AN EVALUATION OF THE JOB OFFERS WITH A FOCUS ON CZECH DIGITAL ENTREPRENEURS AND START-UPS

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Abstract: The presented paper evaluates job offers posted by Czech start-ups, using data from the StartUpJobs website. The website focuses on advertising job offers for start-ups, using its definition of the term. The paper evaluates job descriptions, technological skills required by the companies, and offered benefits (e.g., remote working). The second part of the paper is focused on digital technology-related positions, as they constitute most of the offers. The structure of the required skills is compared with the worldwide trends and possible shifts in the structure of the offers are outlined, as the Czech job market tends to follow trends presented in the USA and Western Europe countries. As the last point, a variety of job descriptions is used to estimate the extent of products and services provided by digital start-ups and entrepreneurs.
The outcome of the paper can be used by educational organizations to customize portfolios of their courses to match the demand of the job market. Persons interested in working in the IT industry can use the outcome to efficiently plan their education to acquire the most demanded technical skills. The HR officers of companies can see how competitive their segment of the market is and whether their advertisements lack some widely offered benefits.

Keywords:
digital entrepreneurship, job market, software development, start-ups, job advertisements

JEL Classification: M10

INTRODUCTION

Digital entrepreneurship is one of the recent trends in entrepreneurship research. One of the reasons is that digital products and services are one of the key factors influencing the lives of most of the population of the world. Another reason is there are many digital start-ups, such as Alphabet (Google), Meta (formerly Facebook) or Twitter, that rapidly ranked among the world's largest companies. However, success stories of digital entrepreneurs can be found among Czech companies, such as Social Bakers or Avast.
Digital entrepreneurship also faces unique challenges and opportunities. As digital companies provide their services worldwide, a special tax policy is discussed or implemented to make companies pay taxes in countries where their services are consumed. (Bunn et al., 2020) As their product can be digitally distributed and consumed, many digital companies benefit from the recent COVID pandemic, and anti-COVID policies, such as lockdowns, distance education, and remote work. (Modgil et al., 2022) Furthermore, digital companies store and process huge amounts of data, so they can deliver a unique user-tailored experience. (Mariani & Fosso Wamba, 2020) Special regulations are also implemented to protect users' personal data and to define rules of competition among digital companies, such as Uber, and traditional service providers, such as local taxi companies (Collier et al., 2018; Thelen, 2018). On the other hand, digital entrepreneurs may become game changers in a highly regulated environment. (Dong, 2019)

The importance and positive impact of digital entrepreneurship can be observed from multiple perspectives. As the main example, European Commission created the Digital Economy and Society Index which "summarises indicators on Europe's digital performance and tracks the progress of EU countries" (European Commission, 2022b). The index consists of four areas: human capital, connectivity, integration of digital technology and digital public services. (European Commission, 2022a) The leading countries of the index in 2022 are Finland, Denmark, and the Netherlands, while the Czech Republic takes 19th place. Czech Republic achieved the best results in the human capital criteria, being limited by an insufficient number of IT experts. European Commission suggest Czech Republic should invest effort into training more IT experts. (European Commision, 2022) This suggests that the study of the job opportunities in the IT sector is important as superior working conditions and benefits may attract additional workforce to join the IT sector. Additionally, the majority of the components of the DISE index positively affect GPD per capita of countries in Central and Eastern Europe, so digital entrepreneurship positively affects the economy of a country. (Turuk, 2021) Digital entrepreneurship is also expected to support the transition of the economy, as it is expected that many current work positions may be replaced by technology in the future. Digital entrepreneurship is expected to be an important provider of work opportunities, as the amount of job opportunities in information and communication sector has been growing since 2004 (LMC, 2022b).

Digital entrepreneurs need to use various approaches to attract potential employees. Posting job offers to specialized websites is one of the common approaches. These website aggregates job offers from various companies and potential employees can browse and filter offers based on their level of experience, location, personal preferences etc.

The primary aim of this paper is to use the data to evaluate the technological and product structure of Czech digital entrepreneurship. Additionally, the paper aims to provide a review of technical knowledge that is required by the companies that can be used by newcomers to the IT sector to plan their education to maximize their chances to gain convenient employment.

1. LITERATURE REVIEW AND RESEARCH GAP DEFINITION

As a first step, a definition of key terms of the research needs to be established. The definition of digital entrepreneurship is a key point for selecting a data source for data analysis.

1.1 Digital Entrepreneurship

Various definitions of the term digital entrepreneurship can be found in the literature. Based on literature research and a systematic literature review by Kraus et al. (2019), four representative definitions were selected. Zaheer et. al use the term digital start-up to form a definition. According to them, a digital start-up "is a firm, or an organization with an established firm, in its early stages of development and growth in which digital technologies enable at least one of component of a business model in a way that is not just function but vital to the firm" (Zaheer et al., 2019, p. 2). Based on this, digital entrepreneurship is defined as "the process of creating a digital startup as a new business or within an established firm" (Zaheer et al., 2019, p. 3). According to the Davidson and Vaast, digital entrepreneurship is "pursue new venture opportunities presented by new media and internet technologies". (Davidson & Vaast, 2010, p. 8) Similarly, Guthrie defines digital entrepreneurship as "the creation of a venture to produce and generate revenue from digital goods across electronic networks" (Guthrie, 2014a, p. 116). Finally, Guthrie defines digital entrepreneurship as "the creation of a venture to produce and generate revenue from digital goods across electronic networks" (Guthrie, 2014b, p. 116).

A company require specific criteria to be compliant with the provided definitions. There are two possible approaches to filtering job offers. The first is the individual evaluation of each job offer of some generally focused sites (e.g., Jobs.cz) and the second is the selection of a specific data source. As the first approach would be extremely demanding and would require additional data sources, a second approach was selected. StartupJobs.cz site was selected, as it is generally considered the most popular site focused on job

advertisement of start-up companies. The website has developed its own definition of the term start-up as a company, which provides a unique and innovative product or service from the beginning of its operation. It also develops fast and dynamically, and it aims to bring value to society. (StartupJobs.com, 2022a) The definition means the site is not focused only on digital start-ups, however, digital technology-related offers will be selected, as described in Section 2. To be fully compliant with the provided description, digital technologies need to be a core component of a business model of a company. Approaches taken to provide maximal possible compliance with the provided definitions are described in Section 2 of this paper.

Digital entrepreneurship is a relatively new field of study. Several research areas can be found in the literature. Kraus et. all identified the following 6 research areas: digital business models, entrepreneurship process, platform and ecosystem research, entrepreneurship education and social digital entrepreneurship. (Kraus et al., 2019) Zaheer et al. added innovation, social, institutional, and regulatory framework, marketing and growth, performance, and impact on the industry. (Zaheer et al., 2019)

The number of research papers focused on digital entrepreneurship has been growing in recent years and researchers have been using both qualitative and quantitative research methods. (Anim-Yeboah et al., 2020; Baig et al., 2022) Many of the papers use a combination of both methodologies, which "suggests that digital entrepreneurship research is becoming more nature" (Anim-Yeboah et al., 2020, p. 198).

1.2 Job Offer Structure Research

Digital entrepreneurship requires specific skills in both technical and management perspectives. Agile techniques, such as SCRUM, are widely used to manage the development of digital products and services. (Paulk, 2013) From the technical point of view, various technologies and frameworks can be used. A sufficient level of technical knowledge is crucial for digital entrepreneurship.

As has been already mentioned, information technology experts are especially hard to find. This statement of the European Commission is confirmed by many articles, such as (ČTK, 2022; Kučerová, 2021). It is estimated that the IT sector is missing between 15 and 30 thousand experts. Furthermore, highly experienced employees may be hired to work remotely for foreign companies. (Špačková, 2022) These facts result in a highly competitive labour market.

1.3 Evaluation of Technology Usage

There are several approaches to evaluate technology usage. As this paper is focused on digital entrepreneurship, programming languages and connected technologies are especially of interest. The methods proposed in the literature are: open-source repositories studies (Delorey et al., 2007; Ray et al., 2014), online surveys, course surveys, (Meyerovich & Rabkin, 2013), job market sites analyses and interviews with developers from leading domestic companies (Prokop Y.V. et al., 2018).

This paper aims to study the technological structure of Czech digital entrepreneurship, thus, the open-source repository study would not be applicable, as the metadata of the repositories lacks information about the country of origin and size of the owning company. Additionally, many entrepreneurs do not publish their source code publicly. Course survey is limited to student respondents, all of whom may not be fully established in IT sector. The paper uses existing online surveys as additional sources of information.

1.4 Definition of the Research Gap

There was no research paper focused on the evaluation of job advertisements of Czech start-ups by the authors. The paper aims to evaluate the current situation and to define a methodology for the evaluation so that job advertisements can be evaluated periodically and the development of trends in the future can be monitored.

2. USED DATA AND METHODS

A primary source of the data are job advertisements available on the site Startupjobs.cz. All data were collected on 27th August 2022, when there were 953 advertisements posted on the web. The advertisements

include the following information: position title, location, employment type (e.g., full-time employment, part-time employment etc), a list of requirements and used technologies, a list of benefits, a contract type (e.g., employment contract, freelance cooperation etc.), a required level of expertise (junior, medior, senior). Each advertisement also includes a semi-structured text with an introduction of a company and its core business, a description of a position, and additional details about requirements and positions.
As all the start-ups posting advertisements to Startup.com might not be digital entrepreneurs, a sample of companies was created. The business model of the companies of the sample was analysed using company descriptions on Startupjobs.cz and the information websites of the companies. It was found out all of the companies in the sample are compliant with the provided definition of the digital start-up, as digital technologies, digitally distributed products and services are core parts of the business of the companies. As a result, this paper uses the information provided in the 953 advertisements.
As a web survey, Stack Overflow Developer Survey was selected. This survey is performed on yearly bases by Stack Overflow, a large community web. The 2020 survey was filled by 73268 respondents. (Stack Exchange Inc, 2022)
All data processing is done using Python programming language (van Rossum & Drake, 2009) and modules Pandas (McKinney, 2010) and Matplotlib (Hunter, 2007).

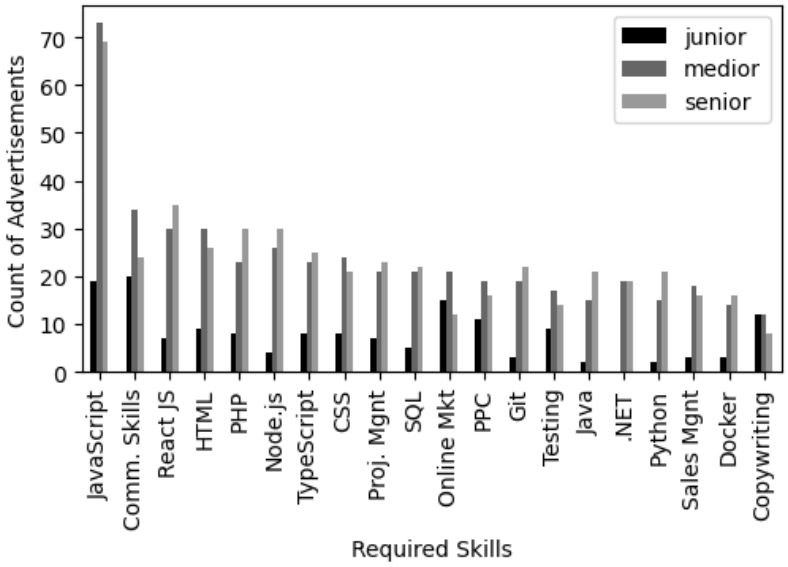
3. RESULTS

The results are focused on the following areas: required skills and used technologies, promoted benefits, location and employment type, titles of advertisements and job positions and language of the advertisements, and an offered salary. These data values were selected because they are available for the majority of the advertisements in a well-structured form, so they can be easily evaluated.

3.1 Required Skills

This section is focused on the evaluation of requirements. A list of required skills is provided for each advertisement, as well as the required general expertise of a candidate. There are three expertise levels used in the advertisements: junior, medior and senior. By the definition of StartupJobs.cz, a junior is a candidate with 2 years of expertise at maximum, a medior is a candidate with 2-5 years of expertise, and finally, a senior is a candidate with more than 5 years of expertise. (StartupJobs.com, 2022b) Some of the advertisements had been marketed as suitable for both junior and senior, omitting medior though. In these cases, they were marketed as suitable also for mediors for this research, as it can be assumed that a position expedient for both junior and senior candidates should be expedient for mediors.
As can be seen in Fig. 1 Count of required skills in the advertisements, JavaScript is by far the most demanded technology. Considering technological skills, it is followed by React.js and Node.js, which are both closely connected with JavaScript, and by TypeScript, which is a strongly typed language built on JavaScript (Microsoft, 2022). Regarding non-technological skills, communications skills, project management, online marketing, sales management, and copywriting are among the top required.

Fig. 1 Count of required skills in the advertisements

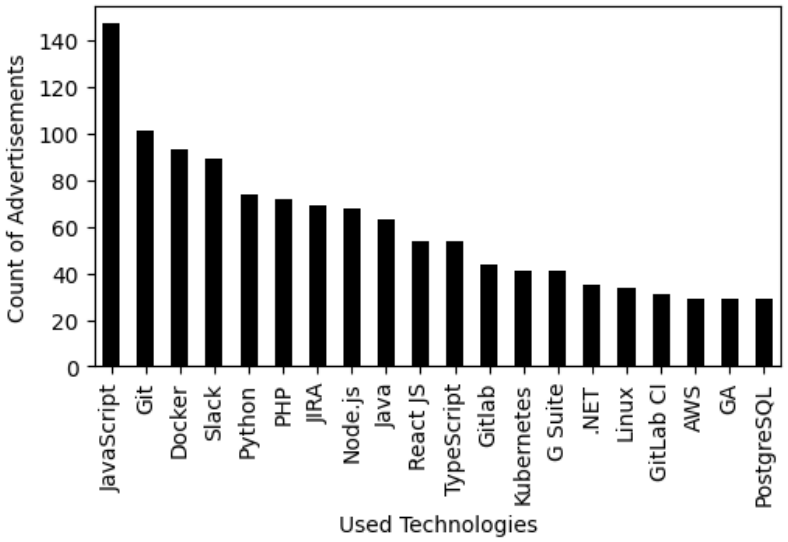


Source: own elaboration

In conclusion, it can be said that candidates with a knowledge of JavaScript have the highest chances to acquire employment in a Czech digital technology start-up.

Some of the advertisements have provided a list of "used technologies", i.e., a list of technologies that are planned to be used by an accepted candidate. The results can be seen in Fig. 2. This information is provided in 505 advertisements (52 %). There was 1 technology defined in 111 advertisements, 2 technologies in 75 advertisements, 3 technologies also in 75 advertisements, 4 technologies in 72 advertisements, 5 technologies in 38 advertisements and 6 or more technologies in 134 advertisements.

Fig. 2 Count of used technologies



Source: own elaboration

The count of used technologies in advertisements can be seen in Fig. 2. As can be seen, JavaScript is both the most required and most used technology. It is followed by Git and Docker, which are lower in the rank of

requirements perspective. This may be explained by the fact that these technologies are easier to master than Node.js, React JS or TypeScript and a potential candidate is capable to learn them quickly. The other possible explanation is these skills (especially Git) are widely used (Synopsys, 2022) and they are omitted from the requirement list for a clearer arrangement of an advertisement. Slack, JIRA or G Suite are other examples of easy-to-learn products. JIRA is also highly customizable software, and a new employee will have to be instructed in the company-customized instance of JIRA anyway. A potential employee also may have a potential preference towards a specific software product and if a company add a preferred product to the list, then the potential employee may be more favourable towards the advertisement.

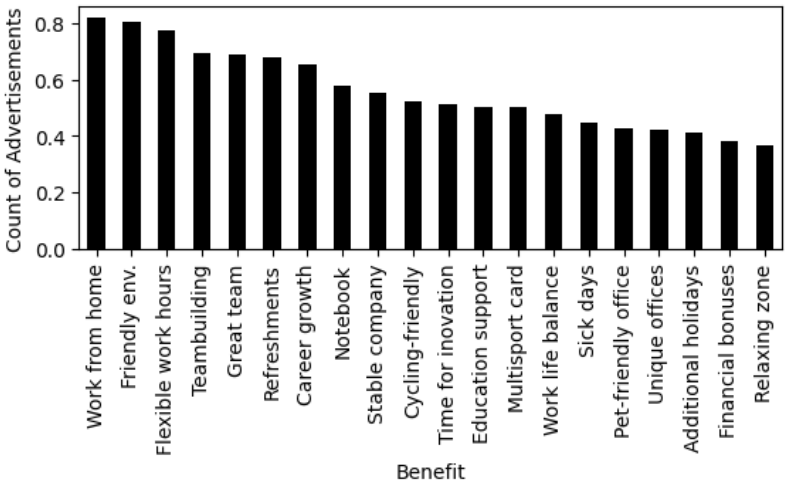
3.2 Promoted Benefits

Each company can provide a list of benefits which are represented as icons in each advertisement. There is no limitation for a count of benefits per one advertisement, so the variability of benefits per one advertisement is high. Some of the benefits can be considered subjective, such as a "friendly environment" or "great team", as these aspects of an environment of a company might be evaluated differently by diverse employees. Some benefits have a more specific form; however, they still differ among advertisements. For example, work from home benefit is specified as an occasional possibility to work from home by some companies, whereas other companies offer a fully remote work regime.

A count of the most common benefits in advertisements can be seen in Fig. 3. The most mentioned benefit is the possibility to work from home, which is present in more than 80 % of advertisements. On the other hand, a lot of companies offer benefits that can be consumed only on-site, such as refreshments, unique offices or relaxing zones. Other benefits, such as cycling-friendly and dog-friendly offices, aim to make commuting to offices more convenient.

The possibility to work remotely is marked in advertisements separately. A possibility to work remotely is marked in 402 advertisements (42 %), whereas 551 (58 %) are not. This implies that about 41 % of remaining job positions require occasional work from an office and the remaining 7 % require regular office attendance.

Fig. 3 Count of benefits in the advertisements



Source: own elaboration

In conclusion, (at least partly) working from home can be considered a standard benefit, nonetheless, many benefits aim to motivate employees to regular attendance of offices. Start-ups also emphasise "soft attributes", such as a friendly environment and a great team, in high percentages.

3.3 Locations, employment type

The location of potential work is an important attribute, as Czech employees rarely move to another city because of work (ČT24, 2018). Despite being allowed to work from home at least for part of a week, a distant location of the workplace presents a limitation for many potential employees. The number of locations per advertisement is not limited.

As can be seen in Table 1, most offers are advertised in Prague, followed by Brno, Ostrava and Plzeň. There are several reasons for digital entrepreneurs to select cities, such as the higher availability of a qualified workforce. Cities may be also viable for entrepreneurship in highly regulated sectors (Geissinger et al., 2019).

Table 1 Count of the TOP 10 locations in advertisements

Praha	807
Brno	193
Ostrava	47
Plzeň	33
Zlín	31
Pardubice	30
Hradec **Králové**	29
Olomouc	24
České **Budějovice**	21
Liberec	18
Bratislava, **Slovensko**	18

Source: own elaboration

From the employment type point of view, full-time employment is offered by 901 companies and part-time employment by 249. Thus, the full-time employment offers exceed the part-time employment type, and the number of part-time employment offers is still significant. The employment type is an important attribute of some socioeconomic groups, such as students and parents with small children. As Czech companies strongly express a strong preference towards full-time employees (Veinbender, 2021), the possibility of part-time employment may be a motivation to start working for digital entrepreneurs. Regarding the contract type, an employment contract is offered in 617 advertisements, freelance cooperation in 578 advertisements and an internship in 64 advertisements.

3.4 Titles of advertisements, position groups, language

There is a great variety of titles in advertisements. The most used words in titles of advertisements are a developer (183), manager (99), engineer (75), senior (71) and junior (62). Names of technologies are quite rare in the titles of the advertisements – PHP is used in 41 titles, Java in 20, Python in 14 JavaScript only in 9. Term front end is used 38 times which is fewer than a count of advertisements with frontend development technology, e.g., React JS. The advertisements are also split into groups. A percentage of advertisements in individual groups is shown in Table 2.

Table 2 Advertisements in groups

Group	Percentage of advertisements
Development	48%
Marketing and sales	21%
Analytics	6%
Management	13%
Administrative positions	12%

Source: own elaboration

As can be seen, almost half of the advertisements are listed in the Development group. The majority of advertisements (751) are written in Czech and the remaining 201 are written in English.

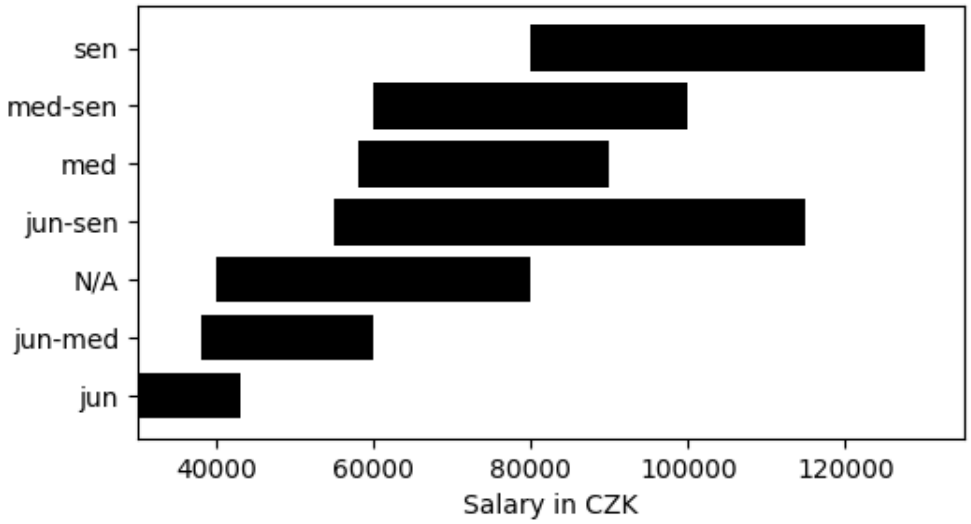
3.5 Salary

Web Startupjobs.cz offers the possibility to specify the salary of the advertisement, however, the salary is not filled 620 (65.1 %) of advertisements. A salary in Czech crown is filled for 332 (34.8 %) advertisements and in Euro for 1 advertisement. Advertisements with salaries in the Czech crown are used in the rest of this section.

Salary is specified as the number of Czech crowns per month in 310 advertisements and as the number of Czech crowns per hour in 21 advertisements. A value is set as an interval for 324 advertisements and as one value for 8 advertisements.

As can be seen in Fig. 4, a median range depends on a level of experience. While the median range (calculated as the median of the lower bound of salary ranges and median of upper bound of salary ranges) of a salary for a junior candidate is between 30000 CZK and 43000 CZK per month, a salary range for a senior candidate is between 80000 CZK and 130000 CZK. Advertisements that are overlapped over multiple levels have, as can be expected, a wider salary range.

Fig. 4 Average salary range for levels of experience



Source: own elaboration

In conclusion, most advertisers do not publish salary information. From the remaining advertisers, a potential employee may expect a significant salary increase with a growth of experience.

4. DISCUSSION

4.1 Required Skills

The popularity of programming languages among professional developers, as given by Stack Overflow research, is given in Table 3. As can be seen, JavaScript is the most popular programming language. Python is more popular than PHP, TypeScript, and Java, whereas Python was the last from the quartet in requirements of Czech entrepreneurs. Python outperforms these languages in the list of Used technologies, however, this information is provided in only 52 % of advertisements, so the list of requirements is a more copious source of information. Periodical analysis of job advertisements could evaluate whether there will be

a shift towards greater popularity of Python among Czech digital entrepreneurs. Multiple languages are usually combined in one project, so the sum of the popularity exceeds 100 %. For example, HTML/CSS and JavaScript is combined in many web-application projects.

Table 3 Popularity of programming languages in Stack Overflow Survey

JavaScript	67.9 %
HTML/CSS	54.9 %
SQL	52.6 %
Python	43.5 %
TypeScript	40.1 %
Java	33.4 %
C#	29.7 %
Bash/Shell	29.47 %
PHP	21.42 %

Source: (Stack Exchange Inc, 2022)

Node.js and React.js are the most popular in the "Web frameworks and technologies" category, used by 46.3 % and 44.3 % respectively. .NET is the most popular in the "Other frameworks and libraries" category, used by 36.4 % of professional developers. Docker is the most popular in the "Other tools" category, used by 68.6 %. And finally, PostgreSQL is the most popular in the Database category, used by 46.5 % of professional developers. (Stack Exchange Inc, 2022)

As a result, the requirements of Czech digital entrepreneurs are in harmony with the current worldwide preferred technofixes. Front-end development is expected to be the main source of work opportunities. The open question is a potential rise of the popularity of Python in the requirements.

4.2 Promoted Benefits

Benefits are considered important by employees, as they are the second most important motivation to change an employer. (LMC, 2022b) The number of companies offering work-from-home rose significantly during the COVID pandemic and a work-from-home is offered to at least some employees by 89 % of Czech companies. (LMC, 2021a) On the other hand, many work positions do not allow working from home and the possibility to work from home is limited for many work positions. Taking data from the largest job advertisement site Jobs.cz, 8891 advertisements from 21788 (41 %) include a possibility to work from home. (LMC, 2022a) An open question is whether the Czech digital entrepreneurs will keep offering work from home in the current ratio, as this working model also has disadvantages and there is no clear consensus regarding the motivation of home-working employees. (Bočková & Lajčin, 2021) Currently, rising prices of gas and energy may also influence the preference of both employers and employees.

Digital entrepreneurs also differ from other companies in other benefits. They emphasize "soft" benefits, such as a friendly environment and great time, whereas large companies tend to attract employees on benefits such as meal tickets, pension fund contributions or paid services of contract partners. (LMC, 2021b)

It is expected that digital start-ups will keep emphasizing "soft" benefits, as these attributes are commonly anticipated by a potential employee and a potential employee may substitute these benefits for a higher salary and financial benefits offered by larger companies.

4.3 Locations, employment type

The structure of employment differs among regions of the Czech Republic. For example, 10.5 % of full-time employees work in the information and communication services sector in Prague, whereat it is only 1.2 % in the Liberec region. The country-wide average is 3.8 %. (Český statistický úřad, 2022b) Many regional governments aim to attract digital entrepreneurs by founding business incubators, however, the efficiency of such support is questionable. (Dvouletý et al., 2018) Additionally, Prague and Brno are ahead of other

locations so they will most probably keep their leading positions in a long term. It can be also expected that they will keep open part-time employees, however, other companies may start to open part-time positions in a greater number and digital entrepreneurs may be forced to compete with larger companies for this group of employees.

4.4 Salary

The average salary in the Information and communication services sector in the Q2 2022 was 69854 CZK. (Český statistický úřad, 2022a) Also, the Czech Statistical Office publishes salary distribution for individual sectors, however, these data are hard to compare with the salary ranges. For example, the median range of senior candidates was between 80000 CZK and 130000 CZK, whereas 25.9 % of all employees in the Information and communication services sector were in this salary range in 2021. (Český statistický úřad, 2022c) Similarly, 23 % of employees are in the median medior range and 20.9 % in the junior range. A more detailed study of advertisements outside the start-up environment would be required to compare the salary level between start-ups and the rest of the economy. Additionally, a salary can be skewed by different types of employment, as it usually means gross salary for an employee and an invoiced sum of money per man-day by a contractor.

CONCLUSION

It can be expected that Czech digital entrepreneurs are going to focus on the growth of capacity in front-end development, as technologies used for this are most required. A potential employee with knowledge of JavaScript and related technologies can select from the greatest number of advertisements. On the other hand, communication skills are also required for many positions. Potential employees may expect to work from home as the main benefit, however, employers often expect employees to attend the office for at least part of the week.

If a person wants to join an IT start-up with little technical knowledge, he/she can maximize his/her chance by focusing on the study of JavaScript and related technologies. Living or being able to commute to Prague or Brno is also a great advantage, however, daily attendance at a company office is rarely required.

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