	42,479	34,377
Number of IT service workers (except for trading, distribution)	68,605	75,692	76,419	59,481	55,361

Thus, the statistics show that the IT industry is experiencing strong growth, especially in the hardware, software and digital content industries, all maintaining high growth, on average nearly 30% year on year. In particular, Vietnam's outsourcing market has a certain place on the world map. Vietnam has been ranked by the consulting firm A.T.Kearney to rank 6th in the list of outsourcing destinations in the world. In addition, the research firm Tholons also rated Vietnam as the 8th leading country providing IT services. HCMC and Hanoi City also rank in the top 20 among the 100 most attractive cities for outsourcing.

It is also reported there is a strong increase in the demand for recruiting highly specialized IT personnel nationwide with Fintech-related fields such as AI (artificial intelligence), Data Science, Big Data, Cyber Security. Particularly, in Ho Chi Minh City, the IT industry is considered one of the four key industries creating high added value. The demand for human resources in 2020 continues to increase sharply in all positions: network security, programming, application development, web design and operation, technology process design and implementation, electronic engineers, IC design, electronic technician, maintenance of electronic systems as reported by HCMC Center for Forecasting Labour Needs and Labour Market Information.

Due to the strong demand for the workforce in term of quantity and quality, the labour market is currently suffering from the shortage of supply. It is suggested that the shortage of supply is due to a number of reasons: (1) The quality of graduates has not met the requirements of employers, (2) There are many shortcomings in training and career guidance in human resource training, (3) The number of lecturers teaching IT is limited, (4) There is limited human resource preparation for the industry. This shortage is expected to continue to the future.

Telecommunications industry

The telecommunications industry has been the "golden egg" for Vietnam's economy with a healthy rise year on year. But in recent years, Vietnam's telecommunications market has had signals of saturation when revenue is still concentrated in traditional telecommunication services such as voice call and SMS with fierce competition from Internet-based services (OTT).

The statistics in Table 6 below show that the number of enterprises in the telecommunications industry is quite stable over the years, the service areas: fixed broadband internet access, satellite telecommunications, land mobile telecommunications and satellite mobile telecommunications are on the increase in the number of businesses but not significantly, while maritime mobile and fixed land mobile telecommunications services show signs of strong saturation and even decrease in number.

Table 6. Telecoms operator (2021 ICT White book)

Indicator	2016	2017	2018	2019	2020
Number of enterprises providing fixed land telecommunication services	74	73	64	66	69
Number of enterprises providing fixed-broadband Internet access		61	58	61	64
Number of enterprises providing satellite fixed telecommunication services	1	2	3	3	3
Number of enterprises providing terrestrial mobile telecommunications services	5	6	6	6	7
Number of enterprises providing satellite mobile telecommunications services	3	3	3	4	6
Number of enterprises providing maritime mobile telecommunications services	1	1	1	1	1

The number of telecom personnel in the country also saw a significant decrease in the period from 2016 to 2017 (from 71 thousand people to 68 thousand people). However, since 2018, there have been signs of growth again (Table 4).

Table 7. Workers in the telecommunication industry by years (2021 ICT White book)

Indicator	2016	2017	2018	2019	2020
Number of personnel working in telecommunications field	71,298	68,094	77,205	79,140	79,943

However, it is forecasted that Vietnam's telecommunications market is expected to grow further as providers are racing to test and deploy 5G services. Government plans on the fourth industrial

revolution, smart city building, start-up issues and national innovation network program, enabled by 4G and 5G networks, IoT and advanced mobile telecommunications, will help Vietnam's telecommunications industry continue to grow after a period of saturation.

1.4. ICT in Ho Chi Minh City

In recent years, Ho Chi Minh city has been in the top list of ICT revenue, ICT enterprises and It employees (ICT Whitebook 2020, 2021). By the end of 2018, the number of enterprises specialized in information technology and telecommunications in Ho Chi Minh City was about 5,636, an increase of 23% compared to 2016, and accounting for 3% of the total number of enterprises registered in the city. Specifically, the hardware business currently has 327 companies, software technology 3,441, digital content 617 and IT services 1,251 firms. Software manufacturing enterprises now account for 60% of the whole industry. Service businesses account for 22%, and the rest are hardware, electronics, and digital content businesses. Ho Chi Minh City also one of the four major cities/provinces accounting for a majority share of ICT enterpises in Vietnam.

Particularly, Ho Chi Minh City is home of many start-ups in ICT. It is reported that in 2019, start-ups in ICT successfully raised funds with a total value of more than 670 million USD for about 50 projects, but Ho Chi Minh City alone accounts for half with 23 projects equivalent to more than 300 million USD. Furthermore, in 1300 start-ups of the city in 2018, 900 are start-ops in ICT. Ho Chi Minh city is also home of the largest IT park of the countries.

Despite the rapid development and use of a highly qualified workforce compared to other industries, the ICT industry still account for a modest proportion in Ho Chi Minh City's economy. Data in 2017 showed that the ICT revenue accounted for approximately 3% of the entire city. It is quite modest compared with some other sectors: 7.1% of the processing industry, 23.6% of the construction industry, 30.9% of the transport industry, 62% of the banking industry.

Ho Chi Minh City is considered as the key city for the labour market in the southern economic region. The IT industry in this city has a human resource demand that accounts for 4% of the total labour demand of the country, requiring workers at various levels such as many intermediate, college and university levels and at various positions such as programmers, system engineers, network engineer, hardware engineer, tester, software development staff, web programming designer. Particularly, Ho Chi Minh City also shows a record number of IT personnel in 2018 at 100,403. Corresponding to hardware technology they are distributed in electronics (20,822 employees), software technology (59,049 employees), digital content technology (4,715 employees), and IT services (15,817 employees). Regarding labour qualifications, according to the results of the 2017 Economic Census: college and university qualifications account for the main proportion of 67.4%; Masters account for nearly 2%.

2. Methodology

2.1. Types of survey

In the study, we used 3 types of survey: face-to-face interview, phone interview and CAWI (computer-assisted web interview). Various types of survey were used due to the situation of Covid-19 with lockdown and limitation on direct personal contact.

A face-to-face interview was conducted at the premise of an enterprise in interest. For every interview, a team of 2 persons were formed: one for asking the questions and the other one for recording the answers. The interviewees were senior staff of the enterprises (CEO, director, deputy director, head of human resources department). The interviewees were contacted in advance to arrange for the meetings.

Due to the Covid-19, a face-to-face interview had become impossible. A phone interview was used for surveying. Similar to a face-to-face interview, senior staff at the selected enterprises were contacted through telephone to arrange for an interview. Before the interview, the questionnaire was sent to the interviewee so that the interviewee got familiarized with the questions. During the call-in, the interviewer explained in details about the questions and recorded the answers.

CAWI were conducted using Google platform and Lime platform. Lime is an open source tool for online survey (https://www.limesurvey.org). Lime package was installed on the university server and the questionnaire was upload onto the platform. For Google platform, a Google form was used for uploading the questionnaire (https://docs.google.com/forms/u/0/?tgif=c). The purpose of using both CAWI tools was to explore the features and evaluate the usability of the two tools. The enterprises were contacted by email to ask for doing the survey. A reminding email was sent to the enterprises that did not complete the survey after 2 weeks.

2.2. Questionnaires

The questionnaires were designed based on the templates provided by the University of Padova (see Appendix). There are 2 questionnaires: one questionnaire about the activities and professions in the ICT sector and one questionnaire about the professional figures in the ICT sector (See Appendix). The questionnaire about the activities and professions in the ICT sector is used to obtain information on the enterprises' main business activities, their employment of ICT personnel, their perspectives on business development and employment in the sector. The questionnaire about the professional figures is used to obtain information on the job titles, the skill needed in the sector. While the designed questionnaires follow closely the samples provided by the University of Padova, there are questions that have been changed or newly included on fit the local context. These questions are those that are related to the classification of business activities, types of ownership, the classification of business size, knowledge and skills required for the professional titles.

The questionnaires were tested in the pilot study. After the pilot, the questionnaires were adjusted with some words changed and sentences rephrased to improve the clarity of the questions. The questions about the skills and knowledge required for the professional figures were incorporated into the questionnaire instead of being separated as the original questionnaires.

For the CAWI interview, the face-to-face questionnaire was adapted so that it could be more suitable for a web survey. For example, instead of asking the interviewee to fill their number of working years, the web questionnaire provides the selectable options of working years. The professional figures were also not surveyed in the CAWI interview. The CAWI questionnaires are available at

- Google platform: https://docs.google.com/forms/d/1ZHnzTF_KQUN66vzWvTCBxQ13WhRd8s5_eELBsyWrErU/edit?usp=sharing
- Lime Platform: https://limesurvey.ntt.edu.vn /index.php/456411

2.3. Survey duration

- Face-to-face interview at the enterprises' premises: from March 10, 2021 to May 6, 2021
- Phone interview: from July 13, 2021 to September 08, 2021
- CAWI: from July 29, 2021 to September 10, 2021

2.4. Enterprises surveyed

A total of 61 enterprises were surveyed. Of which, 10 were conducted at the enterprises' premises, 27 were conducted through telephoning and 24 were surveyed by CAWI.

The enterprises for the face-to-face and phone interviews were randomly selected from the database of Nguyen Tat Thanh university.

For the CAWI survey, a total of 365 enterprises were contacted by email to invite for the survey. The contact details of 275 enterprises were sourced from the database of Nguyen Tat Thanh University. The contact details of the other enterprises were collected from the member listing of VINASA (Vietnam Software & IT services; https://vinasa.org.vn). A total of 29 responses were received from the CAWI survey (7.9%). Of which, 17 enterprises responded via Google form and 12 enterprises answered through Lime Survey. However, there were 5 duplications of responses.

3. Quantitative data

3.1. Main activities of the surveyed enterprises

Here we asked the respondents providing information on the ownership of their enterprise, their business locations, their types of business activities. The types of business activities are classified

according to Vietnam Standard Industrial Classification by Prime Minister's Decision no. 27/2018/QD-TTg.

Most of the surveyed enterprises (90%) are private enterprises. The enterprises with foreign-directed investment account for 8% while the state-owned enterprises take 2%. 95% of the surveyed enterprises have their headquarters in Ho Chi Minh city while the remained operate as branches. A majority of them also operate at several premises in the city (75%). Only 15 (25%) surveyed enterprises operate at only location in the city.

Figure 1 provides information on the primary business activities of the enterprises. It could be seen that most of the businesses (85%) identify Computer Programming, Consultancy and Related Activities as their primary business. A significant portion of them (39%) also have the primary businesses in Data Processing and Information while telecommunication accounts only a small part for business for the surveyed enterprises. Furthermore, approx. one half of them (43%) identify more than one primary activity with 2 percent operating in up to 6 (six) main activities (Figure 2).
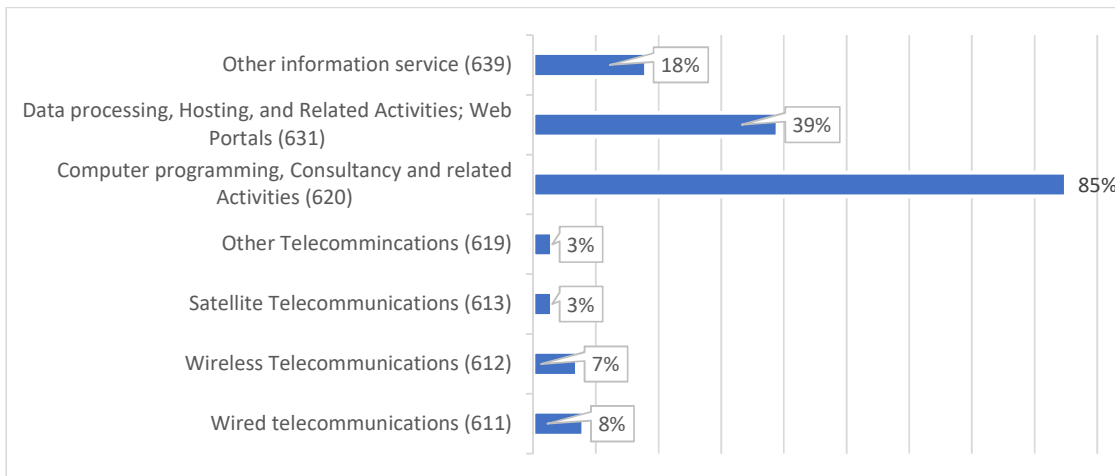

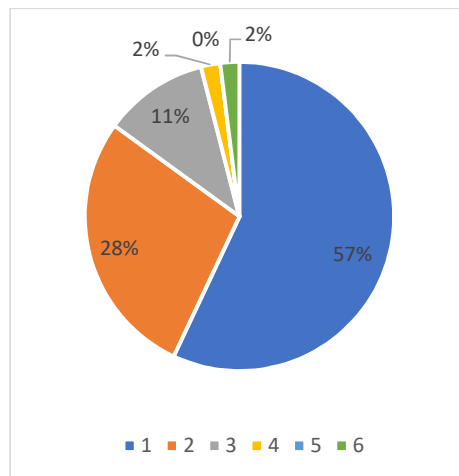**Figure 1. Primary business activities of the surveyed enterprises.**

Figure 2. Number of main business activities.

The enterprises were also asked to provide information on their secondary business activities. Figure 3 provides information on secondary business activities of the enterprises. Only 19 enterprises (31%) identify that they have secondary business activities. For these enterprises, most of their secondary business activities fall in the area of telecommunication and other information service.
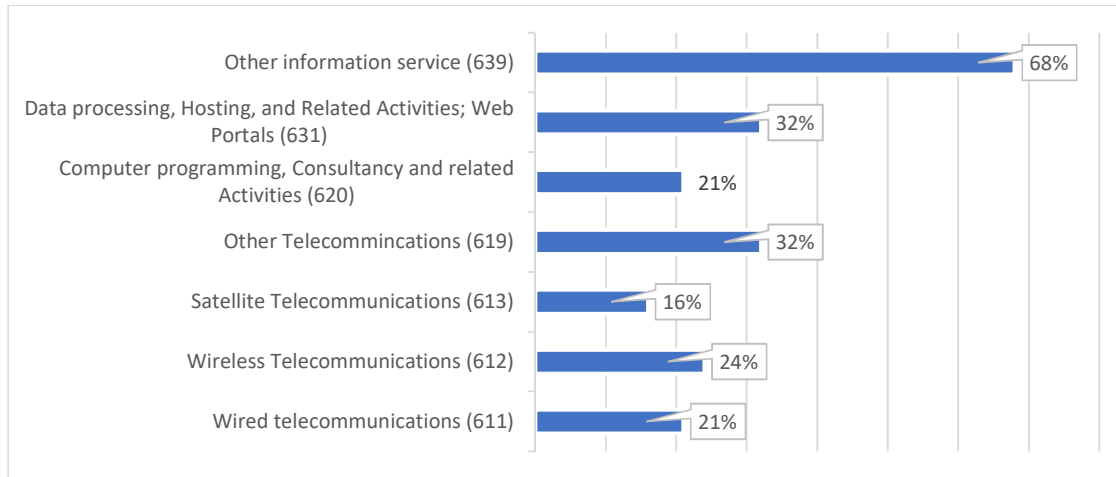

Figure 3. Secondary business activities of the surveyed enterprises.

3.2. Staffing of the surveyed enterprises

A significant part of the sampled enterprises (41%) are large business (with more than 100 persons)[1] with some business with more than 1000 staff. On the other hand, small business with staffing of less than 50 persons also accounts for a sizeable portion (41%). Hence, it could be suggested that the survey would express a balanced view from the large and small enterprises.
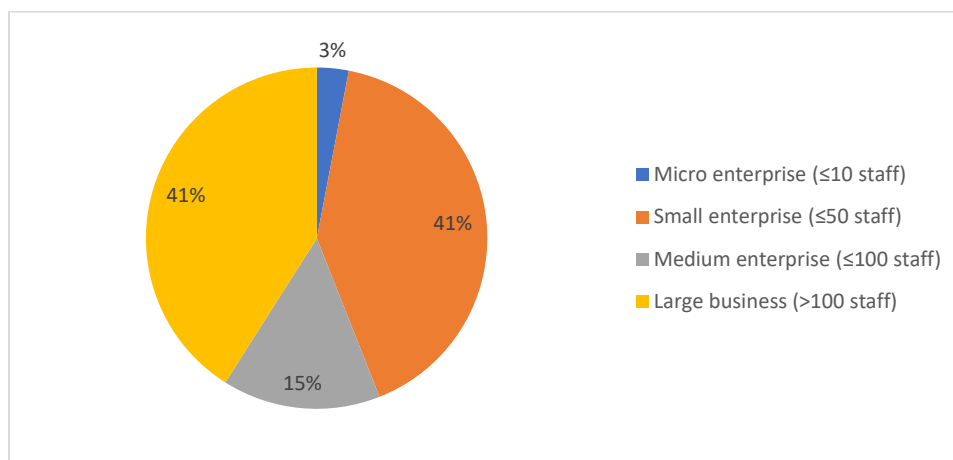

Figure 4. Sizes of the surveyed enterprises.

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[1] The classification of business size follows the decree numbered 80/2021/NĐ-CP of the Government of Vietnam

It is also found that female staff accounts for an important size at the surveyed enterprises. The averaged percentage of female staff at these enterprises is 32% with the largest percentage of the female staff at 63% and the smallest percentage at 3%. Figure 5 shows that more than 50% of the sampled enterprises have their female staff falling between 20% to 50% of the total staff.
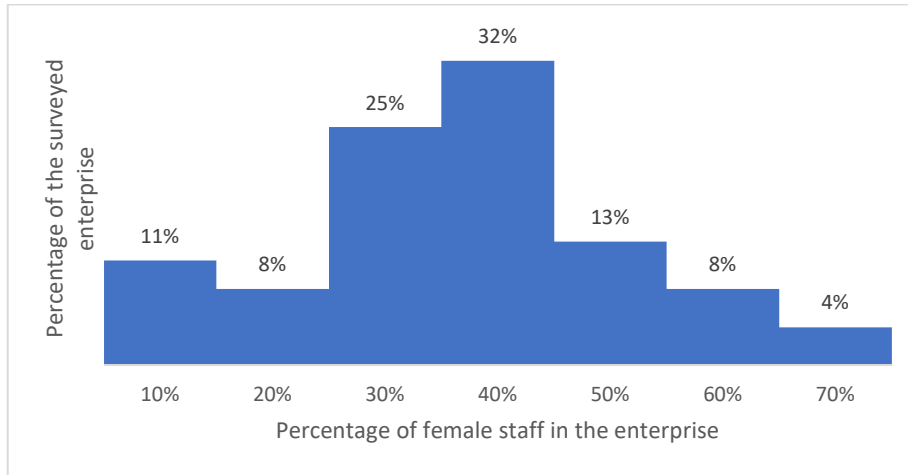
Figure 5. Distribution of enterprises according to the percentage of female staff.

Among the surveyed enterprises, fresh graduates do get a good opportunity of employment. The averaged percentage of fresh graduates at the surveyed enterprises is 14% (the median value is 12%) with one enterprise reporting a very high percentage at 75%. A majority of them (63%) employ fresh graduate at less than 20%. Nevertheless, 18% of the surveyed enterprises reported no fresh graduates among their staff (Figure 6).
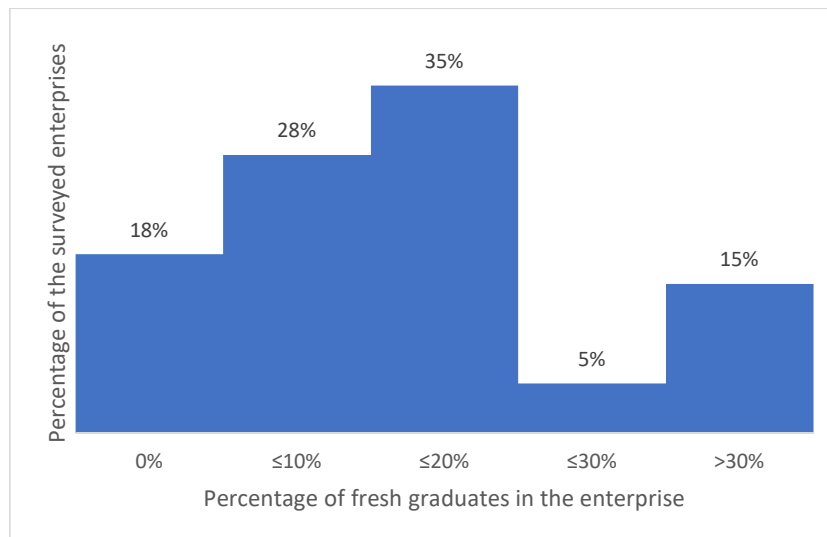

Figure 6. Distribution of enterprises according to the percentage of fresh graduates.

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Figure 7 shows the distribution of the types of labour contracts used for employment at the surveyed enterprises. It can be seen that most of the enterprises use indefinite and definite-term labour contracts when employing. 50% of the surveyed enterprises have more than 40% of their staff employed with indefinite-term labour contract and similarly 56% of these enterprises reported more than 40% of their staff having a definite-term labour contract. In fact, the medians of the percentage on the total employed staff for the indefinite-term and definite-term contracts are correspondingly 38% and 48%. The high percentage of the long-term contracts suggests the stable employment in the IT sector. Moreover, the higher percentage of definite-term contracts indicates the high percentage of the staff newly joining these enterprises, considering the current practice in Vietnam of signing definite-term contracts with the staff that newly join.
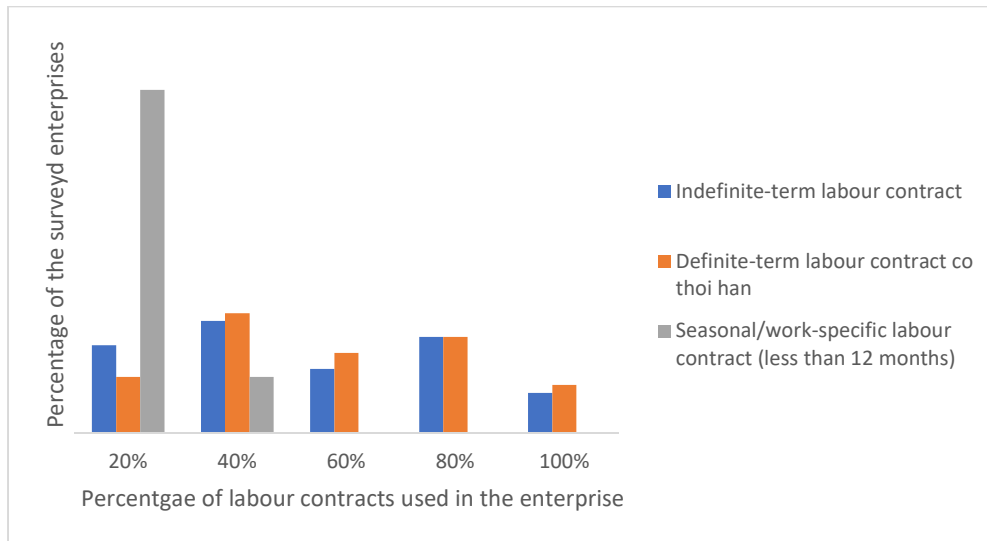
Figure 7. Distribution of the enterprises according to the types of used labour contracts.

Furthermore, 38% of the surveyed enterprises reported the use of freelance professionals. The surveyed enterprises have been asked to identify the activities that they have hired freelancers for (only the activities that are related to their main business, excluding sale, accounting, legal, etc.). Table 8 gives the frequencies of the activities identified by the enterprises. The most frequently-mentioned activities are related to software development and design. The sizeable percentage of enterprises using freelancer in these activities suggests the shortage of high-qualified staff in these areas.

Table 8. Frequencies of the activities that employ freelance professionals.

Activities that use freelance professionals	Frequency
UX/UI Design (Thiết kế UX/UI)	23%
Systems/ Software Deployment (Triển khai phần mềm/ hệ thống)	6%
Technology Consultant and Technical Support (Tư vấn công nghệ và hỗ trợ kỹ thuật)	10%

Product/Software Development (Phát triển phần mềm/ sản phẩm)	35%
Software Testing (kiểm thử phần mềm)	16%
Data input (nhập liệu)	10%

Furthermore, 82% of the enterprises reported the presence of interns in their operation. The surveyed enterprises have been asked to identify the specialisations that they have internship. Table 9 lists the specializations and the frequency that theses specialisations mentioned by the respondents. It appears that the specialisations related to Information Technology, Software Engineering, and Computer are in demand. This demand fits to the main business areas of the surveyed enterprises which mainly operate in Computer Programming.

Table 9. Frequencies of the specialisations that have interns.

Areas	Specialisations	Frequency
ICT-related	Information Technology (Công nghệ thông tin)	23%
	Software Development (Phát triển phần mềm)	23%
	Computer Science (Khoa học máy tính)	4%
	Information Systems (Hệ thống thông tin)	4%
	Network Administration (Quản trị mạng)	3%
	Sofware Testing (kiểm thử phần mềm)	3%
	Web Design (Thiết kế web)	3%
	AI Engineer (Trí tuệ nhân tạo)	2%
	Computer Service (Dịch vụ máy tính)	2%
	Design (Thiết kế)	2%
	Mobile Programming (Lập trình mobile)	2%
	Business Analysis (Phân tích nghiệp vụ)	2%
	Telecommunication (Điện tử viễn thông)	2%
	Solution Consultant (Tư vấn giải pháp)	1%
Business related	Sale and Marketing (Kinh doanh và tiếp thị)	15%
	Human Resources (Quản trị nhân sự)	7%
	E-commerce (Thương mại điện tử)	2%
non-IT technical related	Electrical and Mechanical Engineering	1%
	Graphic Design (Thiết kế đồ họa)	1%
	Medical Engineering (Kỹ thuật y tế)	1%

3.3. Recruitment situation of the surveyed enterprises

Despite the Covid-19, the job market in 2020-2021 looked positive. Responding to the question whether the enterprise hired staff in the last 12 months, 80% of the surveyed enterprises said "yes" for hiring. Only, 5% of them had reduced the number of staff instead of hiring more (Figure 8).
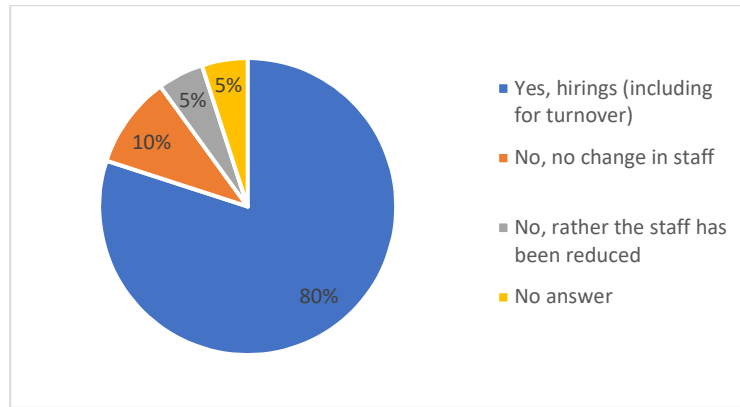

Figure 8. Recruiting in the last 12 months.

Table 10 elaborates on the professional figures being hired by the surveyed enterprises. Most of hiring were related to IT area, of which the most popular professional figures were Programmer, Solution Consultant, Software Engineer and QC Staff. For management positions, the professional figures being hired were also IT-related and mostly middle-management positions.

Table 10. Professional figures recruited by the enterprises in 2020-2021.

Areas	Professional figures	Number of hiring
Technical	Programmer (Lập trình viên)	758
	Solution Consultant (Chuyên viên tư vấn giải pháp)	300
	Software Engineer (Kỹ sư phần mềm)	246
	QC staff (Nhân viên kiểm thử)	144
	IT Staff (Nhân viên IT)	46
	Deployment Staff (Nhân viên triển khai)	15
	Business Analyst (Nhân viên phân tích nghiệp vụ)	10
	Data Engineer (Kỹ sư dữ liệu)	4
	UI/UX Designer (Nhân viên thiết kế UI/UX)	3
	AI Engineer (Kỹ sư AI)	2
	Product Designer (Kỹ sư thiết kế)	2
Management	Project Manager (Quản lý dự án)	17
	Department Manager (Trưởng phòng)	5

	Team Leader (Trưởng nhóm)	1
	Admin Staff (Hành chính văn phòng)	16
	Sale Staff (Nhân viên kinh doanh)	9
	Marketing Staff (Nhân viên marketing)	5
Administration	PR Staff (Nhân viên truyền thông)	4
	Accountant (Nhân viên kế toán)	3
	HR Staff (Nhân viên nhân sự)	3
	Total	1593

The job market is also good to fresh graduates. Answering on the question whether they hired fresh graduate, 79% of the hiring enterprises said "yes". Table 11 give the information on the specialisations of the recruited fresh graduates and the corresponding number of recruits. The most popular specialisation for recruited fresh graduates are Information Technology, Computer Science, Software Engineering, which fit to the pattern of the most recruited professional figures reported. It could be noted that the number of recruited fresh graduates accounts for approximate 35% of the new recruits.

Table 11. Specialisations of the recruited fresh graduates.

Areas	Specialisations	Number of recruits
ICT related	Information Technology (Công nghệ thông tin)	283
	Computer Science (Khoa học máy tính)	88
	Software Engineering (Kỹ thuật phần mềm)	47
	Information System (Hệ thống thông tin)	13
	Computer Network (Mạng máy tính)	6
	Electronic and Electrical Engineering (Kỹ thuật điện - điện tử)	43
	Electronics - Telecommunication (Điện tử - viễn thông)	2
Other technical	Mechanical Engineering (Kỹ thuật cơ khí)	20
Business	Business Administration (Quản trị kinh doanh)	12
	Accounting (Kế toán)	8
	Economics (Kinh tế)	1
	Human Resources Management (Quản lý nguồn nhân lực)	1
Non-identified	Other (Các ngành khác)	26
	Total	550

Furthermore, the outlook for the job market in ICT is positive in the future according to the responds of the enterprises on the question whether they continue to hire in the next 2 years. 90% of them said "yes" on hiring in the next 2 years while only 3% had no plan for new staff (Figure 9). Table 12 gives the consolidated estimation on the number of new hiring for each professional figures in the future. Among the ICT-related professional figures, the titles IT Engineer, Software Engineer, Programmer continue to dominate the job demand. However, Data Engineer shows a trend of large demand in the next 2 years.
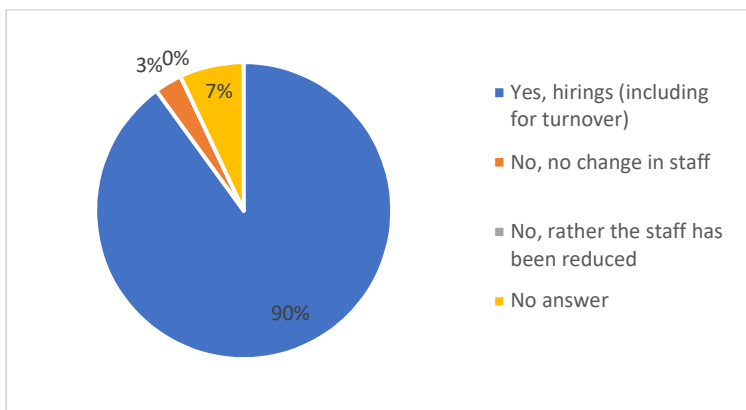
Figure 9. Recruiting in the next 2 years.

Table 12. Estimate of new hiring for professional figures.

Area	Professional figures	Estimated number of new hiring
	IT Engineer (Kỹ sư công nghệ thông tin)	3647
	Software Engineer (Kỹ sư phần mềm)	312
	Programmer (Lập trình viên)	254
	Data Engineer (Kỹ sư dữ liệu)	58
	Electronic and Electrical Engineering (Kỹ sư điện - điện tử)	43
	QC staff (Nhân viên kiểm thử)	30
	IT Staff (Nhân viên IT)	27
	Telecommunication Engineer (Kỹ sư viễn thông)	21
	Product Designer (Kỹ sư thiết kế)	10
	Deployment Staff (Nhân viên triển khai)	8
	Systems Engineer (Kỹ sư hệ thống)	8
ICT- related	Network Administrator (Quản trị mạng)	3

	Business Analyst (Nhân viên phân tích kinh doanh)	2
	Project Manager (Quản lý dự án)	50
Sales and Administration	Sale Staff (Nhân viên kinh doanh)	37
	Marketing Staff (Nhân viên marketing)	24
	Admin Staff (Hành chính văn phòng)	10
	PR Staff (Nhân viên truyền thông)	10
	Accountant (Kế toán)	3
	Customer Care (Chăm sóc khách hàng)	1
Other	Mechanical Engineer (Kỹ sư cơ khí)	20
	Total	4578

On the other hand, 75% of the enterprises reported having difficulties in recruiting. Regarding the reasons for the difficulties, 30% of the surveyed enterprises cited the inadequacy of candidates, 26% cites the small number of application, and 22% cited both the above reasons (Figure 10). For those 22% that cited other reasons for the difficulties, the mismatch between the offered and the asking salaries was the most common reason for hiring problems. The reasons for recruiting difficulties highlight the unbalance between the demand and supply of ICT human resources. There is a shortage of ICT human resources in overall and a shortage of high-qualified ICT human resources specifically, which is leading to an increase in asking remuneration that is over the affordability of enterprises.
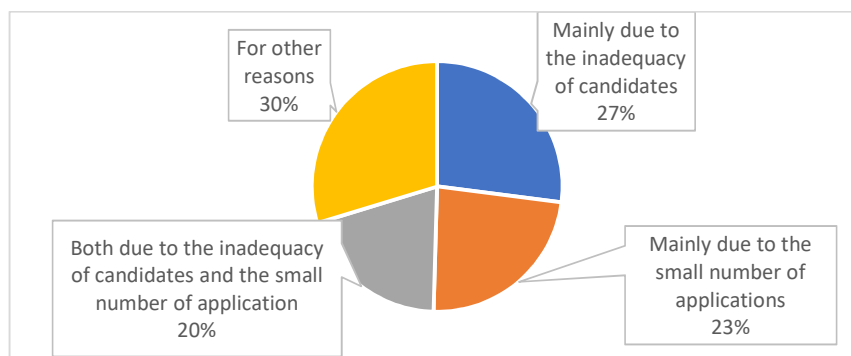
Figure 10. Reasons for recruiting difficulties.

Table 13 gives information on the professional figures that the enterprises have recruiting difficulties. The most frequently-mentioned figures are those related to information technology, specifically programming and software engineering. The demand for the professional figures in programming and software engineering will probably continue in the future as shown in Table 14. Programmer and Software Engineer together account for 50% in the nominated list of professional figures in future demand by the enterprises. It could be note the prominent position of the professional figure AI Engineer in both tables.

Table 13. Professional figures that the enterprises had recruiting difficulties.

Professional figures	Frequencies
IT Engineer (Kỹ sư CNTT)	34%
Programmer (Lập trình viên)	32%
Software Engineer (Kỹ sư phần mềm)	8%
Network Administrator (Quản trị mạng)	6%
AI Engineer (Kỹ sư AI)	4%
Electronic and Electrical Engineering (Kỹ sư điện - điện tử)	4%
Telecommunication Engineer (Kỹ sư viễn thông)	4%
Deployment Staff (Nhân viên triển khai)	2%
Mechanical Engineer (Kỹ sư cơ khí)	2%
QC staff (Nhân viên kiểm thử)	2%
Systems Engineer (Kỹ sư hệ thống)	2%

Table 14. Professional figures that the enterprises expected in demand in the future.

Professional figures	Frequencies
Programmer (Lập trình viên)	42%
AI Engineer (Kỹ sư AI)	8%
Software Engineer (Kỹ sư phần mềm)	8%
QC Staff (Nhân viên kiểm thử)	6%
Data Engineer (Kỹ sư dữ liệu)	5%
IT Security Engineer (Kỹ sư an ninh IT)	4%
Cloud Engineer (Kỹ sư cloud)	3%
IT Staff (Nhân viên IT)	3%
ERP Specialist (Chuyên viên ERP)	2%
IoT Engineer (Kỹ sư IoT)	2%
IT Infrastructure Engineer (Kỹ sư hạ tầng IT)	2%
Network Administrator (Quản lý mạng)	2%
Solution Consultant (Nhân viên tư vấn giải pháp)	2%
Systems Engineer (Kỹ sư hệ thống thông tin)	2%
Project Manager (Quản lý dự án)	2%
Team Leader (Trưởng nhóm)	1%

Marketing Staff (Nhân viên marketing)	5%
Nhân viên e-commerce (Nhân viên thương mại điện tử)	2%
Sale Staff (Nhân viên kinh doanh)	2%

3.4. Business results and future directions of the surveyed enterprises

The surveyed enterprises were asked to provide information on the sources of their clients. On the average, 46% of the clients of the enterprises are from Ho Chi Minh city, 23% of the clients of these enterprises are from other provinces and cities of Vietnam, and 31% of the clients are from overseas. Although the averaged numbers indicate the stronger share of domestic clients in the activities of the enterprises, there is a contrast among individual enterprises. An enterprise has a tendency to serve mainly either domestic clients or overseas clients. 64% of the sampled enterprises have less than 20% clients from overseas while there are a noticeable number of the IT enterprises (19%) serving dominantly overseas clients. Indeed, 15% of them serves only overseas clients.

Despite the Covid-19, most of the surveyed enterprises reported positively on business results. 87% of them reported their business goals achieved or achieved better than expected. This report is consistent with the recruiting situation of the enterprises. These enterprises were also positive about the future. 82% of them expected the business is growing in the future.
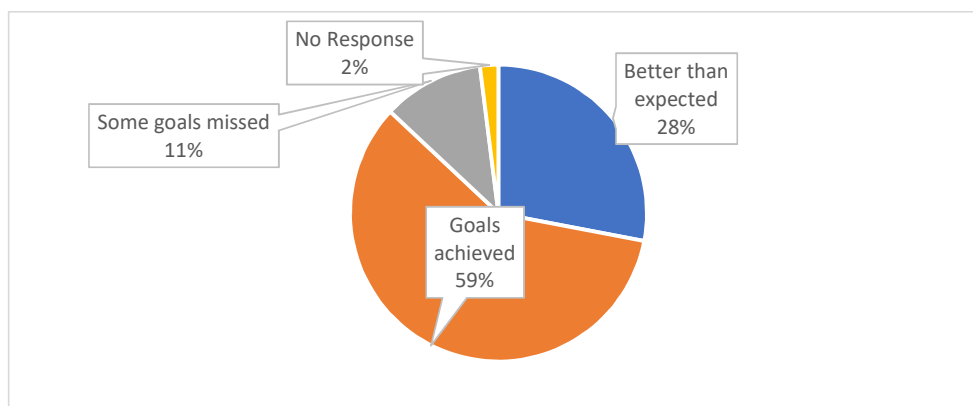

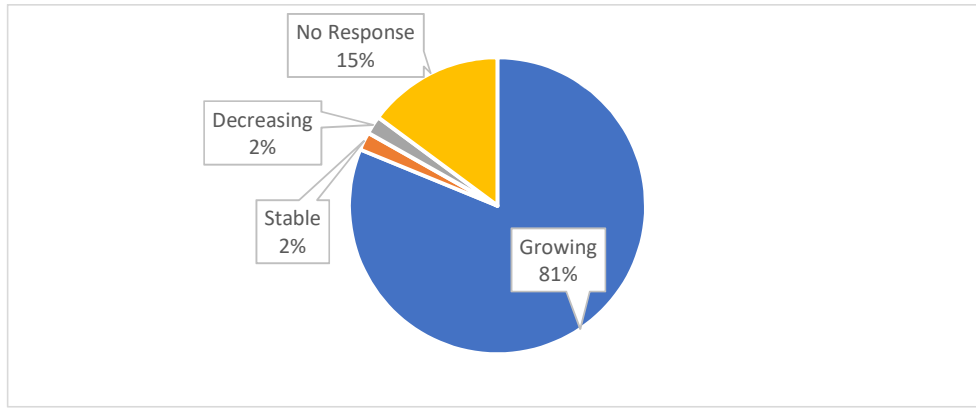**Figure 11. The enterprises' business results in the past year.**

Figure 12. The enterprises' business results in the past year.

The positive outlook of business also reflects in their answers on the future investment and direction of the enterprises (Table 15). A substantial portion of the surveyed enterprises (more than 70%) indicates that they will invest in expanding service, staff training/upskilling, research and development.

Table 15. Future investment and direction

Items	Currently investing	Intends to invest in the near future	Already invested sufficiently	I do not intend to invest / I do not consider it important	No opinion
1. Renovation/change of business location	15%	21%	16%	28%	20%
2. Replacement/modernisation of equipment	30%	20%	26%	8%	16%
3. Acquisition of new software	23%	21%	20%	20%	16%
4. Quality management system certification of company processes	21%	31%	18%	13%	17%
5. Entry/increase in overseas markets	41%	28%	7%	13%	11%
6. Search for new customers	72%	10%	8%	0%	10%
7. Expansion of the services offered	54%	16%	11%	2%	17%
8. Introduction of new professional figures currently not present in the enterprise	28%	25%	18%	13%	16%

24

9. Increase of professional figures already present in the enterprise	31%	31%	11%	10%	17%
10. Staff training/upskilling	74%	8%	7%	2%	9%
11. Research and development	64%	13%	11%	0%	12%

4. Organisational structure and professional figures

4.1. Typical organisational structures

Most of the enterprises are organized into functional departments: marketing, sales, accounting, administrative, software development, quality assurance (Figure 13). Smaller enterprises may have a simpler organizational charts through combining functional departments such as sale with marketing, accounting with administrative, software development with quality assurance (Figure 14). Larger enterprises with various business areas or location can have hierarchical functional organisational structure (Figure 15). A business unit is often a separate division within a organisation that has certain autonomy to implement its own operations to deliver a specific product type. A few enterprises have a matrix structure with business units and functional departments working together in projects (Figure 16).
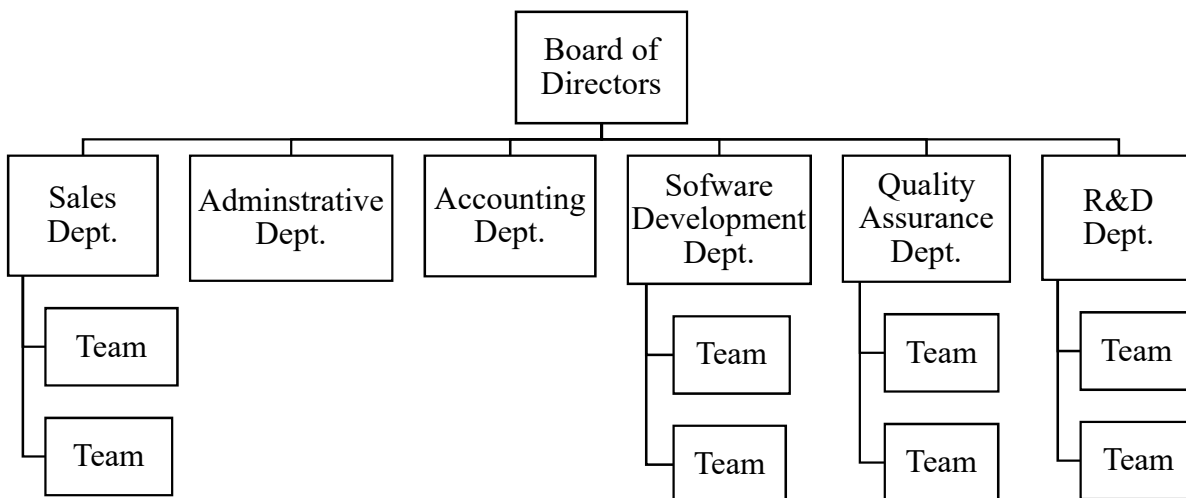

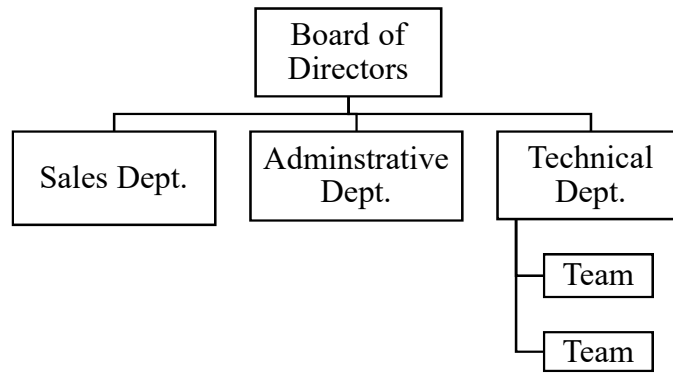**Figure 13. Functional organisational structure**

```
                    ┌──────────────┐
                    │   Board of   │
                    │   Directors  │
                    └──────┬───────┘
        ┌──────────────────┼──────────────────┐
┌───────────────┐  ┌───────────────┐  ┌───────────────┐
│               │  │  Adminstrative│  │   Technical   │
│  Sales Dept.  │  │     Dept.     │  │     Dept.     │
│               │  │               │  │               │
└───────────────┘  └───────────────┘  └───────┬───────┘
                                           ├──┌────────┐
                                           │  │  Team  │
                                           │  └────────┘
                                           └──┌────────┐
                                              │  Team  │
                                              └────────┘
```

Figure 14. Functional organisational structure at small enterprises

```
                                    ┌──────────────┐
                                    │   Board of   │
                                    │   Directors  │
                                    └──────────────┘
   ┌────────┬──────────┬───────────┬─┴──┬──────────┬──────────┐
┌──────┐ ┌──────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────┐
│ Sales│ │ Admin│ │Accounting│ │  Sofware │ │  Quality │ │ R&D  │
│ Dept.│ │ Dept.│ │  Dept.   │ │Developme │ │Assurance │ │ Dept.│
│      │ │      │ │          │ │ nt Dept. │ │  Dept.   │ │      │
└──────┘ └──────┘ └──────────┘ └──────────┘ └──────────┘ └──────┘
                      ┌────────────────┴───────────────┐
               ┌──────────────┐              ┌──────────────┐
               │  Branch or   │              │  Branch or   │
               │Business Unit │              │Business Unit │
               └──────────────┘              └──────────────┘
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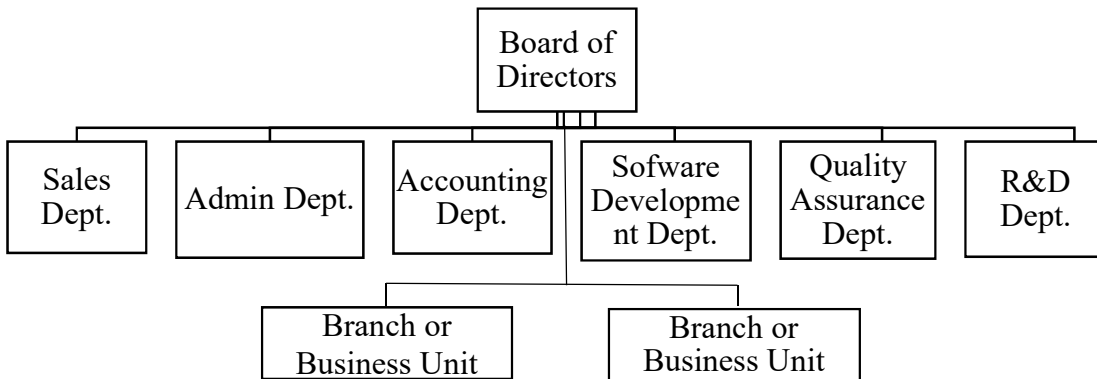
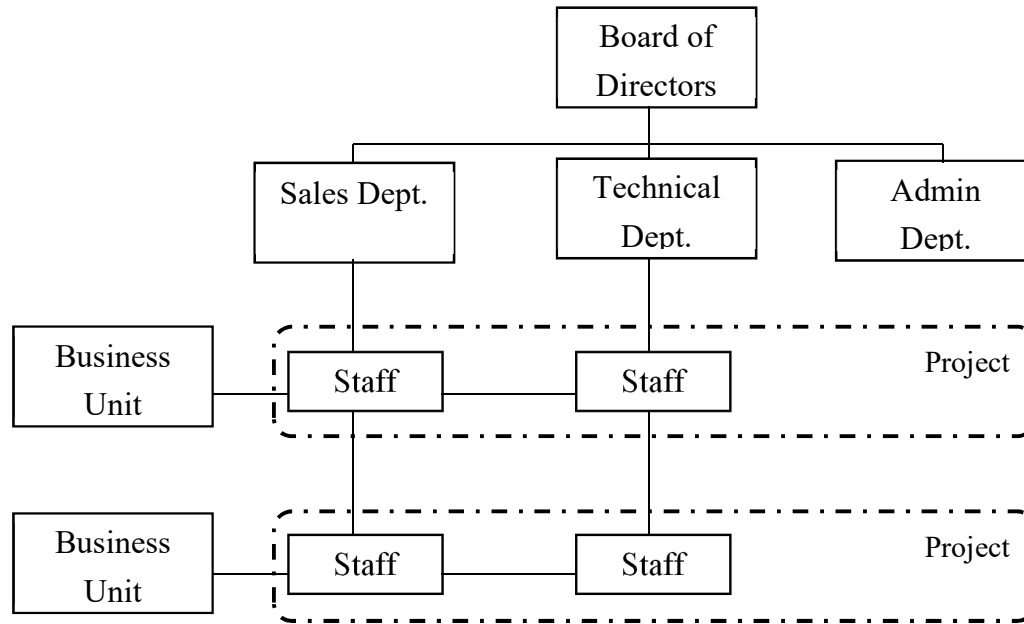**Figure 15. Hierarchical Functional Organisational structure at large enterprises**

Figure 16. Matrix organisational structure

In a functional organisational structure, dpeartments can typically have functions as follows:

- Board of Directors: BoD is the highest decision-making body in an organisation. Their function is leading the organisation and making major decisions for the organisation. Their duties include overseeing company operations, leading the development of the organization's long- and short-term strategies, managing the organisation's resources, managing the organization's resources, implementing strategic plans.
- Sales Department: The main function of a sales department is selling products or services for the organisation. A sales department can consist of a number of sales teams that work together to make sales, bringing revenues for the organisation. Their responsibilties also include handling sales issues, connecting custumers with other daprtements, building and maintaining relationships with customers.
- Administrative Department: this department generally provide the organisation support in the areas of human resources (HR), strategic planning, legal affairs, facilities and security. Its responsibilities include ensuring availability of stationeries and other office supplies, ensuring a clean and orderly office environment, ensuring the safety and secrutiy of workplace, the delivery and storage of documents, acquiring and managing the organisation's assets, the selection, recruitment and career development of staff, the development and implementation of HR policies.
- Accounting Department: This department is responsible for overseeing the monetary transactions and the budgetary planning and control of the organisation. Their responsibilities include storing financial information, ensuring the payment of funds into and out of a

company, preparing financial statements and reports for the organisation's leaders and investors, preparing tax reports, preparing budget.

- Software Development Department: the main function of the department is developing and delivering products and services to customers. A software department can consist of a number of teams that work separately on various software or colloborate with each other on a major product. Depending on the product, a team is comprised of 5 or more members taking various roles including a team leader, a developer, a business analyist, UX/UI designer, a tester. The responsibilties of the department include identifying customer's needs; designing, developing and deploying solutions for customers, providing training for customers, resolving technical issues.

- Quality Assurance Department: the main function of the department is ensuring a quality product. Their responsibilities include testing products during all phases of the software development lifecycle, identifying errors and bugs in products, providing developemt teams with complete information on product quality, working with development teams to resolve quality issues.

- R&D Department: The main function of an R&D department is to keep an organisation competitive by providing insights into the market, improving the existing products/services, and developing new services/products. Their responsibilities include researching and developing new technologies and new processes, experimenting with new technologies.

4.2. Professional figures

Programmer (Lập trình viên)

Programmers write code for computer programs, websites and mobile applications. They also are involved in maintaining, debugging and troubleshooting systems and software. This professional figure can have other name: Coder, Developer. Sometimes, the title is also differentiated by the frameworks and platforms that the professional figure works with such as Android Programmer, Mobile Programmer, Web Programmer, C/C# Programmer, Java Programmer, NET Programmer, PHP Programmer, Backend Programmer, Frontend Programmer, Full stack Programmer, etc. The title can be modified to reflect the seniority level of the position such as Senior Programmer, Junior, Fresher.

Requirements:

- At least bachelor degree in computer and information technology areas such as Computer Science (Khoa học máy tính), Software Engineering (Kỹ thuật phần mềm), Information Technology (Công nghệ thông tin).
- Depending on a particular position, a programmer is required to be familiar with or an expert in a certain programming framework, platform, software, and language such as Android, iOS, Java, PHP, NET, C#.

- For an entry/fresher level, no experience is required. For junior level, 1 or 2 years of experience are required. For more senior level, more than 4,5 years of experience are required.

Duties:

- Analyse customer needs;
- Write and test codes for computer programs, websites and mobile applications;
- Develop technical solutions to customer requirements;
- Update and optimize existing software and applications;
- Support end-user about software problems;
- Maintain and troubleshoot software and systems;

QC Staff/Tester (Nhân viên kiểm thử phần mềm/kỹ sư kiểm thử phần mềm)

QC Staff/Tester is the person who is responsible for assessing software quality through manual and automated testing. They are responsible for finding and reporting bugs and glitches. This title can have some variants such as QC Engineer, QA Engineer.

Requirements:

- At least bachelor degree in computer and information technology areas such as Computer Science (Khoa học máy tính), Software Engineering (Kỹ thuật phần mềm), Information Technology (Công nghệ thông tin).
- Knowledge of testing methodology, tools, and testing management software such as Agile methodology, Katalon, Selenium.
- For an entry level, no experience is required. For more senior level, 3 or more years of experience are required.

Duties:

- Analyse design documents;
- Work with the software development team to develop testing strategies;
- Develop and write test cases, checklist;
- Execute testing, detect defects, log defect in the defect tracking system;
- Report test results;
- Investigate defect reports and work with developers to correct;

Software Engineer (Kỹ sư phần mềm)

Software Engineer is another title for Programmer or Software Tester. An enterprise when advising for Software Engineer often refer to a Programmer but in some cases to a Tester.

Requirements:

- At least bachelor degree in computer and information technology areas such as Computer Science (Khoa học máy tính), Software Engineering (Kỹ thuật phần mềm), Information Technology (Công nghệ thông tin).
- Depending on a particular position, a software engineer required to be familiar with or an expert in a certain programming framework, platform, software, and language such as Android, iOS, Java, PHP, NET, C#; to be familiar of the software development process and testing methodology.
- For an entry level, no experience is required. For more senior level, 3 or more years of experience are required.

Duties:

As a programmer:

- Analyse customer needs;
- Write and test codes for computer programs, websites and mobile applications;
- Develop technical solutions to customer requirements;
- Update and optimize existing software and applications;
- Support end-user about software problems;
- Maintain and troubleshoot software and systems;

As a tester:

- Analyse design documents;
- Work with the software development team to develop testing strategies;
- Develop and write test cases, checklist;
- Execute testing, detect defects, log defect in the defect tracking system;
- Report test results;
- Investigate defect reports and work with developers to correct;

IT Engineer/ IT Staff (Kỹ sư CNTT/nhân viên CNTT)

The main responsibility of IT Engineer/IT Staff is to provide IT support to end-users. This professional position is present in almost all enterprises as a computer network is a tool necessary for today business. This professional figure may be sometimes called IT Helpdesk. In this case, the figure will provide IT support for outside customers.

Requirements:

- At least bachelor degree in computer and information technology areas such as Information Technology (Công nghệ thông tin), Computer Engineering Technology (Công nghệ kỹ thuật máy tính), Computer Network and Data Communication (Mạng máy tính và truyền thông dữ liệu).

- Knowledge of CMS frameworks (Wordpress, Joomla), network services (domain, SQL, VPN), common office software (MS Office), web programming, office computer and network equipment. A certificate on network administration (such as MCSA, CCNA) is a plus.
- An experience in IT support is often preferred.

Duties:

- Maintain computer systems and networks;
- Identify and recover errors and incidents relating to software, hardware and networks;
- Set up software and support end-users in using software;
- Install network equipment and other IT equipment;
- Operate websites and recover website incidents;
- Support network administrator in operating server systems;

Data Engineer (Kỹ sư dữ liệu)

In this Information Age, enterprises must deal with a massive amount of data, hence creating a need for data engineers who can collect and manage large quantities of data. Data Engineers build systems that collect, manage, and convert raw data into usable information so that organizations can use to evaluate and optimize their performance. This position may be also called Database Engineer.

Requirements:

- At least bachelor degree in computer and information technology areas such as Information Technology, Computer Science.
- Proficiency of common programming languages such as C#, Java, Python, R, Ruby, Scala and SQL. A good understanding of ETL (extract, transform, load) tools and APIs for creating and managing data integration jobs. Knowledge of relational and non-relational databases (NoSQL databases, Apache Spark, MySQL and PostgreSQL) and Unix-based operating systems (OS) such as Unix, Solaris and Linux. Being familiar with tools and frameworks for machining learning, deep learning, big data. Knowledge of cloud computing and data security is a plus.
- An experience in data engineering is often preferred.

Duties:

- Analyse customer requirements;
- Design data warehouses;
- Develop ELT tools and database pipelines;
- Develop algorithms to transform data into useful information;
- Create new data validation methods and data analysis tools;
- Develop Business Intelligence system;

Business Analyst (Nhân viên BA/chuyên viên phân tích nghiệp vụ)

A business analyst is a bridge between the customer and the development team. They are responsible for identifying, analysing the customer requirements and transferring these into technical requirements that the development team can use for developing solutions. This position often requires knowledge and skills in IT and business.

Requirements:

- At least bachelor degree in computer and information technology areas such as Information Technology, Information System. Degrees in business areas could be applicable.
- Knowledge of software development process, especially software requirement analysis and modelling languages and tools. Basic knowledge of programming, databases and testing techniques. General understanding business processes. Depending on a position, a specific business domain knowledge is a plus (banking, insurance, health care, human resources, etc.).
- For entry level, basic experience in developing or testing software is often required. For more senior level, 3 or more years of experience are required.

Duties:

- Work closely with the customer to identify, clarify and analyse the customer requirement;
- Build various requirement specifications (user requirement specification, functional specification, system requirement specification, etc.), use cases, user stories;
- Work with the development team to provide the solution proposal to the customer;
- Support in testing, verifying bugs/issues with the customer;
- Write user guide and train staff in how to use the new application;

UI/UX Designer (Nhân viên thiết kế UI/UX)

An UI/UX designer is a professional who designs the user interface (UI) and the user experience (UX) for a mobile app, website, and software. They create what a user will see and experience (layout, colour, fonts, images, button, menu, information flow, etc.) when interacting with a software or a website. This professional figure is also called Product Designer.

Requirements:

- At least bachelor degree in computer and information technology areas or in graphic design;
- Knowledge of common wireframing, prototyping and designing tools (Sketch, Figma, InVision, Adobe Suite, Visio, etc.). Knowledge of web technologies and platforms (HTML, CSS, iOS, Android). Knowledge of aesthetic and usability principles;
- From entry to senior levels.

Duties:

- Investigate user requirements;
- Develop a comprehensive UI/UX design strategy for the product;
- Produce UX design solutions through wireframes, visual and graphic designs, flow diagrams, storyboards, site maps, and prototypes;
- Design UI elements and tools such as navigation menus, search boxes, tabs, and widgets;
- Develop UI mock-ups and prototypes;
- Test UI elements and UX solutions;
- Collaborate with the marketing and development teams to optimize the user experience;

Deployment Staff (Nhân viên triển khai)

This professional figure can be also called Software Deployment Staff or Project Deployment Staff. The main responsibility of this position is to deploy, configure, and update software solutions at the customer site. Their focus is ensuring that the installed software functions as expected and the deployment process causes no disruption to the customer operation.

Requirements:

- At least bachelor degree in computer and information technology areas;
- Depending on the installed system, specific knowledge and skills of software technologies and platforms will be required. However, knowledge of networking, database, server technologies are generally required;
- From entry to senior levels.

Duties:

- Work with the customer to develop a deployment plan that meets their need;
- Deploy new systems at the customer site, update existing systems, or decommission old systems as needed;
- Test and troubleshoot installed systems;
- Guide and train the customer on using the installed systems;
- Provide technical support to the customer;
- Help in creating user guides;
- Create tools for automatic deployment.

Software Architect (Thiết kế phần mềm)

Software architect is person who design system architecture. Software Architect not only analyzes customer requirements (inside or outside the company) and then makes a system design but must closely monitor the Developer team when building the system, operating the system as well as when maintaining and expanding the system to ensure they follow the design correctly. Software Architect's work goes with project from start to the end.

Requirements:

- Bachelor's degree or equivalent in Computer Science, Information Technology. Master degree is an advantage.
- Experience in software development and a minimum of 3 years of experience in system architecture design or technical team leader.
- Extensive hand-on experiences in defining software architecture models of large-scale software systems from scratch using UML, 4+1 Model, C4 Model
- Deep knowledge of common architectural patterns and service design (SOA, microservices, messaging, twelve-factor methodology, integration patterns…)
- Experience with programming languages: Php, Python, JavaScript, node.js, C#, Java…, coding in RDBMS, NoSQL (MySql/MariaDB, PostgreSql, SQL Server, Redis, MongoDB, Cassandra, ES.
- Knowledge of statistics, data mining, machine learning and operational excellence of production systems is a plus
- Experience establishing legacy modernization and migration roadmaps for large-scale applications.

Duties:

- Work with the product manager and other stakeholders to clarify and document platform requirements/specs (functional and non-functional).
- Defining and create platform architecture models using modern software architecture, design patterns and solutions for high performance, high scalability, high availability, security, integrability and maintainability.
- Work with the development team to implement platform core services/base framework.
- Provide and monitor platform architecture design documentation, coding standards, implementation guidelines as well as ensure high quality implementation/code quality for the development team.
- Ensures that all relevant project teams follow a common set of principles and patterns and utilize a standard set of technology frameworks and libraries.
- Participate in technical reviews and lead the team in solving technical issues, contribute and maintain software architecture design standards, base frameworks, coding standards, best practices, common libraries at company level.

Network Engineer/Systems Engineer/Network Administrator (Kỹ sư mạng, Kỹ sư hệ thống, quản trị mạng)

A Network Engineer is responsible for deploying, operating, maintaining, and troubleshooting of computer networks. This professional figure can be also called Systems Engineer or Network Administrator. The main difference between a Systems Engineer and a Network Engineer is that

system engineers develop the computer system while network engineers work on these networks that have been developed. The difference between a Network Engineer and a Network Administrator is a Network Engineer provides technical support for clients while an administrator is often an in-house personnel. This position may be called IT Infrastructure Engineer.

Requirements:

- At least bachelor degree in computer and information technology areas;
- Knowledge of IP network/VLAN/VPN/Security products. Knowledge of network protocols (such as STP, HSRP, VRRP, EIGRP, OSPF, Policy Base Routing, IP SLA, EtherChannel, etc.). Knowledge of server operation systems (Linux, Window). Knowledge of network devices (such as Cisco, Juniper, etc.). Holding certification in network administration (such as CCNP, CCSA) is a plus;
- Experience in network administration is preferred.

Duties:

- Install, configure, and maintain network equipment and devices;
- Monitor network performance, analyse, and recommend required tunings to boost performance;
- Perform system upgrades including service packs, patches, hot fixes and security configurations;
- Troubleshoot network outages and connectivity issues;
- Implement security tools, policies, and procedures

Cloud Engineer (Kỹ sư điện toán đám mây)

A cloud engineer is a professional that builds and maintains cloud computing infrastructure. Their Duties include cloud architecting (designing cloud solutions for organizations), development (coding for the cloud), and administration (working with cloud networks).

Requirements:

- At least bachelor degree in computer and information technology areas;
- Knowledge of common cloud platforms (such as Amazon Web Services, Microsoft Azure, Google Cloud, and IBM Cloud). Knowledge of data storage and security on cloud. Knowledge of networking protocols. Knowledge of common programming languages used in cloud computing (such as Python, Java, Ruby). Knowledge of network operating systems such as Windows and Linux.
- Experience in cloud computing is often preferred.

Duties:

- Develop and implement cloud infrastructure;
- Configure cloud infrastructure components;
- Migrate computer systems to the cloud;
- Create applications and databases that perform on the cloud;
- Monitor cloud management and data storage services;
- Develop and maintain scripts to automate system tasks.

AI Engineer (Kỹ sư AI)

AI engineers are professionals who use artificial intelligence and machine learning techniques to develop applications and systems. AI engineers focus on developing the tools, systems, and processes that mimic human functions. This position is linked with Data Engineer. While a data engineer deals with collecting and managing data, an AI engineer focuses on developing application to process the data.

Requirements:

- At least bachelor degree in computer and information technology areas, or in Applied Math and Data Science;
- Proficiency of programming languages (Python, R, Java, and C++). Knowledge of probability, statistics, and linear algebra. Knowledge of big data technologies (Apache Spark, Hadoop, and MongoDB). Knowledge of AI algorithms and frameworks (machine learning algorithms, deep learning algorithms, Theano, TensorFlow, Caffe, Keras, and PyTorch).
- Experience in AI Engineering is often preferred.

Duties:

- Develop AI-based applications;
- Research and develop AI models and algorithm;
- Transform machine learning models into APIs that can be integrated with other applications
- Build end-to-end a Machine Learning application;
- Automate AI infrastructures.

Telecommunications Engineer (Kỹ sư viễn thông)

Telecommunications engineers design, construct, install and service telecommunications equipment and systems. Telecommunications engineers are often employed by major telecommunications providers or telecom equipment suppliers. They are also called Telecom Infrastructure Engineer.

Requirements:

- At least bachelor degree in Electronic Engineering – Telecommunication;

- Knowledge of telecommunications systems such as mobile networks, CCTV, PABX, PA, ACS, IP and VoIP. Knowledge of software for designing telecom networks and systems.
- From entry to senior levels.

Duties:

- Design, develop, test and install voice and data telecommunications networks;
- Develop proposals and determine costs and timelines for telecommunications projects;
- Test and implement new products and services;
- Configure networks and interconnected systems;
- Research, analyse and design system specifications;
- Identify and solve issues with current network systems;
- Monitor systems and identify needs for upgrades and enhancements;

IoT Engineer/ IoT Developer (Kỹ sư IoT, Lập trình viên IoT)

IoT Engineer is in charge of developing and managing solutions that use IoT technologies. While IoT Engineer deals with the creation and development of the IoT devices, sensors and software, IoT Developer is concerned mostly with the development of software applications that utilise IoT devices. Other related names are Embedded IoT Engineer, Embedded Software Engineer, Firmware Engineer.

Requirements:

- At least bachelor degree in ICT areas such as Computer Science, Information Technology, Software Engineering, Telecommunications, Electronics Engineering;
- Knowledge of firmware and hardware programming (Embedded-C, Embedded C++, Python). Knowledge of sensors. Knowledge of machine learning and AI. Knowledge of IoT platforms (Netbeast, Neura, OpenSensors and Node). Knowledge of IoT architecture and principles.
- Experience with programming front-end and back-end systems is preferred.

Duties:

- Analyse customer needs;
- Develop software that allows IoT devices to function and connect to other devices;
- Design, code and test features of IoT devices;
- Design platform solutions that are cloud-compatible and work with IoT applications;
- Research and develop IoT technologies.

Solution Consultant (Chuyên viên tư vấn giải pháp)

Solution Consultant is primarily responsible for developing new business opportunities for an enterprise. This position is not sole sales person. Part business analyst, part sales person, a Solution

Consultant works closely with the sales and technical teams to develop IT solutions that are suitable to the customer needs.

Requirements:

- At least bachelor degree in ICT or business areas;
- A combination of knowledge in relevant IT solutions and business administration;
- Experience in presale, software development, marketing is preferred.

Duties:

- Work with the customer to identify their IT needs;
- Introduce and advise the customer on feasible IT solutions that are suitable to their needs;
- Work with the technical team to propose IT solutions that are suitable to the customer needs;
- Work with the sale team to prepare cost estimation and payment plans for the customer consideration;
- Work with the sale and technical teams to prepare proposals for tendering;
- Analyse the market to identify market trends.

Team Leader/ Department Manager (Trưởng nhóm/Trưởng phòng)

The main responsibility of IT Team Leaders is to lead and coordinate their teams to achieve the goals set by the senior management. They oversee the day-to-day functions of their teams to make sure their activities on track. They also train and guide junior staff so that they can be equipped with new knowledge and skills required for their jobs. Depending on the size of a team and the organisational structures of an enterprise, this position could be call Department Manager or Technical Manager or Technical Director.

Requirements:

- At least bachelor degree in ICT. A degree in business and management is an advantage;
- Depending on the technical nature of their teams, a possession of comprehensive knowledge and technical skills in a certain technical field (software, testing, database, security, networking, cloud computing, IT solutions, etc.) is required. Soft skills such as communication, negotiation, organisation, leading and motivating are also required.
- Experience is required.

Duties:

- Carry out administrative functions;
- Plan team activities;
- Give direction and guidance to team members;
- Coordinate the work of team members;

- Coordinate with other teams and departments;
- Coach and mentor team members;
- Report to the senior management;

Project Leader/ Project Manager (trưởng nhóm dự án/ quản lý dự án)

A Project Leader is a person who is responsible for the success of an IT project. They plan, organize and implement all activities of a project to ensure IT solutions delivered on time and within the budget. Depending on the size of a project and the organisational structures of an enterprise, this position could be call Project Manager or Project Director.

Requirements:

- At least bachelor degree in ICT. A degree or certificate project management in business and management is an advantage

Duties:

- Work with the customer to identify their needs;
- Work with the sales and technical teams to develop a proposal for the customer consideration;
- Set project goals and develop plans, budgeting estimates to meet those goals;
- Maintain project timeframes and status reports;
- Manage resources for projects (such as computer equipment and staff);
- Coordinate project team members;
- Coordinate with related teams and suppliers;
- Liaise with the customer for project updating;
- Conduct risk assessments for projects;

4.3 Employability skills

In the interview, we also asked the interviewee to identify the non-technical skills and personal characeristics that are required from the employee. The following skills are identified across the professional figures:

- Teamwork and cooperation skills: the employee is expected to know how to coordinate his/her work with others. In buidling a cooperative relationship for teams, it is important that the employee has an attitude of cooperation and display a genuine concern for others.
- Communication skills: communication is strongly required in all professional figures. One of the most important communication skills required is effective speaking and presenting. Good communication skills also demand active listening. Furthermore, ability of reading professional documents and writing report is also essential for all professional figure.
- Goal management skills: the employeee should be able to manage his own time and the time of others. He/ she knows how to set goals and utilize time and manage workload efficiently

to achieve the set goals as well as monitor, define, prioritize and complete tasks without direct oversight.

- Problem solving skills: It means the employee should be able to identify complex problems and review related information to develop and evaluate options and implement solutions. In solving problems, it is important that the employee has abilities of pracical, analytical and logical thinking. He/she should also have a cognitive flexibility that enables innovative thinking to develop new ideas for and answers to work-related problems.

- Foreign language: ability to communicate in English is essential for all professional figures. At lower levels of job positions, the employee is expected to be able to read and understand technical documents. They are also expected to be able communicate (write, speak) in English at basic level. Senior positions are often required to fluently communicate in English. Some enterprises that are specialised in offshore service can also prefer employee with other language (for example Japanese) fluency.

- Personality: the employers appreciate highly the personalities of intitiave, dependability, integrity, stress tolerance, persistance, and attentive to details.

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Appendices

Questionnaires

Email content to Businesses for Survey

Kính gửi

Trường Đại học Nguyễn Tất Thành hiện đang phối hợp với trường Đại học Padova (Ý), Đại học Salamanca (Tây Ban Nha), Đại học Lisbon (Bồ Đào Nha) và một số trường đại học và hiệp hội doanh nghiệp tại Việt Nam và Ý thực hiện Dự án quốc tế "Khảo sát thị trường lao động ngành Công nghệ thông tin và Viễn thông".

Dự án có mục đích giúp phản ánh đúng về thực trạng thị trường nhu cầu lao động tại các doanh nghiệp hoạt động trong Công nghệ Thông tin và Viễn thông (ICT) để từ đó đáp ứng tốt hơn nhu cầu nhân lực của Doanh nghiệp.

Nhà trường trân trọng kính mời Quý doanh nghiệp tham gia vào nghiên cứu này thông qua việc trả lời các câu hỏi của bảng khảo sát với tư cách là nhà lãnh đạo doanh nghiệp/ nhà quản lý cấp trung/ trưởng các bộ phận tuyển dụng của doanh nghiệp/ chuyên viên nhân sự của doanh nghiệp. Bảng khảo sát cần khoảng 10 phút để trả lời. Mọi thông tin mà Quý doanh nghiệp đều được bảo mật và chỉ sử dụng để thống kê nhu cầu lao động.

Để tham gia vào khảo sát, Quý Anh/ Chị có thể nhấn vào link dưới đây.

https://docs.google.com/forms/d/1ZHnzTF_KQUN66vzWvTCBxQ13WhRd8s5_eELBsyWrErU/edit?usp=sharing

Rất cảm ơn sự đóng góp quý báu của Quý doanh nghiệp cho sự nghiệp giáo dục đào tạo của Nhà trường.

Để biết thêm chi tiết về dự án xin tham khảo website: www.labmovie.eu/vi

Trân trọng,

Dear…….

Nguyen Tat Thanh University is currently collaborating with the University of Padova (Italy), the University of Salamanca (Spain), the University of Lisbon (Portugal) and a number of universities and business associations in Vietnam and Italy in implementing the international project "Labour Market Observatories in Vietnam Universities".

The project's purpose is to help accurately reflect the current labor market situation at enterprises operating in Information Technology and Telecommunications (ICT) so as to better meet the human resource needs of the enterprises.

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We would like to cordially invite you to participate in this survey by answering the questionnaires as business leaders/middle managers/heads of recruitment departments, HR specialist of the enterprises. The survey takes about 10 minutes to respond. All information that your business provided is confidential and only used for statistics of the labor demand.

To participate in the survey, you can click on the link below.

https://docs.google.com/forms/d/1ZHnzTF_KQUN66vzWvTCBxQ13WhRd8s5_eELBsyWrErU/edit?usp=sharing

Thank you very much for your valuable contribution to the education and training system development.

For more information about the project, please refer to the website: www.labmovie.eu/vi

Best regards,