A Survey on State of Software Quality Assurance in Bulgaria

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This paper provides results of two surveys conducted in 2014 and 2018 among the participants in one of the biggest conferences about software testing and quality assurance in Bulgaria called QA: Challenge Accepted. The survey results reveal important and interesting findings about software testing practices and software quality assurance (SQA) community related to the demographics of the SQA professionals, their education, certifications, technologies being tested, software development methodologies, programming languages and test automation tools used, as well as knowledge gaps identified. Whenever possible, the results for Bulgaria are compared to other similar studies worldwide. The main goal of the survey is to provide a state of art for the SQA community and identify potential issues that need to be addressed by industry and researchers.

CCS CONCEPTS

• **General and reference~Surveys and overviews** • **Social and professional topics~Quality assurance** • Social and professional topics~Testing, certification and licensing • Software and its engineering~Software testing and debugging • Software and its engineering~Collaboration in software development

KEYWORDS

software testing, software quality assurance, test automation tools, software development process, software technologies

1 Introduction

The IT sector in Bulgaria has grown 600% in the last decade. Also, software business in Bulgaria is the best performing sector of the ICT industry in this country, according to Bulgarian National Radio report [1]. According to Emerging Europe Alliance for Business Services, Innovation and Technology, Bulgaria is a world leader in outsourcing [2]. This is also backed up by the U.S. Department of Commerce's International Trade Administration, who mention that Bulgarian ICT market reached USD $1B in 2016 and call Bulgaria "the Silicon Valley of Southeastern Europe" [3].

SQA is a crucial part of the software development lifecycle, consisting of systematic activities providing evidence of the fitness for use of the total software product. SQA is a planned effort to ensure that a software product fulfills these criteria and has additional attributes specific to the project, e.g., portability, efficiency, reusability, and flexibility. It is the collection of activities and functions used to monitor and control a software project so that specific objectives are achieved with the desired level of confidence [4]. Most software companies have a separate SQA unit or group, dedicated to quality assurance.

A survey to gather more information about the SQA in Bulgaria was first carried in 2014 with 214 respondents, participating in a technical conference called QA: Challenge Accepted [5]. The same survey was repeated in 2018 with 318 participants during the relevant edition of the same conference, where respondents answered the same questions, with several additional questions related to workplace and knowledge gaps. This paper presents the findings of the survey, which, to the best of our knowledge, is the first survey on software testing and quality assurance carried out in Bulgaria. Where possible, survey results were compared to results of similar publicly available surveys worldwide.

As one of the paper's authors is part of the organizational committee of the QA: Challenge Accepted conference, and an SQA professional with more than 15 years commercial experience in IT, and both authors are also lecturers at the University of Ruse, Bulgaria, the authors are confident that the findings in this paper will be of interest for both researches and professionals in IT and SQA in particular. Although the survey is not so representative compared to more systematic ones carried out, it is unique as it looks at the Bulgarian IT sector from slightly different perspective, focusing on characteristics of SQA professionals and more precisely their demographics, education, certifications, technologies, methodologies, programming languages and test automation tools used, as well as knowledge gaps identified. The survey results will help to identify the current state of art for the Bulgarian IT sector as one of the top economy sectors. These findings will also allow one to make a comparison about the SQA in Bulgaria within a 4 years period, to provide checkpoint basis for

other similar surveys carried out in future, observe the trends, and identify the areas of strengths and weaknesses, encouraging more academia-industry collaborations in terms of educating and training future SQA professionals.

2   Respondent Demographics

2.1   Respondents Gender

Figure 1 shows that the respondents gender gap in SQA naturally closed in the last four years - the balance between men and women at least in the software testing field is achieved, as female professionals' percentage grew from 32% in 2014 to 49% in 2018.
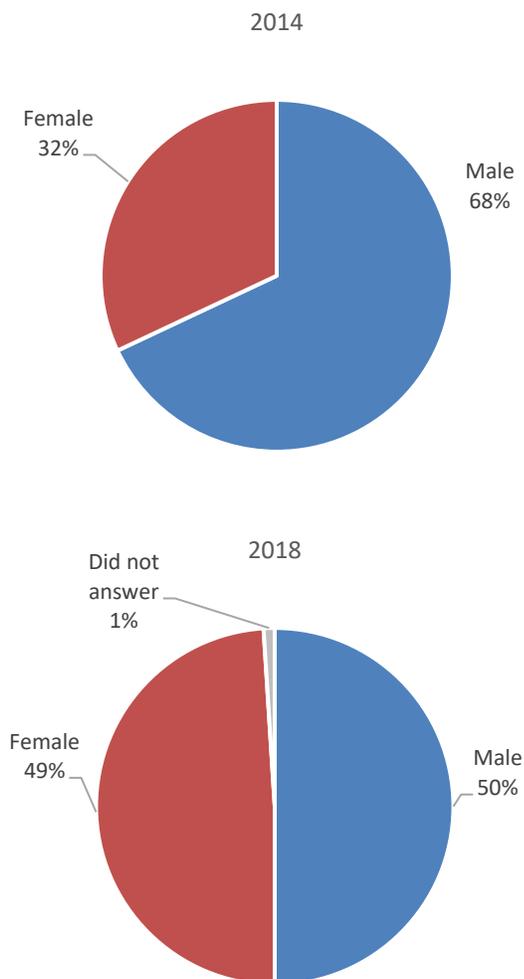

Figure 1 Respondents by gender in 2014 and 2018

2.2   Respondents Age

On Figure 2 one can see a summary of respondents age. One can easily recognize that the number of young professionals (below age of 30) increases. As the software industry is relatively young, it is

not surprising that there are more professionals aged above 35. This explains why the average percentage of people aged between 31 and 35 dropped drastically from 41.43% in 2014 to 22.68% in 2018. Also, the respondents' average age increased from 29.57 years in 2014 to 30.93 years in 2018.

2.3   Respondents Professional Experience

Figure 3 shows the distribution of respondents according to their professional experience in SQA field. Similar to the results from Figure 2, we can see that the relative number of junior professionals, as well as very senior ones, increases, at the expense of medium-experienced professionals.

Average professional experience slightly decreased – from 4.5 years in 2014 to 3.81 years in 2018. For the last calculation, we considered "less than 1 year" experience as 0 years, and "more than 10 years" as 11 years.
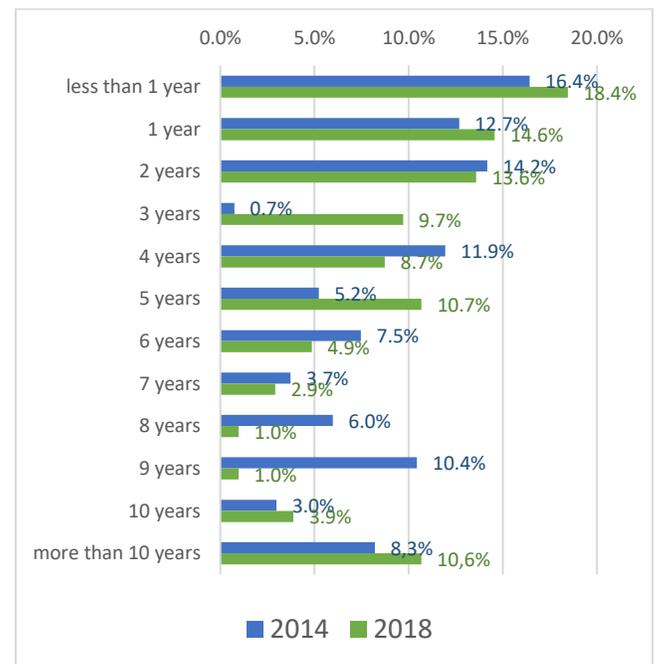

Figure 2 Respondents by years of professional experience in SQA

The respondents from 2018 are employees from 97 different Bulgarian IT companies, in addition to 23 freelancers or consultants.
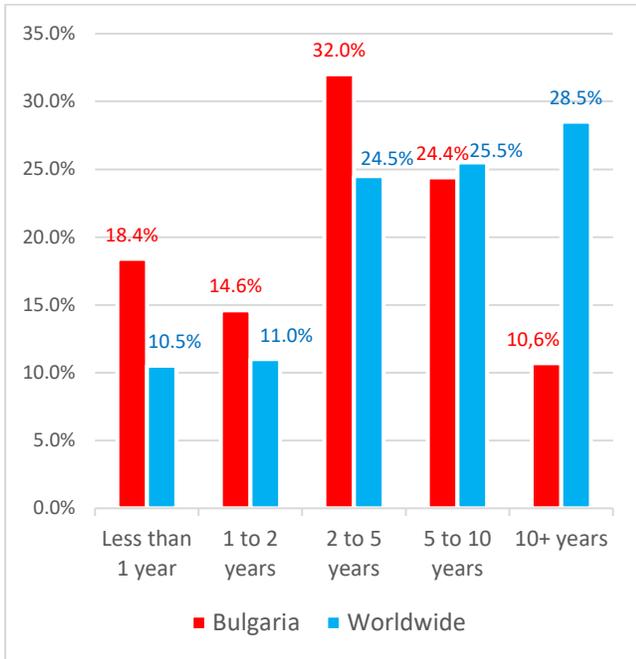
Figure 3 Professional experience in SQA: Bulgaria vs. Worldwide

We also compared the results from our survey for 2018 to the results from State of Testing report produced by PractiTest for the same year [6].

Based on all above, there are two important trends. The first one is that the flow of new testers is strong, and it even grows more in the last year. In Bulgaria this flow is even bigger compared to the rest of the world. We also see that SQA professionals stay in the field for more years. Looking inside the numbers, larger companies tend to have employees with more experience, while smaller companies appear to be more open to hire testers with less experience [6].

2.4 Respondents Education

Figure 5 shows the distribution of respondents according to their education level. Generally, education level is preserved between 2014 and 2018, showing that 12% of participants in the survey have graduated high school, 41% (43% in 2014) have bachelor's degree, 46% (43% in 2014) have master's degree, and 1% (2% in 2014) have PhD degree. However, there is a significant increase of SQA professionals who came from a different professional field – bachelors have increased from 8% to 18% (2.25 times), and masters have increased from 11% to 26% (2.36 times). This means that more than half of the SQA professionals (54%) do not have university degree in informatics, computer science or related field. There are several reasons for that, and the main one is related to the big demand for IT professionals, combined with shortage of trained people which makes companies train non-IT professionals. From economical point of view, the average wage in the IT sector in Bulgaria is four times higher than the country average [1], which also forces many people to change their professional orientation.
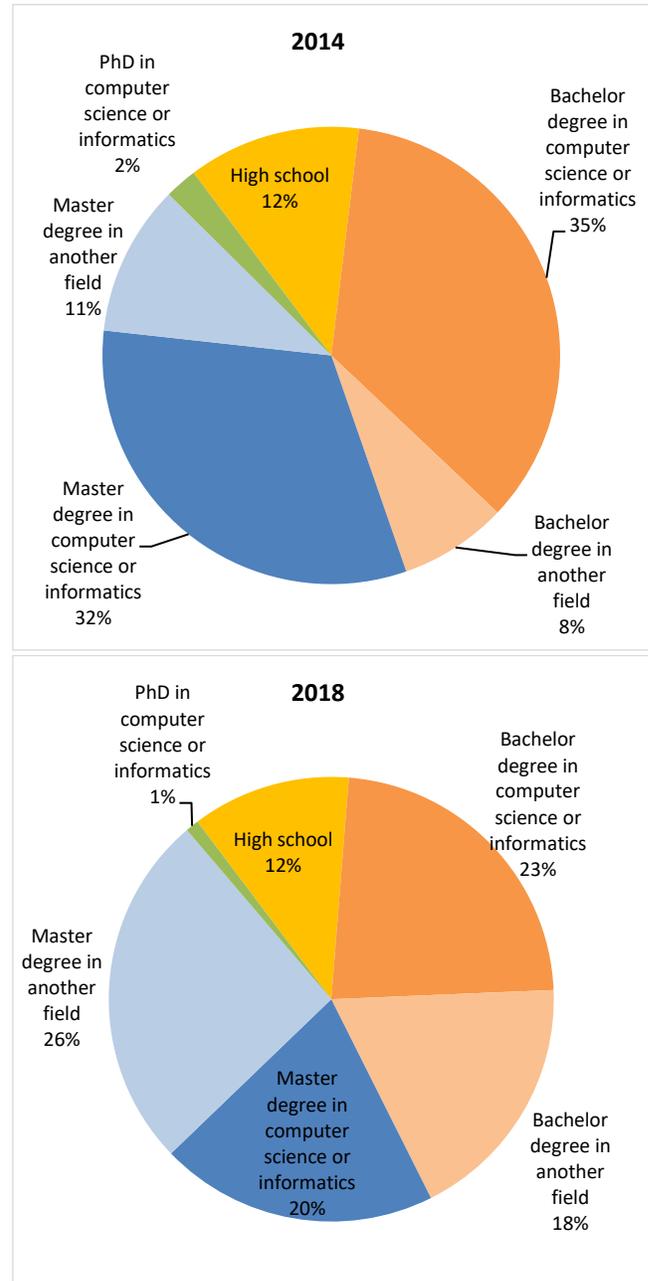

Figure 4 Respondents by education in 2014 and 2018

3 Development Process, Tools and Technologies

3.1 Software Development Methodology

Bulgarian IT sector is one of the earliest agile methodology adopters. For comparison, a survey carried out in Turkey was made in 2014. At that time people using agile methodology in Turkey were 45% [7], or 40% less compared to Bulgarian professionals at that time.

The percentage of Bulgarian SQA professionals who use agile (or lightweight) methodologies has risen from 84% in 2014 to 93%

in 2018, as shown on Figure 6. Nowadays, Bulgaria is no different to the rest of the world – according to State of Testing report produced by PractiTest, the percentage of SQA professionals who use agile methodologies worldwide has risen from 82% in 2016 to 89% in 2018 [6]. While numbers are very similar, they are also showing that Bulgaria is adopting agile methodologies quicker compared to the rest of the world.
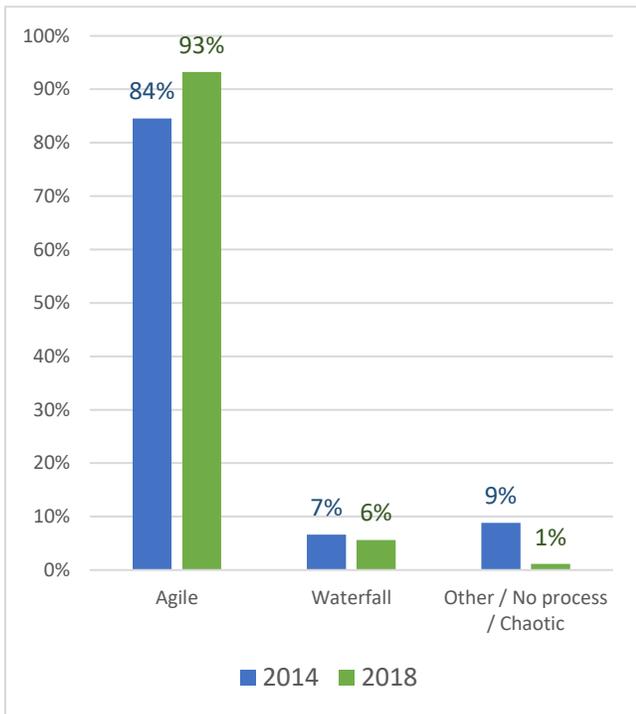

Figure 5 Software development methodology used

Waterfall (or heavyweight) methodologies slowly lose popularity in Bulgaria, dropping from 7% to 6%. Also, the number of people who claim not to follow a process, use custom process, or work chaotically, has decreased from 9% to 1%.

3.2 Programming Languages Used

Figure 7 shows a list of programming languages, sorted by their popularity in 2018 among respondents. Java is the most popular programming language among the SQA professionals. In 2018, C# become the second most popular programming language, leaving the third place to SQL. SQL then is followed by JavaScript, PHP, C/C++ and Python which end the list of programming languages known to more than 10% of the SQA professionals. The relatively young programming languages Go and Scala became more popular among the SQA community in the last four years. The number of SQA professionals who cannot code in any language has increased more than twice - from 12.7% to 26.5%. These statistics prompted checking the number of languages SQA professionals in Bulgaria can code in (Figure 8). While 41.3% of the respondents claimed to know more than three programming languages in 2014, their

number has decreased to 16.4% in 2018. The average number of programming languages per respondent dropped from 2.52 to 1.93.
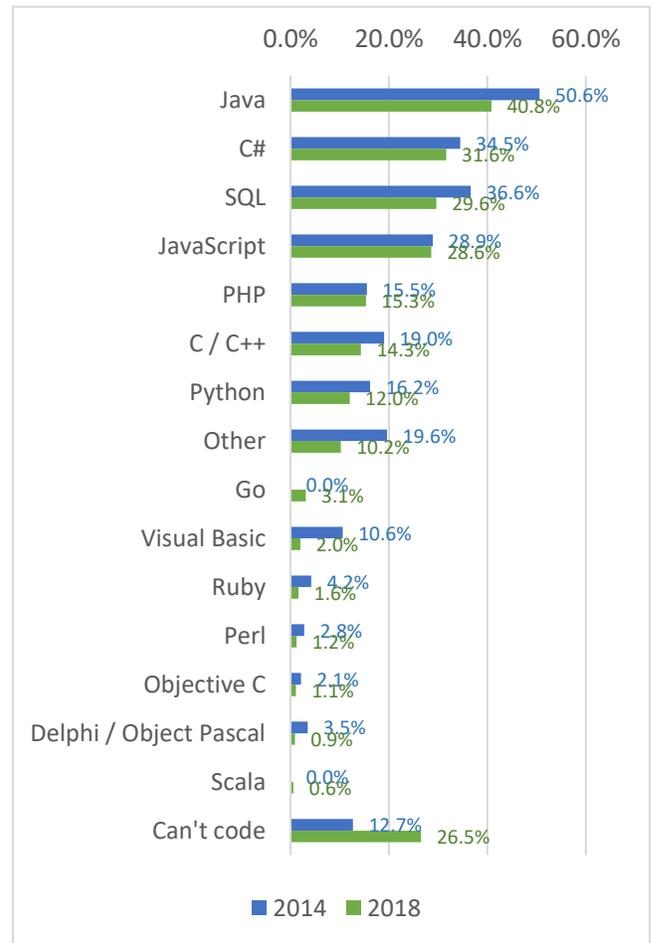

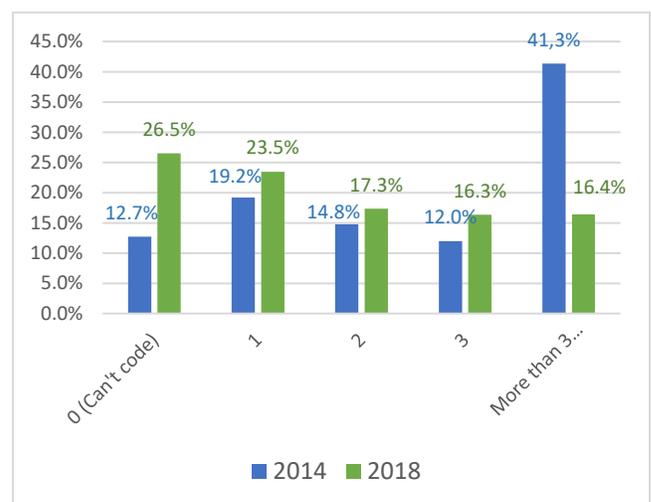**Figure 6 Programming languages respondents can code in**

Figure 7 Respondents per number of programming language they can code in
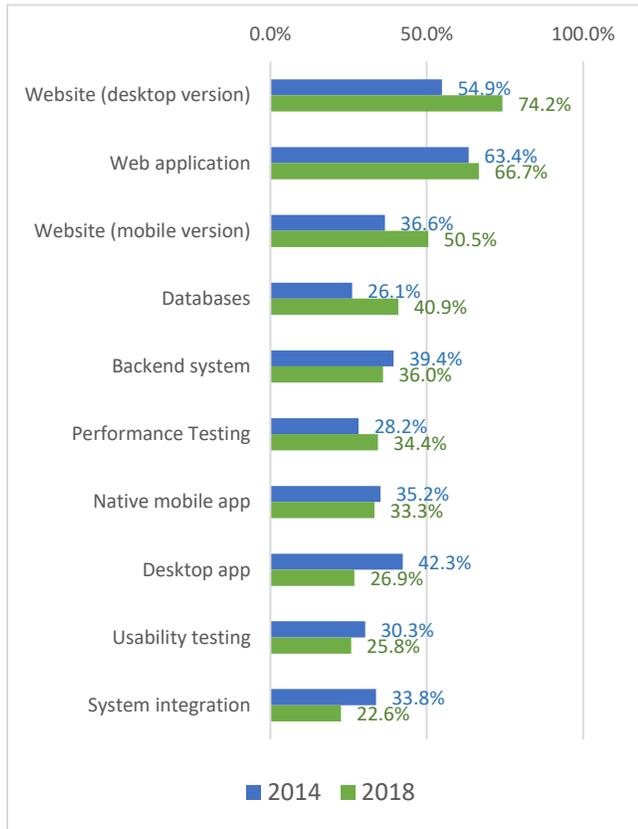
3.3 Technologies Being Tested

Figure 8 Technologies being tested by respondents

Web technologies have become the major field of software testing, including both desktop and mobile versions of websites, as well as web applications (Figure 9). Testing of databases and performance testing are also increasing in Bulgaria, while there is slight decrease in system integration testing, as well as testing of the backend, native mobile apps, desktop applications and usability testing.
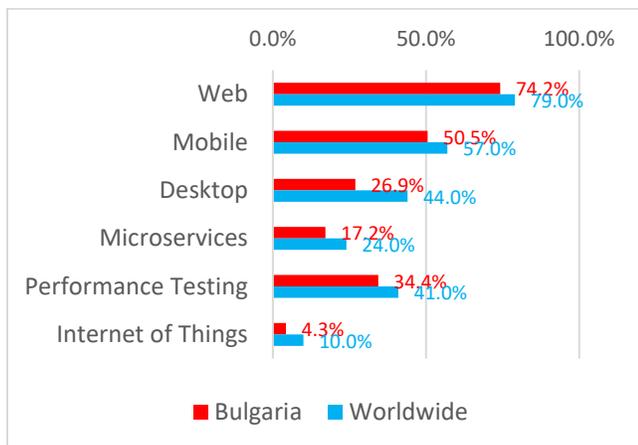

Figure 9 Technologies being tested: Bulgaria vs. Worldwide

For all technologies, we can see that less SQA professionals in Bulgaria test them compared to the world average. There can be many reasons behind this finding. Authors' opinion is that the daily work of the Bulgarian SQA professionals is more specific compared to their colleagues worldwide, i.e. they tend to focus on narrowly profiled tasks, activities and duties.

3.4 Test Automation Tools

There is no perfect test automation tool. It is very important that automated testing tools are mature enough, as it takes time until the tools are polished according to the needs of their users. Adding licensing costs, documentation availability, specifics of the software under test, learning curve for using the tools, etc. creates a lot of factors that need to be taken under consideration when choosing the automation tool [7].
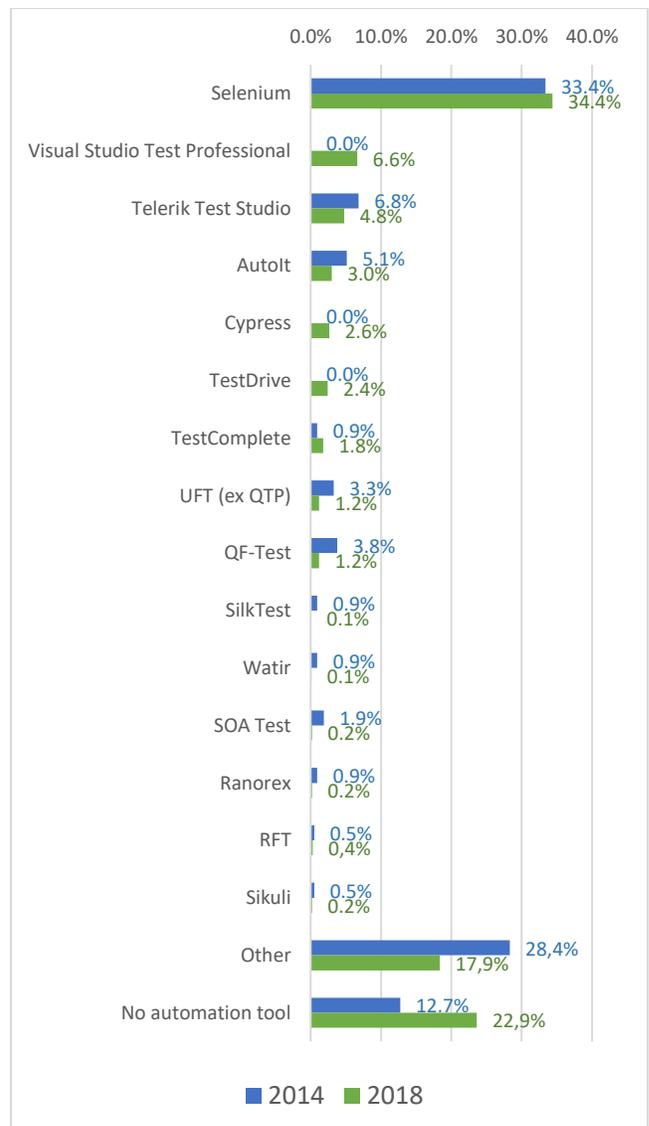

Figure 10 Test automation tools used by the respondents as primary tool

Figure 11 shows how much automation tool usage changed in just four years. While Selenium popularity slightly increased, even this top-scoring tool is used by just one-third of the SQA professionals. There are tools that are entirely new, such as Visual Studio Test Professional (6.6%), Cypress (2.6%) and TestDrive (2.4%). Others, such as SilkTest, Watir and SOA Test have lost their popularity in the meanwhile. Additionally, many people (17,9%) use non-popular automation tools or code their own ones, according to their specific needs. As the percentage of people who cannot code has doubled from 2014 to 2018 (Figure 6), and using automation tool requires coding skills, it is a logical outcome that the percentage of people who do not use automation tool at all has risen from 12.7% in 2014 to 22.9% in 2018.

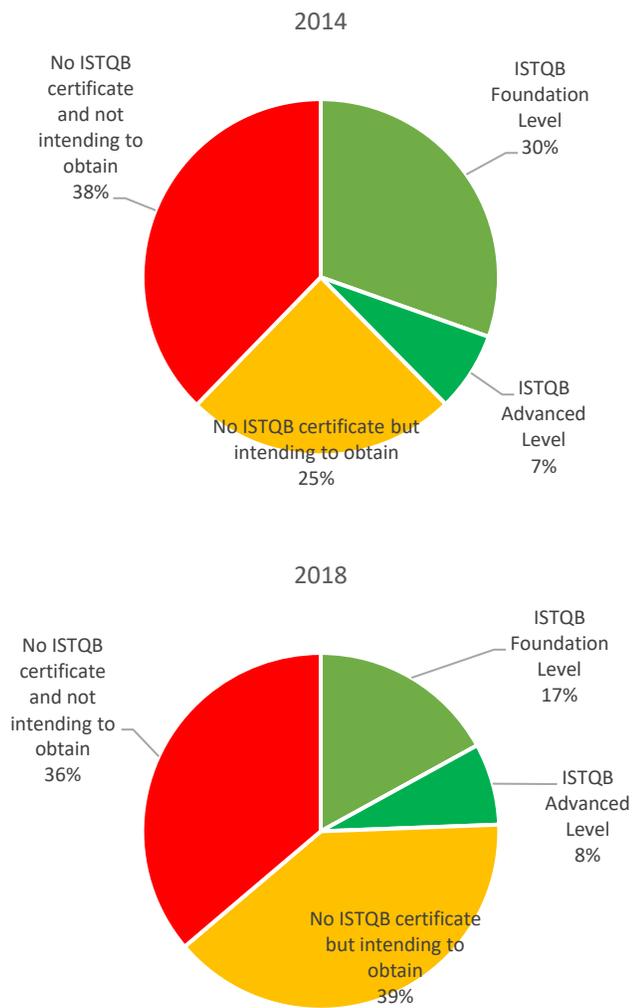## 4 Certification and Knowledge Gaps

4.1 Certification

The International Software Testing Qualifications Board (ISTQB) is a software testing qualification certification organization that operates internationally. ISTQB Certified Tester is a standardized qualification for software testers and the certification is offered by the ISTQB.

The qualifications are based on a syllabus, and there is a hierarchy of qualifications and guidelines for accreditation and examination. The ISTQB is a software testing qualification certification organization having over 605,000 certifications issued; the ISTQB consists of 60 member boards worldwide representing 82 countries as of December 2018 [8].

The number of SQA professionals without ISTQB certificate increased from 63% in 2014 to 75% in 2018 which means nowadays only 1 out of 4 testers is certified by ISTQB (Figure 12). Although there are not popular certification alternatives in the SQA community, ISTQB certificates are being more and more questioned, and many companies do not consider certificates when hiring. This is also backed by the results worldwide where certifications have dropped from 43% in 2017 to 40.5% in 2018 [6].

4.2 Knowledge Gaps

Figure 11 ISTQB certified respondents in 2014 and 2018

Figure 12 Knowledge gaps according to respondents

The last question on the survey conducted in 2018 was "What do you consider as your biggest knowledge gap?" and could be answered in free form.

All answers were categorized (Figure 13), and most of them (31 people) were related to test automation. The second most popular concern of SQA professionals (29 people) is about gaining seniority in terms of career path, technical growth and specific knowledge needed to become more professional. Third and fourth place are for non-functional testing – performance, load and stress testing (24 people), then security and vulnerability testing (22 people). These are followed by management and leadership (21 people), effectively using time at work (20 people) and what the newest trends in SQA field are (18 people), specific coding questions (17 people), how to do mobile testing (17 people), how to apply Scrum properly (16 people) and how to use and test cloud-based technologies (16 people).

All of these indicate training needs for SQA professionals in various fields such as automated functional and non-functional testing, adoption of specific technologies, fundamentals of agile methodologies, leadership, mentorship, etc.

5   Conclusion

The main goal of the survey reported in this paper is to provide a snapshot of the current SQA state of art, methodologies, tools and programming languages used, as well as professionals' demographics, education, certification and capabilities. Having two snapshots – one from 2014 and one from 2018 allows the identification of important differences that occurred in the last four years.

The survey results demonstrate very dynamic changes among the SQA community in Bulgaria. On one hand, these changes are related to considerable growth in the IT sector, with more junior professionals starting their career as SQA engineers or testers, and experienced professionals staying in the field.

On other hand, although agile methodologies and web testing take dominance, the tools used for test automation are changing too rapidly, with Selenium being the only automation tool widely and maturely used in Bulgaria. This is causing difficulties for the professionals to keep up to date with the newest trends in SQA.

Another interesting paradigm which is emerging relates to the people from other sectors coming to IT sector. In 2018, more than half of the SQA professionals (54%) do not have university degree in informatics, computer science or related field. Only 1 out of 4 professionals is ISTQB certified, and only 3 out of 4 professionals can write in any programming language. Bulgarian IT professionals also have less professional experience and less variety in their testing activities, compared to the rest of the world.

Indeed, the Bulgarian IT professionals are among the top performing ones, but the survey results reveal that there are challenges ahead related to both technology and human resources aspects.

As a result of the above, knowledge gaps in many different areas occur, and this imposes future risks about the software quality, as well as the competitiveness and efficiency of the SQA professionals in Bulgaria.

The authors of this paper believe that addressing such issues will be a powerful driving factor for both the IT industry and academic researchers. The current situation as well as the knowledge gaps identified can help one to better plan recruitment, training and education of new employees. The authors encourage more insight into the problems and intend to motivate a search for solutions to the open research issues in SQA described in this paper.

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