AI-driven chatbot as a support tool for developers during the onboarding process

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This thesis explores the onboarding process for developers and investigates the potential of using artificial intelligence-driven chatbot technology to improve the process. The aim is to develop draft requirements for a chatbot software tool that can increase the efficiency of the onboarding process for the Crowd Collective company. By leveraging the power of AI, the chatbot tool has the potential to reduce the time and effort required for onboarding, while improving the experience for developers. The significance of this work lies in the potential to help companies streamline their onboarding process, save resources, and ultimately, achieve their goals more efficiently.

The first part of the thesis provides a comprehensive analysis of the onboarding process, including best practices, challenges faced by employees and companies, and the benefits of effective onboarding. Through an extensive review of literature, articles, this study demonstrates the importance of onboarding and argues for the need to improve the process. The analysis of chatbots used in education shows that this technology can address the gaps in the current onboarding process.

The second part of the thesis focuses on the experiences of developers during onboarding and the need for improvement from the company's perspective. The conducted survey and interviews reveal the flaws in the current process, and an interview with a company representative highlights the need for improvement. The analysis of available technology enables the creation of technical draft requirements for an AI-driven chatbot, including its features and implementation timeline.

The thesis serves as a basis for the development of a tool that can improve the onboarding process for developers and demonstrates its business value. Additionally, it highlights the need for future research on security and ethics in the use of AI-driven chatbots.

Keywords
Onboarding, Chatbot, AI, support tool, AI as a tool, chatbot tool

Contents

Abbreviations iii
1 Introduction 1
1.1 Objectives 2
1.2 Research questions 3
1.3 Scope 4
2 Onboarding of new employees 6
2.1 Definition of onboarding 6
2.2 Costs of onboarding 10
2.3 Problems in Onboarding 14
2.4 Onboarding Best Practices 17
3 Helping onboarding with Artificial Intelligence 27
3.1 Artificial Intelligence tools in onboarding 28
3.2 Chatbots mentors for onboarding 30
4 Research design 37
4.1 Research approach 37
4.2 Investigation methods 38
5 Results from the developer survey 42
5.1 Participants of the survey 42
5.2 Satisfaction with onboarding 43
5.3 Support for onboarding 43
5.4 Negative experiences 44
5.5 Preferred support for onboarding 47
5.6 Open ended answers 49
6 Results from management interviews 52
7 Discussion 54
7.1 Research question 1: What is the significance of onboarding form the employee's and the company's perspective? 54
7.2 Research question 2: What do developers find the most difficult after they have been assigned on a project? 57
7.3 Research question 3: What are the current AI techniques already used in IT education? 58
7.4 Research question 4: How can we apply AI in our processes to make better support for developers? 59
7.5 Recommendations: draft requirements for the AI-driven chatbot 61
8 Conclusion 64
References 67

Appendix 1 72
Appendix 3 73

Abbreviations

AI	Artificial Intelligence
CEO	Chief Executive Officer
FAQ	Frequently Asked Questions
HR	Human Resource
HRM	Human Resource Management
ID	Identification
IT	Information Technologies
ITS	Intelligent Tutoring System
Juniors	Junior level developers
E-commerce	Electronic commerce
Q/A	Questions and Answers
LMS	Learning Management System
NLP	Natural Language Processing
ROI	Return on Investment
VP	Vice President

1 Introduction

Onboarding is the process of integrating new employees into an organization and getting them up to speed with the company culture, practices, and workflows. According to the Society for Human Resource Management, onboarding is defined as a process that helps new hires become familiar with all the details of their future jobs. This process should be fluent and easy for new employees, helping them acquire the required knowledge, skills, and attitudes expected from them in the organization (Kumar & Student, 2017).

Ensuring high quality and cost-effectiveness in the onboarding of professionals is crucial. In the rapidly evolving IT/ICT industry, the education and integration of developers into organizations is essential for success. The onboarding process plays a critical role in ensuring high-quality and cost-effective integration of professionals. However, every onboarding process requires additional time, costs, and human resources, which can be a challenge for companies. This can be especially true for inexperienced junior developers who often lack experience in real projects or onboarding processes. As a result, some organizations may avoid hiring inexperienced developers due to the difficulties associated with onboarding. Failing to provide an effective onboarding experience can lead to early attrition of specialists, which can be a costly outcome for companies.

This thesis investigates how onboarding could be made more reliable and cost-effective with the help of AI-based onboarding agents. The contractor of this thesis is Crowd Collective, which provides its customers with senior developers who are trained to mentor junior developers in their projects. Junior developers that are hired to work in pair with seniors are educated by Crowd Collective's sister company. Sometimes there is a struggle to find a correct project for them, as a junior developer does not have enough experience to start with a large project or take on a certain technology as fast as experienced developers. The education of junior specialists lasts only about 3-4 months, and even though those people are highly motivated to begin their career path as developers, most of them do not have a solid picture of what development of a large project is all about. They need to learn a lot during their first months, the process takes a lot of time and resources from the host organization. While onboarding is a challenge for all levels of professionals, it can be particularly challenging for inexperienced junior developers. However, it is important to note that senior developers can also face obstacles during the onboarding process. For example, they may be accustomed to

certain workflows or technologies that are different from those used by the organization they are joining. They may also need to learn about the company's unique culture and practices. Therefore, ensuring a smooth onboarding experience for both senior and junior developers is critical to the success of an organization.

The onboarding process can be a challenging task, often requiring significant time, effort, and resources to ensure that new employees are effectively integrated into the company. However, with the help of Artificial Intelligence (AI), this process could be automated, streamlining the process and providing significant benefits for both the employees and the company. For instance, AI can provide targeted training and support to new employees, enabling them to perform better on projects and reducing the likelihood of issues or mistakes. This can ultimately lead to improved results for clients, which can help to motivate companies to take on less-experienced professionals.

Furthermore, implementing AI-powered onboarding tools can help companies reduce the costs and resources required to support new developers. By providing automated support and training, companies can reduce the burden on their support staff and enable them to focus on other critical tasks. Additionally, this reduction in resources can lead to increased revenue growth, as the company can take on more projects and satisfy more clients.

It's important to note that such a tool would not only be useful for external onboarding processes, but also for internal ones. By training on data from within the company, this tool can provide targeted support for employees at all levels of seniority, helping them to develop new skills and excel in their roles.

1.1 Objectives

The thesis aims to investigate the onboarding process in detail. The objective is to define the best practices of onboarding and to identify the issues that companies and employees face during this process. Additionally, the thesis aims to define the goals and benefits of onboarding from the company's perspective. Once the goals and problems are established, the manuscript explores the potential of AI to assist in addressing these issues and achieving the goals of onboarding. It also examines whether AI can enhance the employees' experience of the process. For that a thorough analysis of available AI tools (chatbots) and their usage in educational

processes is to be researched. The main objective is to create technical requirements for the AI chatbot that could be later implemented and used during onboarding processes.

1.2 Research questions

The research problem is to investigate how an AI chatbot can assist developers in the rapidly evolving IT/ICT industry. It is essential to educate developers to equip them with the necessary skills to succeed. Therefore, the following research questions are aimed at understanding the goals of IT/ICT education and how an AI chatbot can help young specialists:

1. What is the significance of onboarding for employees of different seniority levels, from both the employee's and company's perspective?

This question helps us to understand what goals we need to achieve by educating the developers. This allows us to understand what the tool needs to focus on as a result, in other words it defines the path that the tool will follow in helping young specialists.

2. What are the most common challenges that developers face after being assigned to a project?

This question aims to identify the common issues faced by developers at various seniority levels after they have been assigned to a project. The results will help to determine the focus areas of the tool, ensuring that it addresses the most common and critical challenges faced by developers at all levels.

3. What are the current AI techniques already used in IT education?

This research question helps us analyze the tools used in education determine the most useful techniques that can be used in the new tool aimed at helping developers.

4. How can Crowd Collective apply AI in their processes to better support developers?

This research question is a summary of all the above: by the time we get to answer this question, we will have a clear picture of what the problem areas are, what tools and techniques can help to solve those problems and finally how it may affect the

company's processes. This tells about the ways the tool can be applied in those processes and the expected results of the AI support system usage.

1.3 Scope

This research aims to discover if AI can make this process smoother, provide better onboarding experience and decrease the time needed to be effective. This allows to build a solid base that will allow an AI assistant creation, if it will be proved that AI can be used for education and support of the developers. Surveys and case studies are needed to answer most of those questions. Qualitative research on AI used in education is required to show the possibilities of AI in education and analyze existing cases it is also important to research current onboarding practices used in technical companies, analyze best practices, their influence on developers, and discover known difficulties and issues in the process.

The second chapter of the research opens the topics of onboarding, talks about its benefits and best practices, elaborates on main problems, especially concentrating on developers onboarding in technical projects.

The third chapter opens a topic of Artificial Intelligence and chatbots, researches the usage of chatbots in educational processes and shows its challenges. It also describes existing chatbots that could become a base for the tool.

Fourth and fifth chapters are devoted to empirical research. It describes methodology of the research and presents discussion over the results of the research.

The last chapter presents draft system design for the chatbot tool that can be developed based on the results of the research presented in the third chapter. Additionally, it presents the development plan, discuss timelines and milestones, analyse needed resources and risks involved in the development of a new AI chatbot tool.

Table 1. Overlay matrix

Research questions	**Theoretical framework (chapter)**	**Empirical research (chapter)**
1. What is the significance of onboarding for employees of different seniority levels, from both the employee's and company's perspective?	2	4, 5
2. What are the most common challenges that developers face after being assigned to a project?		5, 6
3. What are the current AI techniques already used in IT education?	3	
4. How can we apply AI in our processes to make better support for developers?	3	5, 6

2 Onboarding of new employees

This chapter investigates onboarding process in detail: sets the definition of the term and elaborates on its characteristics. It talks about its cost, best practices, and main problems, especially concentrating on developers onboarding in technical projects.

2.1 Definition of onboarding

Throughout the last 30 years, research results from various studies and surveys have shown that effective onboarding is crucial for the success of new hires and the organizations they join. In fact, in 1996, a study found that 93% of all organizations involved their new hires in some sort of a training process that helped them in the orientation and become more confident in their new company. Despite the importance of onboarding, the process may not yet be familiar to everyone, and many might not even know what the word or the process means. As Kumar and Student (2017) point out, this lack of awareness can lead to inadequate onboarding practices, which can harm both the employee and the organization.

Onboarding can be seen as a process that helps employees to reach maximum productivity by setting the goals and strategizing, education, socializing and allocating resources (Bauer & Erdogan 2011). While some might believe that the onboarding process is about reading manuals, there is much more to it: he believes this process is the creation of an integrated and highly productive organization member, onboarding should help new hires to get familiar with all details of their future jobs fluently and easily, showing them the required knowledge, skills, and teaching the attitude and behaviours that are excepted from them in the employer's organization (Kumar & Student 2017).

In his book "Successful Onboarding: How to Get Your New Employees Started Off Right", David Lee writes, that onboarding has a basic orientation process and the following three-to-six months period where a new hire gets "up to speed" in his or her own area of work (Lee 2006, 7). He notes, that even before the word "onboarding" started to be used as a term to describe the process of introducing a new employee into the organization, the process itself already had existed for a long time.

Onboarding can be compared with a socialization process inside the organization (Kumar & Student 2017). Back in 1979 socialization was described to define the process of obtaining knowledge, skills, attitudes, and behaviours that are needed to participate in the organizational processes as a successful member (Maanen & Schein 1979).

The goal of the onboarding process is to form a strong and long-going relationship between the employer and employee at the same time forming the bond with the working place and confirming the decision (Kumar & Student 2017).

Bauer and Green (1994) talk about the importance of establishing positive relationships between employee and the company as early as possible, as newcomers' attitude and beliefs are formed at exceedingly initial stages. It takes 90% of new employees six months to make the decision whether they stay inside the company (Aberdeen Group 2006). At the same time, it can take only 30 days to decide whether they feel welcomed and connected to the organization (Friedman, 2006).

In their article or book "A review of onboarding literature," Dai and de Meuse (2007) provide a thorough answer to the question of why onboarding is important. While their focus is primarily on the executive onboarding process, the findings and concepts can be applicable to lower-level hires as well. The authors begin by examining key statistics and timeframes associated with the onboarding process, providing valuable insights into the benefits of an effective onboarding program which are higher levels of job satisfaction, increased organizational commitment, lower turnover rates, and improved job performance. Additionally, effective onboarding has been linked to improved employee retention, which can lead to cost savings for the organization (Dai & de Meuse 2007).

However, there are many executive hires who would fail at their jobs (Ciampa & Watkins (1999) and by Bradt, Check, and Pedraza (2006). For example, research shows that executive hires have a failure rate ranging from 40% to 64%. he estimated time for new leaders to become familiar with their new role is around four months, which does not necessarily mean productivity. It is only after an average of six months that new leaders become productive. The measurement for that estimate comes from the time when a new leader's work becomes profitable for the company and starts to cover the company's costs of onboarding that person. It is crucial for companies to measure the ROI (return on investment) of their onboarding programs, as this can help

them to evaluate their effectiveness and make informed decisions about future investments in onboarding (Wells 2005).

2.1.1 Historical development of the terminology

The idea of onboarding has existed, yet it has been described with different names throughout the years.

Based on research conducted in 1996 by Anderson, Cunningham-Snell & Haigh, it was found that 93% of organizations involved their new hires in a training process to help them with orientation and confidence-building in their new company. However, despite the benefits of onboarding, in the following two decades, there was a significant decrease in the number of companies that had implemented an onboarding process. According to the Aberdeen Group's 2006 study, only 40% of companies had a formal onboarding process in place, with 24% not having or planning to implement one.

It is important to note that these results were obtained from different audience groups, and further details about these groups could provide a better understanding of the trends observed. Figure 1 provides a visual representation of the evolution of the onboarding concept over time.

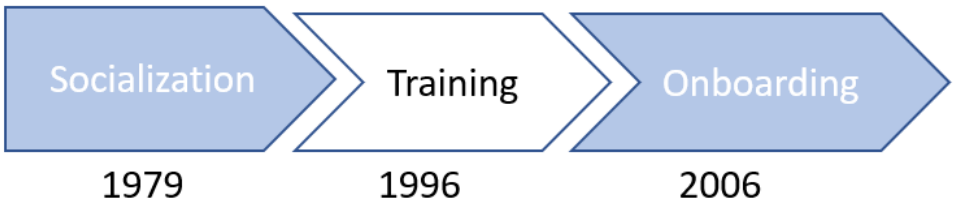

Figure 1. Development of onboarding concept in time.

Over the past decade, many companies, including Fortune 500 corporations as well as small and medium-sized businesses, have revaluated their traditional orientation programs and shifted towards implementing more effective onboarding practices. This trend has been driven by the impressive results demonstrated by companies that have successfully adopted onboarding programs: productivity of new hires increased, as well as their engagement levels inside the company. Onboarding helped in reducing turnover, and it showed positive effects and elevation in the potential hires' interest in the companies' employment brands (Stein & Christiansen 2010).

In 2015, a survey was conducted to determine the extent to which organizations had implemented formal onboarding programs for new hires. The survey included a diverse range of companies across various industries and sizes. According to the results, 66% of the participating organizations reported that they had implemented some aspects of a formal onboarding process beyond basic orientation. This suggests that while many companies recognized the importance of onboarding, they may not have fully integrated it into their overall talent management strategy. Additionally, the survey found that 53% of the companies invested in proper onboarding of new employees during their first year. This suggests that companies were aware of the importance of onboarding not just during the initial orientation period but throughout the first year of employment (Bauer 2015).

In their Harward Business Review article “New leaders need more than onboarding” Byford, Watkins & Triantogiannis (2017) describe that onboarding process can be applied to management personnel. They suggest using a term “Integration” instead of “onboarding” as it “suggests more aspirational goal —doing what it takes to make the new person a fully functioning member of the team as quickly and smoothly as possible” (Byford, Watkins & Triantogiannis 2017). They analyse results of Egon Zehnder’s online survey in which 588 executives at the VP level and above took part at. The conducted survey shows that new hires who receive a structured onboarding program can reach full performance faster than those who do not. In this context, "full performance" refers to the ability to make critical decisions based on the information received and delegate tasks to the appropriate people for execution. The study found that the time it takes for new hires to reach this level of performance can be reduced by a third, from six months to four months, by providing an effective onboarding program. This is based on the premise that the onboarding program should not just be limited to basic orientation but should also include coaching, mentoring, and ongoing support to help new hires become productive members of the organization. The source article emphasizes that onboarding alone is not enough, and that companies should also focus on integrating new hires into the organizational culture and providing them with opportunities to develop their skills and knowledge. They point that such a reduction makes a significant impact as badly organized transition is not only expensive for the company but also reduces the quality of the new executive’s” brand” and jeopardises employee commitment.

2.2 Costs of onboarding

Onboarding is an investment to any company. The higher the employer's salary is, the higher are the costs, and especially the most financial damage the company will suffer when facing a failed hire. In the case of executives, the failed hire's cost could be as high as several million dollars (Dai & De Meuse 2007).

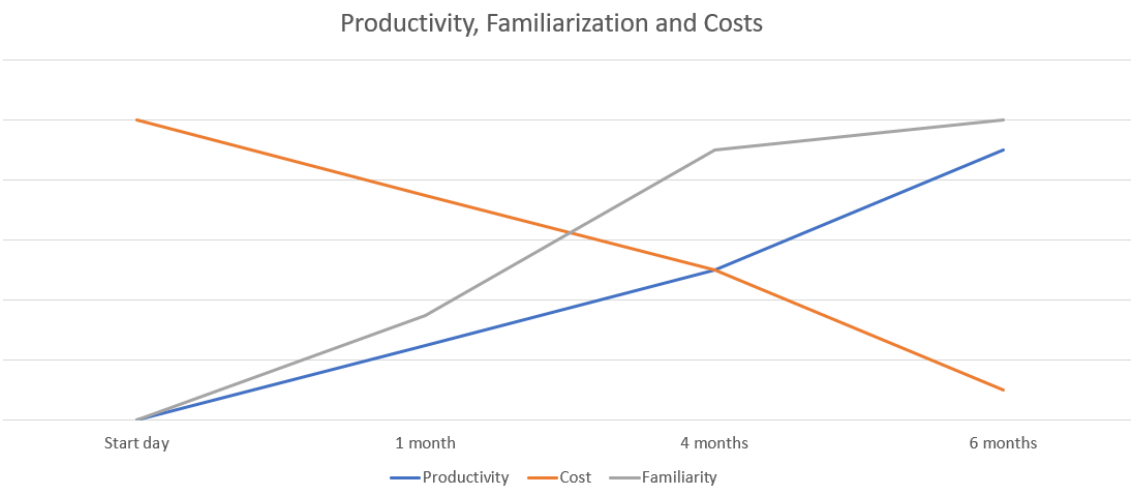

Figure 2. Dynamics of productivity, familiarization, and costs over time (Adapted from Davila & Pina-Ramirez 2018).

In their book "Effective Onboarding: What works in Talent Development" Norma Davila and Wanda Pina-Ramirez present that in the US onboarding costs vary from $4,000 for a frontline employee to over $50,000 for an executive recruitment. According to the authors, costs on onboarding can include various processes such as identifying and defining job needs, revising job descriptions, creating and posting job announcements, selecting candidates through resume screening and interviews, negotiating contracts, conducting background checks, and completing paperwork related to salary and benefits (Davila & Pina-Ramirez 2018). Figure 3 describes these costs in more detail.

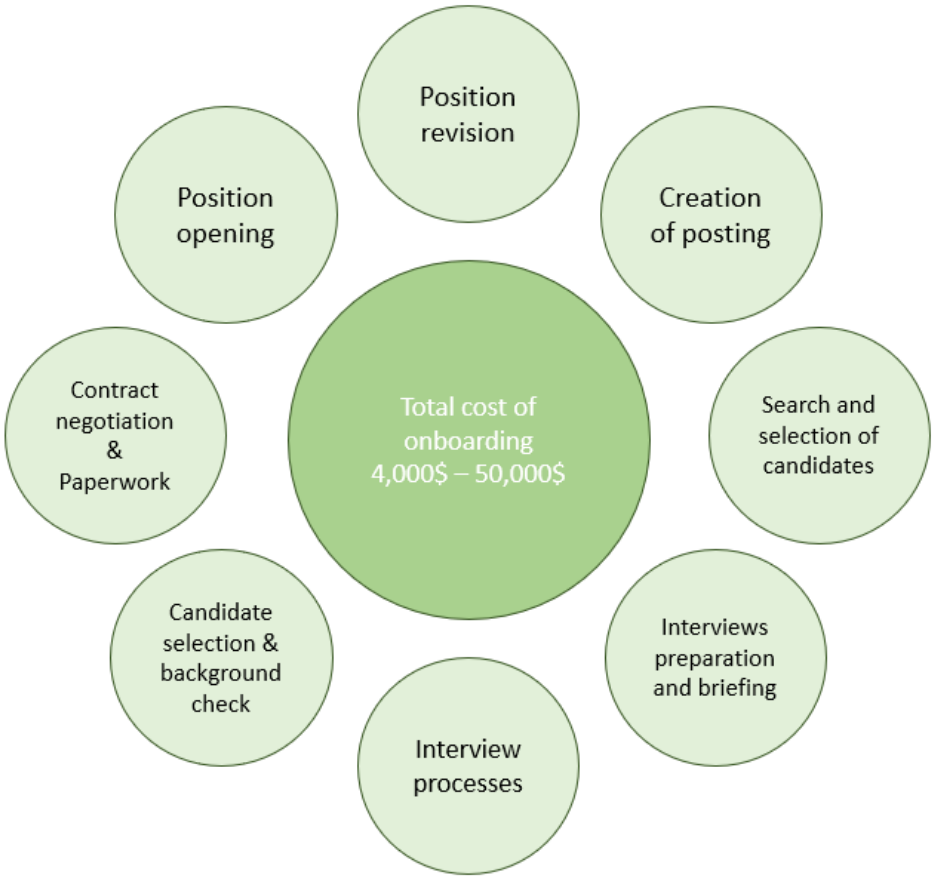

Figure 2. Breakdown of onboarding costs (Adapted from Davila & Pina-Ramirez 2018 and Dai & De Meuse 2007).

The effectiveness of onboarding can be observed with the Return Of Investment (ROI) of the onboarding process (Dai and de Meuse 2007). As an ultimate failure, if a new hire decides to leave the company, the investments for hiring that person are lost. Achievement of the onboarding's goals becomes the key performance indicator for the entire hiring process. Day and Fedele (2012) allocate two main factors:

- time productivity
- engagement and retention

Kumar and Student (2017) point out that to achieve reductions in turnover, get better engagement and enchantment in productivity from new hires companies need to pay extra attention on effective onboarding, as it results it happier more satisfied employees who believe they made a right decision in choosing this specific company, they understand its objectives and strategy more clearly and are ready to be dedicated to achieving company's expectations (Kumar & Student 2017).

A proper onboarding experience reduces the risk of losing the new hire. At the same time, participants of a structured onboarding process are 69% less likely to leave their company after three years. Another study conducted at Ernst & Young company[1] shows that carefully planned onboarding doubles the chances of the worker to stay with the company after two years of employment (Ganzel 1998).

Over the years, various studies have shown the importance of onboarding in increasing employee engagement and retention. One such study conducted by the Brandon Hall Group reported that organizations with a strong onboarding program experienced a 69% increase in employee engagement and a 65% increase in retention. Another study by Talent Management Solutions revealed that companies with a formal onboarding process had a 50% higher retention rate compared to those without one. The Work Institute conducted a study which found that organizations with a comprehensive onboarding program had an average retention rate of 91%, whereas those without a program had a retention rate of only 60%. Additionally, a report by the Institute of Corporate Productivity (i4cp) showed that companies with strong onboarding programs had a 40% lower turnover rate than those without a program.

Bauer (2015) in his work agrees that creating a great onboarding experience will go a long way. He describes a study conducted by A Boston Consulting Group It found the difference between organizations that carefully plan the onboarding and those that leave that to chance are up to 2.5 times the profit growth and 1.9 times the profit margin.

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[1] Study by Ernst & Young (EY): Joining Ernst & Young (EY) – Employee Onboarding. URL: https://www.comparably.com/companies/ey/joining-employee-onboarding. Accessed 12.05.2023

Figure 4 summarizes the significance of the onboarding process from the perspective of employee engagement and retention.

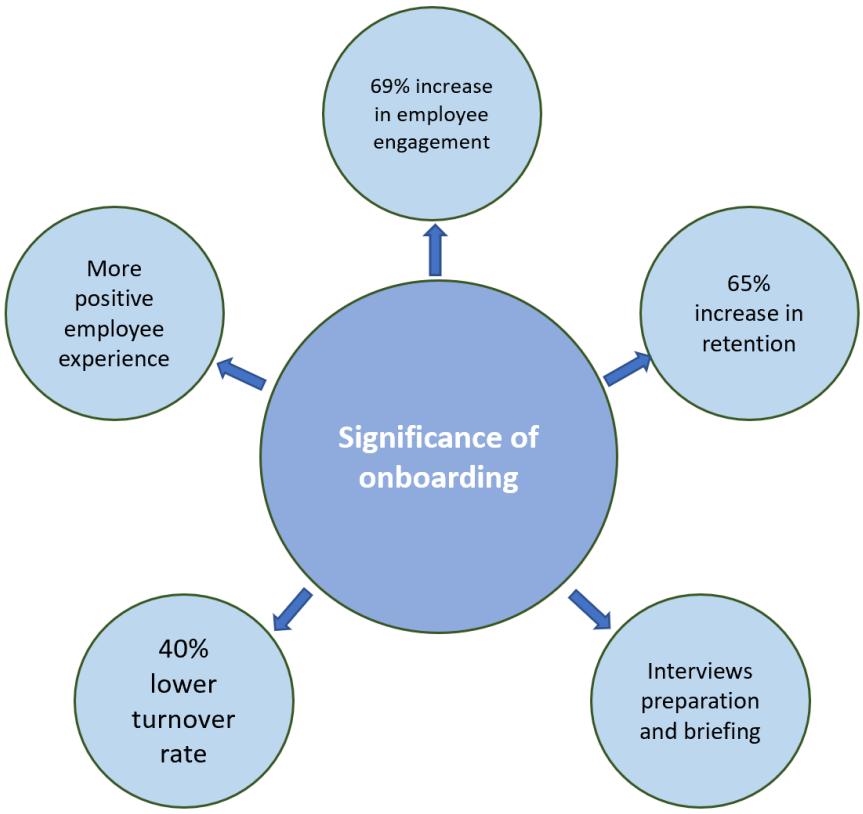

Figure 4. Significance of onboarding (Adapted from Ganzel 1998)

The study conducted in 2003 by Heweitt Associates shows that companies that prioritize the development of strong onboarding practices are more likely to achieve high levels of employee engagement. The researchers stress the importance of establishing a comprehensive onboarding program that aligns with the company's values and culture, provides clear communication and support, and encourages continuous learning and development. By doing so, companies can foster a positive employee experience that not only boosts engagement but also strengthens their reputation as an employer of choice (Hewitt Associates 2003).

Furthermore, onboarding has been proven to reduce turnover rates significantly. For instance, according to Hammonds (2005), the Hunter Douglas company was able to reduce turnover to 16% after upgrading their onboarding practices in only 6 months. Before that the company measured their turnover at 70%. More impressive results were achieved in Omaha by Designer Blinds company, whose decision to implement

better onboarding practices played a key role in reducing turnover from 200% to under 8% annually (Lee 2006).

2.3 Problems in Onboarding

The negative impact of poor onboarding processes on an organization's bottom line cannot be underrated. When employees have a negative experience during the onboarding process, they are highly likely to leave the company soon after. This not only results in a loss of valuable resources and the cost of recruiting and training new employees, but it also negatively impacts overall morale and productivity. Furthermore, when employees leave shortly after joining the company, it sends a message to other employees that the company does not value its employees and is not an attractive place to work. This can also make it more difficult to attract top talent in the future (Kumar & Student 2017).

Apart from impact on the retention, onboarding also has a strong correlation to business results. High turnover rates result in the loss of valuable resources and the financial burden of recruiting and training new employees. Lack of productivity can lead to delays in completing projects and negatively impact the overall performance of the organization. These issues can result in significant time and financial losses for the company (Davila & Pina-Ramirez 2018).

The high rate of employee turnover is a concern across all industries, but it is particularly challenging in the Information Technology (IT) sector. The high turnover rate in IT industry has long been a cause for concern among companies operating within this sector.

Studies have consistently shown that the IT industry is among the top categories for turnover, with the highest turnover rate for any job sector recorded at 13.2% in 2017 (Booz, 2018). Furthermore, research conducted by Forrest (2018) has revealed that more than one out of five software engineers leave their jobs within the first year, with a staggering 21.7% turnover rate. Given these alarming statistics, it is crucial for companies in the IT industry to take action and address the issue of employee turnover. The present study aims to focus specifically on turnover in the IT sector, as it is here where the problem is most prevalent.

For instance, Boatman and Erker (2012) point out, that half of the newly hired workers rate their onboarding program as poorly executed. And the study shown in Forbes magazine shows that more than 50% of newly hired employees leave the company within the first 12 months after they joined (Davila & Pina-Ramirez 2018).

Despite significant investments in onboarding initiatives, many companies are still facing challenges in effectively integrating new hires, leading to longer time-to-productivity, higher employee turnover, disappointed hiring managers, and subpar return on investment. Stein & Christiansen believe the statistics are clear, with a considerable proportion of external hires leaving the company within two years, and less than one-third of executives having a positive experience during their onboarding process. This is a major concern for companies as they invest heavily in recruiting and hiring new employees but fail to retain them due to ineffective onboarding processes.

Moreover, Stein & Christiansen stress that nearly one-third of executives who join a company as external hires fail to meet expectations in their first two years, indicating that onboarding processes are not effectively preparing them for success within the company. This not only results in lost productivity and wasted resources, but also a negative impact on the company's reputation and ability to attract top talent in the future.
In addition, almost one-third of employees who have been with their current employer for less than half a year are already seeking new job opportunities, which is a clear indication that onboarding processes are not effectively engaging and retaining employees. This results in high turnover rates, which can be costly for companies in terms of recruitment, training, and lost productivity.

In conclusion, the failure of onboarding processes to effectively integrate new hires and retain employees is a significant concern for companies. It results in longer time-to-productivity, higher turnover rates, frustrated hiring managers, and a mediocre return on investment. Companies must re-evaluate their onboarding processes and invest in innovative approaches that effectively integrate new hires and engage employees to ensure long-term retention and productivity (Stein & Christiansen 2010).

Despite the significant resources and efforts invested in onboarding processes by many organizations, the results often fall short of expectations. A global survey of 198 HR executives revealed that while most believed their companies effectively handled the basic orientation and administrative tasks for new hires, only half felt their

organizations effectively facilitated alignment between new hires and their teams. Even fewer, less than a third, felt that their companies effectively helped new executives adapt to the company's culture and political climate. Furthermore, research has shown that poor onboarding can lead to negative consequences such as longer time-to-productivity, higher attrition rates, and a lack of satisfaction from both new hires and hiring managers.

To truly maximize the potential of new hires and avoid these negative consequences, companies must move beyond basic orientation and administrative tasks and prioritize custom-designed onboarding experiences. These tailored approaches will enable new leaders to quickly assimilate and fully integrate into the organization, leading to a more rapid and successful transition. Such experiences can include things like mentorship programs, job shadowing, and opportunities for new hires to meet and connect with a diverse group of employees across different departments and levels of the organization. Additionally, companies can also leverage technology to supplement socialization efforts, such as utilizing new-hire portals or online social networks to connect new hires with veteran employees (Byford & al. 2017).

Studies have identified several common challenges in the onboarding process that can negatively impact new hires' success in their roles. One of the most significant challenges is a lack of clear expectations and role definition, according to the Society for Human Resource Management (SHRM). Another challenge is insufficient training and development opportunities, which can prevent new hires from reaching their full potential. Poor communication and integration with team members is also a major challenge, as highlighted by a report by the Brandon Hall Group. Limited feedback and support during onboarding can lead to new hires feeling disengaged and unsupported, as noted in a study by the Harvard Business Review. Additionally, high turnover rates within the first year of employment can be a significant problem, indicating that the onboarding process has not been effectively implemented, according to the Center for American Progress.

To prevent these challenges and ensure the success of new hires, organizations should strive to create a positive onboarding experience. This can include providing clear expectations and role definition, comprehensive training and development opportunities, effective team integration, regular feedback and support, and addressing any concerns or issues that new hires may have. By doing so, organizations can improve their retention rates and ensure that new hires are engaged and satisfied in

their roles. Figure 5 summarizes different challenges of the onboarding, based on the literature.

Figure 5. Challenges of onboarding (Adapted from Stein & Christiansen 2010, Society for Human Resource Management, Byford & al. 2017, Boatman and Erker 2012)

2.4 Onboarding Best Practices

To achieve the goals and get all the benefits of onboarding, it is important to follow practices that have already proven to be effective and help organizations create a positive onboarding experience that leads to increased employee engagement, higher retention rates, and better job performance. Further we will examine the most significant best practices that ensure companies implement a successful onboarding program. Bauer and Brandt have been used as the main references for most of the text because they are well-respected sources in the field of HR and have conducted research on the onboarding process. Specifically, Bauer's study on onboarding challenges is widely cited in literature related to employee onboarding, and Brandt's report on the benefits of effective onboarding programs is a comprehensive guide that highlights the importance of onboarding for organizations.

Another influential author in the field of onboarding is George Bradt, who, together with Mary Vonnegut, authored the book "Onboarding: How to Get Your New Employees Up

to Speed in Half the Time". In their book, Bradt and Vonnegut outline several factors that he names as "the prerequisites to successful onboarding," which help organizations align around the needs and roles of new employees. Authors emphasizes that these factors help organizations align around the needs and roles of new hires, ultimately leading to successful onboarding. He names three “A”s: “Align”, “Acquire” and “Accommodate”. Alignment means that there is agreement inside the team that there is a role to be filled and the need of a new team member is identified. Next step, “Acquire”, consists of candidate identification process, selection process and finally a decision to hire a new team member. And finally, “Accommodation” which means that the new team member is given the tools and means to fulfil their role and be able to do the work. Figure 6 illustrates this as a linear process.

Figure 3. 3 "A"s of onboarding according to Bradt and Vonnegut (2009)

Planning the new employee’s role and related delegations need to be carefully planned during the onboarding process. This plan sets the beginning of working relationship and demonstrates the value of the new employee for the company. The whole team that accepts the new member should take part in planning and thinking through the new role, its stakeholders, message, and new team member’s first day in the company, including personal and office setup. (Brandt & Vonnegut 2009)

2.4.1 Involve the manager

Brandt emphasizes that the manager needs to participate in creating the new employee’s personal onboarding plan and human resources prove all the tools and support needed. Clear messages, map of stakeholders, delegating time and reserving time slot to put together and make the official announcement, maps of whom to contact, when and how before and after the announcement – all these are the most important things to do to help a recruit to feel welcome and valuable to an organisation, especially if the goal is to make employees feel they can take pride in one. Work and personal needs need to be attended to and accommodated. Work needs include basic things like desk reservation, phone, computer, ID card, payroll, forms and so on.

Personal needs could include the move, housing, help with schools and setting up the employee's family in the new place (Brandt & Vonnegut 2009).

"Do What It Takes to Make Your New Employee Ready, Eager, and Able to Do Real Work on Day One" (Brandt & Vonnegut 2009).

2.4.2 Offer real work on day one

A perfect day one would include an opportunity to do the real work right away. For that the organization needs to mind the details given and put them in line with the opportunities and shared purpose. The team manager is responsible for ensuring the organization provides the perfect day one experience. Human resources should actively participate and manage the implementation of accommodation activities. Of course, the employee herself can help the process by clarifying owns needs and expectations and getting ahead of personal setup.

Bradt and Vonnegut (2009) give great advice on designing and implementing the first day experience the same way as customer experience would have been. A company should pay attention to the impact it makes on the new hire, and what impact the new worker is making on the organization. He says that first impressions can be given only once and should not be left to a chance, as the feeling of that impression would last a long time (Brandt & Vonnegut 2009).

As previously mentioned in relation to costs, the Boston Consulting Group conducted a study on onboarding (Bauer 2015) that identified 'the four Cs' as key elements of the process, which are clarification, compliance, culture, and connection.

Under Clarification they understand the details and context of the role, that include requirements, definitions of done, acronyms to use in external and internal communication etc. They emphasize that the sooner the new company member get ahold of those things and understand his role, the faster he or she will become more productive.

Compliance term in the research of A Boston Consulting Group refers to the normality of the routine work process, such as forms, necessary paperwork, badges, email lists and communications, office things, accounts etc. Handling the compliance part well helps to make new employee's onboarding part of such unpleasant and routing part less burdensome.

Bauer writes that organizations are much alike people in a way they have their unique traits, patterns, expectations, and personalities. Based on that the term “Culture” is used as a reference to learn unique organizational culture. Long-term success of the employee in the organization depends on how well and how fast the new hire can understand and even better, become a part of the organization overall and subcultures within the organization.

2.4.3 Socialize the employee

And finally, to be effective, it is particularly important to form interpersonal relationships, understand support mechanisms and information networks for the new employee. The key to that is Connection (Bauer 2015).

The research described by Bauer conducted by A Boston Consulting Group shows that clarification is the most crucial factor of all C’s. The survey included answers from more than 12 thousand people and showed that Clarity is the only aspect that somehow is connected to all the outcomes and specifically related to the new hire’s performance. It shows that people with clarity of their new roles and who are confident in them, have better onboarding experience and overall organizational success, compared to those who do not have that clarity. Bauer did not stop at the research results and continued the work by conducting interviews with new employees, observed them and did a thorough research of the topic and came to the same conclusion of clarity being the key factor to the success of onboarding and in the company overall. He concluded that clarity is conjugated with the willingness to take risks, asking more questions, being more curious about their new job, the role, their colleagues, and the company and overall are more effective.

In 2008 Nik Shah and Scott Pollak authored a research article called “Best practices for retaining new employees: New approaches to effective onboarding” for service Saratoga. There they describe best practices and techniques.

When an individual begins a new job, they may be at a disadvantage, even if they have many years of work experience and valuable knowledge. This is because they may not be familiar with the various social nuances of the culture within the organization. To help mitigate this, companies often engage in socialization activities, such as group interactions or one-on-one contacts with other employees or assigned "buddies."

These socialization activities are crucial for new employees as they help them to absorb the information, they need to become productive in their new role. Additionally, these activities aid in embedding new hires into the company culture, which helps them to quickly build relationships and personal networks.

By participating in social networks, new hires can acquire a wealth of valuable information and gain significant advantages. These include: knowledge, skills, and abilities needed to perform their job; successful and satisfying work relationships with other staff members; insights and information on formal and informal work relationships and power structures; specific technical language and acronyms, slang, and jargon unique to the company; details on the company's rules, principles, and values and how they help maintain the company's integrity; and facts on the company's history, traditions, and customs and background of key employees.

In conclusion, socialization activities and building social networks are vital for new employees as they help to quickly integrate them into the company culture and provide them with the information, they need to be productive and successful in their new role.

2.4.4 Create confidence

Facilitating clarification and confidence during the onboarding process is essential for ensuring the successful and efficient integration of new hires into the organization. By providing clear and concise information about their role's expectations and purpose, new hires can quickly understand their responsibilities and make meaningful contributions to the company. Clarity serves as the cornerstone for effective onboarding and helps to mitigate any challenges that may arise during the first year of employment, allowing the organization to focus on maximizing the productivity of its new members (Bauer 2015).

2.4.5 Enable mentoring

Many companies understand the importance of a smooth transition for new employees and assign a peer, known as a "host" or "buddy," to assist in this process. The buddy's role is to provide the new employee with information about the company, answer any questions they may have, and assist in making their transition into the company as seamless as possible. This not only helps the new employee gain more confidence, but also allows them to become productive more quickly. For the best results, the buddy should be a person who is relatively new to the company themselves, as they can best

relate to the new-hire situation and are outside the reporting chain for the newly hired employee.

Social networks play a crucial role in helping new employees become culturally acclimated to the company. In addition to assigning a buddy, companies can take other steps to facilitate this process. One effective approach is the use of technology to complement the social aspect of onboarding. For example, new-hire onboarding portals can be used to provide employees with detailed information about the company, including links to company newsletters, streaming video of current employees discussing their experiences, and messages from the CEO or other senior leadership team members welcoming the new hire.

Overall, the key to effectively retaining new employees is to provide them with the support they need to quickly become acclimated to the company culture and become productive in their new role. By utilizing a combination of social networks, buddy systems, and technology, companies can create an effective onboarding process that helps new employees feel welcomed and valued from the very start.

Onboarding is a crucial part of the employee lifecycle, and companies that invest in the onboarding process are more likely to retain their new hires. By using social networking software and automating the process, companies can create a more efficient and effective onboarding process that helps new hires feel welcomed and valued from the very start while also improving the company's operational performance (Shah & Pollak 2008).

2.4.6 Explain expectations clearly

Lack of clear expectations during the onboarding process can lead to confusion and frustration for new hires, as they may not fully understand their responsibilities or the goals of their role. This can result in a lack of direction and motivation, which can negatively impact their productivity and performance.

According to a study by the Society for Human Resource Management (SHRM), a lack of clear expectations for new hires is one of the most common onboarding challenges. The study found that employees who received a clear understanding of their role and responsibilities during onboarding were more likely to be satisfied with their job and stay with the company longer.

When new hires are not provided with clear expectations, it can lead to wasted time and resources, as the employee may struggle to understand their role and may need additional training and support. Additionally, lack of clear expectations can also lead to confusion and miscommunication between the new hires and their managers and colleagues, which can negatively impact team dynamics and productivity.

To mitigate this problem, organizations should ensure that new hires are provided with clear and detailed information about their role and responsibilities during the onboarding process. This can be done through a combination of written materials, training sessions, and one-on-one meetings with managers and colleagues.

2.4.7 Offer training

Insufficient training and development during the onboarding process can lead to new hires not reaching their full potential within the organization. A lack of training can result in new hires not having the necessary skills and knowledge to perform their role effectively, which can negatively impact their productivity and performance (Bauer 2010).

According to a study by Deloitte, a lack of training and development opportunities is a key factor in new hires not reaching their full potential. The study found that organizations that provide comprehensive training and development programs have a higher retention rate for new hires and a lower turnover rate.

When new hires are not provided with sufficient training and development, it can lead to frustration and dissatisfaction, which can negatively impact their motivation and engagement. It can also lead to a lack of confidence and proficiency in their role, which can negatively impact their ability to make meaningful contributions to the company.

To mitigate this problem, organizations should provide comprehensive training and development programs for new hires. These programs should be tailored to the role's specific needs and should include a mix of on-the-job training, classroom-style training, and mentoring. Additionally, organizations should also provide ongoing training and development opportunities to support the professional growth and development of new hires throughout their employment.

2.4.8 Enable communication

Poor communication and integration with team members during the onboarding process can lead to new hires feeling isolated and disengaged, which can negatively impact their performance and the overall productivity of the team (Jones 2014).

A report by the Brandon Hall Group found that poor communication and integration with team members is one of the main reasons new hires fail to succeed in their role. The report states that when new hires are not effectively integrated into the team, they may feel disconnected from their colleagues and may not fully understand the team's dynamics, goals and objectives.

Additionally, poor communication can also lead to confusion and miscommunication between the new hires and their managers and colleagues, which can negatively impact team dynamics and productivity. This can be especially true in remote work situations where new hires may not have the opportunity to build relationships and establish trust with their team members in person.

To mitigate this problem, organizations should ensure that new hires are effectively integrated into the team during the onboarding process. This can be done through a combination of team-building activities, mentoring, and regular communication and check-ins with managers and colleagues. Organizations should also make sure that new hires have access to all necessary resources and information to understand the team's dynamics and objectives. Encouraging team members to reach out to new hires and build relationships with them also can be helpful (Stevenson 2022).

2.4.9 Provide feedback

Limited feedback and support during the onboarding process can lead to new hires feeling disengaged and unsupported, which can negatively impact their performance and motivation. Without regular feedback, new hires may not know how they are performing in their role, which can make it difficult for them to improve or make adjustments.

A study by the Harvard Business Review highlighted that limited feedback and support during the onboarding process can lead to new hires feeling disengaged and unsupported. The study found that employees who received regular feedback and

support during onboarding were more satisfied with their job and were more likely to stay with the company longer.

When new hires do not have enough feedback or support, it can lead to a lack of direction and motivation, which can negatively impact their productivity and performance. It can also lead to a lack of confidence in their role and in their ability to contribute to the company.

To mitigate this problem, organizations should provide new hires with regular feedback and support throughout the onboarding process. This can be done through regular one-on-one meetings with managers, performance evaluations, and opportunities for new hires to ask questions and receive guidance. Providing new hires with access to a mentor or a buddy can also be helpful as they can provide guidance and advice. Providing regular feedback and support helps new hires to understand how they are performing in their role and what they can do to improve, which in turn can increase their motivation and engagement (Sibisi & Kappers 2022).

2.4.10 Provide mentoring

One way of ensuring feedback is to offer mentoring for the newcomer. The host or buddy is typically a current employee who is knowledgeable about the company culture, policies, and procedures, and can serve as a mentor and point of contact for the new employee. This practice helps to ease the transition into the new role, improve the overall onboarding experience, and increase the likelihood of success and retention for the new employee (Shah & Pollak 2008b)

While assigning a buddy to a new hire can have many benefits, different authors, like Becker (2019), Srimannarayana (Srimannarayana 2016), Graybill, Taesil, Offord, Piorun and Shaffer (2013), White, Claptop, Cook (2020) identify some potential problems that organizations should be aware of. Some of these include:

- Inadequate training of the buddy: If the buddy is not professionally trained in their role and responsibilities, they may not be able to provide the necessary support and guidance to the new hire.
- Incompatible personalities: There may be instances where the personalities of the buddy and the new hire do not mesh well, which can lead to a negative onboarding experience for both parties.

- Limited availability: If the buddy is not available due to their own workload or schedule, the new hire may feel abandoned and not fully supported during the onboarding process.
- Unequal workload distribution: In some cases, the buddy may not be able to adequately balance their own work with their responsibilities to the new hire, leading to frustration and burnout.
- Biased information: There may be instances where the buddy has their own biases and provides the new hire with inaccurate or incomplete information about the company or role.

3 Helping onboarding with Artificial Intelligence

This chapter reviews the current literature on Artificial Intelligence and chatbots, researches the usage of chatbots in educational processes and investigates related challenges.

Artificial Intelligence as a term was introduced by John McCarthy in 1958 in a paper called “Programs with Common Sense”. After those years there were many researchers and research papers that built a path for Artificial Intelligence and allow it to turn into something we know today (Negnevitsky 2005).

The modern definition of Artificial Intelligence is based on widely accepted concepts and definitions presented in works of AI researchers, computer scientists, and machine learning practitioners, as well as established academic literature, such as research papers, books, and articles, on the topic of artificial intelligence. Based on the work of such researchers as Suchman & Trigg (1993), McCarthy (2004), Warwick (2011), Russell & Norvig (2022) , Mitchel (Mitchell 1997), Sutton & Barto (Sutton & Barto 2015) Artificial Intelligence can be given following definition: AI, or artificial intelligence, is the simulation of human intelligence processes by computer systems, including learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions), and self-correction. These processes are carried out by software and/or hardware systems, often with the aim of solving complex problems that would normally require human intelligence to solve. The ultimate goal of AI research is to create systems that can perform tasks that typically require human intelligence, such as perception, reasoning, decision-making, and language.

Artificial Intelligence (AI) encompasses a wide range of techniques, technologies, and applications including machine learning, deep learning, natural language processing (NLP), robotics, computer vision, decision making and planning, game playing and predictive modeling. These are described in more detail in Figure 7. These are some of the major areas of AI, and there are many more subfields and applications. The development of AI is a rapidly evolving field, and new techniques and technologies are being developed all the time (Adamopoulou & Moussiades 2020).

Machine learning:	The development of algorithms that allow computers to automatically learn and improve from experience, without being explicitly programmed.
Deep learning:	A subfield of machine learning that uses artificial neural networks to model complex relationships and patterns in data.
Natural language processing (NLP):	Usage of AI techniques to process and analyze human language, including speech recognition, text classification, and sentiment analysis.
Robotics:	Involves the development of intelligent machines that can perceive, reason, and act in the physical world.
Computer vision:	Involves AI algorithms to interpret and analyze visual data, including image and video recognition, object detection, and scene understanding.
Decision making and planning:	Involves the use of AI algorithms to make decisions and plan actions, including expert systems, decision trees, and Monte Carlo methods.
Game playing:	Involves the development of AI systems that can play games such as chess, go, and poker.
Predictive modeling	Involves AI algorithms to make predictions and forecasts, including regression analysis, time series analysis, and decision trees.

Figure 7. Techniques and technologies of AI (Adapted form Adamopoulou & Moussiades 2020).Artificial Intelligence tools in onboarding

Some forward-thinking companies are utilizing technology to enhance their onboarding process by incorporating social networking software. This allows new hires to access internal blogs or wikis where they can discuss their experiences and provide feedback on the onboarding process. Additionally, some companies have established online social networks that link new employees with veteran employees. This helps the newly hired employee achieve desired productivity levels more rapidly, provides a source for helping new hires locate expertise, and injects excitement into the company by exposing all employees to innovative ideas and opinions.

Automating the onboarding process also helps companies improve operational performance. For example, some companies send newly hired employees a link to a new-hire portal where they can obtain information about the company such as the company's code of conduct, ethics, and compliance requirements. On these portals, new hires may also learn about orientation programs, employee benefits packages, and forms they will need to submit on or before their first day of work. By directing new employees to the company's portal for benefits decisions, they have access to automated systems to guide them through critical employee life-cycle events associated with the new-hire process. Dealing with these questions in advance frees up time during the day-one orientation session, allowing the company to focus on socializing the new hires into their team and the culture of their new company.

As mentioned in the previous chapter, assigning a host or buddy to a new employee during the onboarding process is considered a best practice as it helps to facilitate the integration and acclimation of the new employee into the organization. To make the onboarding process more efficient for companies, some parts of this work could be automated using Artificial Intelligence-based chatbots.

The article "Artificial Socialization: How Artificial Intelligence Applications Can Shape A New Era of Employee Onboarding Practices" defines artificial socialization as the process of using AI to create a more engaging and interactive onboarding experience for new employees (Ritz & al 2023). This can include using chatbots to answer frequent questions, virtual reality to simulate the workplace environment, and personalized learning plans to tailor training to individual employees.

The author suggests that chatbots can be used in employee onboarding to answer frequent questions and provide guidance to new hires. Chatbots can provide an interactive and engaging experience for new employees, allowing them to receive immediate responses to their queries and concerns. Additionally, chatbots can help to streamline the onboarding process and free up HR staff to focus on more complex tasks.

However, there are also potential downsides to using chatbots in onboarding. One of the main concerns is the potential for chatbots to lack empathy and human touch, which could lead to a less personalized and less effective onboarding experience. There is also a risk that chatbots could malfunction or provide incorrect information, which could lead to confusion and frustration for new employees.

Overall, the article emphasizes the potential of AI in revolutionizing the onboarding process and creating a more effective and engaging experience for new employees (Ritz & al. 2023).

Possibilities of usage of AI in Human Resource Management (HRM) processes is also explored in the article "Role of Artificial Intelligence in Human Resource Management: Overview of its Benefits and Challenges" by Sanyaolu and Atsaboghena (2022).

The article explores the potential use of AI in HRM processes. The authors provide an overview of AI applications in HRM, such as recruitment, performance management, and employee engagement, and discuss the benefits and challenges associated with its use.

One of the main challenges highlighted in the article is the potential for AI to perpetuate existing biases or create new ones. The authors emphasize the importance of using diverse data sets to train algorithms and regularly auditing AI systems for biases. They also suggest involving human oversight in decision-making processes.

Another challenge discussed in the article is the risk of privacy violations and data breaches associated with the use of large amounts of personal and sensitive employee data. The authors provide strategies to mitigate these risks, such as implementing strong security measures and conducting regular audits and risk assessments.

Overall, the article emphasizes the potential benefits of AI in HRM, but also highlights the importance of addressing the potential challenges and risks associated with its use. The authors note that the implementation of AI in HRM requires careful planning and consideration, including the need for ethical guidelines and policies to ensure that the technology is used in a responsible and effective way (Sanyaolu & Atsaboghena 2022).

3.1 Chatbots mentors for onboarding

Chatbots are a specific type of AI application that involves the development of computer programs designed to simulate conversation with human users. They are typically powered by natural language processing (NLP) and machine learning algorithms, which allow them to understand and respond to user inputs in a way that mimics human conversation. Chatbots can be integrated into websites, messaging apps, and other digital platforms to provide automated customer service, support, or information. They can be programmed to answer specific questions, perform specific tasks, or even engage in more complex conversations (Adamopoulou & Moussiades 2020).

AI provides the foundation for chatbots to perform their functions by using complex algorithms and machine learning models to process and analyze data. When a user interacts with a chatbot, the AI technology behind it is responsible for analyzing the user's input, determining what the user is asking for, and generating a relevant response.

The use of AI in chatbots makes them highly adaptable and capable of continuously improving their responses over time. As chatbots interact with more users and receive more input, they can use the data they collect to train their machine learning models

and better understand human language and user requests. This allows chatbots to respond more accurately and effectively to a wider range of user requests.

The benefits of using AI in chatbots are many. For example, they can process large amounts of data much faster than a human could, allowing them to quickly provide accurate responses to user requests. They can also be programmed to perform a wide range of tasks, from answering simple questions to helping users complete complex transactions. Additionally, AI-powered chatbots can be integrated into websites, messaging apps, and other digital platforms, making it easy for users to access them from a variety of devices.

In summary, AI provides the technology that enables chatbots to simulate human conversation and respond to user requests in a flexible and effective manner. The use of AI in chatbots allows them to continually improve their responses, making them a highly versatile and valuable tool for businesses and organizations (Wollny & al. 2021).

3.1.1 Applications of chatbots in education

Research on AI in education provides a relevant context for observing the potential of chatbots in enhancing learning and supporting students. By using AI algorithms to analyze student performance data and provide tailored feedback, chatbots can help students progress faster and achieve better outcomes. AI-powered tutoring systems can assess a student's current level of understanding and provide targeted feedback and support to help them master new concepts. AI can also help to create more efficient educational systems by automating routine tasks, such as grading assignments and tracking attendance. However, it is crucial to consider the potential ethical and social implications of using AI in education.

Chatbots in education have the potential to make learning more accessible, engaging, and personalized for students. By using AI algorithms to analyze student performance data and provide tailored feedback, chatbots can help students progress faster and achieve better outcomes (Beck, Stern & Haugsjaa 1996).

There are already several research works and articles investigating the possibilities of AI usage in education, its difficulties and challenges. For example, in the article "Artificial Intelligence in Education: Promises and Implications" by Wayne Holmes

(Holmes 2019), the author discusses the potential of AI in education to create more efficient and effective educational systems, providing support for both teachers and learners.

One way that AI can help to create more efficient educational systems is by providing personalized support for learners. AI-powered tutoring systems can assess a student's current level of understanding and provide targeted feedback and support to help them master new concepts. This can help to reduce the amount of time that teachers need to spend providing one-on-one support, allowing them to focus on other aspects of teaching.

AI can also help to create more effective educational systems by analyzing large amounts of data about student learning and providing insights into which teaching methods and materials are most effective. This can help teachers to make data-driven decisions about how to adapt their teaching practices to better support student learning.

Additionally, AI can help to create more efficient educational systems by automating routine tasks, such as grading assignments and tracking attendance. This can help to free up teachers' time, allowing them to focus on more complex tasks that require human input and expertise.

Overall, the author argues that AI can revolutionize education by creating more efficient and effective educational systems that provide personalized support for learners and teachers in their professional development. However, Wayne Holmes emphasizes how important it is to consider the potential ethical and social implications of using AI in education, such as concerns about privacy, bias, and the role of teachers (Holmes 2019).

Holmes (2019) also emphasizes that chatbots can enhance learning and support students and not only as a part of tutoring system. According to Beck, Stern & Haugsjaa (1996), some examples of chatbots used in education are illustrated on Figure 8. These include:

1. Tutoring chatbots: These chatbots use AI algorithms and natural language processing to provide students with personalized support and feedback on their assignments and coursework.
2. Virtual study partners: These chatbots can help students review course material and provide them with customized practice problems and quizzes.
3. Learning management system (LMS) chatbots: These chatbots can help students navigate their LMS and access resources and information about their courses.
4. Admissions chatbots: These chatbots can help prospective students learn more about a college or university and provide them with information about the admission process and requirements.
5. Personalized learning chatbots: These chatbots can provide students with customized learning paths based on their individual learning needs and preferences.

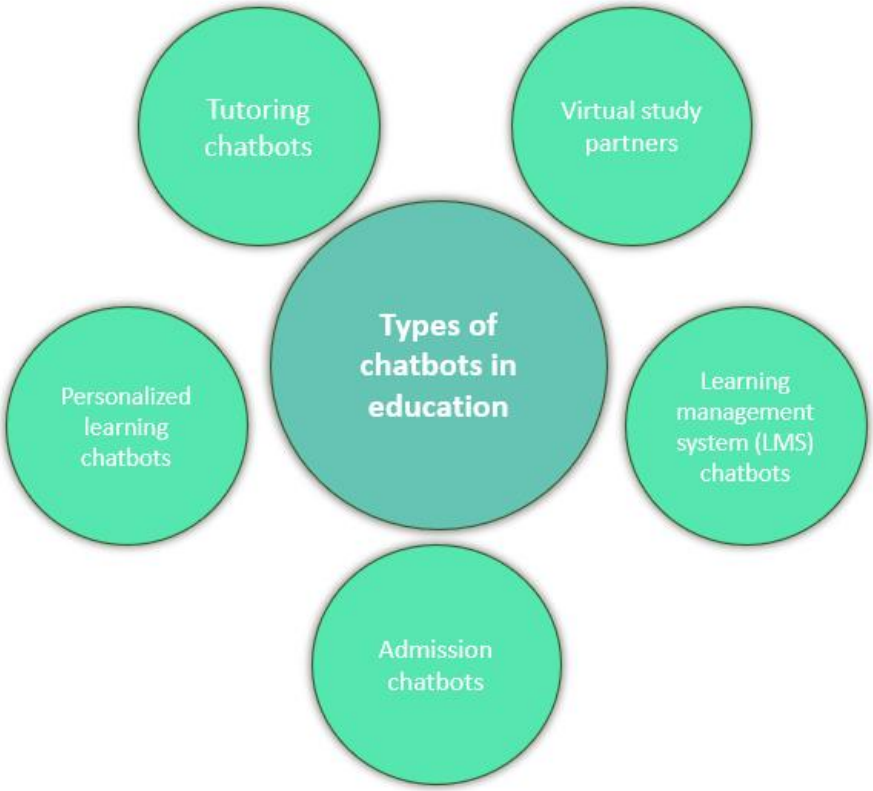

Figure 8. Types of chatbots in education (Beck et al. 2019).

An article titled "Chatbots applications in education: A systematic review " by Chinedu Wilfred Okonkwo and Abejide Ade-Ibijola (2021) identifies various applications of chatbots in educational settings, including supporting learning and teaching, providing personalized feedback, facilitating communication and collaboration, and enhancing student engagement. The authors highlight that AI has the potential to transform education by providing personalized learning experiences, automating administrative tasks, and improving student engagement and outcomes. Some of the specific benefits of using AI in education include personalized learning, automating administrative tasks, and improving student engagement and outcomes. AI can help to create personalized learning experiences by analyzing student data and providing tailored recommendations and resources. It can also help to automate administrative tasks such as grading, scheduling, and data entry, freeing up time for teachers to focus on teaching and learning. Additionally, AI can provide students with interactive and engaging learning experiences that can increase their motivation and improve their learning outcomes.

Figure 9 illustrates some of the specific benefits of implementing AI in education.

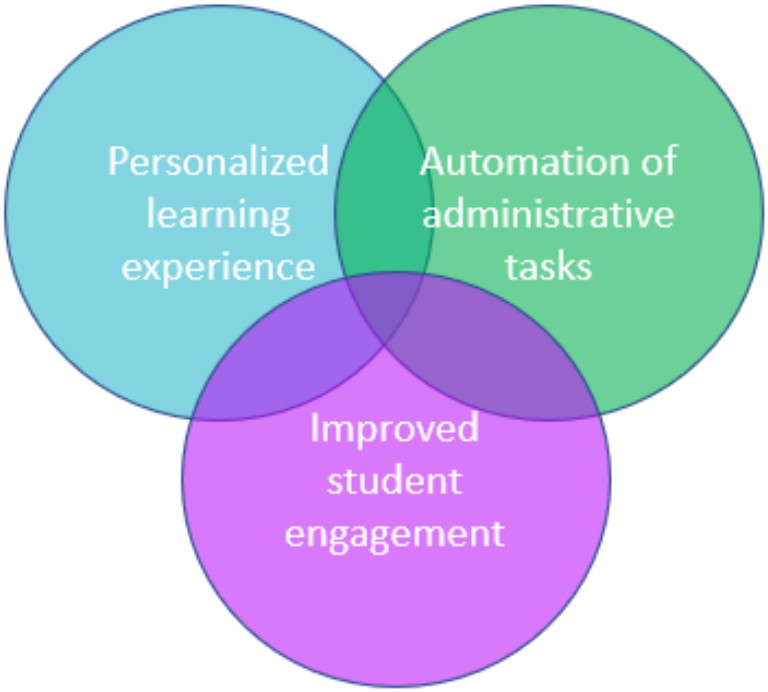

Figure 4. Benefits of AI in education (Okonkwo, Ade-Ibijola 2021).

Okonkwo and Ade-Ibijola identify several challenges to implementing AI in education, including the following:

1. Lack of understanding of chatbot technology: Many educators and students may not be familiar with chatbot technology, which could result in a lack of trust or skepticism about their effectiveness.
2. Limited customization: Many chatbots are designed for a specific purpose or task and may not be easily customizable to fit the unique needs of different educational contexts or student populations.
3. Language and cultural barriers: Chatbots may struggle to effectively communicate with students who speak different languages or come from diverse cultural backgrounds, which could limit their usefulness in diverse educational settings.
4. Data privacy and security concerns: As with any technology that collects and stores personal data, there are concerns about the privacy and security of information shared with chatbots.
5. Integration with existing educational technology: Chatbots may need to be integrated with existing educational technology systems, which could be a complex and time-consuming process.

6. Ethical concerns such as abuse and deception, which is possible to happen when users mistakenly think to be conversing with a real person instead of a Chatbot.

Overall, while AI has the potential to transform education, it is important to carefully consider the benefits and challenges of implementing AI in education and to ensure that it is used ethically and effectively. The article concludes by calling for further research and collaboration between educators and AI researchers to explore the potential of AI in education (Okonkwo & Ade-Ibijola 2021).
Further research will concentrate on chatbots and chatbot technology that can be used in onboarding specifically.

An example of the use of an AI-powered tutoring system is an Intelligent Tutoring System (ITS) that uses AI algorithms to personalize the learning experience for each student (Schmelzer 2019). Tutoring systems can take many forms, including computer programs, mobile apps, and online platforms. Some tutoring systems use chatbot-like interfaces to communicate with students. ITSs can track a student's progress, understand their strengths and weaknesses, and provide customized feedback and guidance. For example, an ITS for mathematics education could use AI to analyze a student's performance on various math problems and provide tailored instruction and practice problems to help the student improve in specific areas. These systems can also provide real-time feedback on student performance, helping students to identify and correct mistakes as they work through problems. The use of AI in ITSs has been shown to be effective in enhancing student learning and improving student outcomes, as well as reducing teacher workload. There are numerous AI-powered tutoring systems available, some of which are listed in Appendix 2.

4 Research design

This chapter describes the methodology and its justification for the conducted research and each of the research questions raised is presented. It describes the research design, data collection methods and its justifications, and data analysis techniques that were selected to ensure validity and reliability of the findings. The chapter contributes to demonstrating the necessity of the research and helps prove its significance to the field.

4.1 Research approach

There are two types of research approaches used in this kind of work: qualitative and quantitative. Both have a different purpose. According to the definitions given by Raimo Streefker (2019)

> *"**Quantitative research** is expressed in numbers and graphs. It is used to test or confirm theories and assumptions. This type of research can be used to establish generalizable facts about a topic. Common quantitative methods include experiments, observations recorded as numbers, and surveys with closed-ended questions" (Streefker 2019).*

And his definition for qualitative research is the following:

> *"**Qualitative research** is expressed in words. It is used to understand concepts, thoughts or experiences. This type of research enables you to gather in-depth insights on topics that are not well understood. Common qualitative methods include interviews with open-ended questions, observations described in words, and literature reviews that explore concepts and theories" (Streefker 2019).*

Quantitative research is based on numerical data analytics. Based on that data it is possible to come up with illustrations and conclusions that prove or refute a theory or make some forecast. We found that the quantitative approach is not fitting well for this

research topic, as we need to collect empirical evidence of a phenomenon that exists in the complex social world. Therefore, we decided to conduct interviews, and gather data about people's experience and thoughts with a more qualitative stance. We needed to understand the difficulties in their field of work.

The con of qualitative research is that it is not possible to get standardized data, also there will be no statistical component in it. But in this case (developing an AI service for one company) standardization and validation of the data is not required. The experiences of the developers are purely empirical data, the research aims to create a service base to help those developers and aid in their day-to-day needs. There is not much, if almost not at all numerical data to be collected, so that is obvious why qualitative descriptive ("in descriptive research, you collect data about your study subject without intervening" (Streefker 2019)) research is the only possible approach here.

4.2 Investigation methods

This research has four parts: a survey and a semi-structured interview for developers. Also, an interview with the contractor company's employees was conducted. While answering the research questions in Chapter 6, we also rely on the literature review presented in Chapter 2. Based on these activities, we propose a structure for an AI chatbot onboarding agent is built based on the requirements (from management interviews), possibilities (literature review) and real demand (developers' survey and interviews). Table 2 displays how research activities contribute to the research questions.

Table 2: Mapping of research questions and activities

	Developer survey	Developer interview	Employee interview	Literature review
RQ1	x	x	x	x
RQ2			x	
RQ3	x			
RQ4			x	x

4.2.1 Developers' viewpoint

As already mentioned, for data collection developers' survey and interviews were used. The survey was built in an online tool called "Survey Monkey" and the link to the interview was sent though different channels like discord community groups, open developers and IT related Facebook communities, the link was placed in Linked in, slack channels.

The survey method was chosen as the data collection method for this study due to their ability to efficiently gather large amounts of quantitative data from a diverse sample. This allowed to obtain a comprehensive understanding of problematic areas in developers onboarding processes, select the aspects of onboarding that could be delegated to the AI chatbot and improved by it. The method suited well for research purposes, as it allowed to gather large amounts of data at a low cost.

The survey was conducted using Survey Monkey tool. Research questions can be seen in the appendices 3. The survey consisted of 9 questions.

First question asked how many years of experience in software development the respondents had now of answering the survey. The options were from less than a year to more than 5 years of experience.

Second question was a yes/no questions and asked whether the onboarding process went smoothly for the developer's first work assignment.

3rd question was a multiple-choice question and asked to select everything that applies from positive sides of the onboarding process.

4th was also a multiple-choice question but asked to list all negative sides that applied for the developer's 1`st project onboarding.

5th question asked for an opinion weather FAQ, or a Q/A guide would have helped the developers during the onboarding.

6th question asked for an opinion on an AI tool helper, whether it would help during the onboarding process. Both questions gave options on agreement scale (from strongly agree to strongly disagree).

7th question asked to mark everything that an AI tools could have helped with in developer's opinion.

8th question was an opened question to let responders give and thoughts and comments about their first project or onboarding process.

And 9th question was given to responders to give their contact information in case they wish to be contacted for a personal interview.

To get more data from the developers a semi-structured interview was used. Doyle (2020) defined a semi-structured interview as a type of meeting where the interviewer does not adhere to a strict set of predetermined questions. Instead, the interviewer poses open-ended questions to encourage a dialogue with the interviewee rather than a traditional question-and-answer style format.

The decision to use semi-structured interview as one of the data collection methods was based on several factors. First, this type of interview allowed to gather more information while staying close to the topic, it let the interviewees to open more about the problems, produce some examples, and let them to open about problems as the interview was conducted in a form of the dialog with follow up questions. Overall, this method allowed for some flexibility and open-endedness in the interviews to allow participants to share their perspectives and experiences in their own words. People for the interview were selected from the poll of survey participants and the most interesting age cases were selected for detailed interviews. The questions of the interview were focused on the details of the onboarding process, the difficulties, and the positive sides of the process and the possible impact the onboarding had on the interviewee. This let participants to discuss their experiences and perspectives in a more nuanced and personal way than a structured survey and add more value to the research as one of

the goals of the tool to be designed is tightly relates to well-being. A total of 4 interviews were conducted during the research process.

4.2.2 Management viewpoint

Another source for the data is company's management. They can provide information about the requirements for the alumni to be assigned on the project, also they can tell more about types of the projects and clients, describe the process of how they select people for those projects in detail. Semi-structured interviews can be used in this case as well. For this part of the research just a few (one or two) members of the company's management group are enough, as they would have sufficient information on the topic.

The interviews were conducted both personally and through video meetings. Management interviews were conducted face-to-face. Overall, there was 1 interview with HR representative from Crowd Collective, that was conducted in February 2023, and 3 interviews with age case representatives of the survey respondents: one person who had very full onboarding experience and was fully satisfied with the process, one developer who had no onboarding whatsoever and one person with very poor onboarding experience. All developers' interviews took place in the beginning of March 2023.

Transcripts of the interviews were done with recording device and then analysed and grouped into most common topics and then written down as summaries. The interviews of the developers took place after literature and AI tool analysis, as after the literature analysis it also became possible to add more questions about features of the AI services. The management interview was conducted right after the literature research to shape the list of requirements that became a good base also for the tool shaping and interview questions for the developers can be at least partially based on those requirements.

5 Results from the developer survey

When conducting the research for this thesis, a total of 52 individuals participated as responders in the survey. As soon as the main subject of this thesis centre around the development of a tool to assist young developers in the beginning of their career, the focus of the research was the onboarding process during the first project of the respondents. Below are the results of the research.

5.1 Participants of the survey

As it can be seen on Figure 10, 67.31% of participated in the survey had more than 5 years of experience, 13.46% had from 3 to 5 years of experience, 15.38% less than three years but more than 1, and only 3.85% had less than one year of experience in software development.

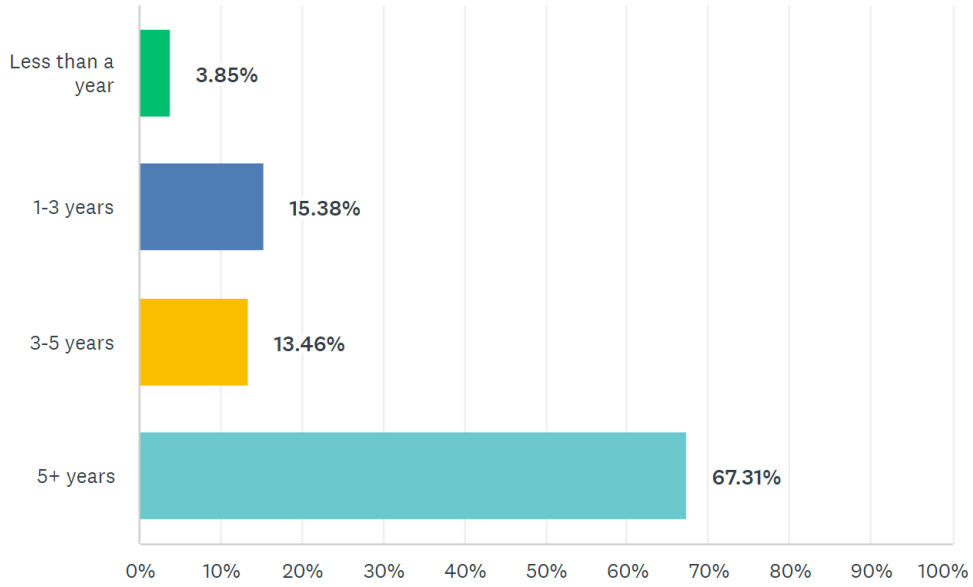

Figure 10. Survey participants' work experience in years.

5.2 Satisfaction with onboarding

As evidenced by the pie chart displayed on Figure 11, a significant majority of the survey respondents, 69.23% of the total, were not completely satisfied with the onboarding process they experienced and encountered various issues and problems during their first project as developers.

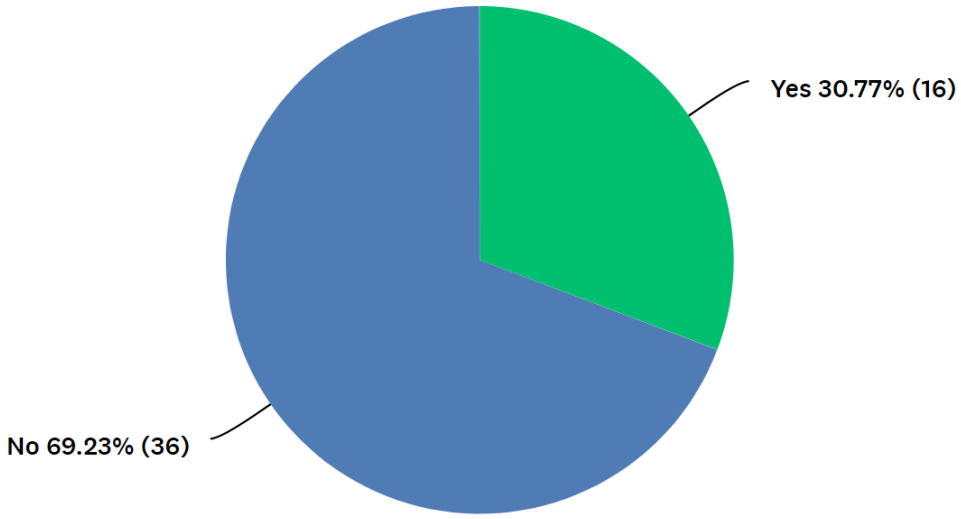

Figure 51. Satisfaction with onboarding.

Despite high rate of dissatisfaction there were still quite a lot of positive aspects experienced by respondents.

5.3 Support for onboarding

A considerable proportion of the survey participants, 59.62%, received help from the team they joined. Similarly, over half of the respondents (55.77%) reported being assigned a mentor to assist with the onboarding process. 38.46% were already familiar with the technology used on their project.

However, this question brought positive aspects of onboarding process experienced by the survey participants highlighted several areas where improvements could be made. For example, only 34.62% were provided with documentation to become familiar, with only one respondent finding the materials to be well-written and easily comprehensible. Only 13.46% of the respondents were provided with video materials and courses

related to the project. And the warrying only 1.92% of all responders marked, that the documentation was well written and easy to understand.

Regarding the clarity of the onboarding process, just 17.31% of the respondents had a clear picture of how to proceed with the project after the onboarding, while 15.38% experienced that the project structure was clear from the start. Moreover, respondents were given the opportunity to provide additional feedback, and 11.54% used that opportunity, from which the most reported having no onboarding process whatsoever. One respondent noted that while they received help from a colleague, it was not sufficient to finish the project alone. However, one person had a highly positive onboarding experience receiving constant communication and feedback from the company.

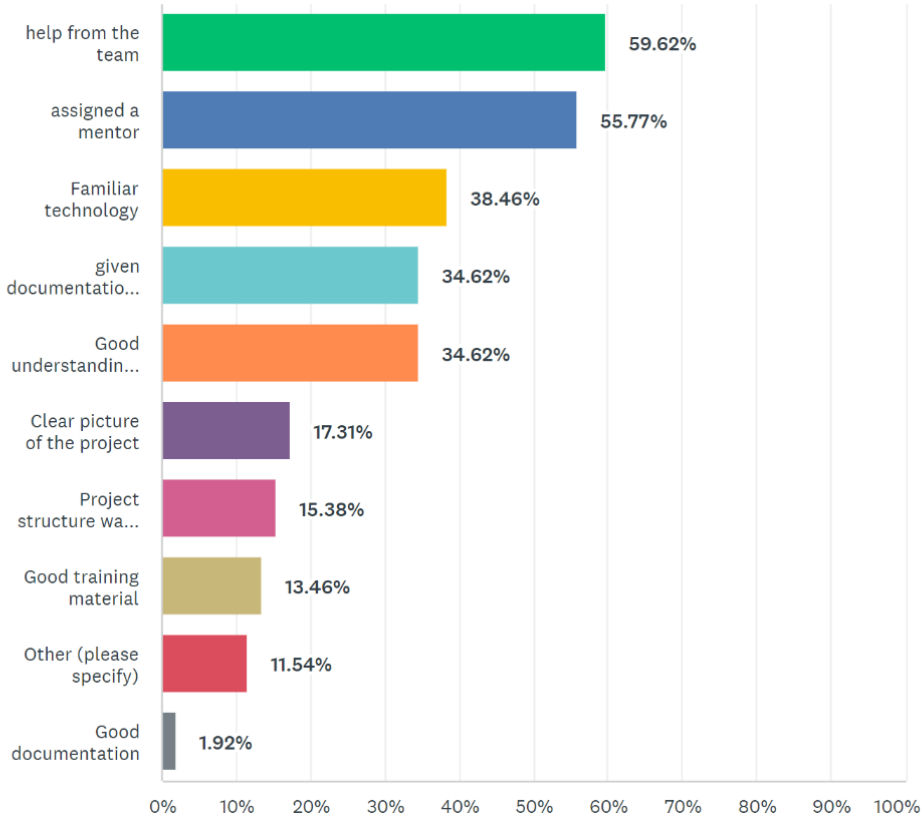

Figure 62. Positive experiences in onboarding.

5.4 Negative experiences

Questions four aimed to dive deeper into the problematic aspects of the onboarding process for the respondents. The survey provided respondents with a list of potential issues that they may have encountered during their onboarding process and allowed

them to select all the items that applied to their specific situation. The results are displayed in Figure 13.

Out of the respondents, 60% reported not receiving access to adequate training materials, or received materials that were not relevant to the project they were assigned to. This could lead to a lack of understanding of the project requirements and may result in delays or errors in the project's execution.

55% of respondents reported not being provided with project documentation or having to search for the documentation themselves. This lack of information can cause confusion and frustration, leading to difficulties in understanding project requirements and deadlines.

More than half of the respondents (52.5%) who received documentation for the project reported that the materials were poorly written or difficult to comprehend, leading to misunderstandings and mistakes during the onboarding process. This can be a significant hindrance to the success of the project and could lead to delays and additional costs.

A considerable number of respondents (40%) felt lost when they joined the project and did not know how to proceed. This lack of guidance can lead to frustration and wasted time, both for the employee and the company. Similarly, 40% could not understand the project structure and did not know where to start, causing delays and mistakes in the project execution.

Over a third of respondents (37.5%) reported that they were not assigned any mentor or other dedicated person to guide them through the process. This lack of support can be overwhelming, leading to frustration and an inability to complete tasks on time. Additionally, 37.5% felt that the team they joined did not have time for proper introduction to the project, or their answers did not help. They felt like they had to deal with everything on their own.

Finally, a surprising 10% of respondents reported that they did not even know where to look for information about coding languages and other technology they were supposed to work with. This highlights a significant gap in the onboarding process, which can lead to misunderstandings and wasted time.

In addition to the multiple-choice options, respondents had the opportunity to answer freely, with one person reporting a positive experience during their onboarding process.

However, one respondent mentioned that even though a mentor was assigned, the person did not have proper information and had to deal with the start of the project alone. This lack of support could be detrimental to the employee's performance and could result in additional costs and delays for the company. The results are presented in form of a horizontal bar chart on Figure 13.

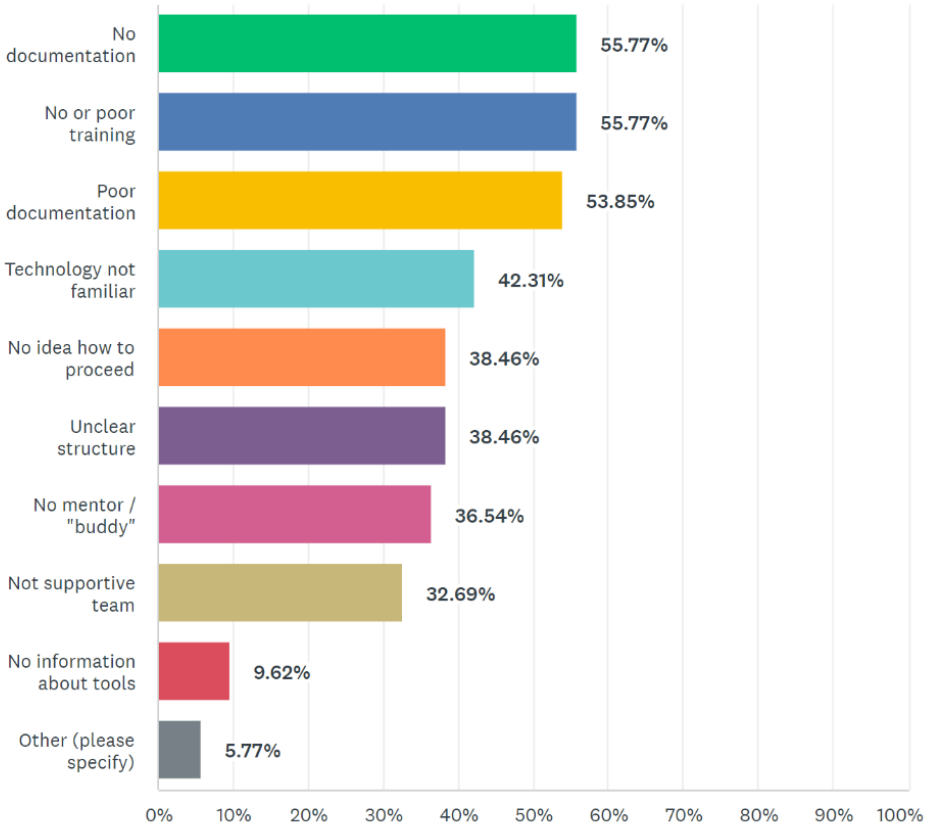

Figure 73. Negative experiences in onboarding.

5.5 Preferred support for onboarding

Question 5 asked participants to rate the usefulness of an FAQ tool or guide on a scale of strongly disagree, disagree, neutral, agree, and strongly agree. In response to whether an FAQ tool or guide would be useful in the onboarding process, majority of respondents indicating that they believe an FAQ tool or guide would be useful. Specifically, 36.54% strongly agreed and 40.38% agreed (As total of nearly 77%). 21.15% were neutral, and only 1.92% disagreed. No respondents selected the "strongly disagree" option. Figure 14 illustrates these numbers.

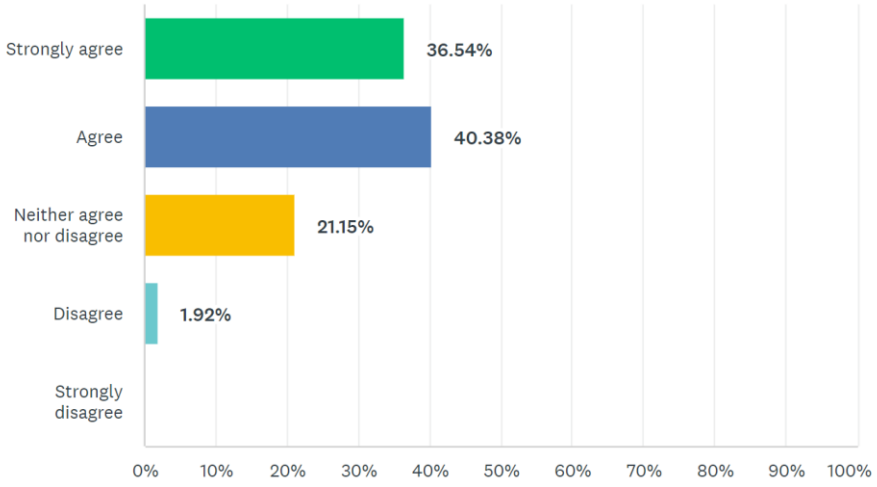

Figure 84. Opinion about usefulness of FAQ tool in onboarding.

In question 6, participants were asked to share their thoughts on the usefulness of an AI tool as a guide in the onboarding process. Figure 15 illustrates the responses, which were more evenly spread across the options.

While the majority of respondents (46.15%) agreed that an AI tool would be useful, with 19.23% strongly agreeing and 26.92% agreeing, considerable number of respondents were neutral (32.69%). Additionally, 21.16% of participants disagreed with the statement, with 17.31% disagreeing and 3.85% strongly disagreeing.

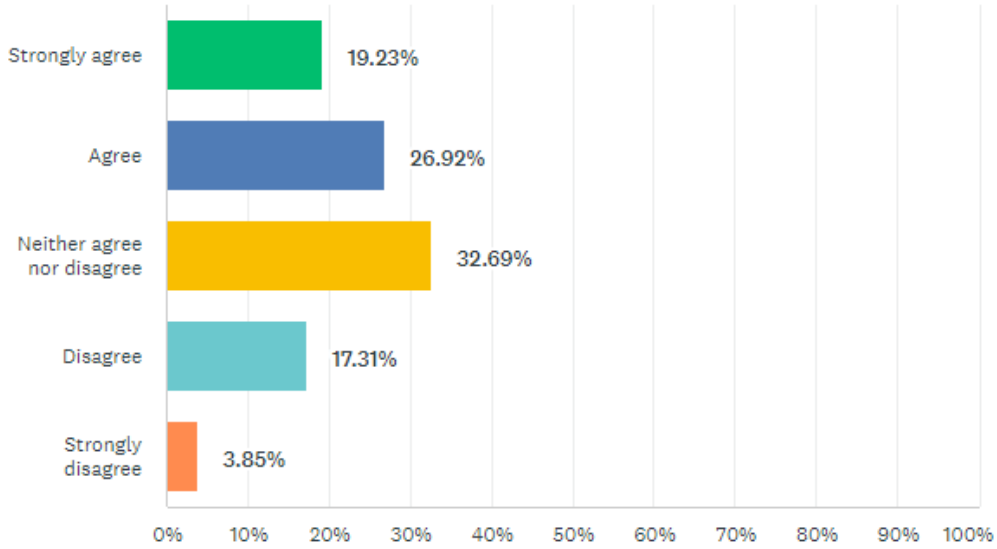

Figure 9. Opinions on AI tool usefulness in onboarding process.

Question 7 provided further insight into how developers believe an AI tool could be useful in the onboarding process. Respondents were asked to select from a list of potential areas where an AI tool could be helpful, as well as they were given an opportunity to provide open-ended feedback. Figure 16 illustrates the distribution of responses to this question.

The majority of respondents (63.46%) agreed that an AI tool could be useful in providing information about the project, including documentation, project-related training, and other resources. Additionally, 50% of respondents felt that an AI tool could be helpful in providing step-by-step guidance, providing developers with tasks to complete during the onboarding process.

Other areas where respondents felt an AI tool could be useful included tracking progress during onboarding (48.08%), providing help with project-related technology (36.54%), and proactively asking for information on potential problems (28.85%). Some respondents also felt that an AI tool could be useful in providing support to consultancies and passing information to supervisors in case of any problems (23.08%). However, only a small percentage of respondents felt that an AI tool was not necessary (15.38%) or that it could provide mental support (11.54%).

In addition to the pre-defined answer options, participants had the opportunity to provide open-ended feedback. Four respondents shared their thoughts, with one suggesting that an AI tool could provide guidance through the code paths of a complex

project to implement changes faster, another suggesting that the tool could serve as a dictionary for domain-specific terminology, and a third arguing that automating the onboarding process to a machine is bound to fail due to the unique nature of each project or product. Finally, one respondent believed that a well-designed AI tool could be a powerful addition to the onboarding process.

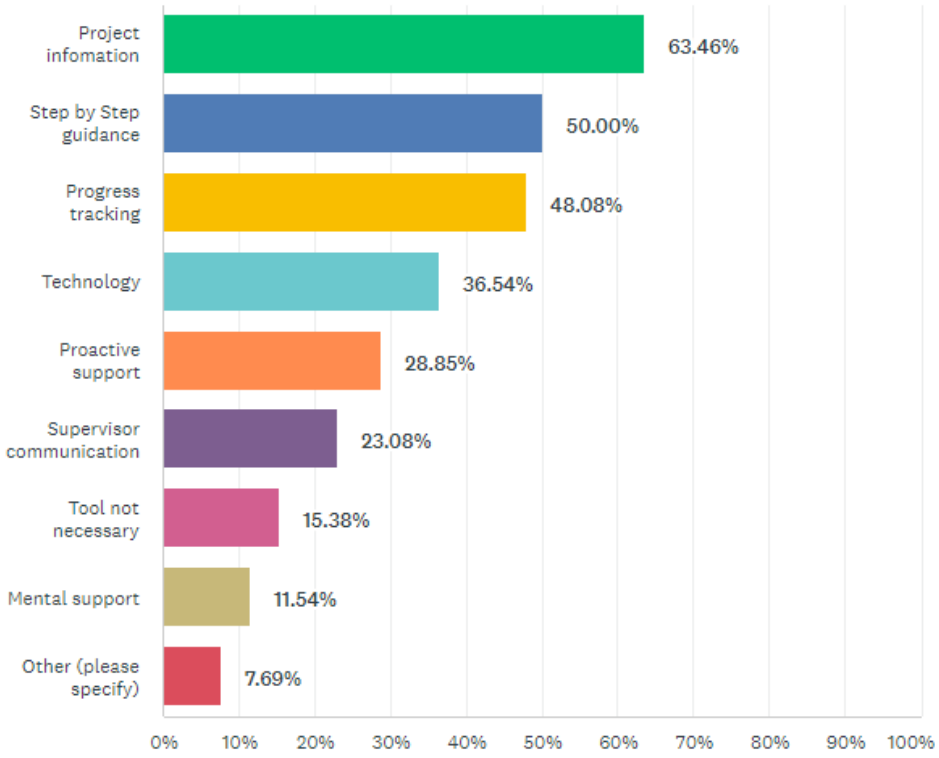

Figure 106. Relevance of possible features of AI tool in onboarding.

5.6 Open ended answers

The last question was an open question that gave an opportunity to share thoughts on the first project, onboarding, or anything else, in form of open text. This question was meant to gather answers to find common themes and patterns. The question was optional, so there were only 10 responses that could be used for this cause. The themes, appeared in the responses included the following:

Importance of mentorship and support: Several respondents mentioned the importance of having a mentor or someone to guide them through the onboarding process and provide support when needed.

Need for clear documentation and processes: Some respondents noted that having clear documentation and processes in place can be helpful for onboarding new developers, and that an AI tool may not be necessary if these resources are readily available.

Challenges with onboarding at small companies or startups: A few respondents mentioned that onboarding can be particularly challenging at smaller companies or startups, where there may be less structure and support available.

Potential limitations of AI tools: Some respondents expressed scepticism about the usefulness of AI tools for onboarding, particularly for more unique or complex projects.

Fear or hesitation in seeking help: One respondent mentioned feeling afraid to reach out to their mentor for help, highlighting the importance of creating a supportive and welcoming environment for new developers.

Two wordclouds were generated based on these answers. Figure 17 illustrates the word cloud generated based on direct responses from the survey, figure 18 illustrates the word cloud generated based on the analysis of those responses.

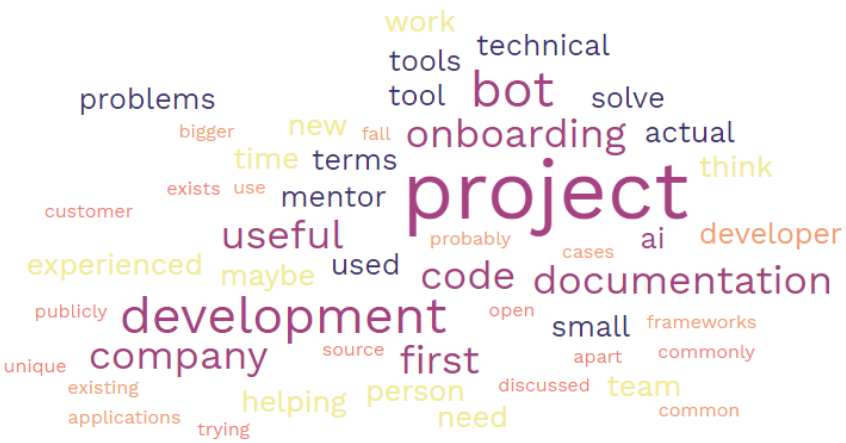

Figure 117. Word cloud generated based on direct responses from the survey

Figure 128. Word cloud generated based on the analysis of responses

6 Results from management interviews

As the main result of this thesis is drafting technical requirements for the AI tool that can be used in my current company, it was important to research the company's need.

The collection of information happened though an in-person interview with a representative of Crowd Collective Company's HR and included the following questions:

- What is a current onboarding process in the company?
- What challenges the company has during the onboarding process?
- How AI tool can help to make the process smoother?
- How do developers prepare for the upcoming client's project?
- What feedback newly joined developers had for the onboarding process?

Based on the interviews, the current process was found to be extremely manual. Several people are handling the onboarding process currently and they are checking the list of things to do from the file in Notion application. It became obvious from the interview that there are quite a few situations when the new employee's questioned being "balled", in other words passed from one person to another without anyone knowing who the right person would be to answer. There are of course some basic answers in Notion, but only a few of them.

The view in notion goes under the header "Pre- & Onboarding. Each signed developer has a personal card there where there is tasks for Crowd Collective personal to handle. The tasks are grouped into topics like "Things to do (HR)", "Between sign and start", "Start day". Under each topic there is a number of tasks in from of check boxed list, such as invitations to different social channels, ordering keys to the office, credentials, trainings, meeting bookings etc. Each task needs to be checked manually when completed. Sometimes it is unclear if one task or another is being taken care of by another person, which creates double work. The new employer's card can have three different statuses which relates to the topic group to be handled.

The process can be defined as unclear both for the company and for the hire, especially for the pre-onboarding stage, there a lot of duplicating work and information that needs to be kept "in memory".

From the company perspective many of those processes can be automated and that is the area a chatbot could be useful. For example, the tasks that could be given to chatbot to handle can be:

- help in task handling for HR, like making sure that credentials are created in every system used by the company.
- equipment handling which includes selecting working tools and possible making the order or at least sending the order to the HR that would handle it.
- providing information of what to do during the first day, giving some tasks to the employee
- sending emails and adding the employee as member in channels/crowds
- reminding the employee to update information in the company's welcome to CroCo page (as part of given tasks, for example).

In addition to those tasks more additional ones can be added. For example, when a new hire is singed, the bot could proactively create a "ToDo"-list for the hire and sends updated to required people beforehand. It should provide low effort on questions, add gamification into the process to make it more interactive, act as a "buddy" to the new hire guiding her through the process and providing feedback in the end of the day.

It would be interesting to create such a tool with a perspective of expanding to become a support tool for customers' projects as well, but main priority should be interval process from the perspective of the company.

7 Discussion

The analysis of the literature and the research made it possible to answer the research questions presented in the beginning of this manuscript.

7.1 Research question 1: What is the significance of onboarding form the employee's and the company's perspective?

This chapter explores the significance of onboarding from both the perspective of the employee's and the company's perspective. It proves that onboarding process is critical to integrating new hires into an organisation and familiarizing them with the company culture, policies, and procedures.

As it was shown in Chapter 2.1, from the employee's perspective, onboarding is a critical process that helps new employees feel welcomed, supported, and empowered. One of the primary benefits of onboarding from the employee's perspective is that it provides an opportunity for new hires to gain a deeper understanding of the company's culture and values (Shah & Pollak 2008, Byford & al. 2017, Jones 2014). This understanding can increase their engagement and motivation, as they feel more connected to the organization's mission and vision. When employees understand the company's culture and values, they are more likely to align their work with the company's goals, resulting in improved job performance and increased productivity (Bauer & Erdogan 2011, Stein & Christiansen 2010, Bauer 2015).

Moreover, onboarding provides new employees with the necessary information and tools to perform their jobs effectively. This aspect of onboarding is especially critical for new hires who may be unfamiliar with the organization's processes and systems. Onboarding can help to clarify job responsibilities, set expectations, and provide training and resources to help new employees succeed (Kumar & Student 2017, Bauer 2010). When new employees feel prepared and equipped to do their jobs, they are more likely to feel confident and satisfied in their work, leading to increased job satisfaction.

Finally, onboarding can help new employees build relationships with their colleagues and supervisors. The onboarding process can facilitate introductions and provide opportunities for new employees to meet their team members and supervisors (Jones 2014, Stevenson 2022, Shah & Pollak 2008). This aspect of onboarding can be especially important for new hires who may be relocating or who are starting a new job in a new city. When new employees feel supported and connected to their colleagues

and supervisors, they are more likely to feel a sense of belonging and loyalty to the company. This can lead to increased employee retention rates and reduced turnover.

Many resources used in chapter two prove, that overall, from the employee's perspective, onboarding is essential because it provides new hires with a clear understanding of the company's culture and values, the necessary tools, and resources to perform their jobs effectively, and the opportunity to build relationships with their colleagues and supervisors. These benefits can increase employee engagement, job satisfaction, and retention rates, resulting in a more productive and successful organization (Shah & Pollak 2008, Wells 2005, Dai & De Meuse 2007, Ganzel 1998, Davila & Pina-Ramirez 2018).

From the company's perspective, onboarding is a crucial process that can have significant impacts on business outcomes. One of the most critical benefits of onboarding is its ability to reduce turnover and increase employee retention rates[2]. Employee turnover can be costly for companies, both in terms of time and money (Bauer 2015). By investing in a comprehensive onboarding program, companies can help new hires feel supported and valued, leading to increased job satisfaction and a greater likelihood of remaining with the company long-term (Byford & al. 2017, Brandt & Vonnegut 2009). This can save companies significant costs associated with recruiting, training, and onboarding new employees (Bauer 2015, Dai and de Meuse 2017, Kumar & Student 2017).

In addition to reducing turnover, onboarding can also increase productivity and reduce the time it takes for new employees to become fully productive. The onboarding process provides new hires with the necessary information and tools to perform their jobs effectively. This can help new employees quickly acclimate to their new roles and become productive members of the team. By reducing the time it takes for new employees to become fully productive, companies can improve their overall productivity, leading to increased revenue and profitability (Bauer 2015, Byford, Watkins & Triantogiannis 2017, Ciampa & Watkins 1999, Bradt & al 2006).

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[2] Studies by: Brandon Hall Group, Talent Management Solutions, The Work Institute, Institute of Corporate Productivity (i4cp), A Boston Consulting Group

Moreover, onboarding can help to create a positive company culture, which can improve employee morale and job satisfaction. A positive company culture is critical to attracting and retaining top talent. When employees feel valued, supported, and connected to the company's mission and vision, they are more likely to feel motivated and engaged in their work. This can lead to increased job satisfaction, which can result in improved job performance, increased productivity, and reduced turnover (Bauer 2015, Shah & Pollak 2008).

In addition to these benefits, a positive company culture can also help to differentiate companies from their competitors. When companies invest in creating a positive workplace culture, they can attract top talent and improve their reputation in the industry. This can lead to increased business success and profitability in the long term.

It is important though to remember that despite onboarding's importance there are potential drawbacks of onboarding that should be acknowledged. For instance, some employees may feel overwhelmed by the amount of information provided during onboarding, which can result in information overload. Additionally, some companies may not have the resources to invest in a comprehensive onboarding program, which can lead to an incomplete or inadequate onboarding experience for new hires (Kumar & Student 2017, Davila & Pina-Ramirez 2018, Booz 2018, Forrest 2018, Boatman and Erker 2012).

To summarize, from the company's perspective, onboarding is essential because it can reduce turnover, increase productivity, and create a positive company culture. By investing in a comprehensive onboarding program, companies can improve their business outcomes, attract, and retain top talent, and improve their reputation in the industry.

In conclusion, a comprehensive onboarding process is critical for both employees and companies. The sources that were provide insights into the benefits of onboarding and emphasize the importance of investing in this process to ensure the success of new hires and the company as a whole. By prioritizing onboarding, companies can create a positive work environment, increase employee engagement, and reduce turnover rates, resulting in a more productive and successful organization.

7.2 Research question 2: What do developers find the most difficult after they have been assigned on a project?

This research question has been answered during the conduction of developers' research in the survey.

Already the first answer in the survey presented in chapter 5.2 opens a lot on current situation with developers' onboarding. This finding by itself already highlights the need for developing a better process and strategy to support developers as they undertake their first professional projects. Such a high proportion of developers expressing dissatisfaction of the onboarding process creates a real need for addressing the issue and creating additional tools and mechanisms to improve the onboarding experience and help ensure long-term satisfaction and success of developers in the field.

As already proved in previous chapter, team support is a critical component of onboarding process, which help new hires to feel welcomed and confident in their role.

Having a mentor can be an incredibly valuable resource for new developers, as it allows them to ask questions, seek feedback, and gain insights from someone with more experience in the field. This can help to reduce anxiety and uncertainty and can facilitate a smoother transition into the new role (Sibisi & Kappers 2022, Shah & Pollak 2008).

The fact that the majority of respondents were familiar with the technology, is a crucial factor, as familiar programming language and tech stack helps developers to feel more comfortable and confident with the tools and technologies they are expected to work with, and it also reduces the amount of time and effort required to get up to speed on the project.

The conducted survey clearly highlights the need to provide developers with more effective and user-friendly documentation of the project and company processes and underscores the importance of providing ongoing support and resources to new developers, in order to help them feel valued and supported in their work. This finding was proved in the survey which results are described in the chapter five. What was unexpected, that even the question aimed to discover positive sides of onboarding has shown a clear gap warrying in the projects' documentation. As it was show in chapter 3, AI and chatbots in particular can already be used as a tool that can help build comprehensive documentation thus cover this gap in onboarding processes.

This suggests that there may be a need for clearer communication and guidance around project expectations and goals, in order to help new developers feel more confident and capable in their work.

They felt like they had to deal with everything on their own, leading to stress and inefficiency.

7.3 Research question 3: What are the current AI techniques already used in IT education?

Chapter 3 of the theoretical background answers the research question and provides examples of AI-powered systems, analysing their capabilities and impact on students' performance in education. The chapter also presents primary sources of research on AI in education and discusses the tool's benefits, challenges, and use cases.

Usage of AI in education undoubtedly can provide many benefits such as personalizing learning experiences and increasing efficiency and effectiveness in educational practices (Ritz & al 2023). One of the most important benefits it provides is personalization, as it enables AI-powered systems to analyse student data and adapt to individual learning needs and styles, providing tailored learning experiences and recommendations (Beck, Stern & Haugsjaa 1996, Holmes 2019). AI can also reduce amount of time spent on the routine tasks for teachers and other educators, like automating grading, tracking attendance, and providing instant feedback to students, freeing up teachers' time to focus on other tasks that require human input and expertise. AI-powered tutoring systems, for instance, can reduce the amount of time teachers spend providing one-on-one support, allowing them to focus on other aspects of teaching. Teachers can also make data-driven decisions based on information provided by AI systems and learn how to adapt their teaching practices to better support student learning. However, it is essential to consider the potential ethical and social implications of using AI in education, such as concerns about privacy, bias, and the role of teachers (Sanyaolu & Atsaboghena 2022, Okonkwo & Ade-Ibijola 2021).

One of the best examples of AI-powered tutoring systems is an intelligent tutoring system (ITS), which uses AI algorithms to provide personalized learning experiences for each student (Schmelzer 2019). ITSs can take the form of computer programs, mobile apps, and online platforms, and can track students' progress, understand their strengths and weaknesses, and provide customized feedback and guidance. Examples of well-known ITSs include ALEKS, Knewton, Carnegie Learning, Smart Sparrow, DreamBox Learning, and McGraw Hill Connect, among others.

Research has been conducted in several academic journals, including JETDE, Journal of Artificial Intelligence in Education, JCAL, IJAIED, and BJET, among others. Furthermore, there have been numerous articles that discuss the role of AI in education, including the ethical considerations involved.

The research shows the usage of AI in education has enormous potential and can revolutionize techniques and practices currently used (Okonkwo & Ade-Ibijola 2021). Its ability to personalize learning experiences and increase efficiency can benefit both learners and teachers alike. However, it is crucial to be aware of the potential ethical and social implications involved in implementing AI in any area that requires high level human interaction, empathy and critical thinking including education. Which means there is still a lot of space for further research and exploration needed to understand how AI can be safely utilized in educational processes, so it is ethical and beneficial for all participants.

7.4 Research question 4: How can we apply AI in our processes to make better support for developers?

From the perspective of technology, AI chatbot can easily be described as a buddy with artificial intelligence. Using the benefits of machine learning technology allows for mitigation of potential issues and reduction in the costs associated with assigning such a “buddy” and make the whole onboarding experience as smooth as possible (Adamopoulou & Moussiades 2020).

Based on the analysis of research of current possibilities of AI in HR processes and onboarding, made in the chapter 3.2, the main benefits of using AI in onboarding and other HRM processes include:

- Increased efficiency: AI can automate many routine and repetitive HR tasks, freeing up HR staff to focus on more complex and strategic activities.
- Improved decision-making: AI can analyse large amounts of data and provide insights that can help HR managers make more informed decisions.
- Personalization: AI can provide a personalized onboarding experience for employees by tailoring the onboarding process to their individual needs and preferences.
- Reduced bias: AI can help to reduce bias in recruitment and other HR processes by removing human subjectivity and using objective criteria.

- Improved employee engagement: AI can provide an interactive and engaging onboarding experience for new employees, helping to increase their engagement and retention.
- Streamlined processes: AI can help to streamline HR processes, such as recruitment and performance management, by automating administrative tasks and providing real-time feedback.

The use of AI in HRM processes has the potential to improve the efficiency, effectiveness, and overall employee experience of these processes (Wollny & al. 2021). However, it is important to address potential risks and challenges associated with the use of AI, such as bias and privacy concerns, to ensure that the technology is used in a responsible and ethical way (Okonkwo and Ade-Ibijola 2021).

These results suggest that while many participants see the potential benefits of an AI tool as a guide in the onboarding process, there is still some uncertainty and scepticism among respondents. It is important for organizations to carefully consider the potential benefits and drawbacks of implementing an AI tool in the onboarding process, and to gather feedback from employees to ensure that any new tools or technologies are truly meeting their needs.

Overall, the responses to Question 7 suggest that developers see the potential for AI tools to improve the onboarding process in a variety of ways. However, there is still some uncertainty and scepticism, as well as a recognition that each project is unique and may require a customized approach.

On ChatGpt and its potential as an onboarding chatbot[3]

ChatGpt is an AI-powered chatbot developed by OpenAI, a research organization dedicated to advancing artificial intelligence in a safe and beneficial manner. This chatbot is based on the GPT-3.5 architecture, which uses deep neural networks to generate human-like responses to user inputs. With ChatGpt, users can have natural

[3] Based on information provided on OpenAI website. URL: https://openai.com/. Accessed: 09 May 2023.

language conversations on a wide range of topics, from customer service to education (openAi website).

The research conducted in this thesis shows that the process of onboarding has a critical impact on the new hires and is also important and very responsible stage for the hiring organization. A well-designed process helps new employees to feel welcome in the company they are joining, form solid understanding of their roles and responsibilities and become productive members of the organization much more quickly. ChatGpt has several features that make it an excellent option for an onboarding chatbot:

- Natural language processing: ChatGpt can understand and respond to natural language inputs, making it easier for new hires to ask questions and get the information they need.
- Automation: ChatGpt can automate routine and repetitive tasks, such as filling out paperwork or setting up email accounts. This automation can save time for both new hires and HR personnel, allowing them to focus on more critical tasks.
- Gamification: ChatGpt can gamify the onboarding process by offering rewards or badges for completing specific tasks. This gamification can make the onboarding process more engaging and enjoyable for new hires.
- Real-time feedback: ChatGpt can provide real-time feedback on new hires' progress, allowing them to see how they are doing and adjust their approach accordingly.
- Integration with existing platforms: ChatGpt can integrate with existing platforms, such as Zapier or BotPress, allowing it to automate onboarding/offboarding tasks and access company data from Notion, Slack, and Outlook.

Implementation of ChatGpt as an onboarding chatbot requires careful planning and execution, as by itself it can only provide textual information, so an integration with another robotic platform is necessary, but the benefits can be significant for both new hires and HR personnel. By using ChatGpt as an onboarding chatbot, it is possible to create a more engaging, efficient, and effective onboarding process.

7.5 Recommendations: draft requirements for the AI-driven chatbot

As discussed in the previous chapters, the onboarding process for developers can be challenging due to various difficulties that they encounter. These difficulties include

documentation, training, information about the project, technology-related questions, and guidance and progress tracking. To mitigate these challenges, AI can be incorporated into the onboarding process to provide better support for developers. By automating routine and repetitive tasks, progress tracking, and providing more engaging and interactive experiences, an AI-driven chatbot can assist HR personnel in streamlining the onboarding process.

From a technological standpoint, an AI chatbot can be viewed as a buddy with artificial intelligence. The chatbot can provide an interactive platform for new hires to access information, ask questions, and receive real-time feedback. The use of a chatbot also presents an opportunity to mitigate potential issues that can arise with human "buddies." Furthermore, the implementation of a chatbot can significantly reduce the costs associated with onboarding and make the overall experience smoother for both new hires and HR personnel.

Possible features of an AI-driven chatbot for onboarding include helping to create, maintain, and navigate project documentation, ensuring that project requirements are understood, providing information and help with project technology, offering step-by-step task guidance, real-time progress tracking, and feedback. Additionally, the onboarding process can be made more efficient by automating the routine administrative tasks typically handled by HR personnel.

From the analysis of ChatGpt's possibilities when integrated with other robot frameworks that can help in task automation, it is evident that an onboarding chatbot can be designed to guide HR personnel and new hires through the pre-onboarding stage, which includes signing the contract and providing necessary paperwork. During the onboarding process, the chatbot can provide a checklist of tasks to complete, such as setting up company email and Slack accounts, attending an orientation session, and completing any necessary training. Moreover, gamifying the onboarding process can make it more engaging for new hires. The chatbot can offer rewards or badges for completing certain tasks and provide a platform for new hires to ask questions, provide feedback, or share their experiences.

To integrate an AI-driven chatbot with an existing platform, Zapier or BotPress can be used to automate onboarding/offboarding and other routine tasks. The platform should have access to the company's Notion account, Slack, and Outlook. Own bot credentials need to be created, and automations set in the platform. ChatGPT can be used to handle communication between the chatbot and new hires.

The estimated time for minimum lovable product (MLP) implementation is around five to six months with a team of two developers working 100% of the time. The technical plan creation takes two weeks, credential creation takes two to three days, and the learning curve for the platform takes four to six weeks. Integration with Notion and the first automations take four to five weeks, ChatGPT integration takes two to three weeks, and testing and fixing take two to three weeks. Improvements and adjustments take three to four weeks.

The successful implementation of an AI-driven chatbot for onboarding requires further research on some very crucial aspects of AI integration into processes that are typically handled by humans. One of the most critical issues is the need to ensure confidentiality and security of sensitive employee data. Since the chatbot will handle personal information such as social security numbers and other sensitive data, it is essential to comply with all data privacy regulations and ensure that the chatbot follows the highest standards of data protection.

Another critical aspect that requires attention is the need to maintain process consistency with ChatGPT, given its current capacity of information memory is limited. Developers must ensure that the chatbot is programmed to provide accurate and reliable responses to user queries within the limits of its current capacity. This may require developing a more sophisticated and dynamic conversational framework that can optimize the use of the available characters and provide the most relevant and useful responses to users.

And finally, more than anything else a human touch is expected and needed during the onboarding process. Without human presence, human empathy, and real emotions it is impossible to build the personal connection and for the sense of belonging within the team and the company. While AI chatbots can provide efficient and effective onboarding support, they cannot fully replace the benefits of human interaction. This means it is extremely important to carefully build the process the way it is well balanced between chatbots and people taking part in the onboarding.

8 Conclusion

In conclusion, the study presented in this thesis has addressed the research questions posed at the outset by investigating value, feasibility, and possibilities of creating a chatbot driven artificial intelligence tool from perspective of companies, developers, and HR personnel.

This study has contributed to the understanding of the importance of onboarding process for new employees and the challenges that developers face during their onboarding process. It has provided new insights into the potential benefits and drawbacks of utilizing AI chatbot service in the onboarding process, which have not been previously explored. These findings have important implications for the tech industry, as they can be used to improve the onboarding experience for new developers, increase their productivity and job satisfaction, and reduce turnover rates.

Through the use of literature research, with help of developers' survey and interviews, company representative interview, and workshop among company workers, this research has shed light on the value, feasibility, and possibilities of creating an AI chatbot service for onboarding developers. The data analysis revealed that comprehensive onboarding processes are critical for both employees and companies. By prioritizing onboarding, companies can create a positive work environment, increase employee engagement, and reduce turnover rates. The research also showed that AI has enormous potential in education, but it is crucial to be aware of the potential ethical and social implications involved in implementing AI in areas that require high-level human interaction.

The survey findings indicated a need for developing a better process and strategy to support junior developers during their first professional projects. The majority of respondents expressed dissatisfaction with the onboarding process, highlighting the need for addressing the issue and creating additional tools and mechanisms to improve the onboarding experience. The survey also emphasized the importance of team support and having a mentor for new developers. Familiar programming language and tech stack also help developers feel more comfortable and confident, reducing the amount of time and effort required to get up to speed on the project. The survey highlighted the need for providing developers with more effective and user-friendly documentation of the project and company processes and providing ongoing support and resources to new developers.

The interview with company representatives showed that the current onboarding process is extremely manual and involves several people handling the process. This often results in confusion and inefficiency that includes human error and duplication work, with new employees being passed from one person to another without anyone knowing who the right person would be to answer their questions. The interview also highlighted a clear gap in the projects' documentation, which AI chatbot tools could potentially fill.

Overall, this research has provided valuable insights into the value of the onboarding process, highlighting its importance for any company, the general need for an improvement among developers and thus adding to a business value of the tool that can improve the process. It showed the potential of a chatbot in education, proving that such a tool is capable of taking on the tasks related to the onboarding, and in particular identified areas in our company's current onboarding processes where an AI-driven chatbot tool can potentially help improve the process.

The initial goal for this thesis was to create a technical plan for an AI chatbot tool that can be used during the onboarding process of our developers in our customers' projects, but during the interview with a member of HR team in the company it became clear that such a tool would be of a great use for internal onboarding process, as there are many aspects of the internal process that can be improved. Points of improvements include manual work, question "balling", human errors, and repetitive tasks. After investigation of the topic, it became evident, that an AI chatbot will be a great asset for as the internal use as much as during customer projects' onboarding.

While this study has provided valuable insights into the potential for utilizing AI chatbot service in the onboarding process, there are some limitations that should be acknowledged. For example, there are ethical (bias in algorithms) and security concerns that need to be addressed and thoroughly researched, there is also a concern about propagating data collected in one company on other companies in the industry so the tool may not be generalizable to other companies or industries. And there may be various external factors that could impact the effectiveness of the AI chatbot service in the onboarding process, such as changes in the industry or technological advancements that were not accounted for in the study. Future research could address these limitations to assess the potential impact of utilizing AI chatbot service in the onboarding process.

Overall, this research has demonstrated the significance of onboarding process for new developers and the potential for utilizing AI chatbot service to improve it. The findings of this study provide a foundation for further research and contribute to the ongoing discourse in the field of talent management in the tech industry.

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Appendix 1. Project Risk Management Plan

PROJECT RISK MANAGEMENT PLAN					
SEVERITY	***PROBABILITY***				
	Rare	**Unlikely**	**Possible**	**Likely**	**Almost Certain**
Catastrophic		No developers interested in participating in the interviews			
Major	Client company decides not to support and participate the project		Major timetable conflicts with perosnal and work life		
Moderate		All written material gone due to technical issues			
Minor				Minor personal and work timetable issues overlaping with already planned project events	Technical issues, inteview and meeting planned dates postponing
Insignificant					Vacations, sick days of participants

Appendix 2. Well-Known Intelligent Tutoring Systems

This appendix provides a list of some of the most well-known intelligent tutoring systems used in education. These systems use AI algorithms and data analysis to provide personalized and effective learning experiences for students in various educational settings, including K-12 schools, higher education, and online learning platforms. While the features and capabilities of these systems can vary widely, they all aim to enhance student learning outcomes through tailored support and feedback.

Well-Known Intelligent Tutoring Systems:

- ALEKS (Assessment and LEarning in Knowledge Spaces)
- Knewton
- Carnegie Learning
- Smart Sparrow
- DreamBox Learning
- McGraw Hill Connect
- ALEKS PPL (Personalized Learning)
- Aplia
- WebAssign
- Mathspace

Appendix 3. Developers' Experience Of Their First Project Survey

* 1. How many years of experience in software development do you have at the moment?

- ◯ Less than a year
- ◯ 1-3 years
- ◯ 3-5 years
- ◯ 5+ years

* 2. Remember your first work assignment. Was your onboarding process smooth in your opinion?

- ◯ Yes
- ◯ No

* 3. Positive sides: Select all that apply to your onboarding process in your first project

- ☐ I was assigned a mentor to take me through the process
- ☐ I was given documentation to read
- ☐ The documentation for the project was well written and easy to understand
- ☐ I had access to training material (videos, webinars, courses) that were strongly related to the project
- ☐ I got a lot of help from my team: they patiently answered my questions and explained what I should do
- ☐ With the help and materials I got I got a clear picture how to proceed with the project
- ☐ The coding languages and frameworks used in the projects were familiar for me
- ☐ I got a clear picture of the project structure from the start
- ☐ Even though I didn't have a clear picture of the project structure, I had a good understanding of how to proceed and where to seek information
- ☐ Other (please specify)

* 4. Negative sides: Select all that apply to your onboarding process in your first project

- [ ] I was not assigned a mentor or any other dedicated person to take me through the process
- [ ] I had to look for the project documentation myself or none existed
- [ ] The documentation for the project was poorly written and difficult to understand
- [ ] I did not get access to training material (videos, webinars, courses) or the material I got wasn't related to the project
- [ ] The team I joined did not have time for proper introduction to the project and/or their answers didn't help. I felt like I had to deal with everything on my own
- [ ] I did not have a clear idea how to proceed with the project and felt lost
- [ ] The coding languages and frameworks used in the projects were not familiar for me
- [ ] I did not know where to look for information about coding language and/or frameworks used in the project
- [ ] I could not understand the project structure and/or did not know where I should start from
- [ ] Other (please specify)

* 5. I feel that a Q/A or a sort of FAQ guide would help a lot in the onboarding process

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

* 6. I think that an AI tool that would guide me could help a lot in the start of a new project

- ◯ Strongly agree
- ◯ Agree
- ◯ Neither agree nor disagree
- ◯ Disagree
- ◯ Strongly disagree

* 7. If an AI helper existed, what should it be able to help with?

- [ ] Help me getting all necessary information about the project
- [ ] Help me with the coding language, framework and other technical questions
- [ ] Give me tasks in the format of what I should do next (step by step guidance)
- [ ] Be proactive and ask me about difficulties I may have encountered
- [ ] Other (please specify)
- [ ] Follow the progress of the onboarding
- [ ] Provide emotional support and cheer me up
- [ ] For consultants: notify my company about possible problems on the client's project
- [ ] I find such a tool unnecessary

8. If you have any thoughts and comments about your first project and the onboarding process you would like to share, please do so below

9. Several people will be selected for a live/online interview. If you wish to help with the research and participate in the interview, please leave your contact details

Name	
City/Town	
Country	
Email Address	
Phone Number	