HOW LATVIAN DEVELOPERS LEARN NEW TECHNOLOGIES. A CONCLUSIVE REVIEW AND ANALYSIS OF SURVEY DATA

KĀ LATVIJAS IZSTRĀDĀTĀJI APGŪST JAUNĀS TEHNOLOĢIJAS. APTAUJAS DATU APSKATS UN ANALĪZE

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Abstract., *The goal of research is to give an overview of the skills, tools and informal learning methods used by Latvian software developers and IT students to learn new technologies and compare results with similar international survey conducted by "Stack Overflow". Furthermore, another author's survey campaign aimed at IT industry employers to study their opinion about current workforce situation in Latvia's IT industry's labour market, and main criteria that are important for hiring new job applicants. This insight research is based on survey, where 8 employers and 52 software developers and students responded on the questions.*

Keywords: *e-learning, information technologies, learning platforms, system developers.*

Introduction

Because of technological advancements in the last decades need for information technologies (IT) specialists has increased, but demand is higher than the supply of the skilled specialists. Universities can provide only a fraction of the needed professionals. There is also a strong belief that systems development and knowledge needed for it are one of the most basic and significant competences that are essential to become successful specialists in the field of IT. Nevertheless, there is a gap between the skills academic institutions teach and what the industry needs, as many students graduate without even writing a program that has more than 1000 lines of code, but most of the working systems consist of millions of lines [1].

This is due to the fact that each have a different goal. The companies of IT sector prefer to employ developers that are trained in using the latest tools and techniques, but the academia's goal, according to Stroustrup, is to produce better professors [1]. On one hand it could be agreed about the academia, but on the other hand they also try to produce better professionals, but there is a gap between what they teach and what is relevant in the industry at the moment. Therefore, there is an emerging trend of people who learn IT related skills through online applications, courses or groups, as they provide the basics and tools and techniques that are compatible with the current trends in the industry.

One of the examples of online learning platforms is "Stack Overflow" (*stackoverflow.com*), that provides tools for learning various programming frameworks and allows to ask questions or problems and discuss them with peers. It provides an environment which in most cases academia lacks, which is a team learning, as it is the most common that in the industry developers are the part of the team and seldomly work alone [1]. Each year the "Stack Overflow" organize survey about how developers learn, build their careers, which tools they're using, and what they want in a job. Over 100 000 developers took the 30-minute survey [2].

The goal of this study is to ascertain whether a similar situation is found in Latvian IT industry focusing on acquired frameworks and skills in online learning outside of formal education in Latvia. Therefore, data from "Stack Overflow" survey are compared to the survey data acquired by surveying Latvian IT companies and their developers including opinions of students. Using survey results, authors analyse the current recruitment processes for hiring IT specialists and evaluate the role of the formal education in assessing potential employees by the hiring companies.

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Materials and methods

Two surveys were completed to understand the situation in Latvian IT industry. One had been prepared for the IT companies working in Latvia and the second - for software developers and students, who are studying to become IT professionals. "Google Forms" online service was used to complete the surveys, which provides data gathering and analysis with graphical reflection of the results. Obtained information was used for the empirical study.

Companies for the survey were selected using online services like "1188" (1188.lv), using recruitment websites like "LikeIt" (likeit.lv) and recruitment fair materials of Riga Technical University, which contained companies that are going to participate, and search engines looking for the leading IT companies in Latvia. Both surveys were sent to 39 IT companies specialized in custom software development, testing, support and other IT related services. The most part of the companies are in Riga. Only five of companies are located in other cities of Latvia like Rezekne, Daugavpils and Liepaja.

The first survey contained questions related with the knowledge and capabilities of company employees. Furthermore, to gain their opinion they were asked about the current employment situation of IT industry and what are the main drawbacks in hiring new professionals, including if the company had vacancies, and whether specialists who have taught themselves or by using online learning tolls could be good specialists. Additionally, to the first questionnaire, companies were asked to disseminate the second survey to their software developers.

The second survey contained questions similar to "Stack Overflow" questionnaire in order to be able to compare worldwide situation with Latvian IT industry. Due to the low number of respondents, who are employees of IT companies, students, who study in Rezekne Academy of Technology (RTA), were also surveyed. Furthermore, the survey was circulated in IT forums - *Facebook* group "Freecodecamp" and "boot.ritakafija.lv". The questions ranged from programming experience and education (academic and alternative) to frameworks used daily.

Results and discussion

The following results are based on two surveys described in the section *materials and methods*. Only 8 respondents replied and submitted their answers. 62.5% of companies are located in Riga or in Riga region, others - in the biggest cities of Latvia (Daugavpils, Liepaja, Jelgava, Jurmala, Ventspils, Rezekne etc.). The same percentage (62.5%) can be classified as the small enterprises having up to 50 employees and 37,5 % as micro-enterprises having up to 9 employees employed.

To find out opinions of companies about current labour situation in IT industry, authors asked them to describe it using range from [1; 5], where '1' represents 'very bad' and '5' represents 'very good'. Results are depicted in Fig. 1.

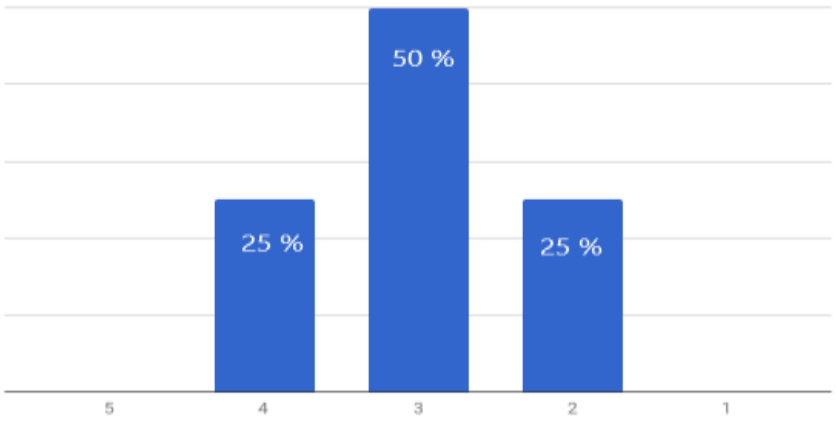

Figure 1. Distribution of answers on the question "How would you describe the current labour force situation in labour market of IT industry of Latvia?"

From all the respondents 50% rated current situation as normal, opinions differed for the other half of answers. Respectively 25% viewed current situation as bad, while other 25% see it opposite as good. Meantime while asked "*Do your company currently have any vacancies?*" 75% answered "*Yes*" and 25% replied with "*No*". In case if job applicants are not complying with company requirements, authors asked respondents "*The main reasons that, in your opinion, make it more difficult to recruit new employees (applicants)*" results are following (see Fig. 2):

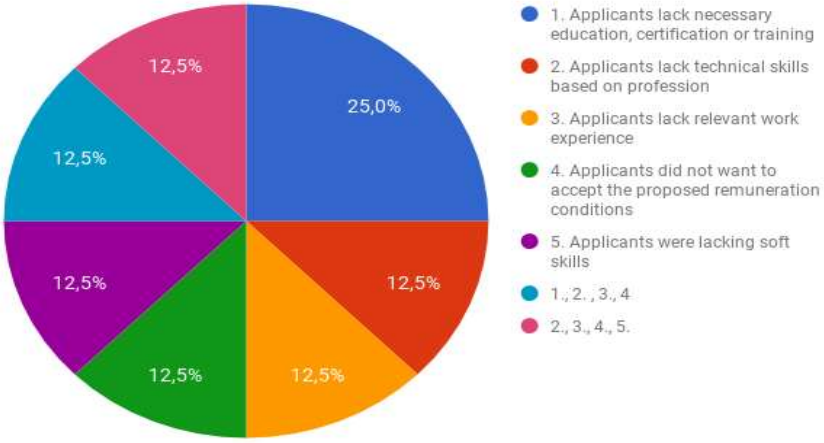

Figure 2. The main reasons, according to companies, why there is difficulty to recruit new employees (applicants)

According to Figure 2, there is no distinct problem or reason for hiring new job applicants. By analysing answers of each respondent, some people have similar opinions: three of them found it difficult to hire new applicants due to their lack of education, certification or lack of necessary training. Other similar opinions were lack of experience, soft skills or technical knowledge based on the job application for which specialists were required. Two of the respondents replied also that one of the reasons was that applicants did not want to accept the proposed pay conditions. This can be viewed also as one of the reasons why our specialists decide to work abroad due to high salary gap comparing to US or other European countries [5]. The Internet recruitment company "CV-Online Latvia" organize special study of salary and remuneration tendencies in Latvia each year. Study includes information on the average monthly net remuneration in Latvia's main business sectors [6]. According to their newest study

(2017), Latvian IT sector has the average net salary of 13980.00 € in year. Comparing with IT recruitment company "DAXX" results, average yearly software developer salary, for example in Sweden, is 43711.00 € [5], which is almost three time greater than in Latvia.

According to the Ministry of Economics of the Republic of Latvia information and information technology specialists, significant shortage of workforce will be in the closest future [3]. Therefore, the special list of occupations was prepared and harmonized in 2017 as a legislative proposal to attract foreign specialists under following preferential conditions [4]:

- if the employee will want to receive an *EU Blue Card* - the minimum wage should not be lower than average gross wage in Latvia multiplying by coefficient 1.2 (instead of the previous 1.5);
- in other cases - foreigners will be able to attract a vacancy, which has been registered at the State Employment Agency for at least 10 working days (instead of the previous requirement - not less than a month).

The list includes 29 professions, with a significant emphasis on the IT sector. Nevertheless, Latvia's competition with other European countries for IT specialists is highly difficult due to high salary gap reasons. Additional or improved current preferential conditions should be viewed.

According to authors, there are two perspectives in viewing formal education effectiveness in preparing new IT specialists, who are ready for work immediately after their graduation. One is the non-formal education perspective and another - pro-formal education. According to Peter Andreas Thiel, American entrepreneur and co-founder of payment system *PayPal*, students that has the right skills and talents should skip college and he'll even pay 100 000 $ to these students to start their own start-ups [7]. Idea is that usually formal education is not teaching students the latest scripting languages, tools or technologies necessary in starting their own businesses or career in IT sector, thus wasting their time and potential. Many IT industry employers have similar point of view that bachelor or masters diploma in computer science is not a key factor in evaluating applicants' conformity to job application, instead programming skills and experience has higher evaluation value. During our company's survey, author's asked employers "*How many employees in your company have learned technology through self-education without obtaining corresponding formal education?* ", almost majority answered that they have at least one employee that has learned programming outside of confirming formal education. Three of the respondents replied that majority of their staff members are without corresponding formal education in computer science and has self-thought the necessary technologies. Also, all respondents have answered that they would employ a developer or programmer without prior formal work experience, but with a wide software development portfolio and activities on the *GitHub*.

Most of the 52 respondents, who responded to the developer's survey were male (80.8%), and the rest either did not want to specify or were women, which represents the existing stereotype that the IT industry mostly consists of male specialists. A similar picture was found in the "Stack Overflow" survey, where 92.9% of the participants were male. Opposite to the companies' results, 57.7% of the developer respondents live in one of the biggest cities and only 30.8% reside in Riga and its region. As can be seen in the Figure 3, the youngest respondents reside in the Latvian biggest cities, excluding Riga. Figure 3 also represents the age of the respondents correlated to their residence. It can be seen that the most of the respondents are 20-24 years old, but it can be explained with the fact, that the survey group included students, who study in RTA. Judging from the results 69.3% of the respondents are below 30 years old. In the "Stack Overflow" questionnaire the 49.2% are in the range of 25-34 years old and 26.1% are younger than 25 years [2]. Situation is not similar, however, authors think, that the study carried out is impacted by the student respondents.

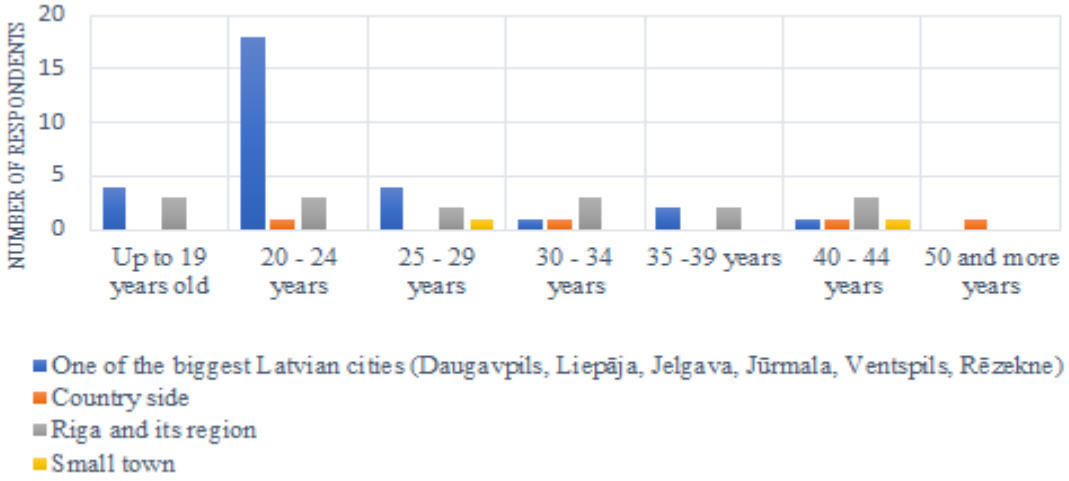

Figure 3. Age of responded developers and their residence

34.6% or 18 respondents currently study to be programmers. As can be seen in Figure 4, 17 out of the 18 respondents currently do not code professionally, but one of them has been doing it for 0-2 years. For the rest of the respondents, there is slight delay for about 2 years between learning and professionally writing code. Additionally, 9 respondents, who have already learned to code some time ago, indicated, that they are still learning and do not code professionally. In the "Stack Overflow" survey 24.8% of respondents expressed, that they have learned to code 2-5 years ago; and 30.1%, - that they professionally code for 0-2 years. Therefore, because of the impacted data by students, data from the "Stack Overflow" survey cannot be compared to the authors' survey data, but overall it can be concluded, that there is a slight delay, when respondents have learned to code and code professionally as both surveys show this trend.

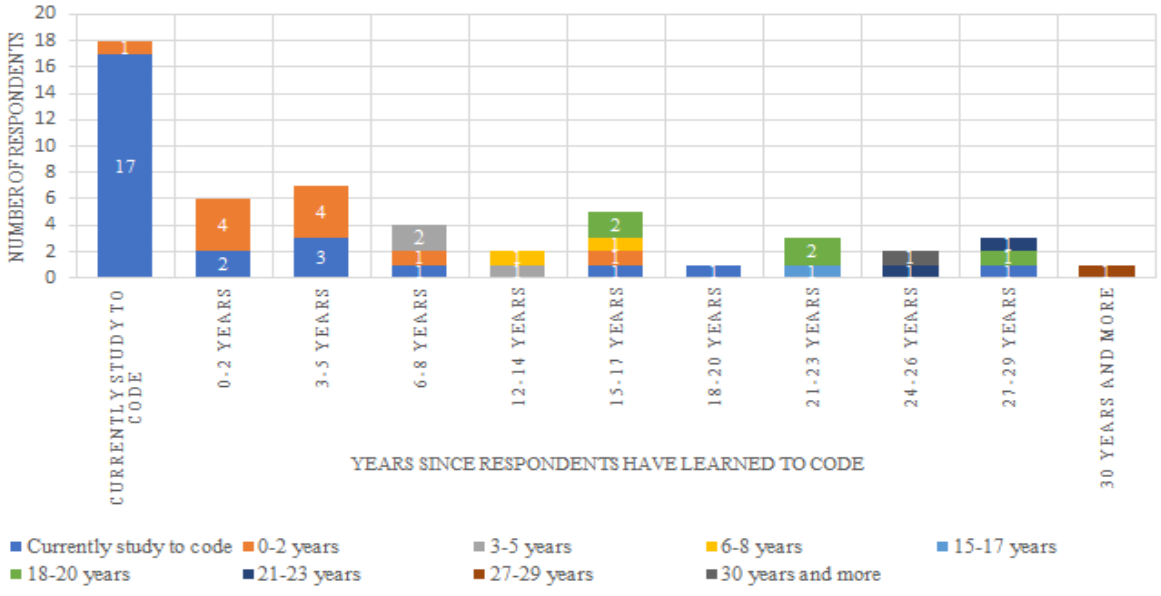

Figure 4. Years since respondents have learned to code and years since respondents code professionally

More than half of the respondents study full time, but the "Stack Overflow" respondents mostly are not students (74.2%), that identifies a slight difference between survey and "Stack Overflow" results. Furthermore, only 32.7% of respondent have a higher education degree (Bachelor or Master's degree), but the "Stack Overflow" results show, that 68.7% of all

respondents have a higher education. 61% of the respondents, who responded, that they have a higher education have a degree in Computer Science. Similar case was found in the "Stack Overflow" survey - 63.7%. That proves authors believe about students' impact into survey.

To the question about whether knowledge obtained through academic learning is useful in the daily work, 37% of respondents agreed. As can be seen in Figure 5, 39.1% of the respondents were neutral and 23.9% consider that information gained from their degree is slightly or even not so useful in their daily work. However, it should be noted that the authors' survey did not contain questions about respondents' current profession, therefore there might be a situation where respondents do not work in a IT related position and due to this the skills learned are not useful in their daily work.

88.5% of all respondents learned a new framework outside formal education. It is similar to "Stack Overflow" survey, where 86.7% learned a new language themselves. 76.1% of respondents have learned new technologies through online courses of coding, 26.1% have participated in a development of open source software development and 19.6% have participated in *Hackathons*. In the "Stack Overflow" questionnaire the data have a similar trend, but the percentage point is for about 10% higher in each type of learning, which means that Latvian developers are not using the online resources as much as their colleagues from other countries, but the trend is still positive. 44 respondents indicated, that they are using "Stack Overflow" questions and answers to learn on their own. Furthermore, 65.4% of respondents answered, that the usage of the above mentioned sources for learning new skills changes the tendencies in the IT industry, therefore increasing the available specialists for the further increasing IT industry as the academic institutions currently cannot meet the continuously growing demand for IT specialists, which in 2020 will reach 700 000 of new professionals [8].

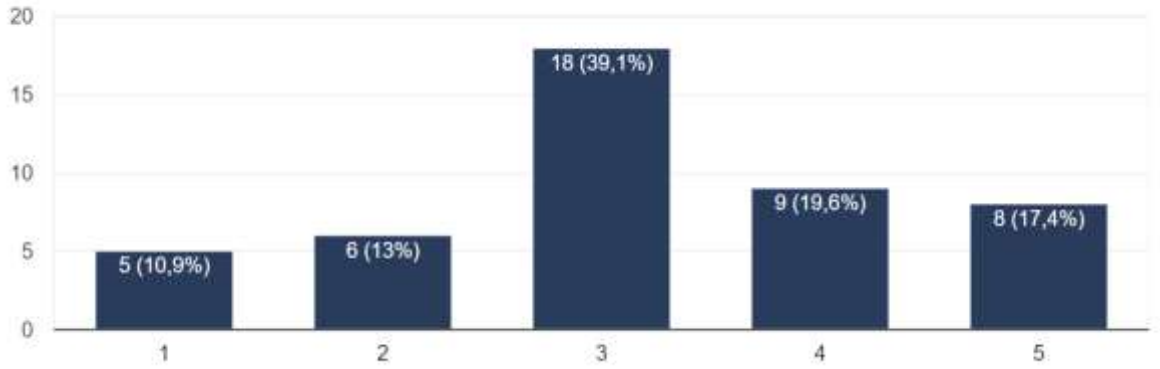

Figure 5: Opinions of the respondents of whether the academic knowledge gained in their academic degree is useful in their daily work (1 -strongly disagree, 5-strongly agree)

The respondents mostly use *HTML/CSS/JavaScript*, *C#*, *C++* and *SQL* in their daily work. The same programming, scripting and mark-up languages are used by surveyed professional in the "Stack Overflow" questionnaire, but amongst the most popular were also found *Java*, *Bash/Shell*, *Python* and *PHP*. The most uses framework and tools in Latvia are *.NET Core*, *Node.js*, *Angular* and *Django*, whereas in "Stack Overflow" *React* and *Spring* are also frequently used. Furthermore, amongst the main databases in both "Stack Overflow" and author's survey *MySQL*, *SQL Server* and *SQLite* are found to be predominantly used in respondents' daily work.

Conclusions

According to employers' answers, the formal education in IT field is not the main factor to select workers, instead programming skills and experience has higher importance. According to the majority of answers, companies have at least one employee who learned programming

skills outside of formal education. Therefore, authors conclude that self-taught programming can be viable as the method of career change. The majority of the surveyed companies has currently open vacancies; that is confirming with reports of Ministry of Economics of the Republic of Latvia about workforce shortage in IT sector. Furthermore, Latvia's competition with other European countries for IT specialists will be highly difficult due to high salary gap reasons. Additional or improved current preferential conditions should be viewed.

For further surveys, authors suggest to prepare an individual survey for students. Current survey doesn't accurately represent the situation of the Latvian IT industry due to the mixed answers of professional developers and students, and the small number of respondents. Furthermore, there is a slight possibility that some respondents could have also participated in the "Stack Overflow" questionnaire, as significant amount respondents indicated that they are using the "Stack Overflow" to learn on their own. However, judging from the results, it can be concluded that e-learning can produce knowledgeable professionals that are skilled in the latest frameworks, databases and tools.

Acknowledgment

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