TALLINN UNIVERSITY OF TECHNOLOGY
School of Information Technologies

Sander Nõmmik 212058IVGM

Applicability of AI-enabled Solutions in Public Employment Services by the Example of Estonia

Master's thesis

Supervisor: Markko Liutkevičius

MA, MSc

Tallinn 2023

TALLINNA TEHNIKAÜLIKOOL
Infotehnoloogia teaduskond

Sander Nõmmik 212058IVGM

Tehisintellekti toega lahenduste rakendatavus tööhõiveametites Eesti näitel

Magistritöö

Juhendaja: Markko Liutkevičius

Magister

Tallinn 2023

Author’s declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

Author: Sander Nõmmik

08.05.2023

Abstract

The topic of artificial intelligence in the public sector has gained prominence in academic literature during the last years. However, the amount of research on the use of artificial intelligence in the public employment services has been modest as first studies exploring use cases were conducted only a couple of years ago. Still, the implementation of artificial intelligence has begun in various labour market organisations as it promises several advantages, yet many challenges and risks accompany the benefits. The aim of this thesis is to explore the applicability of AI-enabled solutions in Public Employment Services by the example of Estonia, and the case of the Estonian Unemployment Insurance Fund is used as the basis for the analysis. To achieve the aim of the study, exploratory single-case study research is used as the research method, which consists of secondary data analysis, semi-structured in-depth interviews and a workshop with experts. By examining the current state of the art, experience, challenges, and future requirements for artificial intelligence of the Estonian Unemployment Insurance Fund, two main aspects can be highlighted while implementing artificial intelligence in Public Employment Services. First, there are certain factors that influence the implementation of artificial intelligence in Public Employment Services such as the acceptance of the end-users, data quality and safety, ethics, legal aspects, existing infrastructure, and the support of the management. Second, there are requirements that a labour market organisation should consider for a successful implementation of artificial intelligence inside the organisation such as a strong project, financial independence, high-tech IT-systems, expertise, pre-assessments, and a developed organisational culture.

Keywords: artificial intelligence, public employment services, challenges, acceptance

This thesis is written in English and is 70 pages long, including 6 chapters, 4 figures and 2 tables.

Annotatsioon

Tehisintellekti toega lahenduste rakendatavus tööhõiveametites Eesti näitel

Tehisintellekt avalikus sektoris on teema, mis on viimastel aastatel akadeemilises kirjanduses esile kerkinud. Uuringuid tehisintellekti kasutamise kohta tööhõiveametites on aga pigem vähe ning esimesed kasutusjuhtumeid avastavad uuringud ilmusid alles paar aastat tagasi. Siiski on tehisintellekti juurutamist alustatud erinevates tööhõiveametites, kuna sellega kaasnevad mitmed eelised. Siiski peab arvestama, et selle kasuga kaasnevad ka mitmed väljakutsed ja riskid. Käesoleva lõputöö eesmärgiks on hinnata tehisintellekti toega lahenduste rakendatavust tööhõiveametites Eesti näitel ning võtta analüüsi aluseks Eesti Töötukassa juhtum. Lõputöö eesmärgi saavutamiseks kasutatakse uurimismeetodina üksikjuhtumi uuringut, mis koosneb dokumendianalüüsist, poolstruktureeritud süvaintervjuudest ja töötoast valdkonna ekspertidega. Eesti Töötukassa hetkeseisu, kogemusi, väljakutseid ja tulevikunõudeid tehisintellektile uurides tõstab lõputöö esile kaks peamist aspekti, mis on seotud tehisintellekti rakendamisega tööhõiveametites. Esiteks on teatud tegurid, mis mõjutavad tehisintellekti rakendamist tööhõiveametites, nagu näiteks aktsepteerimine, andmete kvaliteet ja turvalisus, eetika, juriidilised tegurid, infrastruktuur ja juhtkonna tugi. Teiseks on nõuded, millega tööhõiveamet peaks arvestama, et tehisintellekti tehnoloogiaid edukalt organisatsioonis rakendada, nagu näiteks tugev projekt, rahaline sõltumatus, kõrgtehnoloogilised IT-süsteemid, asjatundlikkus, eelanalüüsid ja hea organisatsioonikultuur.

Märksõnad: tehisintellekt, tööhõiveametid, väljakutsed, vastuvõtt

Lõputöö on kirjutatud inglise keeles ning sisaldab teksti 70 leheküljel, 6 peatükki, 4 joonist, 2 tabelit.

List of abbreviations and terms

AI	*Artificial intelligence*
BI	*Behavioural Intention*
CITIS	*Centre of IT Impact Studies*
DOI	*Diffusion of Innovations Theory*
EE	*Effort Expectation*
EU	*European Union*
EUIF	*Estonian Unemployment Insurance Fund*
FC	*Facilitating Condition*
GDPR	*General Data Protection Regulation*
ILO	*International Labour Organization*
ISS	*Delone and McLean IS success model*
IT	*Information technology*
ML	*Machine learning*
PE	*Performance Expectation*
PES	*Public Employment Services*
SI	*Social Influence*
TAM	*Technology Acceptance Model*
TPB	*Theory of Planned Behaviour*
TRA	*Theory of Reasoned Action*
UTAUT	*Unified Theory of Acceptance and Use of Technology*

Table of contents

1 Introduction 11
2 Literature review and state of the art 13
2.1 Artificial intelligence in Public Employment Services 13
2.2 Challenges connected to the use of AI in the public sector 15
2.2.1 The Four-AI-Challenges Model 18
2.3 Acceptance of AI in the public sector 21
2.3.1 UTAUT Model 22
2.4 State of the art 24
3 Research methodology 26
3.1 Case selection 27
3.2 Data collection and analysis 28
3.3 Limitations 29
4 Results 31
4.1 Public Employment Services in Estonia 32
4.1.1 Use cases of AI in the EUIF 33
4.2 Current state of AI in the EUIF 35
4.2.1 Advancements made in using AI-enabled solutions in the EUIF 36
4.2.2 Occurred challenges during the implementation of AI in the EUIF 37
4.2.3 Technological and infrastructural requirements needed for existing AI-enabled solutions in the EUIF 39
4.3 Factors influencing the applicability of AI in PES 39
4.4 Designing an AI-enabled solution in PES based on future requirements 44
4.4.1 Data needed for AI-enabled solutions in the EUIF 45
4.4.2 Requirements needed for future solutions 45
5 Discussion 48
5.1 Discussion of the results 48
5.2 Factors influencing the use of AI in PES 53
5.3 Requirements for implementing AI in PES 57

6 Conclusion 60
References 62
Appendix 1 – Plain licence for allowing the thesis to be available and reproducible for the public 68
Appendix 2 – Interview questions 69

List of figures

Figure 1. The Four-AI-Challenges Model. Source: [3]. Figure created by the author... 18
Figure 2. UTAUT Model. Source: [56]. Figure created by the author..... 23
Figure 3. Themes used in deductive coding in MAXQDA. Source: Author. 31
Figure 4. PES AI Ecosystem: Enabling Factors for AI Implementation. Source: Author. 59

List of tables

Table 1. The list of the interviewees. Source: Author. 28
Table 2. Tasks of the EUIF. Source: [73]. Table created by the author. 33

1 Introduction

Over the past few decades, public sector organisations have started to integrate high-class technological solutions in their activities to establish strong relationships with the end-users and maintain competitiveness. One of the latest emerging trends for higher efficiency has been the inclusion of artificial intelligence (AI) among other automated solutions in public services [1]. The inclusion of AI techniques can already be noticed in several public sector fields, such as education, healthcare, environmental protection, and social protection [2]. However, it can take years for AI solutions to be widely used in public sector organisations due to several challenges and uncertainties the institutions may face. Therefore, organisations should consider emerging challenges and overall acceptance of the end-users while starting with the integration of AI solutions in their daily activities to ensure successful results [3], [4].

In addition to reshaping public services, the emergence of modern digital technologies has impacted the ways people learn, work and live. Hence, the European Union (EU) has increased their focus on the working people and how to keep them competitive in the labour market mainly through skills development [5]–[7]. So, there is a demand for effective public services focusing on maintaining the competitiveness of people active in the labour market. These types of public services are usually offered by Public Employment Services (PES), which are the institutions focusing on employment topics and connecting the jobseekers with employers. In addition to other public sector organisations, PES also should keep up with the technological changes to offer high-quality and accessible services.

The inclusion of AI in employment services could bring new potential into the services of PES and first attempts have already been made in some countries [6], [8], [9]. Although AI is being integrated into the activities of labour market organisations, capabilities related to AI are still limited and mainly integrated into employment services in developed countries [10]. So, AI technologies can bring new potential into the services of PES, but also several challenges can occur during the implementation of new solutions that PES

must consider. Still, AI-enabled solutions are starting to emerge in employment services as they already have in other public sector fields [8], [9].

The aim of this thesis is to explore the applicability of AI-enabled solutions in Public Employment Services by the example of Estonia. The author of this thesis has chosen a single-case study approach as the research methodology, focusing on the Estonian Unemployment Insurance Fund (EUIF) as the sole institution in Estonia offering a wide set of different labour market services while having some experience in integrating AI-enabled solutions in their processes and daily activities.

The main research questions of the thesis are the following:

- RQ1: How does the Estonian PES offer services at the moment?
- RQ2: What are the factors influencing the implementation of an AI-enabled solution in PES by the example of the Estonian PES?
- RQ3: How to design a suitable AI-enabled solution for an employment service based on the requirements set by PES?

The thesis is divided into six main sections. The first section focuses on the introduction, while the second part covers the literature review of the overall usage of AI in PES, the challenges of AI solutions in the public sector, technology acceptance and the current state of the art of AI in the Estonian public sector. The third section covers the research methodology followed by the fourth part focusing on the current state of using AI in the EUIF and the results gathered in interviews and a workshop in connection with the literature framework. The fifth section is dedicated to the discussion based on the results and the last section covers the conclusion of the research.

2 Literature review and state of the art

The first part of the thesis covers a literature review that outlines the theoretical approach. The section focuses on the AI in PES, the challenges that may occur with the integration of AI technologies, the acceptance of AI solutions in the public sector and the current state of the art of AI in the Estonian public sector. The literature review will be taken as the basis for the case study of the EUIF.

2.1 Artificial intelligence in Public Employment Services

The fourth industrial revolution with the emergence of information technology (IT) has been impactful as processes such as digitalisation and digital transformation have become focus points in organisations to stay competitive and achieve greater efficiency [11]. Through digitalisation an organisation makes changes in their business model and processes for new opportunities, whereas through digital transformation an institution goes a step further by changing their entire organisational culture, business models, processes, and capabilities to satisfy the needs of the end-users and create new value [12]. In the processes of digitalisation and digital transformation in the public sector, the topic of the use of AI has arisen as the innovation needed for smart governance [13]. As in the entire public sector, the increased usage of AI innovations has started to transform PES and their activities.

As AI in PES is a limited yet an emerging field of research, it means that several countries have not separately focused on the development of AI in PES [14]. However, first use cases and researches of integrating AI solutions into employment services can be found in the fields of profiling unemployed people, matching vacancies offered by employers with jobseekers and skills intelligence [6], [8], [9]. From the existing use cases it can be noticed that when PES integrate AI solutions in their services, they tend to focus on creating tools for their employees based on predictive algorithms using machine learning (ML) mainly in the fields of profiling, targeting and matching to increase the efficiency of the organisation [15]. This means that different data such as age, job history,

educational info, skills of the clients of PES, and historical data are being used to make predictions and offer more efficient services [8], [15]. However, PES must consider different aspects while integrating the AI solutions that may affect the expected result.

According to the International Labour Organization (ILO) [10, p. 16], PES must rely on four main capacities for a successful digital transformation: 1) a digital transformation strategy; 2) skilled staff in technology; 3) high-level of data management and analysis; and 4) effective cybersecurity and data protection. As the topic of AI has an important role in the process of digital transformation, aforementioned capacities must be met inside PES for successful integration of an AI solution. Furthermore, Urquidi and Ortega [16, p. 19] state that PES must consider the data collection and use, principles of data use, and interoperability with other institutions to be successful while adopting and integrating AI. As PES are mostly using the data of their clients for the development of AI solutions, one of the focus points must be the security and privacy of the data. In addition, PES must consider and mitigate different risks such as discrimination, exclusion, digital divide, lack of data and lack of suitable infrastructure inside the organisation [16]. In addition, one important group that must be considered are the employees of PES whose work could be influenced by the digital transformation and AI solutions that might accompany the process.

The average accuracy of tools that use predictive algorithms for decision-making stays around 70% in PES [8], [17]. It is discovered that often statistical profiling can be more effective than the employees of PES in assigning clients to correct measures [17], [18]. That raises the question of people versus machines while making decisions and offering services to the clients [15] and whether the tools are actually useful for PES employees and increase the quality and cost-efficiency of services, which Desiere, Langenbucher and Struyven [17, p. 23] note as the most important objective of profiling tools in PES. In addition to the topic of usefulness, PES employees may not accept the tool enabled with AI and not use it as expected by the organisation. The employees may even start to reject the technology due to the fear of the impact it has on their work and the lack of transparency [19]. However, as the profiling technologies are developed to offer additional support to PES employees, the acceptance of the personnel using the solutions must be one of the focus points. Furthermore, Desiere, Langenbucher and Struyven [17,

p. 3] recommend involving all stakeholders in the early stages of new projects, where AI is being used.

In addition to the importance of different factors necessary for successful implementation of AI in PES such as quality data, high-level data management and privacy, legality, and involvement of all stakeholders in the development process, the client must also separately be highlighted as their data is often being used in the process [15] and they are usually the receivers of employment services. AI-enabled solutions create the opportunity to offer the clients better supporting employment services that are correctly related to their needs [17], [20]. Furthermore, clients have the opportunity to receive recommendations based on data and similar experiences of people in the same segment [20]. However, the level of acceptance and maturity of the clients must be acknowledged [16] while implementing new technologies. Furthermore, there is a possibility of discrimination and bias encoded into algorithms through low quality data [10], [15], [16], [20], [21]. The usage of AI solutions could also bring change into the relationships between PES and its clients as decision-making could alter the interaction by ignoring particular details and needs of each client [20]. This means that the client could be turned into a general case, rather than an individual human being with specific needs. However, it must be noted that prejudice and generalisation could also happen in human-to-human interaction between PES and the client [20], where AI-enabled tools are not in use. AI in PES and the public sector in general has many benefits in transforming processes and increasing the efficiency of an organisation. Still, several factors must be considered in the process of development and adoption.

2.2 Challenges connected to the use of AI in the public sector

AI has potential to enhance services and increase the overall efficiency of an organisation. A growing number of public sector institutions have started to integrate AI-enabled solutions in their daily activities to increase productivity [3]. However, compared to the private sector, the usage of AI-enabled solutions in the public sector can still be considered as an emerging phenomenon [1], [22]. Still, researchers find that AI technologies have many benefits for the public sector that make the use of AI worthwhile [1], [22]–[24]. Furthermore, according to Dwivedi et al. [25, p. 26] two outstanding opportunities of AI in the public sector perspective are: 1) reallocation of already scarce

resources of the public sector for more complex problems; and 2) enhancement of trust between a citizen and an organisation. Although there are several benefits that AI may have for a public sector organisation, there are also many challenges that may be reasons why the AI development in the public sector has lagged behind while comparing it to the private sector.

Challenges accompanied by the use of AI technologies in the public sector can be seen as one of the reasons why the AI development has lagged in organisations. Sun and Medaglia [26, p. 374] point out that regarding the implementation of AI there are several challenges that accompany any new technologies, not only AI, such as lack of trust to use new technologies, high costs, low data integration between different institutions, lack of knowledge, insufficient amount of data, and the general fear of substitution and job loss. In addition to general classic challenges of new technologies. Dwivedi et al. [25, p. 26] emphasise three challenges specific to AI: 1) threats of algorithms being discriminatory or bias, e.g. there can already be prejudice or biassed samples present in the training data [27]; 2) lack of transparency of algorithms, e.g. the occurrence of black box problem [28]; 3) fragmenting society, e.g. increasing divide between different groups by reinforcing ideologies, views and opinions [29]. Furthermore, while specifically observing the deployment of AI in public administration, Henman [30, p. 213] identifies four main challenges: 1) accuracy of data that must be free of bias and discrimination; 2) legality of AI and the results affected by the use of it; 3) accountability and responsibility, e.g. who is responsible for decisions made by AI; and 4) using AI technologies for control and power, e.g. the social credit system of China where big data and AI are being used for social control [31]. So, while observing the challenges of AI implementation in the public sector, the focus is put on the transparency and validity of data used for AI, legal issues, and inclusion of end-users.

Since the scope of research conducted in the field of AI implications and challenges in the public sector is still scarce [32], [33], Zuiderwijk, Chen and Salem [23] conducted a separate systematic review of AI use in government and its opportunities. It was discovered that there are many potential benefits of the use of AI such as higher efficiency, more effective risk identification, cost savings and competitiveness, improved data processing, increase of quality in services, social benefits, effective decision-making, higher interaction with citizens, and sustainability [23, p. 8]. In addition to the potential

benefits discovered by Zuiderwijk, Chen and Salem [23], several challenges were emphasised that may accompany the use of AI in government such as poor data quality, organisational and managerial resistance, lack of skills, difficulties of interpretation, ethical problems, confusion on political and legal levels, aggravation of social problems, and damage to economy of a country [23, p. 10]. Even so, Zuiderwijk, Chen and Salem [23, p. 15] mention that there is a lack of theoretical frameworks focusing on AI governance and the challenges of AI use in the public sector.

Wirtz, Weyerer and Sturm [33, p. 819] highlight that there are only two known frameworks that focus on the challenges of the use of AI in the public sector and the governance of AI systems. However, both of these models have their shortcomings. The first model proposed by Gasser and Almeida [34, p. 60] introduces a layered model of AI governance consisting of three key layers: 1) the technical layer, which is the foundation of the model, e.g. the algorithms and data out of which AI is developed; 2) the ethical layer, which is on top of the technical layer, and applies principles to AI technologies; and 3) social and legal layer that regulates the AI systems. Yet, Wirtz, Weyerer and Sturm [33, p. 819] point out that the model does not explain how different layers are tied with each other and how responsibilities in the governance of AI are distributed. The second framework proposed by Rahwan [35, p. 7] argues that for a transparent and accountable AI governance a society-in-the-loop approach is needed, which is an adaptation from the human-in-the-loop concept. Human-in-the-loop approach describes a situation, where AI is in the role of recommender, but the final decision before acting comes from a human [33], [35]. Yet, when AI has a broader function and implications that influence the whole society, society-in-the-loop emerges and describes how society must be engaged in AI governance [35]. This involvement is expressed by Rahwan [35, p. 9] in two different aspects: 1) compromises between different values must be resolved, e.g. compromises between security and privacy; 2) positive and negative outcomes of AI technologies must be distributed among the stakeholders of society, e.g. self-driving cars may increase the safety of passengers, but on the other hand increase the dangers for pedestrians. However, for both models by Gasser and Almeida [34] and Rahwan [35], there are only partial explanations about the challenges of the use of AI [33]. Therefore, Wirtz, Weyerer and Geyer [3] have proposed a model that is focused on the challenges and risks of the use of AI in the public sector.

2.2.1 The Four-AI-Challenges Model

Many topics are mentioned in the discussion of AI governance and challenges in the public sector. Some topics highlighted by several researchers are social impacts and ethics [1], [3], [23], [36]; security and privacy [2], [3] [37]; the implementation of AI technologies [3], [38], [39]; as well as legality and responsibility [3], [23], [25], [26]. Based on these main themes, Wirtz, Weyerer and Geyer [3, p. 601] have proposed the Four-AI-Challenges Model that consists of four major dimensions of AI challenges that should be identified and met for successful implementation: 1) AI Technology Implementation; 2) AI Law and Regulations; 3) AI Ethics; 4) AI Society (see Figure 1).

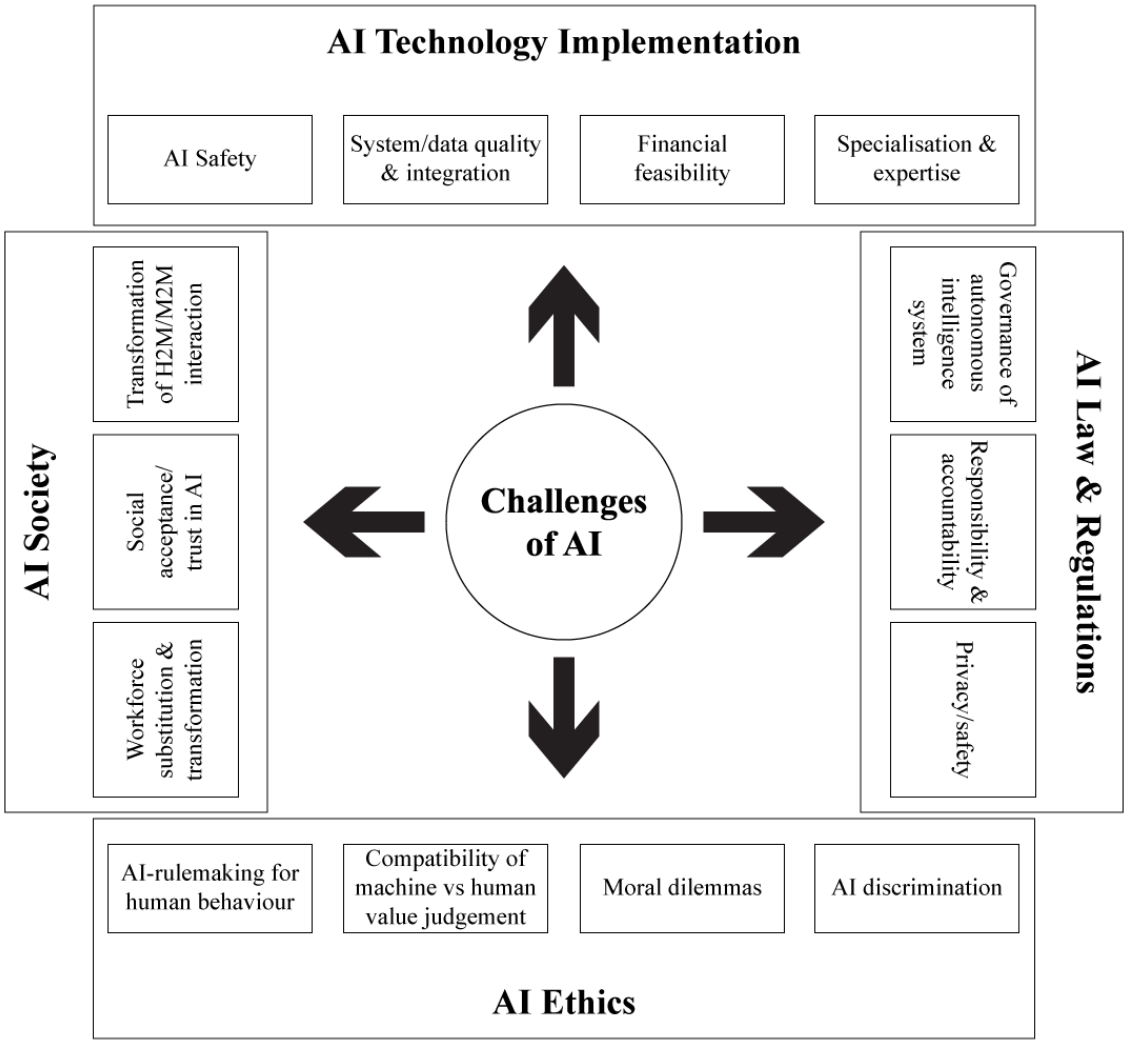

Figure 1. The Four-AI-Challenges Model. Source: [3]. Figure created by the author.

First, in the technology implementation field of AI challenges, according to Wirtz, Weyerer and Geyer [3, pp. 601-602] the main challenges are related to the safety of AI, i.e. general security issues that have to be solved for reliable working of AI [40]; the quality of system and data and their integration, i.e. high-quality systems and data, and data integration are needed for a functioning and effective AI system [41]; financial feasibility, i.e. costs needed for the successful development and implementation of AI technologies [26], [42]; and specialisation and expertise, i.e. the need for experts specialised in AI for successful implementation [3]. This means that for successful implementation of AI technologies an organisation must ensure the overall security and reliability of the system, use high-quality, accurate and unbiassed data, and have enough funds for the creation of suitable infrastructure for AI and for the involvement of experienced AI specialists.

Second, in the law and regulations field of AI challenges, according to Wirtz, Weyerer and Geyer [3, pp. 602-603] the main challenges are related to the governance of autonomous intelligence system, i.e. how to ensure that AI systems work transparently in intended ways; responsibility and accountability, i.e. who exactly are legally responsible and accountable for the decisions and actions that an AI makes [26], [41]; and privacy and safety, i.e. ensuring the privacy of people and protecting their data [43]. This means that in addition to the activities individual organisations can make towards successful implementation of AI technologies, often new legislative and regulatory changes must also be implemented to ensure the security and privacy of data as well as the controlled ways how AI can work.

Third, in the ethics field of AI challenges, according to Wirtz, Weyerer and Geyer [3. pp. 604-605] the main challenges are related to AI rulemaking for human behaviour, i.e. the results and consequences that arise from the decisions and actions made by AI, which can pose threats to end-users [44]; compatibility of machine versus human value judgement, i.e. whether human values can be implemented into an AI system without it becoming autonomous; moral dilemmas, i.e. situations where AI must choose between conflicting situations [35]; and AI discrimination, i.e. how to avoid discrimination and bias in the actions of AI [25], [30]. Some researchers have raised concerns about the ethics of AI, specifically bias and discrimination in their actions that may occur from using data with

low quality [16], [45]. Therefore, challenges related to ethics should be mitigated as they can directly cause AI solutions to be ineffective and imprecise.

Fourth, in the society field of AI challenges, according to Wirtz, Weyerer and Geyer [3, pp. 605-607] the main challenges are related to the workforce substitution and transformation, i.e. implementation of AI could change existing roles of employees or even result in redundancies; social acceptance and trust in AI, i.e. the expectations of end-users regarding the effects and results of AI technologies; and the transformation of human-to-machine/machine-to-machine interaction, i.e. the understanding of interactions among the machines or among people and machines in the context of AI and the challenge of differentiating people from machines and vice versa in communication [33]. Poor transparency could have a negative outcome on the acceptance and usage of AI among the end-users [4], yet the same acceptance plays a big role in the success of AI [46]. Therefore, challenges related to the society aspect should be mitigated to earn the acceptance and trust of end-users, which is an important part for a service or technology to be truly efficient and successful.

Furthermore, the Four-AI-Challenges Model is used by Wirtz, Weyerer and Sturm [33, p. 823] as the basis for the AI governance framework, where they have combined the issues of AI regulation and challenges. The aim of the framework is to provide a guide for public officials dealing with regulatory issues of AI [33]. Therefore, it can be noted that the mapping of AI challenges and taking them into account while developing and implementing AI solutions is important for success and efficiency. Nevertheless, while meeting the challenges, creating AI systems based on algorithms could have a risk of depersonalising some services which in turn could negatively affect the more vulnerable groups of society [47]. This means that the AI solutions should be human-centred to reach as many potential end-users as possible, while still considering aforementioned challenges. In addition to being human-centred, AI-enabled solutions should be explainable, secure and transparent to be trustworthy [48]. Trust, nowadays especially digital trust, is one of the key aspects considered in organisations [49], which means that the acceptance of new technologies is becoming increasingly important.

2.3 Acceptance of AI in the public sector

With the emergence of new technologies, the field of technology acceptance has been popular among researchers to study what influences the end-users to accept or reject a technology [50]. During the decades, several technology acceptance theories have been developed. Some of the most popular acceptance theories are Theory of Reasoned Action (TRA), Theory of Interpersonal Behaviour (TIB), Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), Igbaria's Model (IM), Extension of Technology Acceptance Model (ETAM), Social Cognitive Theory (SCT), Diffusion of Innovations Theory (DOI), Perceived Characteristics of Innovating Theory (PCI), Motivational Model (MM), Uses and Gratification Theory (U&G), The Model of PC Utilisation (MPCU), Unified Theory of Acceptance and Use of Technology (UTAUT), Compatibility UTAUT (C-UTAUT) and several variations based on these models [51]. In addition to aforementioned models, several other adoption models such as Delone and McLean IS success model (ISS), Technology–organisation–environment framework (TOE), Task technology fit (TTF) and Expectation confirmation theory (ECT) have been included in IT-related studies [51]. However, the most widely used models in research about the adoption of IT-technologies are TAM, DOI, UTAUT, TPB and ISS [52], [53].

TAM was first developed by Davis [54] and it states that the acceptance and adoption of a technology relies on the ease of use of the technology and the perceived usefulness in the eyes of the user [52], [54]. DOI was first proposed by Rogers [55] and focuses on five innovation characteristics (relative advantage, compatibility, complexity, trialability and observability) that are impactful and may lead to change [52], [55]. UTAUT is derived by Venkatesh et al. [56] from eight different previous acceptance theories and states that performance expectancy, effort expectancy, social influence and facilitating conditions have a role in affecting the behavioural intention and the usage behaviour of the end-user [52], [56]. In TPB, Ajzen [57] explains that attitudes toward the eventual behaviour, subjective norms related to the behaviour and the perceived control over behaviour can precisely predict the behavioural intentions [52], [57]. According to the ISS model proposed by DeLone and McLean [58] there are six connected categories for measurement of success: system quality, information quality, use, user satisfaction, individual impact, and organisational impact [52], [58].

According to Rana, Dwivedi and Williams [53, p. 30] TAM is a model used the most for researching the willingness of the end-users to adopt new IT solutions. Furthermore, Rana, Dwivedi and Williams [53, p. 30] state that TAM is the most frequently used theoretical approach in research in the field of e-governance adoption. While TAM has been developed further with additional constructs (e.g. TAM2 and TAM3), few studies have used the extended versions [53]. However, Sohn and Kwon [59, p. 2] highlight that although researchers widely use TAM in the evaluation of IT acceptance, new innovations have become too complex for this model, and models such as UTAUT and Value-based Adoption Model (VAM) are more precise in the field of AI acceptance. Furthermore, UTAUT is widely used in the field of e-government [60] and often in studies about the acceptance of decision support systems by the employees of an organisation [61]–[63]. Some researchers tend to add additional constructs to the model such as trust while studying the acceptance of decision support systems [60], [62], which is also a construct in the Four-AI-Challenges Model [3]. Moreover, Hong et al. [64, p. 8] state that UTAUT is an appropriate model for circumstances, where social impact, such as organisational culture or strong leadership, has importance. At the same time, Sarker, Wu and Hossin [13, p. 68] note that AI projects need strong leadership for successful implementation. Therefore, connecting the UTAUT model with the Four-AI-Challenges Model has the potential to detect main factors that should be taken into account while developing AI-enabled solutions in PES.

2.3.1 UTAUT Model

As mentioned before, UTAUT is a model that is derived from several previous theories (including TAM, TRA and TPB) and it analyses the technology acceptance within the given organisation [50]. This means that it is a useful theory for inspecting technology implementations that are conducted within the organisation and that might affect the employees. Presented by Venkatesh et al. [56], UTAUT consists of four constructs that have direct impact on the user acceptance and their use behaviour, and four moderators that influence the relationships between the constructs and the Behavioural Intention (BI) (see Figure 2). In turn, these four constructs of the UTAUT model can be categorised into two separate groups: technology attributes (performance expectation and effort expectation) and contextual attributes (social influence and facilitating conditions) [65].

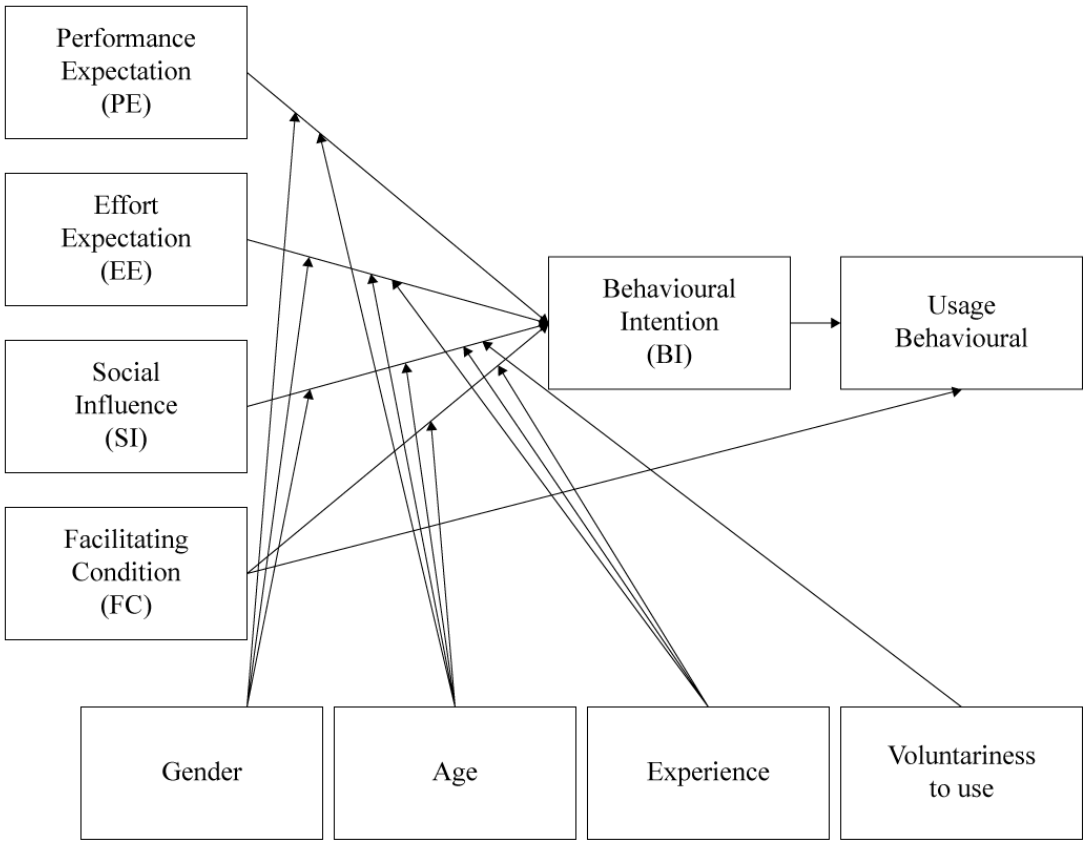

Figure 2. UTAUT Model. Source: [56]. Figure created by the author.

First, the construct 'Performance Expectation (PE)' that affects the BI of a user, refers to the level of usefulness the new technology might have for the tasks of the end-user [56]. The relationship between PE and BI is moderated by gender and age of the end-user [56]. This means that the acceptance could be higher when the end-users perceive actual benefits that the technology could have on their performance. Second, the construct 'Effort Expectation (EE)' that has an effect on the BI of an end-user, refers to the ease of use that the user associates with the new technology [56]. The relationship between EE and BI is moderated by gender, age and experience [56]. This relationship shows that if the technology is easy to use and explainable, the technology acceptance could be higher. Third, the construct 'Social Influence (SI)' that affects the BI of a user, refers to the opinion of a person using the new system and the influence they might have on other users [56]. The relationship between SI and BI is moderated by gender, age, experience and voluntariness to use [56]. This means that if the user believes that others are finding the new technology helpful, then the technology acceptance of the user could be higher.

Fourth, the construct ‘Facilitating Condition (FC)’ that affects the usage behaviour and is not explained by the BI, refers to the level of infrastructure that the user believes the organisation has [56]. The relationship between FC and the usage behaviour is moderated by age and experience [56]. This relationship refers to the fact that strong supporting infrastructure has the potential to raise technology acceptance.

Researchers have found that the accuracy of the UTAUT model is rather high, as the model explains approximately 70% of variance in behavioural intention [56], whereas about 50% of variance in the actual use of technology [66]. Furthermore, it is found that all the aforementioned constructs positively influence the use of AI-enabled solutions [56], [67]. As researchers have started to complement UTAUT with additional constructs [65], e.g trust and attitude, UTAUT combined with the Four-AI-Challenges model could bring more thorough insights into the applicability of AI-enabled solutions in PES.

2.4 State of the art

In 2019, an expert group led by the Ministry of Economic Affairs and Communication of Estonia and the Government Office prepared a national AI strategy 2019-2021, which was based on four main goals [68]. The aim of the strategy was to boost the uptake of AI in the public and private sector, increase relevant skills, grow the research and development base and develop the legal environment [69]. The strategy contained different measures and activities meant to advance the uptake of AI that were synchronised with and supporting relevant EU-level AI activities. While observing the aim to advance the uptake of AI in the public sector, planned activities mainly focused on: 1) raising awareness inside organisations through courses, meetings, success stories, workshops and guidance materials; 2) promoting the use of data through increasing availability of open data, developing data governance and improving the quality of data; 3) developing, financing and supporting new AI projects, e.g. financing research on implementation of decision-making support in institutions, creating technological sandboxes for testing, and developing the BürokrattAI interoperable AI solution concept [68]. By the end of the year 2021 approximately 80 AI-related projects were conducted in more than 40 public sector organisations [69]. The strategy was followed by a modified version for the years 2022-2023 to improve capabilities to uptake AI in institutions with

no previous experience, while empowering organisations that already have had previous AI-related experience.

The aim of the new Estonian AI strategy is to increase the use of AI in the public sector and private sector as well as in the educational and research sector [69]. Furthermore, changes in legislature and data as an enabler are in focus [69]. By the end of 2023 the amount of AI-related projects in the public sector is expected to be 130 in more than 60 organisations, while approximately 40 AI-related codes used in several projects are planned to be published [69]. New planned activities regarding the advancing of AI in the public sector mainly focus on: 1) improving data governance through carrying out data literacy courses, creating guidelines and privacy conceptions, financing data science projects, and conceptualising data privacy sandbox framework; 2) advancing the AI-related experience inside public sector organisations through creating instructions and courses for developers, starting new projects and publishing working codes in cooperation with public and private sector, raising awareness and acceptance of AI-enabled solutions inside organisations, and offering a common infrastructure for developing of AI in institutions; 3) developing and implementing BürokrattAI solution in different public sector organisations [69]. So, additional focus is set on data governance as an important part of an AI-related project.

The general objective of the Estonian national AI strategy 2019-2021 was to have at least 50 use cases of AI in the public sector by the end of 2021 [70]. Several existing use cases and further developments in public sector organisations were separately listed by the expert group. For example, the EUIF was mentioned as an organisation that uses AI to match jobseekers with available positions and that is developing the algorithm even further with a jobseeker profiling solution [70]. Therefore, it can be said that there have been first experiences in implementing AI solutions in the Estonian PES.

3 Research methodology

The aim of this thesis is to explore the applicability of AI-enabled solutions in public employment services by the example of Estonia. The main research questions and sub-questions that will be addressed in the thesis are the following:

- RQ1: How does the Estonian PES offer services at the moment?
    - RQ1.SQ1: What advancements have been made in using AI-enabled solutions in the Estonian PES?
    - RQ1.SQ2: What are the main challenges in implementing AI-enabled solutions in a public sector organisation by the example of the Estonian PES?
    - RQ1.SQ3: What are the key technological and infrastructural requirements for implementing AI-enabled solutions in PES?
- RQ2: What are the factors influencing the implementation of an AI-enabled solution in PES by the example of the Estonian PES?
- RQ3: How to design a suitable AI-enabled solution for an employment service based on the requirements set by PES?
    - RQ3.SQ1: What existing data owned or received by the Estonian PES can be used for an AI-enabled solution?
    - RQ3.SQ2: What requirements are needed to fulfil to use AI-enabled solutions in the Estonian PES?

The aim and research questions of the thesis require an exploratory qualitative method as there are no thorough frameworks focusing on the applicability of AI, its challenges and acceptance in PES. To address the research questions and achieve the aim of the study, a single-case study research has been chosen by the author as the research method.

The single-case study research will consist of secondary data analysis of existing literature, use cases, articles and documents of PES. Furthermore, semi-structured in-depth interviews will be conducted with the representatives of the Estonian PES, specialists experienced in developing AI-enabled solutions for PES and researchers studying the impact of AI-enabled solutions in the public sector to gain multiple views and diverse knowledge. The single-case study research design is appropriate for the current study as it helps the researcher to obtain in-depth information about the current situation in real-life context [71]. Furthermore, as there is little preliminary data about AI usage and challenges in the Estonian PES, the case study will be exploratory [72]. The insights gathered through exploratory case study research can then be used in the analysis to explore the applicability of AI-enabled solutions in PES which is necessary for achieving the aim of the study.

To understand the aspects necessary for the implementation of AI-enabled solutions in PES, the overall challenges of AI in PES, the current solutions of the EUIF, their requirements and accompanying challenges, semi-structured interviews are necessary to explore the situation and gain diverse knowledge through multiple views. However, carrying out interviews, transcribing them and using qualitative analysis methods is time-consuming. Therefore, another data source for the research is secondary data such as academic literature, use cases on the topic of AI in PES, documents and articles related to the Estonian PES and other necessary materials.

3.1 Case selection

The EUIF was chosen as the organisation for the analysis in the research. There are several reasons for that choice. First, the EUIF is the only organisation in the public sector of Estonia offering employment services while having gained initial experience with AI solutions and has integrated these solutions into public services [73]. Moreover, as they have already implemented first solutions, they have experience with the acceptance of their employees and how it has affected the implementation process. Second, Estonia is known as one of the frontrunners in e-government and its development, innovation, and the overall usage of new technologies in the public sector [74]. Therefore, the current research could offer some interesting and valuable insights into the field of AI-enabled

solutions in PES as first steps have already been taken in an environment favouring innovation.

3.2 Data collection and analysis

Data collection within this thesis consists of secondary data analysis, semi-structured interviews, and a workshop, whereas semi-structured interviews and a workshop, and their results are of the highest importance.

Through secondary data analysis, information about the state of the art was collected that was useful for the preparation of interviews and a workshop and finding connections with the literature review. Furthermore, information gathered from documents, use cases and articles was used to complement the insights gathered from the interviews and a workshop.

The author of the thesis interviewed eight experts of the field in the period from March to April 2023 (see Table 1). The experts were chosen based on their connection to the EUIF and different AI projects that the organisation has been a part of. Five semi-structured interviews were conducted individually and one workshop with three experts was conducted, which followed a structure similar to the semi-structured interviews. The interviews and workshop lasted from 50 to 80 minutes.

Table 1. The list of the interviewees. Source: Author.

Interviewee number	**Organisation**	**Position**	**Relevance with the AI projects in the EUIF /Low/Mid/High)**
Interviewee 1 (I1)	Tallinn University of Technology	Early Stage Researcher	Mid
Interviewee 2 (I2)	Estonian Unemployment Insurance Fund	Development Expert	High
Interviewee 3 (I3)	Estonian Unemployment Insurance Fund	IT Development Manager	Mid
Interviewee 4 (I4)	Estonian Unemployment Insurance Fund	Head Specialist	High

Interviewee number	Organisation	Position	Relevance with the AI projects in the EUIF /Low/Mid/High)
Interviewee 5 (I5)	Estonian Unemployment Insurance Fund	Head of Department	High
Interviewee 6 / workshop (I6)	Center of IT Impact Studies (CITIS)	Analyst Senior Researcher Junior Research Fellow	High

To further understand and analyse the data gathered from the interviews, thematic analysis was used as a method for finding and analysing patterns across the data set [75] and generating insights based on the results. In this case, the analysis was conducted with the help of a qualitative data analysis software MAXQDA. Throughout the analysis conducted in MAXQDA, deductive coding was used, which means that analysable groups of data [76] were derived from the theoretical frameworks [77], which were examined in the literature review. Furthermore, this specific methodology was chosen to find representative and reliable connections, analyse and interpret results with the help of categorising, while staying coherent with connected theories [77], [78].

3.3 Limitations

The research will meet several limitations such as the generalisation issue as the study will be based on the experience of a single PES and can therefore be context-based [79]. Furthermore, subjectivity cannot fully be eradicated from the study as the main research questions and qualitative analysis will be related to the Estonian PES and their experience. However, as similar questions were asked from all the interviewees, single subjective statements can be checked. Moreover, the current thesis only focuses on the organisational context of implementation of AI in PES. However, in the design and development of an AI-enabled solution in PES the end-users and their needs are an important factor that must be considered. So, the research from the point of view of the end-users, both the employees of PES and their clients, is also needed.

The current research is not accompanied with ethical issues as no personal data was collected during the research and interviews, the participation of the interviewees was voluntary, participants were informed of the purpose and content of the research, qualitative data gathered from semi-structured interviews and a workshop is anonymous, and interviewees that were willing to share their experience and thoughts cannot be identified in the research.

The research is plagiarism-free and the results will be presented correctly to the readers and the evaluation committee. Moreover, the results of the research will also be shared with the EUIF and CITIS as a suggestion to consider while implementing AI-enabled solutions in the future.

4 Results

In this chapter the results about AI use in the EUIF are focused on through the analysis of secondary data, semi-structured interviews, and a workshop. Through deductive coding used in MAXQDA, main themes and sub-themes were detected (see Figure 3) necessary for answering research questions presented by the author of the thesis.

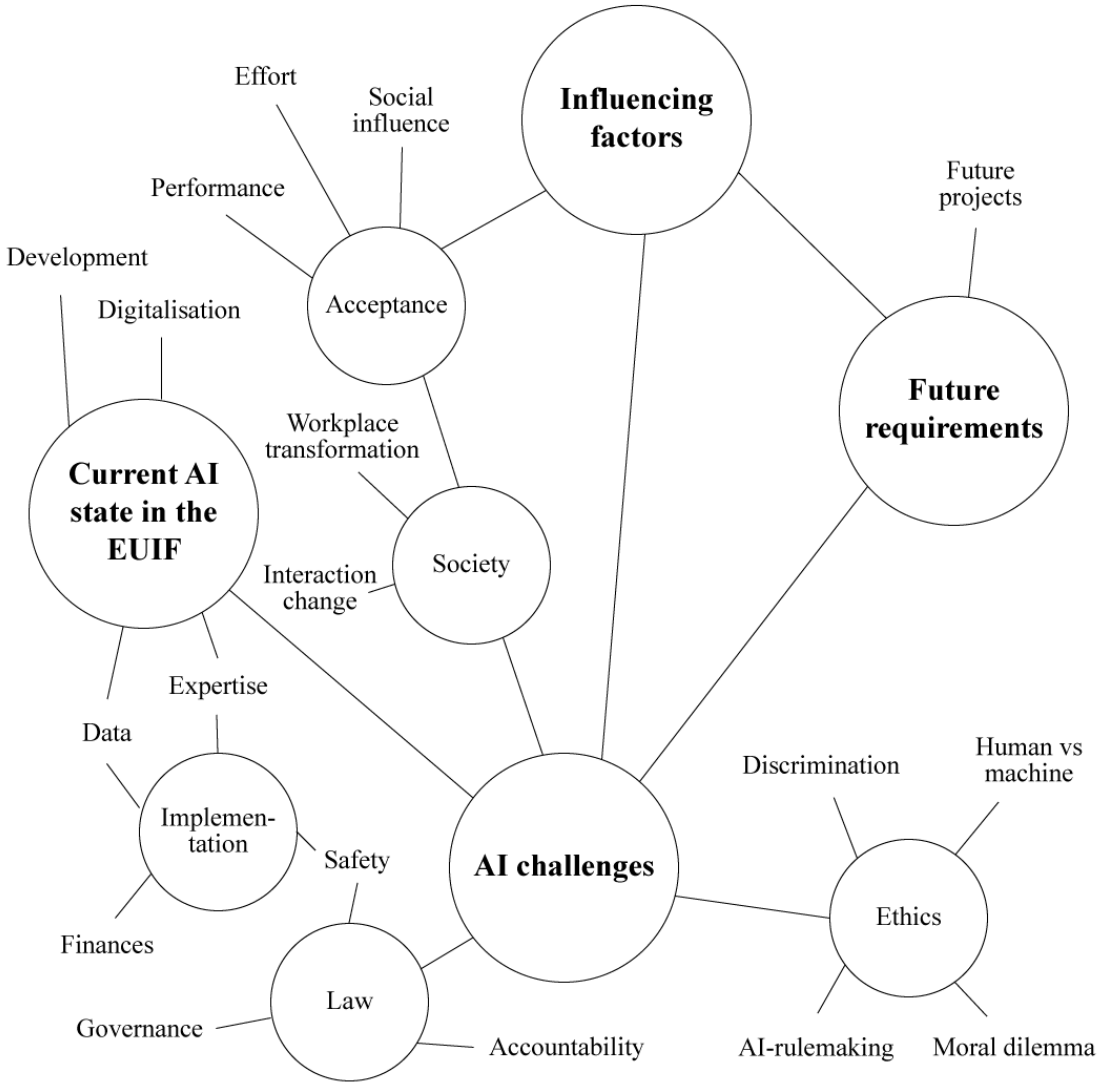

Figure 3. Themes used in deductive coding in MAXQDA. Source: Author.

4.1 Public Employment Services in Estonia

Recent crises such as the war in Ukraine and the impacts of COVID-19 pandemic as well as the emergence of new technologies have had great influence on employment topics. Furthermore, aforementioned crises are actively impeding employment growth [80]. This means that the employment services should be efficient to overcome the impediment of employment growth and support the workforce quality development. PES use a combination of passive and active labour market policies while providing employment services to the end-users [81]. The public sector organisation offering labour market services to the citizens in Estonia is the EUIF.

The EUIF is an organisation that acts independently from the Estonian government and offers services to unemployed people, jobseekers, employees, employers as well as the youth. However, the EUIF is still a public legal entity whose activities are based on two major legal acts: the Unemployment Insurance Act that depicts the EUIF in general and the unemployment insurance system of Estonia; and the Labour Market Services and Benefits Act that describes employment mediation and other related services [82]. The EUIF aims to reduce unemployment in Estonia and the average duration of it, support economic changes, and increase quality labour supply and cost-effectiveness by providing active labour market policies, offering subsidies, and assessing the working capability [82]. Therefore, the EUIF can be depicted as the sole public sector organisation offering employment services in Estonia.

The main strategic goals of the EUIF are to: 1) reduce unemployment and shorten its average period per person; 2) prevent unemployment and support staying in employment; 3) increase the labour supply; and 4) develop the EUIF as a competence centre [73]. Furthermore, the organisation carries out several tasks that can mainly be divided into three categories: offering labour market services, paying benefits, allowances and subsidies, and assessing work ability (see Table 2) [73].

Table 2. Tasks of the EUIF. Source: [73]. Table created by the author.

Task	**Services to complete the task**
Offering labour market services	• Job seeking counselling • Employment mediation • Career counselling • Labour market training • Work trial • Wage subsidy • Start-up subsidy • Job club • Psychological, debt and addiction counselling • Working with a support person • Commuting benefits • etc.
Payment of benefits, allowances, and subsidies	• Unemployment insurance benefit • Redundancy benefit • Employer's insolvency benefit • Unemployment allowance • Work ability allowance • Reimbursement of social tax for a person with reduced working capacity • etc.
Assessment of work ability	

These three categories include offering several services such as employment mediation, career counselling, offering labour market trainings, degree study allowance, business start-up subsidy, unemployment insurance benefit, unemployment allowance and many more [73]. Furthermore, the EUIF has had first experiences in AI-enabled solutions, as one of the interviewees stated:

"The first artificial intelligence, it was actually created in 2018 and it was the automatic matching of job offers." (I4)

4.1.1 Use cases of AI in the EUIF

The first experience of the EUIF with AI was employment mediation, which processes the CV of a person looking for work through the EUIF and automatically matches them

with job offers that have suitable requirements (I3; I4; I5). One of the AI applications developed under the national AI strategy of Estonia was the decision support tool for the EUIF named OTT [83], which was created in cooperation with the public and private sector. OTT is a data analysis tool based on machine-learning that predicts the probability of the registered unemployed people becoming employed again, highlights factors affecting this probability, helps consultants offer solutions to clients based on their individual needs and therefore increases the efficiency of the EUIF [73], [84]. OTT uses the overall data of unemployed people and the labour market from the past five years and generates different probabilities, such as the possibility of finding a new job and the likelihood of becoming unemployed again and introduces different factors that change these indicators [85]. OTT is used to make the daily work of the EUIF consultants easier, faster and more effective by sorting unemployed clients into different groups and giving them risk assessments. That means consultants can prioritise their clients and draft individual recommendations for each client.

In addition to OTT, the EUIF has participated in two additional larger AI-related projects called MALLE and MAITT. MALLE is a tool that evaluates the impacts of labour market services on the reemployment of an unemployed person, while contributing to the more efficient resource allocation spent on services [73]. MAITT was a project to create a tool with ML and AI support developed by the University of Tartu that estimates the risk of becoming unemployed among the already working people [86]. Therefore, it can be stated that due to the involvement in the national AI strategy, the EUIF has received new AI-related competencies, tools and cooperation opportunities to use in daily activities to offer services more efficiently. These competencies are already put into use for new projects, as one interviewee mentioned:

"We(EUIF) will have a new pilot project, where we will test AI to see how we can identify the skills required by different occupations from these job offers (...)" (I2)

However, there can be several challenges and requirements that must be faced before, during and after implementation of an AI-enabled solution.

4.2 Current state of AI in the EUIF

This section tackles the first research question *RQ1: How does the Estonian PES offer services at the moment?* Furthermore, three sub-questions will be tackled to fully address RQ1 – *RQ1.SQ1: What advancements have been made in using AI-enabled solutions in the Estonian PES?*; *RQ1.SQ2: What are the main challenges in implementing AI-enabled solutions in a public sector organisation by the example of the Estonian PES?*; *RQ1.SQ3: What are the key technological and infrastructural requirements for implementing AI-enabled solutions in PES?*

The interview questions addressing RQ1 were directed to grasp the current state of AI in the EUIF by examining the overall digitalisation (or even digital transformation) of the organisation, ongoing developments concerning AI and other automated solutions, challenges that occurred during these advancements and existing infrastructural requirements of the EUIF needed for implementation of AI-enabled solutions.

Several interviewees mentioned that the EUIF has integrated different technologies in its daily activities to reach higher efficiency in offering services, e.g. automate mundane technical processes to give counsellors of the EUIF more time to focus on the clients (I1; I2; I3; I4; I5). However, there are still processes that cannot be automated, especially when the situation includes weaker parties such as the unemployed or people with reduced work ability (I2; I3; I5) or services that are very specific with many requirements (I5). One of the interviewees mentioned:

"We(EUIF) are a labour market institution, and we also deal with weaker parties, for example clients with reduced work ability (...) You cannot decide or do much with a machine there, you still have to look at each case specifically." (I3)

Although several processes have been made more efficient in the EUIF by integrating different technologies into processes and generally the employees are highly competent users of information systems (I4), several interviewees stated that the organisation is still in the transition period and has not reached the end-goal of digital change (I1; I2; I5). Furthermore, the EUIF is still in the transition period of digital change, as one of the interviewees stated:

"I would say that, in this respect, the EUIF is in a transition period. If you look at the digital change theory, you have three levels that you can go to. Firstly, you have the kind of digitisation that all public sector organisations have done. (...) then there is digitalisation, where you integrate digital solutions into the existing processes, and the third is digital transformation, which focuses on the fact that the basic logic of the organisation is immediately built based on technology. In fact, no organisations have reached the third stage, yet the EUIF itself is one of the closest to it in the Estonian context, but they are still in the field of digitalisation, where they have work processes that are built on a combination of technology and paper." (I1)

4.2.1 Advancements made in using AI-enabled solutions in the EUIF

The latest fiscal year report of the EUIF highlights two solutions that are based on data and are AI-enabled – decision support system OTT and MALLE that evaluates the impact of labour market services [73]. Interviewees added two solutions to that list – employment mediation solution that automatically matches jobseekers with job offers (I3; I4; I5) and MAITT, which is a project that focused on generating unemployed risk for people still at work [85] and is halted right now (I1; I4; I5; I6). However, some interviewees stated that OTT and employment mediation solution are actually AI-enabled (I3; I4; I5), while MALLE is more of an automated solution and less an AI-solution (I2; I6).

Both solutions, OTT and employment mediation, have been developed in cooperation with outside partners with three end-user groups in mind: counsellors of the EUIF, employers and clients (I1; I2; I3; I4; I5; I6). However, the ideas for the solutions have not come fully within the EUIF. Interviewees have stated that OTT has been created in cooperation, where the EUIF, CITIS and developer Nortal worked on the project from the beginning idea to fully usable solution (I2; I5; I6). However, with employment mediation the need existed inside the EUIF, yet the development was completely developed by an outside partner (I3; I5). One interviewee mentioned:

"In terms of employment mediation, there had been an expectation to get a smart, clever solution that would speed up the work, but the specific way in which it could be done is still very clearly the solution proposed by our(EUIF) development partner." (I5)

In terms of success, the two aforementioned solutions have followed completely different paths. Several interviewees agreed that the employment mediation solution has been very

successful as it is actively in use and the worries about substitution that counsellors had in the beginning have faded and replaced with new tasks (I3; I5). However, OTT has not been that successful as several challenges occurred in the acceptance and adoption due to the fact that the end-user, the EUIF counsellor, was not included in the development process in the early stages (I1; I2; I3; I4; I5; I6). One interviewee commented on the adoption of OTT in the early stages:

"(...) well, I will just say it was not integrated into their workflow. And that is why in the beginning the use was rather chaotic and small." (I2)

4.2.2 Occurred challenges during the implementation of AI in the EUIF

Interviewees highlighted the acceptance and adoption of OTT by the EUIF counsellors as one of the main challenges (I1; I2; I3; I4; I5; I6). The main problem pointed out was that the counsellors were not included in the development process, were first introduced to the solution, when they already had to use it with their clients, and they did not see the clear benefit the solution would have on their daily work nor have trust in it (I1; I2; I3; I4; I5; I6). During one of the interviews, it was mentioned that:

"(...) it came from the top down within the EUIF, it definitely was not the desire of the consultants for the modern IT solutions." (I6)

In addition to trust and acceptance, another challenge from the societal level that occurred during the implementation of OTT and employment mediation solution, was the fear of substitution among the counsellors (I3; I5). One individual commented:

"Well, let us put it this way, at the beginning of OTT, there was a flicker that maybe now there is no need for a consultant, because the machine now assesses whether the customer needs to be dealt with or not." (I3)

Several interviewees mentioned ethical challenges that arose with the implementation of OTT. Specifically, the results of OTT are only visible to the counsellor and not to the client who is being analysed by the system. The EUIF and CITIS have discussed and planned to reveal the results to the unemployed also but have not done so due to the unknown effect it could have on the person (I2; I4; I5; I6). An interviewee expressed:

"If there is a client, who will get a prediction that they have a very low prognosis, then it can have an even more negative effect on self-efficacy. Or also such self-righteousness can occur where they say they cannot do anything. And the same situation can happen with people in green. If they feel confident and also have a good prognosis, then it could happen that they do not make an effort and will lose opportunities." (I4)

Some individuals interviewed expressed challenges that have occurred in the field of law regarding OTT and decision-making based on the data of the unemployed. The main legal basis for OTT is the conducted impact assessment (I2; I4). However, there were still complexities in the early stages of the development as the project leaders had to have several discussions with different lawyers and institutions, where compromises were made (I5). As Europe is developing a new AI Act [87], new challenges may occur in the field of law for the EUIF. Furthermore, confusion still exists today on the legality of OTT, as one interviewee mentioned:

"I still have a bit of a suspicious feeling as I have not received a very solid confirmation from the lawyers that everything is correct. I have a feeling that they themselves also have a little doubt (...)" (I2)

Another topic that emerged from some interviews, both in the fields of technology implementation and law, was safety. As the EUIF uses the data of their clients, they must receive the consent of the clients to analyse their data and they must comply with the General Data Protection Regulation (GDPR) (I4). This means that the EUIF must depersonalise data before analysing it with OTT and due to it could not use some specific datasets, which in turn may reduce the accuracy of the system (I3; I6). Moreover, there have been issues regarding the right to analyse data this way, as one individual highlighted:

"(...) with things like OTT (...), which are like analytical tools, the main bone of contention has still been, whether we(EUIF) have the right to receive this information, to process this personal data (...), then it is, as always, such a huge confusion, whether we are even allowed to analyse our things (...)" (I5)

4.2.3 Technological and infrastructural requirements needed for existing AI-enabled solutions in the EUIF

All the interviewees pointed out the importance of existing data with high-quality, in a processable form and in sufficient amount (I1; I2; I3; I4; I5; I6). However, some interviewees specified that safety measures must be taken by the EUIF in the process so that the data could be protected, anonymised and not accessible to not involved parties (I3; I6). Moreover, AI-enabled solutions have been possible in the EUIF due to the amount and quality of the data the organisation processes (I3; I4; I5). One of the interviewees remarked:

"Of course, from the point of view of data analysis, our(CITIS) work was simplified by the fact that these datasets were all in one place and were all available at the EUIF." (I6)

Moreover, strong infrastructure was mentioned as one of the requirements that was crucial for the success of AI-enabled solutions in the EUIF (I2; I3; I4; I5; I6). This includes efficient existing IT systems inside the EUIF with well-designed data architecture, sufficient overall IT capability of the organisation, properly working data exchange with other organisations, existence of back ups and a strong cooperation with hosting partners, in case there is a need for extra servers and greater storage for new solutions to work (I2; I3; I4; I5; I6). Some interviewees highlighted how the data exchange layer X-Road has been one of the important factors (I2; I3). The EUIF has a data warehouse TARU, where different data is stored and actively used for AI-enabled solutions inside the organisation (I2). Furthermore, one individual actually found strong infrastructure as one of the reasons why AI has been possible in the EUIF, as they mentioned:

"Our(EUIF) own background systems are very strong to create good artificial intelligences and due to this it is worth considering that we really have this opportunity to develop AI." (I4)

4.3 Factors influencing the applicability of AI in PES

This section aims to tackle the second research question *RQ2: What are the factors influencing the implementation of an AI-enabled solution in PES by the example of the Estonian PES?*

The interview questions addressing RQ2 were directed to discover main factors that have influenced or may affect the future uptake of AI-enabled solutions in PES by the example of the EUIF.

A clear need and desire for AI inside the organisation itself was mentioned by the interviewees (I1; I2; I3; I4; I5; I6). This means that before starting with the development processes, the organisation must be sure that there actually exists a problem that can be solved with AI (I1; I2; I3; I4; I5; I6). One interviewee commented:

"(...) innovation is very good. Innovation must be supported. Innovation must have a suitable soil in order to invent something new. But doing innovation just for the sake of innovation will get you nowhere, it will not give you any results and it will not offer you any solutions." (I4)

Another important factor mentioned by all the interviewees is a clear long-term support from the top management (I1; I2; I3; I4; I5; I6). In addition, many interviewees pointed out the importance of a strong project team and a project manager dealing directly with the implementation of AI solutions inside the organisation (I1; I2; I5; I6). One of the individuals mentioned the importance of a project team and a manager by the example of OTT as follows:

"(...) you need someone who communicates with developers and prototype developers from CITIS. Someone who is ready to communicate with them, who is ready to interpret, who is ready to attend their workshops, get to know their prototypes - it is also a very important element here." (I1)

Several interviewees emphasised the importance of involving the end-users of AI solutions in the EUIF, that in PES and AI context are the counsellors at the moment, in the development processes as soon as possible (I1; I2; I3; I4; I5; I6). Furthermore, it was mentioned during some interviews that employees exist in the EUIF who are less willing to accept new technologies (I1; I3; I4; I5). So, there is a need for constant presence, training and guidance about topics such as how new solutions would help in optimising everyday work, what effort is expected from the end-user, how to understand the new solutions, how does the new solution affect the communication with the client (I1; I2; I3; I4; I5; I6). An interviewee highlighted, how an organisation should act in a situation, where some of the employees are against the proposed solutions:

"Now, here it is worth remembering, you will always have those you cannot convince, there will always be some resistance within the organisation. But in this case, early communication is important, you create a core group that supports it, and it must also include people from this final end-user group that support it. Of course, during this process, you have to use several different ways to involve them. That is, you involve them in different decision-making phases, especially when you start to map out this new solution or new process that is going to be implemented. You also constantly communicate developments, you also organise different pilots in this regard. You also organise trainings. It is important that you have constant communication, two-way communication, back and forth, right. Why it is necessary is that it helps to reduce opposition. You will always have those who are opposed, but you will actually have a larger group that is ready for this change, but you have to be able to communicate this change with the right message." (I1)

During the interviews, all four fields of challenges identified by Wirtz, Weyerer and Geyer [3] were mentioned. In the implementation field it was mentioned that the existing infrastructure should be developed enough to enable the implementation of AI, not limit it (I1; I4; I5; I6). Furthermore, experienced specialists are needed in the development process, especially in the data analysis field, and these specialists may also be from a partnering organisation outside PES (I1; I2; I3; I4). However, with outside partners there is a risk that they cannot fully comprehend the culture, goals and processes of PES (I1). As mentioned before, high-quality data in sufficient amount is crucial for successful implementation of AI-enabled solutions. Yet, a factor that has occurred in Estonian context, is that the country is small, which means that in some fields there is not enough data (I1; I2; I4). So, there is a possibility that in some fields of PES AI cannot be integrated into processes due to small sample sizes (I1; I2; I4). In addition to data, a resource that an organisation needs for implementing AI is finances. Some interviewees emphasised that financing in the public sector can be difficult as many organisations are funded by structural funds (I1; I5). One interviewee mentioned:

"What else is really important and which is definitely a big plus of the EUIF here, and why the EUIF has been able to use these digital solutions in the first place. Such things cannot be done with the support of any structural funds. You cannot do such things when you do not know if and how much money you have for the next year (...) This can

also be seen a lot in the public sector, in my opinion, where they try to develop some kind of information system with the support of structural funds (...) then something is being done and already at the moment it is accepted, life has moved on and the need has changed, but since you made it from structural means, you have to show how it works for you for X years." (I5)

In the legal field of AI challenges, the aspect most mentioned was the safety and privacy of the data used in the AI-enabled solutions in the EUIF. This means that when the development or modelling for AI is done in cooperation with external partners, then the data would not be personalised in any way and is compliant with GDPR and other laws (I2; I3; I4; I6). Some European PES, e.g. Danish and German PES, have expressed concern over this kind of data processing and due to this have not developed AI-enabled solutions (I2; I4). One of the interviewees mentioned the dilemma that exists in organisations that sometimes the development takes place before the legal framework actually is completed (I1). Furthermore, as the EUIF is an organisation in the public sector of Estonia, some interviewees mentioned that the daily activities of the Estonian PES must be in accordance with the law, e.g. with the Unemployment Insurance Act and the Labour Market Services and Benefits Act [82] (I1; I3; I5). An interviewee commented:

"Of course, no matter what we do here in the EUIF, whether we deal with artificial intelligence or provide services to people on a daily basis, in any case, it all has to fit within the framework of the law. (...) so that no matter what we do here, whether we do some kind of activities here ourselves or process data or release data, we have a very strong legal basis, which in my opinion is very good, otherwise everyone will interpret it as they want." (I3)

On the topic of ethics and AI, some factors emerged from the interviews. One factor mentioned was the level of intelligence, i.e. to what extent can a model-based evaluation be justified and how far should the solution go in decision-making, especially when the decision could also be negative to the client (I1; I3). Moreover, possible discrimination was mentioned as a risk due to poor quality and biassed data that can be used as input for AI-enabled solutions (I1). Another ethical factor emphasised in the interviews was the dilemma of machine versus human. For example, some comparisons have shown that OTT is more precise than the EUIF counsellors (I4; I5). This leads to a dilemma whether decisions should be made by a machine or should each individual be examined separately

as a human, not as a case (I1). One of the interviewees outlined this dilemma by the example of OTT:

"You have a central dilemma within the organisation, you have the dilemma of a case and a human. This dilemma means to what extent we should treat a problem, in this case a person who comes to us to ask for a service, as a human or as a case. With the case it is specifically the recommendation that artificial intelligence actually gives you regarding long-term unemployment or how high the unemployment risk rate is. This gives a fairly accurate answer by itself and basically tells us to what extent we(EUIF) as an organisation should spend resources to provide a service to this person. But now the question here is whether we should always behave like this, because it is actually about individuals who come to ask for a service. They come to ask for a service, and as a public sector organisation there is actually an obligation to provide this service, even if it is a case with very high-risk rates and a very low probability that this resource expenditure will pay off. It is that people on their part are actually looking for such (...) they still look for an interactive element, and that is why human intervention is put inside the process." (I1)

On the topic of society and AI, the factor mentioned the most during the interviews was the acceptance of AI, which has already been described in this section. Another factor that must be considered is trust, i.e. trust and quick cooperation between development partners (I6), trust in specialists dealing with AI-enabled solutions in the organisation (I3), and trust in the solution itself and the results it produces (I2; I4). In addition, the organisation must take into account the factor of transformation that the AI-enabled solution may bring. This may result in bigger changes (or in some extreme cases redundancy) in the work of end-users (I1; I3; I5). An individual mentioned their experience in the EUIF with employment mediation:

"The organisation has grown, new tasks have arisen, no one has fallen off massively and, well, today, in fact, no one can imagine that such a tedious task could actually be done by oneself with paper and pencil or by surfing in various employment portals." (I5)

4.4 Designing an AI-enabled solution in PES based on future requirements

This section aims to tackle the third research question *RQ3: How to design a suitable AI-enabled solution for an employment service based on the requirements set by PES?* Moreover, two sub-questions are tackled to address the RQ3 – *RQ3.SQ1: What existing data owned or received by the Estonian PES can be used for an AI-enabled solution?*; *RQ3.SQ2: What requirements are needed to fulfil to use AI-enabled solutions in the Estonian PES?*

The interview questions addressing RQ3 were directed to understand the prerequisites that should be considered before starting with the design of a new AI-enabled solution in PES, detect main data needed for the solutions, and learn about the main requirements that the EUIF has to follow to use AI-enabled solutions.

Several prerequisites emerged during the interviews. It was mentioned that the main research question must be presented inside the organisation before the design and development process of an AI solution, i.e. there has to be a clearly stated need and interest (I1; I3; I5). Furthermore, there must be expertise on the topic inside the organisation as well, so the organisation could give valuable input, could be equal partners to experts outside of the institution and could be able to clarify the specifics also in-house (I2; I4). One interviewee mentioned on the topic of OTT:

"We(EUIF project team) had to make it very clear for ourselves, because, well, it is not possible to go in-depth with counsellors on these topics if you do not know the answers yourself." (I4)

Along with strong expertise inside the organisation, a clear project plan should be composed beforehand, where the overall goal is described with tasks that must be completed to achieve that goal (I5). Moreover, a coordinator of the project, a project manager, is needed who leads, is responsible, dares to take decisions, coordinates and draws attention to different aspects regarding the project (I3). Before starting with the design, the team should analyse what role can be given to the AI solution in the labour market services context as there are clients who are in a very sensitive situation (I1). Also, it should be assessed if the solution (or some parts of it) can be actualised in the local labour market, as one of the interviewees commented:

"And also assess, perhaps pre-assess, whether what is technically possible due to the data, and whether it should be done at all." (I6)

4.4.1 Data needed for AI-enabled solutions in the EUIF

As mentioned before, high-quality processable data in sufficient amount is needed for AI implementation. Furthermore, data exchange layer X-Road has been one of the important factors in the EUIF (I2; I3) to receive data from other organisations and another advantage has been the data warehouse TARU, where different data is stored and actively used inside the organisation (I2). Typical data that is used in already working AI-enabled solutions in the EUIF includes different values about the person such as gender, education level, past employment, unemployment period, right to benefits, health restrictions [85] (I2; I5), and data about the overall labour market situation such as type of available jobs in regions and number of unemployed people [84].

Also, as there are some future plans regarding AI-enabled solutions in motion in the EUIF, there were some mentions about data needed for these projects in interviews. One pilot planned in the EUIF in cooperation with CITIS is in the field of skills intelligence (I2; I6). The field of skills intelligence and identification of skills gaps is a new area where many PES are trying to implement AI tools [88]. To identify the skills gap of a person in the EUIF, data about skills is gathered from job advertisements, available trainings and the past employment history of the person and based on this data recommendations will be made to the client (I2; I6). One interviewee explained:

"We want to do a pilot project (...) basically in the future it will be that there are job offers, then there will be the CV of the person. From there we will be able to identify what are the required skills of different job offers, the skills of people, what is the common part, what is missing, and the third point in the future could also be the trainings we offer, so that the AI could then recommend that since you lack these skills, you could, for example, get them from this training." (I2)

4.4.2 Requirements needed for future solutions

Interviewees separately emphasised some additional requirements for the EUIF regarding future AI-enabled solutions.

One of the requirements needed is one of the most important resources of all – time (I2; I3; I5; I6). Future projects mean weekly meetings, discussions, testing and development (I2). Frequently it is done in addition to other duties, as one interviewee noted:

"Then for sure, do we have the resources regardless of the fact that, well, it may seem exciting and all, yet it also requires additional resources and interest from the service departments to deal with this kind of extra research, in addition to their daily work." (I3)

Another requirement mentioned in interviews is a well-developed organisational culture (I1; I4; I5). This means that there should be openness for new AI solutions inside the organisation from all levels (I1; I5) and the willingness to change existing processes (I6). Furthermore, the organisation should be ready to change the solution itself in the future, according to the needs of the end-users (I4; I6). In one of the interviews, on the topic of process changes it was mentioned:

"I would simply say that projects live or die based on whether the client is actually still realistically ready to change their work processes. Because, well, you can make all kinds of models and they can be very good. But if nothing is done with the result there, nothing will change. In other words, the willingness to change your existing processes must be there, and especially the bigger the change, I think, the more difficult it is. It seems to me that the EUIF is very open and ready to do this." (I6)

Several interviewees emphasised the importance of an independent budget (internal funding) that can be planned by the EUIF itself in the long-term in opposition to the fixed term financing that many public sector organisations use (I1; I3; I5). However, this entirely depends on what type the organisation is and whether they can distribute their budget like this. An interviewee commented:

"(...) the thing about OTT was that they(EUIF) were able to pretty much do it with internal funding, so that they did not have to ask for external funding. But many do not have such a situation in the public sector, they have to ask for fixed-term financing. The problem with fixed-term financing is that when the deadline falls and the project ends, it is necessary to either write a new project or find another source for it in order to get new financing. So, let us say you get the project ready, you have implemented the prototype,

and then you discover errors after the project has ended, and you do not have funding, then you have to find a new source of funding." (I1)

Final requirement separately emphasised was the legal basis of the new solution as the EUIF has to follow legal acts in its daily activities and also be in accordance with AI regulations in Europe (I2; I6). One individual remarked:

"As a prerequisite, you must, well, in a word, clarify the legal environment, whether we(EUIF) have any rights at all to compile any data and look at it." (I3)

5 Discussion

By combining literature review with qualitative data analysis, the author of this thesis discovered several aspects that have an important role for the applicability of AI-enabled solutions in PES by the example of the EUIF. Based on the analysis, the author will discuss the results, the influencing factors that appeared from the case of the EUIF that have an effect on implementing AI in PES, and the requirements for implementing AI in PES based on the case of EUIF.

5.1 Discussion of the results

In this section the results will be discussed in proportion to research questions proposed by the author of the thesis.

RQ1: How does the Estonian PES offer services at the moment?

The Estonian PES uses active and passive labour market policies to reduce and prevent unemployment and offer services to their main target groups - unemployed people, working people, employers, and youth. In the daily activities, the EUIF has started with digital change to integrate technologies in their activities to reach higher efficiency and several tasks have been automated in this process. This is done, so the counsellors would have more time to focus on their clients and offer high-quality services. However, there are some services inside the EUIF that still need an individual approach without the help of automated or AI-enabled solutions.

In addition to the overall digital change, the EUIF has begun to integrate AI-enabled solutions in their tasks and processes, e.g. solutions for employment mediation and decision-making. According to the interviewees, the experience with the AI-enabled solutions has been on the positive side as they have improved the efficiency of tasks and have created additional time as a resource for the counsellors. Thus, it can be stated that the AI in the EUIF has improved the efficiency and quality of services provided to the clients.

RQ1.SQ1: What advancements have been made in using AI-enabled solutions in the Estonian PES?

In the Estonian PES, the main two AI-enabled solutions that are integrated into the processes are the labour mediation tool and the decision support system OTT. These projects are daily used by the employees yet have been different in their success.

The labour mediation tool was developed with a developer partner and has been in use in the organisation since 2018. Moreover, it has been successful and completely accepted by the employees, as it automatically matches jobseekers with suitable job openings. This leaves more time for the counsellor to individually discuss the problems with the clients and discuss the suitability of job offers recommended by the tool. Thus, better quality and more efficient service is provided to the end-user.

The decision support system OTT was developed in cooperation with the developer partner Nortal and data analysts from CITIS and has also been in development since 2018. However, the success of the tool has been more problematic. The EUIF employees had difficulty accepting it, since they were not involved in the process, the content was difficult for them to understand, and clear benefits were not noticed. However, as OTT is precise and supported by the management board of the EUIF, constant training and two-way communication is taking place in-house to surpass the challenges of adoption and acceptance of the counsellors. This shows that the expectation of the management is that OTT would be used as willingly as the labour mediation tool is currently being used.

The EUIF is planning other advancements with AI in the field of skills intelligence, as a new AI-enabled solution is in development that will use the data of clients, job offers and trainings to discover the skills gap.

RQ1.SQ2: What are the main challenges in implementing AI-enabled solutions in a public sector organisation by the example of the Estonian PES?

Interviewees mentioned several challenges that have accompanied the implementation of AI-enabled solutions inside the organisation. The main experienced challenges emerged from the interviews were the acceptance and adoption of AI-enabled solutions by the end-users, fear of substitution of the employees, ethical challenges, and restrictive legal aspects. So, it is important to meet these challenges and deal with them constantly, so the

solution would be applicable in PES. Mainly, PES should include the employees in the development process, while also guaranteeing two-way-communication. PES should also assess the legal and ethical aspects, so the challenges would be known to the organisation beforehand and would not hinder the process. Furthermore, the organisation must acknowledge that legal and ethical aspects may change during time, which means that they must be ready to modify the solutions accordingly.

In addition to handling challenges, the EUIF also has had to meet several requirements and possess resources for the implementation of AI-enabled solutions.

RQ1.SQ3: What are the key technological and infrastructural requirements for implementing AI-enabled solutions in PES?

Interviewees mentioned that the existence of suitable infrastructure and data is a precondition for the implementation of AI-enabled solutions in PES. Furthermore, the EUIF was highlighted as a great example, where infrastructure has helped AI to be successful in the organisation. The key technological and infrastructural requirements mentioned were working data exchange system, background IT systems with well-designed data architecture, and existence of back ups and cooperation with hosting partners. Furthermore, another advantage that the EUIF has, is the data warehouse TARU, where different data is stored and actively used for AI-enabled solutions inside the organisation. From the experience of the EUIF it can be noticed that the organisation must be technologically competent already before the development and implementation of AI.

As Jannsen et al. [41] have emphasised the importance of high-quality data for an effective AI solution, all the interviewees also pointed out the importance of existing data with high-quality, in a processable form and in sufficient amount for successful predictive data analysis tools and precise results. Furthermore, high-tech existing infrastructure is needed to keep this data safe.

By meeting these requirements, PES can ensure the consistency, precision, and success of AI.

RQ2: What are the factors influencing the implementation of an AI-enabled solution in PES by the example of the Estonian PES?

From the interviews several factors emerged that have an influence on the implementation of AI-enabled solutions in PES. The main factors mentioned were the clear need inside PES, support of the management, acceptance of the end-users, data quality and safety, legal aspects, ethical factors such as discrimination, and trust.

To successfully implement AI-enabled solutions in PES, there must be a clear need and desire for this inside the organisation. This means that the PES needs to have a problem that must be resolved, and they must also have analysed it before implementation in order to assess the reasonability of AI. This kind of situation means that PES must be a smart customer as they should know what they order, what they want to improve, how they want to improve the situation and how would the organisation accept and adopt it.

Furthermore, support of the top management is needed. Without this support it would be very difficult to integrate new solutions into everyday work as it demands different resources and time.

One of the major factors influencing the implementation of AI solutions inside PES is the acceptance of it, as several interviewees emphasised the importance of involving the end-users in development processes as soon as possible. Furthermore, during the interviews all four fields of AI challenges in public sectors identified by Wirtz, Weyerer and Geyer [3] were mentioned. This means that PES must consider with the implementation factors, such as infrastructure, expertise, data quality and finances; legal factors, such as data quality and legal acts; ethical factors, such as level of intelligence of AI, discrimination and dilemma of machine versus human; and societal factors, such as acceptance, trust and transformation.

These aforementioned factors are useful to consider while improving existing AI-enabled solutions, or even while designing new processes. Thorough analysis of influencing factors is discussed by the author in section 5.2.

RQ3: How to design a suitable AI-enabled solution for an employment service based on the requirements set by PES?

In addition to aforementioned challenges and factors that are influencing the uptake of AI in the Estonian PES and should be considered while designing new AI-enabled solutions, several requirements emerged from the interviews that PES should consider before starting with the design and implementation of an AI-enabled solution. The main requirements mentioned were a strong expertise inside and outside PES, a good project team, pre-assessment of the solution and a well proposed project with a clear problem.

Thus, to design a solution there must be a project team with expertise about PES and AI. On one side, the team must have knowledge about the processes, culture, and norms of PES, while on the other side the team must have experience with topics such as data, data analytics and AI. Moreover, there must be a project plan with a clear problem and assessments so the reasonability of AI could be certain before the development and design processes. These results refer to the importance of analysis before starting with the design of an AI-enabled solution in PES.

Concrete requirements for the design of AI-enabled solutions in PES proposed by the author are discussed in section 5.3.

RQ3.SQ1: What existing data owned or received by the Estonian PES can be used for an AI-enabled solution?

Several interviewees mentioned data that has been used in already developed AI-enabled solutions. Furthermore, as there are future plans for AI in the EUIF, some additional necessary data was mentioned.

Mainly, so that AI could successfully operate in PES, data about the clients is needed. Data of the clients normally used in AI in PES can be their gender, age, education level, past employment, unemployment period, right to benefits, health restrictions and CV [85]. Furthermore, what is important and has helped the implementation process of AI in PES is the data exchange with other organisations, who own the data that the EUIF does not have. The EUIF also has their own data warehouse, which has proven useful for already existing AI-enabled solution as the data is all in one place, which in turn simplifies the work of data analysts.

Therefore, different data is needed from several sources to implement a successful AI-enabled solution.

RQ3.SQ2: What requirements are needed to fulfil to use AI-enabled solutions in the Estonian PES?

In previous sections several factors have been mentioned that are connected with requirements such as the support from the management, strong existing infrastructure and IT systems, involvement of end-users in development processes and their acceptance, working data exchange with other organisations, great expertise inside and outside the organisation, and the existence of high-quality data. However, interviewees separately highlighted requirements needed for future solutions such as time, well-developed organisational culture, independent budget, and business and impact assessments.

This means that PES must comprehend the effect that the future digital change may have on the organisation and act accordingly, while valuing openness and innovativeness. Moreover, PES should conduct business and impact assessments, and review before designing, which kind of solutions can be designed and implemented, what is their purpose and what data can be used for it. In addition, PES needs to secure a stable funding and allocate resources if needed to successfully implement AI.

So, from the interviews it emerged that PES have several requirements to take into account to begin with the design of a new AI-enabled solution. Concrete requirements for the design of AI-enabled solutions in PES proposed by the author are discussed in section 5.3.

5.2 Factors influencing the use of AI in PES

Results show that by the example of the EUIF AI is applicable in PES, yet several aspects must be considered. Based on the analysis the key influencing factors emerged from the use of AI in the EUIF were: 1) acceptance of the end-users; 2) data quality and safety; 3) ethical questions; 4) legal aspects; 5) existing infrastructure and knowledge and 6) support of the top management.

First, the acceptance of the end-users has a major effect on the eventual success of implementing an AI solution [46]. The EUIF has mainly used AI in the form of ML for

predictive algorithms, such as OTT, to improve the work and efficiency of their employees, similarly to other PES [15]. This means that the acceptance and adoption of AI of the end-users who, in this case are the counsellors of the EUIF, can be thoroughly researched inside the organisation. Also, according to Wirtz, Weyerer and Geyer [3] acceptance is a part of societal field AI challenges in the public sector. In interviews, acceptance of the counsellors was highlighted as an important factor that has influenced the AI-enabled solutions inside the EUIF. Interviewees pointed out that the counsellors were hesitant to accept OTT as they did not trust the system, did not entirely understand it, could not notice the positive benefits it had on their performance, and therefore did not see the need for it. These problems could have risen from the fact that the counsellors were not involved in the early stages of the project, although involvement of all stakeholders as early as possible is recommended in new AI projects [17]. It was mentioned that due to the low acceptance, the adoption of OTT was slow and hectic. In accordance with the UTAUT model [56], it can be noticed that low performance and effort expectation of the counsellors had negatively affected their behavioural intention. According to some of the experts, the acceptance of OTT only started rising after constant two-way communication, trainings, guidance and finding a supportive core group, who frequently used the system. This shows that constant work was done to raise levels of performance and effort expectations, while social influence through the supportive core group also positively changed the behavioural intention of other counsellors. So, acceptance of the end-users, and involvement of them in different processes, should be one of the focus points of PES developing AI, as the end-users can greatly affect the success of the solution.

Second, as PES are mainly dealing with ML, they need high-quality data for an effective and working solution [41], which also has to be protected to ensure privacy of people [43]. It was mentioned in the interviews that the quality of data plays a crucial role in order to develop a precise AI solution that is useful. Furthermore, some interviewees emphasised that it has to be of high-quality and depersonalised to ensure accuracy and prevent discriminatory and biassed decisions. This means that the training data must already be free of bias and discrimination [27]. Also, the sufficiency of data was mentioned. Yet, as Estonia is a small nation, it means that the EUIF has less data to use in comparison to bigger countries to develop their solutions. This means that analysis must be done beforehand in PES to realise which data can be used in order to ensure the

privacy of the owners of the data while still developing an accurate solution. Thus, as data is the main input used in AI in PES, the quality and safety of it must be ensured to actually receive precise and useful solutions to increase the quality and cost-efficiency of services.

Third, ethical questions may arise while using AI in PES, which in turn may affect the way AI-enabled solutions are used or may even be one of the reasons to change the solutions. According to Wirtz, Weyerer and Geyer [3] ethics is one of the four main topics of AI challenges in the public sector. Some interviewees mentioned the question of how to avoid discrimination and bias that may occur with OTT in the EUIF, e.g. the level of predicted risk of unemployment might change based on the fact whether the person lives in a city or in the countryside. Furthermore, discrimination and bias can be present in the actions of AI, e.g. OTT, due to the poor quality of data [27]. Therefore, input and output must be analysed to prevent bias results. Another ethical question raised by several interviewees, was how far should the solution go in decision-making, i.e. could the machine actually make negative decisions by itself. That can also increase the risk of dehumanising services [47], which raises the ethical question of people versus machines [15] in service provision and could negatively affect the more vulnerable part of society, e.g. the unemployed people. Also, the ethical question of showing the results of OTT to the clients emerged from several experts. One interviewee mentioned that in the beginning there was a plan to actually show the results not only to the counsellors, but to the clients too. However, due to ethical questions and possible demotivating results this plan was soon withdrawn. So, as AI solutions must be fair in their actions, different ethical questions may have an effect on how AI-enabled solutions in PES are designed and developed, which makes it an important influencing factor for the applicability of AI in PES.

Fourth, as PES are public sector organisations, there are specific regulations and law frameworks they have to follow in their daily activities. This means that they have to design their solutions, and AI, in accordance with the law [15]. According to Wirtz, Weyerer and Geyer [3] law is also one of the four main topics of AI challenges in the public sector. Legality of the EUIF activities was mentioned in the interviews as automatic decision-making is not allowed in the EUIF and the first contact in the Estonian PES has to be face-to-face. This means that from the EUIF side there has to be a counsellor to interpret the results of OTT. Furthermore, as usually AI solutions in PES

are data-based then data protection, that is also a key capacity for successful digital transformation [10], should be one of the focus points in the EUIF as the organisation is legally responsible for their solutions and the results they produce. Some PES have actually highlighted law and regulations as one of the reasons they have not developed AI-enabled solutions. Furthermore, EU-wide regulations may have additional effects on already working solutions and AI-enabled systems in development, as many interviewees mentioned that they are alarmed due to the new AI Act that may bring new changes into the existing solutions of the EUIF and future plans. So, law is a factor that must be considered while developing AI solutions in PES, but organisations have to be ready to change existing systems as well, as new regulations may emerge and amendments can be made to already existing law.

Fifth, for successful technology implementation, which is one of the main fields of AI challenges in the public sector [3], interviewees mentioned the importance of existing infrastructure and knowledge, both inside and outside PES. Skilled staff in technology is emphasised by ILO [10] as one of the main capacities PES has to rely on for digital transformation. Interviewees explained that skilled staff in the fields of AI and data analysis in the EUIF is necessary for two reasons – on one hand people must have sufficient digital literacy to use the solutions every day, yet on the other hand there has to be expertise on the topic of AI to give valuable input to related partners outside of the organisation. In addition to skilled staff, it was stressed that well-functioning IT-systems in PES are a strong prerequisite for new AI solutions. This means that PES with strong infrastructure have the opportunity to plan the implementation and integration of more complex technologies as there is a supporting environment. One additional strength that the EUIF has, is TARU – a data warehouse used in-house, where all the data the Estonian PES collects is compiled. This is used already now for ongoing developments of OTT to make it more efficient as it greatly simplifies the work of data analysts and developers. Next to IT-systems and TARU, a working data exchange with other organisations was separately mentioned. Every PES should consider interoperability with other organisations for successful adoption of AI [15]. The EUIF has a major advantage compared to other PES, as they use a data exchange layer X-Road which is highly used in Estonia with over 200 members participating and approximately 1 million end-users [89]. Hence, existing technical infrastructure is an important factor for PES. If there are

well-developed IT-systems and data-related technologies already present in the organisation, it is far easier to develop and implement AI-technologies.

Last, support of the top management board was mentioned in every interview as a factor that simplifies the processes regarding AI implementation in PES. Managerial resistance has been mentioned as a challenge that may accompany the use of AI in the public sector [23], so it is important to involve the management in the development process and get their support from the early stages. Moreover, the support for AI in the top management of PES can be seen as a major social influence that has a positive effect on behavioural intention of the PES employees [56]. The interviewees mentioned that without the support of the management board it would not have been possible to devote that much time and funds into AI solutions such as OTT. Furthermore, it was mentioned that without the support of the management the AI projects would have been rather pointless. This means that if there is no support nor interest from the management of PES, there is a high probability that the development of AI-enabled solutions is very difficult or even non-existent. Thus, the involvement of the management board of PES and their support is an influencing factor as in case of positive support it may secure additional resources and focus for the AI implementation and the acceptance of the solution through social influence, whereas non-existent managerial support could prove fatal to an AI-enabled solution in PES.

5.3 Requirements for implementing AI in PES

The analysis of this thesis has shown that AI-enabled solutions can be applied in PES and several PES have already started with implementing AI in their processes. However, to apply AI-enabled solutions in PES in the future, the author of this thesis has highlighted following requirements that should be taken into consideration based on the results: 1) a strong project with a clear need; 2) financial independence; 3) high-class IT-systems; 4) expertise; 5) business and impact assessment; and 6) a well-developed organisational culture.

First, the project team of PES dealing with AI should compose a precise project plan, where several aspects are stated such as the clear problem that needs to be solved by AI, goals a PES wants to achieve, tasks that need to be performed to reach the goals, stakeholders that must be included and necessary resources such as data, time and

finances. In this way it is certain that the focus on the development process is always existent and precise, even when, for example, people inside the project change.

Second, PES should be financially independent at least to some level, not be dependent only on structural funds and be able to plan long-term budgets. This is due to the fact that development of AI is a longer process that may change in time, so stable funding is necessary for continuous and successful progress.

Third, PES should have existing high-class IT-systems that could accommodate and complement new AI-enabled solutions. The existence of these systems would help to ensure the reliability and security of AI, assure the privacy and safety of used data, and enable interoperability, which is necessary for high-quality and accurate data in sufficient amount.

Fourth, PES should involve experts of the field for successful implementation of AI-enabled solutions. In this case there should be a balance of partners from inside and outside of PES connected to the AI. This means that there has to be sufficient knowledge in PES to be able to give valuable input, to have a say in the project and to be an equal partner to data analysts and developers outside PES. Also, there should be experts involved in the project who have had experience in AI-related fields such as development of AI solutions, data science, creation of data-based models, development and maintenance of high-class IT-systems etc. Thus, a project team would be created with valuable expertise contributed by people who on one hand have thorough insight into the organisation and its processes, while on the other hand have had experience with AI and know exactly which data and methods to use for successful results.

Fifth, PES should conduct a business and impact assessment for the planned AI-enabled solutions. With the assessment PES can discover the existing capabilities and resources, evaluate the reasonability of the solution, analyse specific impacts the new solution would have, examine the stakeholders the solution would affect, and explore the specific ways that the stakeholders are affected. This all can also be used as one of the legal basis while using the new AI-enabled solution. Moreover, PES should also assess whether the solution is technically possible with the data available to the organisation, and whether the solution should be developed at all as to what benefits does it offer, what problem does it solve and how self-acting is it in terms of deciding and taking actions.

Last, PES should put their focus on developing an accepting and innovative organisational culture, which can have positive effects on the implementation of AI-enabled solutions. PES should work towards openness and interest, while also encouraging two-way communication to show that all the employees of PES are important and their opinions are valued. When the whole organisation appreciates and values the same principles, while also supporting new approaches and innovation in PES, the success of an AI-enabled solution is more likely.

While following the proposed requirements and considering aforementioned influencing factors, PES can be more certain that the implementation of AI will actually be successful. Hence, based on these results the author proposes a framework for PES called 'PES AI Ecosystem: Enabling Factors for AI Implementation' (see Figure 4).

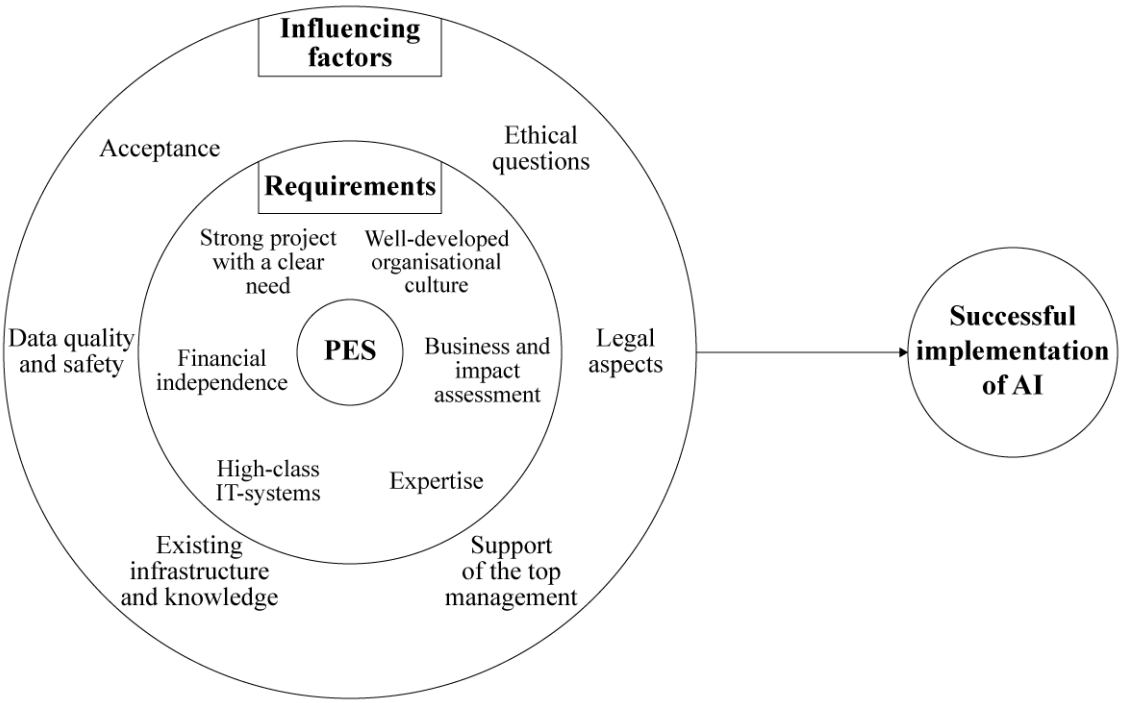

Figure 4. PES AI Ecosystem: Enabling Factors for AI Implementation. Source: Author.

6 Conclusion

With the importance of digital transformation in the public sector, many organisations have started to discover new technological solutions such as AI to transform their processes and improve their efficiency. Such a trend has also been present in PES as several organisations have started to integrate AI-enabled solutions in their daily activities. However, this trend is in the early stages and less focus has been specifically on PES in research. Therefore, the aim of the thesis was to explore the applicability of AI-enabled solutions in PES by the example of the Estonian PES, the EUIF. The thesis relied on the literature review based on AI in PES, on the challenges of AI in the public sector by analysing the Four-AI-Challenges model, and the acceptance of technology by examining the UTAUT model. Moreover, the state of the art of AI in the Estonian public sector and in the EUIF was examined and semi-structured interviews and a workshop with experts were conducted to study the experience the EUIF has had with AI-enabled solutions, and to discover the applicability of AI in PES.

Results emerged from the qualitative analysis show that AI is applicable in PES, yet emphasise that PES should consider several factors that have an influence on the implementation process of an AI-enabled solution. First, the end-users have to accept the solution and be involved in the development process as they have direct influence on the adoption, success and usage rate of new solutions. The data used in solutions should be high-quality in sufficient amount to prevent inaccuracies and discrimination in results. Moreover, the safety of these solutions must be ensured as the data owners are usually the clients of PES. PES also has to consider ethical questions as AI can increase the risk of discrimination and dehumanisation. Legal aspects and their changing nature may have an impact on how AI in PES is developed as PES has specific regulations that they have to follow in their daily activities due to being a public sector organisation, which means that even already developed solutions may have to be changed to ensure the legality. PES should consider developing and maintaining current systems as the existence of high-level technological infrastructure may ease the development and implementation of AI-

enabled technologies. Last, an important factor is also the support from the top management board of PES as they have the power to influence the entire organisation.

Based on the results emerged from the qualitative analysis of this thesis several requirements can be highlighted that could have a positive effect on the success of applicability of AI in PES. First, PES should compose a strong project plan that clearly states the needs, stakeholders, tasks and resources needed. PES should have independent finances for the development and implementation of AI as long-term continuity is needed. Moreover, high-class IT-systems should already be present in PES as they could complement the solutions in development progress. In addition to systems, expertise is needed inside and outside PES to ensure that there is a clear insight into PES and at the same time experience with AI and data analysis is present. PES should also conduct a business and impact assessment to examine the possible impacts the development of AI can have on the organisation and whether the solution is reasonable and actually solves a problem. Last, well-developed organisational culture should be present in PES as the attitude of the employees towards AI may have an impact on the implementation process.

As the current case study only focuses on the EUIF and the Estonian context, it would be beneficial to examine the state of the art, challenges, acceptance and influencing factors of implementing AI in PES in other countries to discover new aspects compared to the current research. The focus of the thesis was on the Estonian PES and the views of experts, yet AI-enabled solutions present in the organisation are being used by several hundreds of employees and also have an effect on the clients. Therefore, the author of the thesis recommends examining the challenges and acceptance of AI in PES from the point of view of the employees and clients in the future to create complementary research and findings to the current thesis and its results.

References

[1] H. Mehr, “Artificial intelligence for citizen services and government,” Harvard Kennedy School, Ash Center for Democratic Governance And Innovation, Cambridge, 2017.

[2] W. G. D. Sousa, E. R. P. D. Melo, P. H. D. S. Bermejo and A. D. O. Gomes, “How and where is artificial intelligence in the public sector going? A literature review and research agenda,” *Government Information Quarterly*, vol. 36, no. 4, 101392, 2019.

[3] B. W. Wirtz, J. C. Weyerer and C. Geyer, “Artificial Intelligence and the public sector—applications and challenges,” *International Journal of Public Administration,* vol. 42, no. 7, pp. 596-615, 2018.

[4] T. S. Gesk and M. Leyer, “Artificial Intelligence in public services: When and why citizens accept its usage,” *Government Information Quarterly,* vol. 39, no. 3, 101704, 2022.

[5] European Commission, “European Skills Agenda - Employment, Social Affairs & Inclusion,” 2020. [Online]. Available: https://ec.europa.eu/social/main.jsp?catId=1223. [Accessed 27 February 2023].

[6] L. Sienkewicz, “Future skills, career guidance and lifelong learning in PES: thematic paper,” Publications Office of the European Union, Luxembourg, 2022.

[7] European Commission, “European Year of Skills 2023,” 2023. [Online]. Available: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-year-skills-2023_en. [Accessed 2 May 2023].

[8] S. Desiere and L. Struyven, “Using artificial intelligence to classify jobseekers: The accuracy-equity trade-off,” *Journal of Social Policy,* vol. 50, no. 2, pp. 367-385, 2020.

[9] A. A. Flügge, “Perspectives from practice: Algorithmic decision-making in public employment services,” in *2021 Conference on Computer Supported Cooperative Work and Social Computing*, Virtual, 2021.

[10] International Labour Organization, “Global report: Technology adoption in public employment services, Catching up with the future,” ILO, Geneva, 2022.

[11] M. Ghobakhloo, “Industry 4.0, digitization, and opportunities for sustainability,” *Journal of Cleaner Production,* vol. 252, 119869, 2020.

[12] I. Mergel, N. Edelmann and N. Haug, “Defining digital transformation: Results from expert interviews,” *Government Information Quarterly,* vol. 36, no. 4, 101385, 2019.

[13] N. I. Sarker, M. Wu and A. Hossin, “Smart governance through big data: Digital transformation of public agencies,” in *International Conference on Artificial Intelligence and Big Data*, Chengdu, 2018.

[14] The Ministry of Economic Affairs and Employment of Finland, “Artificial Intelligence in Employment Services - a Mapping: Final Report,” 2019. [Online]. Available: https://tem.fi/documents/1410877/15020328/Artificial+intellingence+in+employment+services+-+A+mapping/24844ede-0570-c8da-4ed3-

c91ec25b8e76/Artificial+intellingence+in+employment+services+-+A+mapping.pdf. [Accessed 28 April 2023].

[15] J. Körtner and G. Bonoli, “Predictive Algorithms in the Delivery of Public Employment Services,” 2022. [Online]. Available: https://osf.io/preprints/socarxiv/j7r8y. [Accessed 28 March 2023].

[16] M. Urquidi and G. Ortega, “Artificial Intelligence for job seeking: How to enhance labour intermediation in Public Employment Services,” Inter-American Development Bank, 2020.

[17] S. Desiere, K. Langenbucher and L. Struyven, “Statistical profiling in public employment services: An international comparison,” OECD Publishing, Paris, 2019.

[18] B. Cockx, M. Lechner and J. Bollens, “Priority to unemployed immigrants? A causal machine learning evaluation of training in Belgium,” *Labour Economics,* vol. 80, 102306, 2023.

[19] J. Grundy, “Statistical Profiling of the Unemployed,” *Studies in Political Economy,* vol. 96, no. 1, pp. 47-68, 2015.

[20] M. Considine, M. McGann, S. Ball and P. Nguyen, “Can Robots Understand Welfare? Exploring Machine Bureaucracies in Welfare-to-Work,” *Journal of Social Policy,* vol. 51, no. 3, pp. 519-534, 2022.

[21] B. Lepri, J. Staiano, D. Sangokoya, E. Letouzé and N. Oliver, "The Tyranny of Data? The Bright and Dark Sides of Data-Driven Decision-Making for Social Good,” in *Transparent Data Mining for Big and Small Data*, Springer International Publishing, 2017, pp. 3-24.

[22] K. Desouza, “Delivering artificial intelligence in government: Challenges and opportunities,” IBM Center for The Business of Government, Arizona, 2018.

[23] A. Zuiderwijk, Y.-C. Chen and F. Salem, “Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda,” *Government Information Quarterly,* vol. 38, no. 3, 101577, 2021.

[24] W. D. Eggers, D. Schatsky and P. Viechnicki, “AI-augmented government. Using cognitive technologies to redesign public sector work,” 26 April 2017. [Online]. Available: https://www2.deloitte.com/us/en/insights/focus/cognitive-technologies/artificial-intelligence-government.html. [Accessed 10 March 2023].

[25] Y. K. Dwivedi, L. Hughes, E. Ismagilova, G. Aarts, C. Coombs, T. Crick, Y. Duan, R. Dwivedi, J. Edwards, A. Eirug, V. Galanos, P. V. Ilavarasan, M. Janssen, P. Jones, A. K. Kar, H. Kizgin, B. Kronemann, B. Lal, B. Lucini, R. Medaglia and M. D. Williams, “Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy,” *International Journal of Information Management,* vol. 57, 101994, 2021.

[26] T. Q. Sun and R. Medaglia, “Mapping the challenges of Artificial Intelligence in the public sector: Evidence from public healthcare,” *Government Information Quarterly,* vol. 36, no. 2, pp. 368-383, 2019.

[27] S. Barocas and A. D. Selbst, “Big Data’s Disparate Impact,” *California Law Review,* vol. 104, no. 3, pp. 671-732, 2016.

[28] J. Bélisle-Pipon, E. Monteferrante, M. Roy and V. Couture, “Artificial intelligence ethics has a black box problem,” *AI & Society,* pp. 1-16, 2022.

[29] R. Medaglia and D. Zhu, “Public deliberation on government-managed social media: A study on Weibo users in China,” *Government Information Quarterly,* vol. 34, no. 3, pp. 533-544, 2017.

[30] P. Henman, “Improving public services using artificial intelligence: possibilities, pitfalls, governance,” *The Asian Pacific Journal of Public Administration,* vol. 42, no. 4, pp. 209-221, 2020.

[31] R. Creemers, “China's Social Credit System: An Evolving Practice of Control,” SSRN Electronic Journal, 2018.

[32] N. Aoki, “An experimental study of public trust in AI chatbots in the public sector,” *Government Information Quarterly,* vol. 37, no. 4, 101490, 2020.

[33] B. W. Wirtz, J. C. Weyerer and B. Sturm, “The Dark Sides of Artificial Intelligence: An Integrated AI Governance Framework for Public Administration,” *International Journal of Public Administration,* vol. 43, no. 9, pp. 818-829, 2020.

[34] U. Gasser and V. Almeida, “A Layered Model for AI Governance,” *IEEE Internet Computing,* vol. 21, no. 6, pp. 58-61, 2017.

[35] I. Rahwan, “Society-in-the-loop: programming the algorithmic social contract,” *Ethics and Information Technology,* vol. 20, no. 1, pp. 5-14, 2018.

[36] M. Ryan, J. Antoniou, L. Brooks, T. Jiya, K. Macnish and B. C. Stahl, “Research and Practice of AI Ethics: A Case Study Approach Juxtaposing Academic Discourse with Organisational Reality,” *Science and Engineering Ethics,* vol. 27, no. 2, 2021.

[37] B. W. Wirtz and W. Müller, “An integrated artificial intelligence framework for public management,” *Public Management Review,* vol. 21, no. 7, pp. 1076-1100, 2019.

[38] A. Kankanhalli, Y. Charalabidis and S. Mellouli, “IoT and AI for Smart Government: A Research Agenda,” *Government Information Quarterly,* vol. 36, no. 2, pp. 304-309, 2019.

[39] S. Mikhaylov, M. Esteve and A. Campion, “Artificial intelligence for the public sector: opportunities and challenges of cross-sector collaboration,” The Royal Society Publishing, London, 2018.

[40] D. Toll, I. Lindgren, U. Melin and C. M. Madsen, “Artificial Intelligence in Swedish Policies: Values, Benefits, Considerations and Risks,” in *18th IFIP WG 8.5 International Conference, EGOV 2019,* San Benedetto Del Tronto, 2019.

[41] M. Janssen, P. Brous, E. Estevez, L. S. Barbosa and T. Janowski, “Data governance: Organizing data for trustworthy Artificial Intelligence,” *Government Information Quarterly,* vol. 37, no. 3, 101493, 2020.

[42] M. Sharma, S. Luthra, S. Joshi and A. Kumar, “Implementing challenges of artificial intelligence: Evidence from public manufacturing sector of an emerging economy,” *Government Information Quarterly,* vol. 39, no. 4, 101624, 2021.

[43] I. Pencheva, M. Esteve and S. Mikhaylov, “Big Data and AI – A transformational shift for government: So, what next for research?,” *Public Policy and Administration,* vol. 35, no. 1, pp. 24-44, 2020.

[44] A. Krausova, “Intersections between law and artificial intelligence,” *International Journal of Computer,* vol. 27, no. 1, pp. 55-68, 2017.

[45] C. Wang, K. Wang, A. A. Bian, M. R. Islam, K. N. Keya, J. R. Fould and S. Pan, “Do Humans Prefer Debiased AI Algorithms? A Case Study in Career Recommendation,” in *27th International Conference on Intelligent User Interfaces*, Helsinki, 2022.

[46] K. de Fine Licht and J. de Fine Licht, “Artificial intelligence, transparency, and public decision-making,” *AI & Society*, vol. 35, no. 4, pp. 917-926, 2020.

[47] J. Berryhill, K. K. Heang, R. Clogher and K. McBride, “Hello, World: Artificial intelligence and its use in the public sector,” *OECD Working Papers on Public Governance*, vol. 36, 2019.

[48] R. Chatila, V. Dignum, M. Fisher, F. Gianotti, K. Morik, S. Russel and K. Yeung, “Trustworthy AI,” in *Reflections on Artificial Intelligence for Humanity*, Switzerland, Springer Cham, 2021, pp. 13-39.

[49] L. Kluiters, M. Srivastava and L. Tyll, “The impact of digital trust on firm value and governance: an empirical investigation of US firms,” *Society and Business Review*, vol. 18, no. 1, pp. 71-103, 2022.

[50] F. J. Rondan-Cataluña, J. Arenas-Gaitán and P. Ramírez-Correa, “A comparison of the different versions of popular technology acceptance models,” *Kybernetes*, vol. 44, no. 5, pp. 788-805, 2015.

[51] H. Taherdoost, “A review of technology acceptance and adoption models and theories,” *Procedia Manufacturing*, vol. 22, pp. 960-967, 2018.

[52] M. Rad, M. Nilashi and H. Dahlan, “Information technology adoption: a review of the literature and classification,” *Universal Access in the Information Society*, vol. 17, no. 2, pp. 361-390, 2018.

[53] N. P. Rana, Y. K. Dwivedi and M. Williams, “Evaluating alternative theoretical models for examining citizen centric adoption of e-government,” *Transforming Government: People, Process and Policy*, vol. 7, no. 1, pp. 27-49, 2013.

[54] F. D. Davis, “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology,” *MIS Quarterly*, vol. 13, no. 3, pp. 319-340, 1989.

[55] E. Rogers, Diffusion of Innovations, New York: The Free Press, 1995.

[56] V. Venkatesh, M. G. Morris, G. B. Davis and F. D. Davis, “User Acceptance of Information Technology: Toward a Unified View,” *MIS Quarterly*, vol. 27, no. 3, pp. 425-478, 2003.

[57] I. Ajzen, “The Theory of Planned Behaviour,” *Organizational Behaviour and Human Decision Processes*, vol. 50, no. 2, pp. 179-211, 1991.

[58] W. H. DeLone and E. R. McLean, “Information Systems Success: The Quest for the Dependent Variable,” *Information Systems Research*, vol. 3, no. 1, pp. 60-95, 1992.

[59] K. Sohn and O. Kwon, “Technology acceptance theories and factors influencing artificial intelligence-based intelligent products,” *Telematics and Informatics*, vol. 47, 101324, 2020.

[60] V. Venkatesh, J. Thong, F. Chan, P. J.-H. Hu and S. Brown, “Extending the two-stage information systems continuance model: incorporating UTAUT predictors and the role of context,” *Information Systems Journal*, vol. 21, no. 6, pp. 527-555, 2011.

[61] M. Zamberlan and C. Watanabe, “The adoption of an indicator panel in educational management to decision-making support: perception of managers through UTAUT model,” *International Journal for Innovation Education and Research*, vol. 8, no. 6, pp. 266-290, 2020.

[62] A. Prakash and S. Das, “Medical practitioner’s adoption of intelligent clinical diagnostic decision support systems: A mixed-methods study,” *Information & Management,* vol. 58, no. 7, 103524, 2021.

[63] S. Liu, T. Reese, K. Kawamoto, G. D. Fiol and C. Weir, “A systematic review of theoretical constructs in CDS literature,” *BMC Medical Informatics and Decision Making,* vol. 2, no. 102, 2021.

[64] W. Hong, F. Chan, J. Thong, L. Chasalow and G. Dhillon, “A Framework and Guidelines for Context-Specific Theorizing in Information Systems Research,” *Information Systems Research,* vol. 25, no. 1, pp. 1-26, 2014.

[65] Y. Dwivedi, N. Rana, A. Jeyaraj, M. Clement and M. Williams, “Re-examining the Unified Theory of Acceptance and Use of Technology (UTAUT): Towards a Revised Theoretical Model,” *Information Systems Frontiers,* vol. 21, no. 719-734, 209.

[66] V. Venkatesh, J. Thong and X. Xu, “Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology,” *MIS Quarterly,* vol. 36, no. 1, pp. 157-178, 2012.

[67] R. Jain, N. Garg and S. Khera, “Adoption of AI-Enabled Tools in Social Development Organizations in India: An Extension of UTAUT Model,” *Frontiers in Psychology,* vol. 13, 893691, 2022.

[68] Ministry of Economy and Communications, “Estonia’s national artificial intelligence strategy 2019-2021,” 2019. [Online]. Available: https://f98cc689-5814-47ec-86b3-db505a7c3978.filesusr.com/ugd/7df26f_27a618cb80a648c38be427194affa2f3.pdf. [Accessed 2 March 2023].

[69] Ministry of Economy and Communications, “Eesti riiklik tehisintellekti alane tegevuskava ehk kratikava 2022-2023,” 2022. [Online]. Available: https://www.kratid.ee/_files/ugd/7df26f_65582ae6b6d24daa8511d8ea50cab1dd.pdf. [Accessed 2 March 2023].

[70] E-Estonia, “AI - “kratt” strategy Fact Sheet,” 2020. [Online]. Available: https://e-estonia.com/wp-content/uploads/2020-april-facts-ai-strategy.pdf. [Accessed 3 March 2023].

[71] S. Crowe, K. Creswell, A. Robertson, G. Huby, A. J. Avery and A. Sheikh, “The Case Study Approach,” *BMC Medical Research Methodology,* vol. 11, no. 1, 2021.

[72] T. George, “Exploratory Research | Definition, Guide, & Examples,” 2023. [Online]. Available: https://www.scribbr.com/methodology/exploratory-research/. [Accessed 5 March 2023].

[73] Estonian Unemployment Insurance Fund, “Majandusaasta aruanne 2022,” 2023. [Online]. Available: https://www.tootukassa.ee/web/sites/default/files/2023-04/Eesti%20T%C3%B6%C3%B6tukassa%20aastaaruanne%202022.pdf. [Accessed 11 April 2023].

[74] R. Kattel and I. Mergel, “Estonia’s Digital Transformation: Mission Mystique and the Hiding Hand,” *UCL Institute for Innovation and Public Purpose Working Paper Series,* pp. 143-160, 2019.

[75] V. Braun and V. Clarke, “Using Thematic Analysis in Psychology,” *Qualitative Research in Psychology,* vol. 3, no. 2, pp. 77-101, 2006.

[76] A. Coffey and P. Atkinson, “Concepts and Coding,” in *Making Sense of Qualitative Data: Complementary Research Strategies*, Thousand Oaks, Sage, 1996, pp. 26-53.

[77] J. Fereday and E. Muir-Cochraine, “Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development,” *International Journal of Qualitative Methods*, vol. 5, no. 1, pp. 80-92, 2006.

[78] M. Miles and A. Huberman, “Making Good Sense: Drawing and Verifying Conclusions,” in *Qualitative Data Analysis: An Expanded Sourcebook*, Thousand Oaks, Sage, 1994, pp. 245-286.

[79] S. V. Thiel, “The case study,” in *Research Methods in Public Administration and Public Management*, London, Routledge, 2014, pp. 86-102.

[80] International Labour Organization, “World Employment and Social Outlook: Trends 2023,” ILO, Geneva, 2023.

[81] C. Pignatti and E. V. Belle, “Better together: Active and passive labor market policies in developed and developing economies,” *IZA Journal of Development and Migration*, vol. 12, no. 1, 2021.

[82] Estonian Unemployment Insurance Fund, “About töötukassa,” 2023. [Online]. Available: https://www.tootukassa.ee/en/footer/about-tootukassa. [Accessed 6 March 2023].

[83] E-Estonia, “AI to help serve the Estonian unemployed,” 2021. [Online]. Available: https://e-estonia.com/ai-to-help-serve-the-estonian-unemployed/. [Accessed 7 March 2023].

[84] Kratid.ee, “Kasutuslood | Kratid,” 2023. [Online]. Available: https://www.kratid.ee/kasutuslood. [Accessed 6 March 2023].

[85] Nortal, “OTT – an AI-powered success story in the public sector,” 2022. [Online]. Available: https://nortal.com/blog/ott-an-ai-powered-success-story-in-the-public-sector/. [Accessed 7 March 2023].

[86] Tartu University, “Tööpakett 1 “Tööturg” - Projekt Masinõppe Ja AI Toega Teenused,” 2022. [Online]. Available: https://sisu.ut.ee/maitt/toopakett-1-tooturg. [Accessed 7 March 2023].

[87] European Commission, “Proposal for a Regulation of the European Parliament and of the Council: Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts,” 2021. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206. [Accessed 23 April 2023].

[88] OECD, “Harnessing digitalisation in Public Employment Services to connect people with jobs,” 2022. [Online]. Available: https://www.oecd.org/els/emp/Harnessing_digitalisation_in_Public_Employment_Services_to_connect_people_with_jobs.pdf. [Accessed 28 April 2023].

[89] Nordic Institute for Interoperability Solutions, “X-Road World Map,” 2023. [Online]. Available: https://x-road.global/xroad-world-map. [Accessed 28 April 2023].

Appendix 1 – Plain licence for allowing the thesis to be available and reproducible for the public

I Sander Nõmmik (Date of Birth: 27.07.1996)

1. Allow the Tallinn University of Technology without any charges (Plain licence) my work ‘Applicability of AI-enabled Solutions in Public Employment Services by the Example of Estonia’, supervised by Markko Liutkevičius,
   1.1. to be reproduced for the purpose of conservation and electronic publication, including the digital repository of the Tallinn University of Technology, until the end of copyrighted time limit;
   1.2. to be available to the public through the Tallinn University of Technology online environment, including the digital repository of the Tallinn University of Technology, until the end of the copyrighted time limit.
2. I am aware, that all rights, named in section 1, will remain to the author.
3. I confirm that by allowing the use of the Plain licence, no intellectual rights of third parties will be violated as set in the personal data protection act and other legislation.

Signed digitally

08.05.2023

Appendix 2 – Interview questions

1. Please describe your current job position and involvement with the EUIF.
2. In which way are the labour market services mainly offered at the moment?
3. How much, if at all, is your work related to AI or automated solutions in the public sector, e.g. in the EUIF?
4. How has the use of AI solutions evolved over time in the EUIF? How are they currently used and integrated into existing solutions and activities?
5. What have been the main challenges in implementing and using AI solutions in the EUIF?
    a. What have been the challenges at the following levels: technology implementation level, legal level, ethical level, societal level?
6. Based on your opinion and experience, what should be the main prerequisites for the implementation of AI in the Estonian public sector?
    a. How much should the focus be on the technology acceptance of the end-users? How much should the focus be on the performance expectation and effort expectation of the end-users, and social influence?
    b. What should be the technological and infrastructural prerequisites?
7. What are the main factors that should be taken into account when implementing AI in the public sector?
8. How would it be possible to identify the influencing factor already before implementing AI solutions?
9. What existing resources are usually needed for the development and implementation of AI solutions in the public sector?

10. Which main requirements should be fulfilled by the EUIF to successfully design and implement AI-enabled labour market services in the future?

11. Are there any plans to carry out projects related to AI in the EUIF in the future? If yes, then which and on what topic?