
# Studying the technology stack and processes of software companies located in Iceland

Research report

**Helgi Sævar Þorsteinsson**

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B.Sc. Computer Science

Supervisor: Grischa Liebel

Examiner: Grischa Liebel

T-622-UROP

School of Computer Science

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# Abstract

The number of software companies working in Iceland is growing every year. Today, more than 800 software companies are working in Iceland. The variety among IT companies is substantial, with different products targeting different markets being developed using large numbers of different software tools and programming languages, following different processes. For students and startups, this variety can be confusing since there is no clear direction for best using their resources to develop a professional portfolio or a product that best fits the market. For researchers, projects might not have the desired impact due to similar reasons.

This paper describes the research results regarding the technology stack and software processes of Icelandic companies in 2020. The participants of the research are working professionals in the software industry in Iceland. The research was conducted in the fall of 2020.

The purpose was to get a clear overview of what progress and technology tools software companies in Iceland use to create software. The results draw an overview of the most popular tech stack in Iceland and how the software companies develop software. This paper discusses how the survey came about, how it was conducted, and the main results.

An online survey was sent out to carefully chosen professionals working in the software industry in Iceland. The respondents were asked to answer questions regarding what sector they were working in, what processes and tools they use to create software in their working environment. Furthermore, the study covered basic questions on how the company they work for operates.

The survey was sent out to 100 companies. Out of them, we received 50 answers. This paper's main findings are that there are many similarities in how software companies operate in Iceland. It seems like languages like Javascript, .NET, and Python are the most popular in Iceland, and more than 50% of respondents reported that they use relational databases in their development. The main shortcomings are that most responses come from smaller companies, and therefore it is more likely that they have developed most of the newest trends in software development. Scrum is the most popular software process used in Iceland, used by 33,6% of participants. The results also show that the second most popular process was "their own process." This shows that companies are flexible and adaptable when it comes to choosing processes.

# 1. Introduction

Several recent studies exist that draw a picture of software engineering processes used worldwide, e.g., [1]. However, those studies are typically based on data gathered in the US or the major European countries, not necessarily representative of Iceland. Due to its unique geographic location and focus on a limited number of domains, it is not unlikely that the Icelandic IT industry is, in fact, different. Therefore, our study aims to increase knowledge of how the Icelandic IT industry works compared to the picture shown in existing research. This report describes and discusses the results of an online survey regarding how companies create software and operate, conducted in the autumn of 2020.

The information collected was about the company's technology (the so-called “tech stack”) and the processes they use to develop software. The research was set up to answer the following questions:

**RQ1: What software development processes are Icelandic software companies following?**
**RQ2: What technology trends can be identified in the Icelandic software development industry?**

RQ1 aims to answer how software companies operate and work in Iceland. With RQ2, we wanted to get a good overview of what tools are used in Iceland. The tools are generally known as a technology stack. The technology stack differs from place to place, and there is no right technology stack. The term describes what languages and processes are used when developing software. In addition to the technology stack, we wanted to look at internal communication tools to try to identify trends regarding them.

We sent out a survey to Icelandic software companies. We asked questions regarding the companies’ tech stacks, fields/domains they operate in, and the processes they use. Students in IT topics can obtain a representative picture of the technologies and processes used in the Icelandic IT industry. Today, one of the common questions students in computer science have is which technologies to specialize in. This research paper tries to helps students answer that question and decide which topics to study in more depth.

This paper focuses on getting information that is valuable for anyone interested in the software sector in Iceland. The main objective was to get hands-on knowledge of how companies operate and develop software.

The remainder of the paper is structured as follows. The second part explores the background of the research questions and how information regarding the software companies has been obtained through

the years. The third part goes into the method of the research and how it was conducted. The fourth part goes into the results. Finally, chapter five and six go into a discussion regarding the research.

# 2. Background

This chapter presents a brief background on the survey topic, what software development processes companies are using, and what technology trends there are in Icelandic software development. The chapter also presents a background of the research questions and the benefits of collecting information regarding the topic. The second part of the chapter touches on other sources, answering the same research question.

## 2.1 Software development technology stacks

A technology stack gives a clear overview of what trends exist in the software industry. The term technology stack references the underlying elements of a web or mobile application. It is a combination of frameworks, languages, and software products that everything else is built on [2].

Software is everywhere; it is in every sector and influences everything we do, from driving our car to buying goods. The constant change and innovation is healthy and leads to innovation. All this innovation is generated to the same idea, to make software creation more accessible and easier to use.

The popularity of technology stacks changes as newer or better alternatives are introduced, e.g., [4], [6]. Javascript was first introduced in 1995. Today it is the dominant language in frontend development [10]. There are many different versions of Javascript frameworks. Frameworks like React.js have gained attraction and become mainstream in today's frontend development worldwide.

It can be essential for companies to stay up to date with the newest trend to attract the best talent. One of the reasons why it is generally a good idea to research how software development is done in specific regions is to understand each place’s environment. Developers must be aware of the continually changing software engineering environment.

## 2.2 Related studies

Several studies have been conducted on what software processes companies use in their development, e.g., [5], [7], [12]. There are not as many research papers answering the question what tools companies use when creating software. Most of the research regarding the topic mainly focuses on the US or Europe as a whole, but few focus on smaller geographic areas. The results are, in most cases, collected via feedback from users or by mining sites.

Popular sites like Stackshare keep an overview of the technology stack of many companies [8]. They collect their data from many famous companies around the world. The employees of companies fill in the information in order for viewers to gain a good overview and understanding of what is used at each company. “The state of Javascript” is an ongoing online study. The study has an open questionnaire that developers answer yearly [3]. The feedback is compared to last year's feedback to understand how developers use the popular programming language javascript and how emphasis changes. Other studies focus on mining popular programming sites, e.g., Stack overflow. Stack overflow has been extremely popular among programmers in recent years, and by mining Stack overflow, one can get a clear overview of what programmers are using in the real world.

In 2013, joint university research was conducted [6]. Their main goal was to see what computer languages were the most popular ones at the time. They used data from Github and found out that Javascript was by far the most referenced language, followed by Python and Ruby.

In 2016, Chunyang Chen and Zhenchang Xing started out mining the technology landscape of the popular website Stack Overflow [4]. Their main objective was to find out what computer languages appeared most often on the website, and with that argument, they were confident that they could see what was most the most used programming language at each point in time. Their main results were that many languages, JAVA, C++, and C#, as an example, have stayed relatively popular throughout the years. They also note that web development and mobile development has increased in popularity in recent years, the most popular languages being PHP and Javascript.

In 2017, numerous researchers from different schools in Europe studied Hybrid software and system development in practice [1]. The research questions were what processes are used in real life and how those processes are combined in the real world. The results stated that Scrum was the most popular process, with 53,6% of participants' answers. Their main conclusion was that hybrid approaches in managing teams had become mainstream regardless of companies’ size.

In 2012, research studying feedback channels from various stakeholders in software engineering was conducted [9]. The participants of the survey were graduates from Reykjavik University. The research objective was to collect information on what software processes respondents used in their working environment and what were their preferred ones. The results show that Scrum is the most favored and most used software process by the participants. Scrum had been used by 39.6% of participants in the last three months of their work, followed by Kanban with 21.8% and own process by 13.9%. The process that was most preferred was Scrum, with 54.8% of the participant’s answers. Kanban received 21.8% of answers and their own process 9.6% of answers.

# 3. Method

This chapter outlines the research method used to gain information for the research. First, the chapter discusses the conduction and distribution of the survey, then it discusses the distribution of the survey, and finally, the respondents. The research method in this study is a questionnaire-based survey. We decided that the best way to obtain the necessary information was to send out a survey. In order to create an effective survey, we followed professional standards [11].

## 3.1 Survey conduction

I designed the survey with help and input from Grischa Liebel, assistant professor at Reykjavik University, and the mentor of the research. It was constructed in Soscisurvey, an online survey tool (soscisurvey.de). The survey has 20 questions, 14 open questions, and six multiple-choice questions. The questions were developed in cooperation with Grischa Liebel and with feedback from professionals working in the software sector.

The first part of the survey asked general questions regarding the participant's job description, the company, and the sector he/she is working in. The second part focused on the tech stack and software processes, and the third point focused on general knowledge on how employees communicate with each other. The questions of the questionnaire are grouped into four sections: general information about the person answering, information regarding the sector the participant is working in, the technology stack and processes the participant uses when developing software, and open questions regarding how the company operates.

Few pilot tests were conducted in order to exchange the quality of the survey. The participants were professionals working in the software industry in Iceland who have been developing software for many years. We ran a total of five pilot tests with two working CTOs and three software engineers. Marta Kristín Lárusdóttir, an associate professor at Reykjavik University, also gave input on how best to structure the research in this format. Marta and the working professionals gave us feedback on how we should frame the questions to get the most out of the survey. A new pilot survey was conducted after each feedback loop. We asked the participants to write all their ideas in notes using a pre-test feature of the online survey tool.

## 3.2 Survey distribution

To get a good overview of companies in Iceland, we contacted Creditinfo, a credit information provider. Creditinfo has general information about most companies in Iceland. They gave us a list of companies that were classified as software companies. Few companies were not on the list that we contacted. Those companies were collected from different sources like Ja.is and Creditinfo database of companies they have classified as excellent companies. The list from Creditinfo included around 1000 companies that were classified as software companies. We decided that we wanted to contact all companies with more than five employees with added companies from Ja.is, classified as software companies. We added all the companies who were not on our original list to our database. After having finished working on the database, we had in total of 161 companies that we contacted.

When the companies' database had been completed, we sent each company an email requesting a contact within the company who could answer general questions regarding the company's operation. After having received a contact within the company, we sent them an email with a link to the survey. There were two total emails sent out to the participants. The first email, the original email, and the remainder were sent out two weeks apart. We sent the email to 161 companies and received 50 answers. That means that 31.02% of the companies that received the email answered the questionnaire. There were 35 answers after the first email and another 15 emails after the second email. There were 86 people who opened the questionnaire but only 50 valid answers. All the answers were from companies located in Iceland.

## 3.3 Respondents

The respondents were all working in Iceland. 30% of the participants were working as CTOs at their company. 5% of participants were CEOs, and 62% were software developers. Around two-thirds of participants, 57%, were employed by companies with less than 20 people working at the company. 21% of participants were employed at companies with between 20 to 60 employees working at the company, and 23% of participants were working at companies that employed more than 71 people or more. The most common employee number was around 6-10 people; 25% of participants said they were working at a company with that number of employees.

In most cases, 1-4 developers were working within the company, roughly 28%. 20% of companies reported that 11-15 programmers were working at the company, and as well as 61 or more developers were working at the company. 16% of participants answered that 11-16 developers were working at the company, and 18% answered otherwise.

# 4. Results

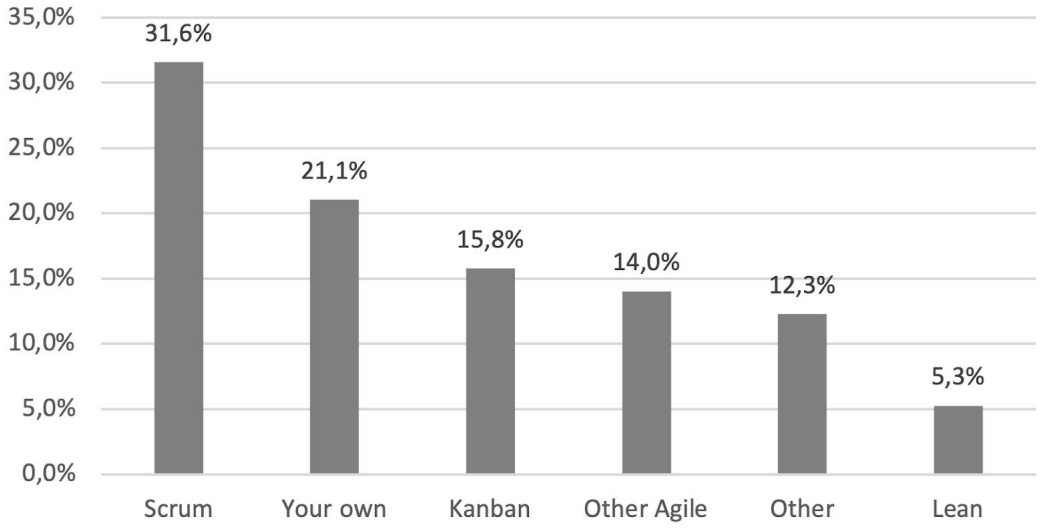
This chapter talks about the results received from the online survey. The chapter describes the results in detail, going over each research question separately.

## 4.1 RQ1: What software development processes are Icelandic software companies following?

The most common software process was Scrum; 31,6% of participants said they used Scrum in their development. The second most common answer was "Your own process," used by 21,1% of participants. Kanban was used by 15,8% of participants, and other agile and other processes got 26,3% of answers. Lean received 5,3% of the answers of participants (Figure 1).

Figure 1 - Software processes

*Question 8: Which of the following software development processes are you currently using in the organization?*



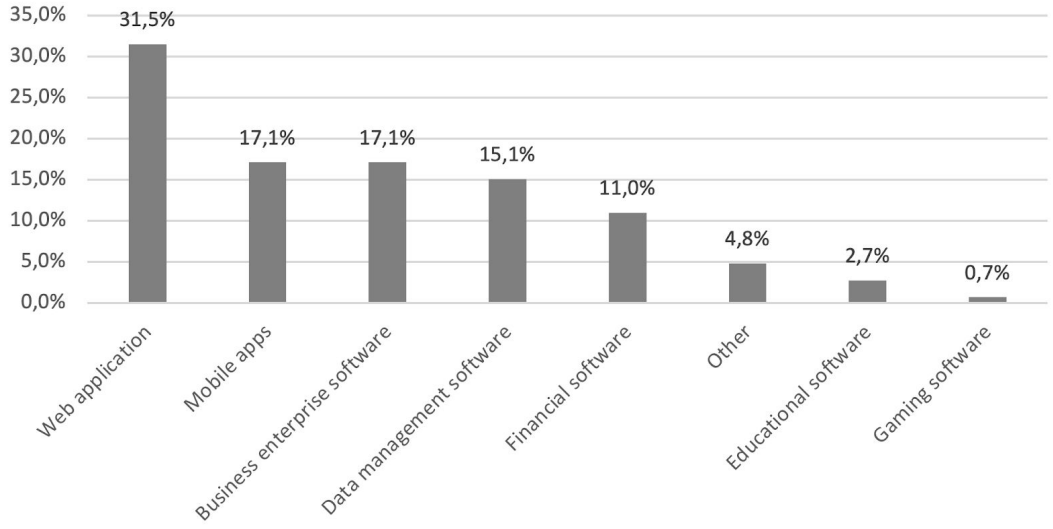

When participants were asked what sector their companies operate in, more than half of participants answered, "Other sectors." The respondents who answered "Other sectors" clarified their answer in a text field. Most of the answers had in common that they were general specific areas within software development. Examples of answers are Cloud computing, the Medical sector, Data integration, or entertainment. 18,1% of participants answered one or more options. 19,7% answered that they were

working in the financial sector. The third most common sector was education, with 8,2% followed up with retail with 6,6% of answers and manufacturing with 4,9%.

When asked to answer what type of software they were developing, the most common answer was web applications, with 32% of the answers. Mobile apps and Business enterprise software were each with 17,1% of answers. 15,1% of participants answered and said they were creating Data management software, and 11% reported that they created financial software (Figure 2).

Figure 2 - General questions

*Question 6: What type of software are you developing? ( Only answer if it applies )*




When asked if the company's software was commercial off the shelf, a ready-made product or contracted, custom made for each customer, the answers split pretty even. 41% of participants said the company made the software for each customer, commercial off the shelf, and 39% said they made their software through a contract, custom made for each client. Roughly 20% of participants answered "Other," indicating that they use a mixture of both options.

When it comes to communication tools within a company, Slack was among the most popular. 45% of participants used Slack to communicate with their co-workers making Slack the most popular tool. Microsoft teams was the second most popular tool, with 20% of participants reporting that their companies use the software. Google meet and Zoom received 8% of the answers each. The tools like Skype, Workplace, Facebook, and Flowdock received a combined 11% of answers, and 7% of participants answered that their company was using other tools.

The participants of the survey reported that around 46% of the companies are outsourcing talent abroad. However, 54% of participants answered that their company was not outsourcing talent abroad.

When asked if companies allowed remote work, 100% of participants answered Yes. That is an indicator of the flexibility of the software industry and how companies have adopted it in the Covid-19 crises. It has generally been the case that software companies offer their employees the change of working from home.

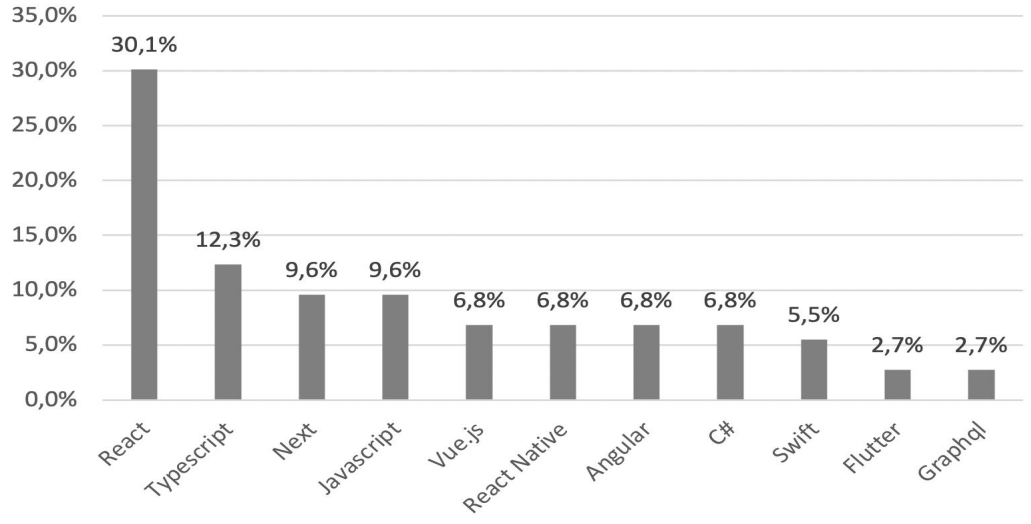
The most popular internal task management tool was Jira, with more than 38% of participants saying they used that in their everyday development. Asana was the second most popular task management tool, with 27% of answers. Trello is used by 14%, and the other is used by 15%. At most working places, the spoken language at the workplace was in 45% of the cases English but 49% of the cases Icelandic.  7% of the answers were a mixture of both options.

## 4.2 RQ2: What technology trends can be identified in the Icelandic software development industry?

The technology stack questions were divided into three main fields, frontend, backend, and databases. The most popular frontend libraries were React, Typescript, Next, Vue, Angular, and React native. All those libraries were written in the programming language Javascript. That means that Javascript was used in frontend development by 82,2% of participating companies (Figure 3).

Figure 3 - Technology stack

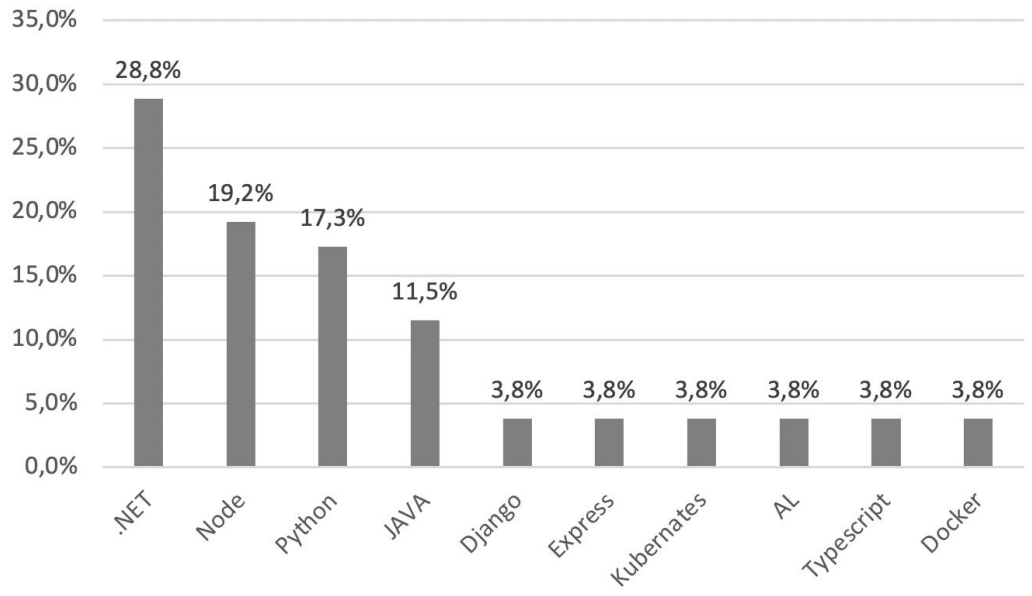
*Question 10: What tech stack do you use when developing front end software?*



The most popular backend language was .NET, with 29% of participant's answers. The language is generally written in C# or F#, languages that have their origin in the C family languages. Node is the second most popular backend language, with 19% of participants using that. Python followers closely with 17% of participants using that language. JAVA has 12% of participating companies using the language (Figure 4).

Figure 4 - Technology stack

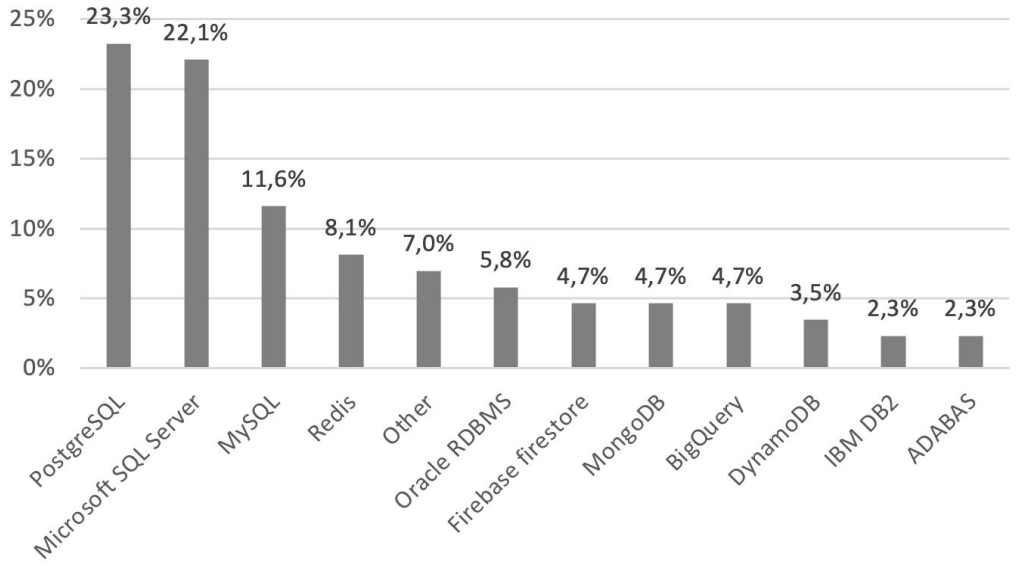
*Question 11: What tech stack do you use to develop back end software?*




The most popular databases are SQL databases. 57,08% of the participants' companies reported that they use SQL databases. The most popular one being PostgreSQL, with 23,36% of the answers. The Microsoft SQL Server followed up with 22,09% of the participants' answers. Redis has received 8,14% of participants' answers, and the Oracle Relational database management system is used by 5,81% of participants. Firebase firestore, MongoDB, and BigQuery are used by 4,65% of participants (Figure 5).

Figure 5 - Technology stack

*Question 12: What databases do you use?*


25%
20%
15%
10%
5%
0%
23,3%
22,1%
11,6%
8,1%
7,0%
5,8%
4,7%
4,7%
4,7%
3,5%
2,3%
2,3%
PostgreSQL
Microsoft SQL Server
MySQL
Redis
Other
Oracle RDBMS
Firebase firestore
MongoDB
BigQuery
DynamoDB
IBM DB2
ADABAS

# 5. Discussion

The survey asked respondents to write what software processes, what languages they use when developing software, and general questions about the company they were working at.

The results show that the most common software processes in order are Scrum, their own process, Kanban, and other Agile processes. Scrum has generally been the most popular software process for companies to use in their development [9]. This is not aligned with other papers on processes, and it seems that Scrum is not as popular as it has been in Europe [3, 15]. The fact that Scrum seems not to be as dominant in the Icelandic software scene and that 21.1% of companies are using their own process could indicate that Icelandic companies are adapting Scrum processes to their own needs.

The results show that the most common frontend software was Javascript, with 82,2% of participant's answers. The most popular libraries, in order, were React, Typescript, Next, React native, and Vue.
The results are aligned with Chunyang Chen, Zhenchang Xing's research [4].

The most popular backend tools were, in order, .Net, Node, Python, JAVA, and Express. This shows the wide variety of languages in back-end development, which is not the case in either frontend or database development.

The most popular databases in order are PostgreSQL, Microsoft SQL Server, MySQL, Redis, and Oracle RDBM. The most popular databases, according to the survey, are relational databases. This indicates that developers wanting to work in database development or maintenance should focus on relational databases.

When looking at the results from above, there can be a pattern at Icelandic companies. Most of them are using Javascript in their front end with some kind of a relational database. It is interesting that the survey indicates otherwise when it comes to backends. The fact that there were so many different languages reported to be used in the backends shows that there is a much higher diversity when it comes to backend development. It will be interesting to see whether that will change in the near future, and libraries like Node, which is used by 19% of respondents, will increase in popularity because it uses Javascript.

Software in Iceland is sold in 41% of cases commercial off the shelf, and in 39% of cases, the software is custom-built for each customer. It is split pretty eventually, which means the software

landscape in Iceland is both contracting and commercial off the shelf. This can underline the variety of industries that software companies are operating in and the number of different companies in Iceland.

As a startup or individual wanting to go into the Icelandic software sector, one of the best alternatives to move forward seems to be to learn React and Javascript to go into front end development. For backend developers wanting to join the software sector in Iceland, it seems mandatory to know Python, Node, or .NET. These are among the most popular backend frameworks in the world and are growing. The relative databases are the best ones to be aware of and know. SQL databases seem to be the most important language.

# 6. Conclusion

This paper investigates two separate research questions to get a better understanding of the Icelandic software scene. The research questions were the following:

- What software development processes are Icelandic software companies following?
- What technology trends can be identified in the Icelandic software development industry?

The results show that the most common software processes were Scrum, their own process, Kanban, and other Agile processes regarding the first question.

Regarding the second question, the most popular frontend libraries were in order React, Typescript, Next, React native, and Vue. Therefore, the findings indicate that Javascript is the most used language when it comes to frontend development. The most popular backend languages were in order Net, Node, Python, Java, and Express. The most popular databases are relational databases. They are, in order, PostgreSQL, Microsoft SQL Server, MySQL, Redis, and Oracle RDBM.

The main objective of this research was to help people to make sense of the often overwhelming and continuously changing software industry. We hope that it gives someone who is taking their first steps into the scene some form of understanding of what is important to know and focus on to open up for job opportunities. It can be interesting to see how the industry will change over time.

I hope that the survey will be used as an example for other students or researchers interested in software development in general and will continue on a regular basis. The survey I created can be used to understand what is important to know and what the job market is really focusing on.

# Acknowledgments

This paper would not have been written if it had not been for the wonderful guidance from Grischa Liebel, who guided me through the whole process and was always available, giving input and suggesting points along the way. The databases from Creditinfo also helped a lot with the process of choosing companies and establishing connections. Their input made the process a whole lot easier. Martha Kristin came up with suggestions for improvement to the questionnaire. The participants took their time and answered in a kind and thorough manner.

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# Appendix

## Appendix A - The first electronic email sent to the participants:

*The first email that was sent to the participants on September 24, 2020:*

Good afternoon,

We are studying what technologies and processes Icelandic companies use to develop software. This information is aimed to give students entering the IT market an overview of what is used and potential areas for specialization. To do so, we have created a short survey. It should not take more than 15 minutes to fill in the survey. The results will be published in the form of a website and a report. We would appreciate it if you could spare this time and answer the survey. We will send a single reminder in two weeks' time.

The survey is conducted by Helgi Sævar, a computer science student at Reykjavik University, under the supervision of Grischa Liebel, Assistant Professor at Reykjavik University (grischal@ru.is). Feel free to contact us in case you have questions or comments!

https://www.soscisurvey.de/techstackresearchfirst/

Please do not forward this link.

Best regards,
Helgi Sævar Þorsteinsson, Computer Science, Reykjavik University

# Appendix B - The second email sent to the participants

*The second email that was sent to the participants on October 8, 2020:*

Good afternoon,

This is a follow-up email regarding a survey researching the software processes and technology stack used by Icelandic companies. If you have already completed the survey, please accept my sincere thanks and as no further involvement is required.

We are studying what technologies and processes Icelandic companies use to develop software. This information is aimed to give students entering the IT market an overview of what is used and potential areas for specialization. To do so, we have created a short survey. It should not take more than 15 minutes to fill in the survey. The results will be published in the form of a website and a report. We would appreciate it if you could spare this time and answer the survey. We will send a single reminder in two weeks' time.

The survey is conducted by Helgi Sævar, a computer science student at Reykjavik University, under the supervision of Grischa Liebel, Assistant Professor at Reykjavik University (grischal@ru.is). Feel free to contact us in case you have questions or comments!

https://www.soscisurvey.de/techstackresearchfirst/

Please do not forward this link.

Best regards,
Helgi Sævar Þorsteinsson, Computer Science, Reykjavik University

# Appendix C - Questions

*The survey questions participants received:*

1. **What is the name of your company?**

2. **How many employees are working at your company?**
   1-5
   6-10
   11-15
   16-20
   21-30
   31-40
   41-50
   51-60
   61-70
   71 or more

3. **What is your job description?**

4. **What sector are you working in?**
   Finance
   Games
   Education
   Manufacturing
   Retail
   Transportation
   Travel
   Other, please specify

5. **How many employees are working in software development at your company?**
   1-5
   6-10
   11-15
   16-20
   21-30

31-40

41-50

51-60

61 or more

6. **What type of software are you developing? ( Only answer if it applies )**

   Mobile Apps

   Web applications

   Business enterprise software

   Data management software

   Gaming software

   Educational software

   Financial software

   Other, please specify

7. **In which category is the software you are developing?**

   Custom made for particular customers (contracted)

   Commercial off the shelf product (customers buy a ready product)

   Other, please specify

8. **Which of the following software development processes are you currently using in the organization?**

   Scrum

   Lean

   Kanban

   Other Agile process

   Your own process

   Other, please specify

9. **What is a tech stack?**

   A tech stack is defined as the set of technologies an organization uses to build a web or mobile application. It is a combination of programming languages, frameworks, libraries, patterns, servers, UI/UX solutions, software, and tools used by its developers.

10. **What tech stack do you use when developing front end software?**

11. **What tech stack do you use to develop back end software?**

12. **What databases do you use?**

13. **What spoken language is used as a main working language at the company?**

14. **Does your workplace support remote work?**

15. **Are you outsourcing programming work?**

16. **What internal communication tools do you use?**

17. **What internal task management tools do you use?**

18. **Do you have any recommendation or advice for people who want to or are taking their first steps in your sector?**

19. **In case you only know about part of your company, who else should we send this survey to, in order to get a more complete picture?**

20. **Anything you want to add regarding the content of this survey?**