TALLINN UNIVERSITY OF TECHNOLOGY
School of Information Technologies

Merilin Liutkevicius 204721IVGM

Readiness for Local and Cross-Border Intelligent Public Employment Services in the European Union

Master's thesis

Supervisor: Markko Liutkevičius
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Merilin Liutkevicius 204721IVGM

Euroopa Liidu valmisolek intelligentseteks tööturuteenusteks kohalikul ja piiriülesel tasandil

Magistritöö

Juhendaja: Markko Liutkevičius
Magister

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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: Merilin Liutkevicius

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Abstract

The aim of this thesis is to analyse current European Union member states public employment services readiness for intelligent services on both local and cross-border level taking into consideration administration, organizational and technological challenges and opportunities.

In order to understand the current situation and the level of public employment services in the European Union, a literature overview including document analysis, in-depth interviews with field experts and semi-structured focus-group interviews, were conducted. The thesis examines the exploratory case of developing an intelligent system for the European labour market and giving input for a project that will be initiated in near future. Moreover, the thesis is analysing the current state of two of the member states' developments, focusing on the technological complexities, as well as administrative and organizational challenges European Union member states have to look out for when designing novel services.

Keywords: Public Employment Services, Intelligent services, Interoperability

This thesis is written in English and is 71 pages long, including 7 chapters, 12 figures and 7 tables.

Annotatsioon

Euroopa Liidu valmisolek intelligentseteks tööturuteenusteks kohalikul ja piiriülesel tasandil

Lõputöö eesmärgiks on analüüsida praeguste Euroopa Liidu liikmesriikide riiklike tööturuasutuste valmisolekut intelligentseteks teenusteks nii kohalikul kui piiriülesel tasandil, võttes arvesse haldus-, organisatsioonilisi ja tehnoloogilisi väljakutseid ja võimalusi.

Euroopa Liidu tööturuasutuste hetkeolukorra ja taseme mõistmiseks viidi läbi kirjanduse ülevaade, mis sisaldas dokumendianalüüsi, süvaintervjuusid valdkonna ekspertidega ja poolstruktureeritud fookusgrupi intervjuusid. Lõputöös käsitletakse Euroopa tööturu intelligentse süsteemi väljatöötamise uurimuslikku juhtumit ning sisendi andmist lähitulevikus algavasse projekti. Lisaks analüüsib lõputöö kahe liikmesriigi arengute hetkeseisu, keskendudes tehnoloogilistele keerukustele, aga ka haldus- ja organisatsioonilistele väljakutsetele, millele Euroopa Liidu liikmesriigid peavad tähelepanu pöörama uudsete teenuste kavandamisel.

Märksõnad: riiklikud tööturuteenused, intelligentsed teenused, koostalitlusvõime

Lõputöö on kirjutatud inglise keeles ja on 71 lehekülge pikk, sisaldab 7 peatükki, 12 joonist ning 7 tabelit.

List of abbreviations and terms

AI	*Artificial Intelligence*
EC	*European Commission*
EEPPASS	*European Social Security Pass pilot project*
EESSI	*Electronic Exchange of Social Security Information System*
eID	*Electronic Identification*
eIDAS	*Electronic Identification and Trust Services*
EIF	*European Interoperability Framework*
ESCO	*European Multilingual classification of Skills, Competencies, and Occupations*
EU	*European Union*
EUDI	*European Digital Identity Wallets*
EUIF	*Estonian Unemployment Insurance Fund*
EURES	*European Employment Services*
ISCO	*International Standard Classification of Occupations*
PES	*Public Employment Services*

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1 Introduction

"An occupation out of harmony with the worker's aptitudes and capacities means inefficiency, unenthusiastic and perhaps distasteful labour, and low pay; while an occupation in harmony with the nature of the man means enthusiasm, love of work, and high economic values, superior product, efficient service, and good pay."

- Frank Parson (posthumously) 1909 [1]

Emerging technologies have given great opportunities for public sector digital transformation. It started with digital signatures and reducing paper-based administration and now more and more intelligent use cases are developed on a national and transnational levels. At the same time data has become one of the most valuable resources giving input into developing these systems. However, still on both local and cross-border level there are many challenges in relation to developing intelligent solutions in some areas. One of the areas is public employment services (PES) who are the point of interaction between citizens and employment law, moreover playing key role matching labour supply and demand [2]. Although, there are many advancements [3] in the field of how to improve and enhance possibilities for career consultants working with jobseekers, enabling either profiling tools (Estonia, Luxembourg, Lithuania) or social assistance maps (Luxembourg, Greece), there are only few fully integrated, digitally working solutions in the European Union (EU) market which are targeted for citizens empowerment. Moreover, taking into account increasing EU labour migration between regions [4], all migrants [jobseekers] should have easily accessible PES services in the destination region. Currently there are many barriers for EU citizens from verification to paper-based administration, not even considering more specific topics in regards to skills and qualifications mismatch [5]. This in turn is negatively affecting the development of intelligent services that provide to citizens individual job and training recommendations based on their previous data. This means that there are political, legal and technological requirements that need to be achieved in order to improve cross-border data exchange.

1.1 Research Background

International Labour Organization report in 2021 [6] revealed that due to COVID-19 outbreak, over 140 million jobs have been lost and situation is especially acute in sectors like accommodation, food services, wholesale and retail commerce, construction and manufacturing. Concerning mostly the small enterprises who lack resources to sustain lengthy interruptions on operations that have been caused by restrictions to control the virus spread. The governments introduced enormous job retention programs, policies (for firms and households), effective vaccination procedures [7] and financial assistance for enterprises experiencing a dramatic loss in revenue. This in turn helped along for a speedy economic recovery from the crisis. Now, taking into consideration the recent energy crisis, International Energy Agency (IEA) 2021 findings [8] discuss that current high prices for coal, gas, petroleum as well as for electricity is not temporary circumstance but permanent. Moreover, Alvarez and Molnar [8] state that: "*the current high coal and gas prices are not the result of a single "shock event" on the demand or supply side. Rather, they result from a combination of supply and demand factors that gradually tightened markets over the course of several months and even years*." This however has greatly impacted the industries which have not had enough time to recover from the corona crisis. One of the major challenges the companies have asserted besides economic crisis and covid-19 aftermath, is recruitment of employees with the abilities necessary to effectively innovate and grow their businesses [6]. Across the world, there is a problem that many people have occupations that are beneath their educational level [9], meaning that what employees actually know and how they actualize that knowledge has a big gap in between. This occurrence suggests that there is a substantial gap between the occupations and education, which was already discussed in 2017 ILO report [5] that emphasized skills mismatch on EU labour markets from two perspectives: undereducated and overeducated workers. When compared to workers who have employment that match their credentials, overqualified workers are more likely to experience salary penalties, poorer job satisfaction, and more turnover, while persistent qualification mismatch can leave scars and have an impact on a worker's career for years to come [10].

Upskilling is a crucial factor in the field of the labour market. In order to provide people with additional options, the Council of EU made a formal recommendation on upskilling pathways already in 2016 [11]. The fact that there are implications that finding a job has gotten more complicated and there are more job seekers than open positions in the

Estonian market [12], reskilling and upskilling is important aspect of nowadays job seeking. It may vary from acquiring new skills through short-term trainings to more advance level as completing micro credential degrees to obtain new qualifications. Micro-degree (also Short Learning Programme) is the qualification that focuses on a specific professional or career discipline and includes one (or more) source of accelerated educational experience, giving Higher Education Institutes (HEI) opportunities to educate more experts and to contribute to Lifelong Learning [13]. These degrees are recognized by employers and provide needed skills for the graduate to be competitive in the labour market [14]. Unfortunately, currently, [13] have highlighted there is no opportunity to respond to skills and qualifications mismatches obtained during the studies as united recognition agreements have not been met. Moreover, what are the learning outcomes of different high schools and higher education institutions programs/curriculums. The situation is a bit better with vocational studies, as there are people studying specific expertise (construction, chef, electrician, photographer, nurse etc.) and with that programme, they will acquire skills and qualifications needed in the labour market for a specific occupation [15].

The First European Skills and Jobs Survey (ESJS) conducted in 2014 [16] discovered that 40% of EU employees moved from an old occupation to a new one where their skills were insufficient, and 45% of EU workers had a skills mismatch with their present occupation. These percentages together caused the EU labour market's productivity to decline by an estimated 2%. Despite the abundance of qualitative and quantitative information concerning the issues of skill mismatches in the EU labour market, there is a scarcity of integration of AI-enabled solutions for providing appropriate skill matching using a human-centred approach [17] [18]. Citizens must be intelligently linked and informed of pertinent possibilities for upskilling and reskilling through occupational training and educational programs in order to overcome skills mismatch.

Demographic changes caused by the ageing population in the labour market are also changing the employment rate and market structure. It is clear that citizens in both young and older population segments need more “activation” mechanisms in the labour market. While there has been an improvement in the employment rate of older workers in the past 20 years, it still lags behind the national average [6]. The major obstacle for older workers is to successfully reintegrate into the workforce after being laid off. In spite of older

employee's higher employment rates, long-term unemployment rates for those aged 55 to 64 have grown, and the inactivity remains common [19]. If employers consider a candidate's personal characteristics and existing skills, qualifications and competencies of that individual when hiring, it follows to be more effective method to find suitable candidates for job listings.

1.2 Problem Statement

The latest health, war, and economic crises have impacted the employment market, causing unforeseen effects that necessitate quick adaptation while showing that close cross-border collaboration between countries is needed now more than ever. Although PES main tasks [18] are coordinating labour intermediation, delivering unemployment benefits and coordinate cross-border mobility as well as labour market adjustment - collecting data of job vacancies and job seekers. According to [18] coordinating cross-border mobility is one areas of the PES tasks that many regions across the world are reluctant to deal with. Cooperation between EU member state countries, their governments and NGOs within these countries, may allow for better matching of unemployed people with job vacancies within and between partner countries as well. Upgrading the data exchange means as well as using the maximum capacity of AI, ML and Big Data analytics possibilities could help improve the service both regionally and cross-border. The war in Ukraine and the growing number of refugees who need both shelter and work in EU countries emphasize the barriers even more. Current refugee programs are in place but connected to labour market services which are not ready for a such high number of jobseekers to quickly offer them vacancies in their needed competence area. Finland's Government has mentioned in their Labour Market Equality strategy [20] that employment of asylum seekers is very complex but they have already started the active integration. OECD 2020 migration policy report [21] mentions the issues related to migrants' highest qualifications authentication as the host countries are usually unsure about real skills that are obtained previously abroad. Hence, it brings out the regional and cross-border qualifications mismatch and brings more pressure on PES to find a suitable solution to the individual.

Currently in digital services offered by PES there is no classification mechanisms to identify what skills are obtained from a specific occupation or educational programme.

Hence, finding new career or training opportunities though PES is mostly inefficient and time consuming because matching is done robustly through out-dated classification which only consists of occupational titles and underlying code numeration [22].

This makes both training and job search for career rise/career path change difficult for the citizen as these services are not supporting the active labour market measures that encourage a proactive, citizen-centric approach. Which in turn has led to an author's interest area and raised the Main Research Question (MRQ): **How can Public Employment Service provision be advanced with raised focus on interoperability and technologies involving artificial intelligence?**

1.3 Research Limitations

There are few limitations to this research that are discussed in this sub-chapter to give overview and justifications of conducted research constraints.

The European Union has 28-member states and the average unemployment rate in EU is at 6.5% [23], varying between member states. To understand the whole big picture of PES systems operating in the region as well as map out overall readiness, all countries should be researched. The overall goal is not to choose specific region for collaboration. Research purpose is to give more recommendations about how to prepare for intelligent system readiness. However, due to thesis capacity constraints, author decided to compare two neighbouring member states, Estonia and Finland. One of the reasons is the fact that by 2021 data [24], there are over 50 000 Estonian citizens living and working in Finland. Considering the high number of citizens, we assume there is a labour market expansion possibility that requires new means of service provision. Other reason is the fact that the countries capitals have unique Memorandum of Understanding for twin-cities cooperation signed in spring 2022 [25]. The main aim is to create cooperation action plan to enhance competitiveness, mobility as well as digital and data management between capital cities. In mentioned counties, the unemployment rates are accordingly in Estonia 6.9% [24] and in Finland 7,3% [26], and considering the cooperation and high mobility between these countries - unemployment is a problem that extends across borders.

Author has used all available data sources from document analysis to exploring available services. Additionally focus-group interviews result with other member states

representatives have been used in this research. However, one of the limitations is the number of stakeholders interviewed. Although author tried to keep the selection of stakeholders as wide and relevant to the topic as possible, employment is very wide topic that needs consistent research collaboration with various quadruple-helix stakeholders.

1.4 Research Questions

In order to investigate main research question, following supporting questions were considered:

SRQ1: What are the administrative challenges when creating intelligent public employment service?

In order to understand how to (successfully) implement a novel solution, there has to be thorough mapping of pre-requisites about what administrative procedures enable or limit development. To answer that question both systematic analysis of materials and focus groups interviews will be carried out.

SRQ2: What are the organizational challenges when creating intelligent public employment service?

In relation to the first question, the second question emphasizes the importance of organizational challenges when developing novel solutions. Answering these questions enables understanding of whether a new solution makes sense when it is difficult to gain general and public support. In other words what are the enablers and barriers organizationally and how hard/easy it is to implement new solutions?

SRQ3: What are enablers and challenges to match data between countries in order to guarantee interoperability for cross-border data exchange?

Are countries ready for intelligent services and what are the main barriers and enablers to prepare for these services? Does everyone understand what is AI and are there enough skills and knowledge in that field? What requirements have to be satisfied in two or more EU member states in order to enable cross-border AI-model that works on same principles. Main aim of this research is to understand current data exchange and find ways how to enable smoother communication between two or more regions.

1.5 Research Motivation

Education is strongly linked to both occupations and skills as it is laying foundation for future career. As one important part of university is to offer individuals high level of continuing education and retraining opportunities, then author, as a university employee, has a strong mission to contribute into this field. Moreover, the author has previously participated in the micro credential and continuing education courses developments. This in turn has given insight into the area on how the study programmes are developed and what is important to keep in mind when developing retraining opportunities. Which, when successfully implemented, are supporting individuals on their career path. Moreover, the author participated in the research and innovation action project proposal development for Horizon Europe 2022-2027 call. Participating as the project manager, leading the multi-disciplinary and international team through focus group interviews, meetings and discussions to establish the most crucial research areas. Analysing the results, proposing solutions and finding the right aspects, are needed to gather literature and conduct qualitative research with field experts and partners. Results and recommendations from this thesis will be an important input to the international project to understand the differences and similarities between interoperability and communication between regions. The main goal of proposed project proposal where author participated is to unify classification and agree on consistent formats, and as a result, the data exchange and service provision for the citizens will be regionally and transnationally improved. Building a unified environment and ecosystem that the two regions are actively using can enhance cross-border data exchange and thereby, job opportunities, mobility and training of these two regions citizens.

2 Research Methodology

The purpose of this chapter is to present the methodology used to answer the research questions stated in the first chapter. In the following sub-section qualitative methods is addressed, following with description of research design of the empirical data collection.

2.1 Selection of Qualitative Approach

According to Morgan & Smiricich and more recently to Denzin & Lincoln, the qualitative research focuses on variety of methodologies and stands more for an interpretive approach than particular set of techniques [27] [28]. In comparison the quantitative method views world as a concrete phenomenon that can be lawfully examined [27]. Qualitative research gives opportunity to research subjects, while seeking to understand them in light of the meanings other individual assign to them. There is a variety of empirical materials including case studies, personal experiences, interviews, observations visual texts etc. used in qualitative research. Researchers frequently deploy various practises in each study to have a deeper comprehension of the subject [28]. In regards to thesis at hand, it is assessed that qualitative approach to data collection is the most appropriate. The empirical data collection was done through interviews, as quantitative questionnaire constraints elaborating questions. With the use of qualitative interviews, the interviewer may quickly explain overall situation to the respondent in the pertinent context to establish a shared understanding. To support the research, exploratory case study methodology was used. In this case study, there are two types of data sources used – the primary (semi-structured in-depth interviews with field experts, semi-structured interviews with research partners and thematic analysis of results) and the secondary (literature overview of current European initiatives, legislations, classifications and services). Additional source exploration was done to map existing services and some validation was done to identify contradictions in primary data sources. According to Yin a case study must deal with a technically unusual situation where there are more variables of interest than data points; as a result, it must rely on multiple sources of evidence and triangulate its data; as an additional result, it benefits from the earlier development of theoretical propositions to direct data collection and analysis [29]. However, “it is an empirical inquiry that investigates a contemporary phenomenon (“the case” in depth and within its real-world context” [29].

An exploratory case study research is used as the main research method to determine desired cross-border employment service solution. It involves interested stakeholders, researchers, specialists and focus group experts to bring together diverse knowledge. Collecting data for case study is different from other methods used to do research. The interviews with key stakeholders must be more open-ended than structured [29]. In case study method the key evidence sources both strengths and weaknesses have to be

carefully considered and researchers should keep in mind that no evidence source has advantage over other as using multiple sources complements case study research [29]. As research about EU intelligent PES is quite wide topic, the authors initial decision was to make semi-structured in-depth interviews with experts and then additionally focus group interviews with representatives from Estonia, Italy, Germany and Finland.

2.2 Data collection methods

2.2.1 Semi-structured In-depth interviews with field experts

Qualitative interviews with various public and private sector body stakeholders is important to complement the primary approach to this research. The stakeholders for interview were selected based on the following semi-structured interview method [30] criteria:

- People who are belonging to the interested party group (Advisory Board) (contributors to the project);
- Field experts

Moreover, the people were selected based on their relation to:

a) Conducted research and development activities in one of the following areas: developing intelligent/digital systems; trustworthy AI; EU law in regards AI, PES developer/specialist, public servant

b) Previous collaboration experience in one of the following areas: interoperability; AI; digital transformation; employment services, education

All interviews were conducted in one-year period starting from October 2021-October 2022. All interviews were conducted virtually, using MS Teams or ZOOM environments in English. Interviews were recorded and transcribed.

Table 1 *List of interviews. Source: author*

Interviewee	Public/private sector body	Interviewee(s)

Interviewee 1	The Finnish Ministry of Foreign Affairs	2 experts from "Virtual Finland" project
Interviewee 2	The Finnish National Tax Administration	Development and digital transformation specialist
Interviewee 3	CeRICT (ICT Regional Competence Center)	2 experts. 1 from EU legislation and private law and 1 Computer Science expert
Interviewee 4	Häme University of Applied Sciences	Project coordinator
Interviewee 5	KEHA Centre (The Development and Administrative Services Centre of Finland's PES)	Two development specialists (Technical and semantic interoperability of KEHA centre activities)
Interviewee 6	Estonian Unemployment and Insurance Fund	Development expert

2.2.2 Semi-structured focus group interviews

As this study is giving input to international project which will be conducted in the future, the stakeholders for interview were selected based on the following semi-structured interview method [30] criteria:

- People who are belonging to the project coordinator member group;

To allow for more organic interaction between the researcher and focus group interviewee(s), the interviews were semi-structured. Semi-structured interviews (SSI) are a good way to interact with focus-group to get understanding of independent thoughts from all participants in a group [30]. However, very useful research method, the same time SSI has many disadvantages from the researcher perspective: they are very labour intense (preparing questions, finding right people, conducting interviews, analysing results) and time consuming. Author conducted 4 focus group interviews with stakeholders who are representing international research organizations that have one united goal- collaboratively develop proof of concept (POC) model of intelligent PES system in the EU. The aim of the interviews was to validate findings from the in-depth interviews conducted with the stakeholders, all while gaining more insights about current

employment market situation in Estonia, Finland, Germany and Italy. Although two respondents were represented in both in-depth and focus-group interviews but this allowed for a more elaborated discussion on the trustworthiness of AI as well as giving examples of ethics, laws and regulation existing in EU to support creating the fundamental basis of intelligent system.

Table 2 *List of focus-group interviews. Source: author*

Estonia	Tallinn University of Technology	1 Data scientist 1 Researcher of Interoperable Systems
Finland	Häme University of Applied Sciences	2 Principal Research Scientist 1 Data scientist
Germany	Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)	2 Principal Research Scientist
Italy	CeRICT	1 Professor of AI ethics and law 1 Professor of Computer Science

The focus-group interviews took place every week virtually, over the course of 1 month in October. All meetings were recorded and transcribed. Each week one theme from NVivo results was chosen and thoroughly discussed.

Through interviews, author main goal was to understand what are the main challenges and opportunities in each region. As all of the regions have very different cultural, political and technical background, the idea was to find different perspective in each region, to still support united intelligent system development. However, as the labour migration from Estonia is most common with Finland and there are over 50 000 Estonian people living in Finland, the biggest focus and structured interviews with stakeholders stayed on Finland and Estonia. With the main goal to identify the differences and similarities as well as scalability and transferability possibilities of united labour market service provision between these countries.

2.3 Data analysis procedures

Data analysis procedures in qualitative research often implicate that analysis is running parallelly with data collection phase, moreover that it starts when researcher starts to look for patterns in the collection phase [31].

For a more detailed understanding of interview results, thematic analysis (TA) was used. In the current thesis, qualitative data analysis method will be used with the help of NVivo. It is a technique for assessing patterns and themes in qualitative data [31]. It is a very efficient data analysis method that is gaining popularity owing to its adaptability and accessibility [32] and is often used to analyse complex interviews. There are six recursive phases of analysis process such as:

- Familiarisation with the interview data. First transcribing the interviews and then looking for similar patterns among answers. This will create basis for the second step;
- Generation of initial codes from the data, to organise data into purposeful groups. It means that from data, first codes will be selected and organised accordingly.
- Generation of codes,
- Application of themes,
- Reviewing themes,
- Definition of themes and generation report of findings.

NVivo was used as open-source tool to analyse and discover interview transcript codes. Through Pearson correlation coefficient main themes were discovered from the interviews, which were then further analysed together with secondary data and using focus-group insights.

3 Theory and State of the Art developments in the European Labour Market

There are administrative, technological and organizational variables that must be considered when creating novel intelligent public employment services for the local and transnational markets. The purpose of this chapter is to present the theoretical background to the problem statement and bring out the most important frameworks, legislations and currently available classifications in daily use.

3.1 Theory

As intelligent and digital systems are using technology, it is important to start from laying foundations from theoretical background of technology acceptance and use as well as looking at various criteria's. This theory is supporting the understanding of what researchers from social science perspective have found out and how to enable the service provision from technological perspective as public employment services need to engage citizens. Theoretically it is important to look into both- technology acceptance as well as the trust and risk factors. For years researchers and practitioners have been trying to tackle theories around Technology Adoption Sphere. Unified Theory of Acceptance and use of Technology (UTAUT) has four main forms that researchers, while examining each in "real life" settings, will be able to identify key influencers of technology use and acceptance. The main constructs pointed out by Venkatesh et al are:

- performance expectancy (PE) – the degree to which a person expects that using the system would enable improvements in work performance.
- effort expectancy (EE) - the degree of comfort connected with the use of technology.
- social influence (SI) - factor that directly influences behavioural intent as a degree which individual believes that significant others opinion on whether they should utilise new system influences them into using.

- facilitating conditions (FC). Research indicated that FC has direct influence on technology use, meaning that institutions must have both organizational and technical infrastructure in place to support individuals [33].

Williams, Rana and Dwivedi analysis discovered that e-government, e-learning and e-commerce have seen the most utilisation of the UTAUT model for technology adoption and acceptance study [34]. However, ten years later, focus has moved from end-user overall technology adoption to perceived risk and trust factors hindering individuals using new technology [35]. According to Colesca, trust is the most crucial aspects in implementation of e-government strategies, while various determinants are impacting the trust: age, gender, education, income and years of internet experience [36]. According to Lanseng's and Andreassen's [37] analysis of Self-Service Technology (SST) research using Technology Readiness (TR), dependability and availability, rather than technological competence or sophistication, are what prevent individuals from using technology and favouring it over human interactions. They emphasise that SSTs should be created with the client in mind and built with the best technology available for the job [37].

3.2 European Initiatives

Artificial Intelligence (AI) for Europe is decision taken by EC in 2018 with a goal to bring EU AI to the top level, all the while ensuring the trustworthiness and human-centric approach to solutions. Although decision was taken, there have not been any further steps taken to fully lay down harmonised rules on AI and legislative acts except for one proposal for regulation in 2021 [38]. Recent report by Oxford Insights on Government AI Readiness 2022 found out that among global leaders are United States of America (USA) which had top of the index scores, following by Singapore [39]. However, regionally Western European countries make up almost half of the top 10 countries including: United Kingdom, Finland, France, Netherlands and Estonia is positioning on the 19'th place [39]. Estonia is following under Eastern European countries where EU countries scored average 59.84, Estonian score in comparison was 70.14, weakest index being in the Technology Sector Pillar, where maturity indicators were:

1. Technology sector capabilities of supplying governments with AI technologies;
2. Technology sector conditions to support innovation;
3. Society supporting technology sector – digital literacy and skills among population.

Although AI readiness is important variable in government but it might not be top priority for public sector services across the world which can be seen in cultural differences on resistance of change in the field of digitalisation [39].

The 2030 Digital Compass: the European way for the Digital Decade is a proposal presenting goals and key responsibilities for successful digital transformation across EU by 2030. This proposal is not only important for overall enhancement of digital transformation in EU services, but also reinforcement of digital skills among whole society and businesses are mentioned [40]. The European Commission invests in helping improve the skills of unskilled and low-educated workers to coincide with the **European Pillar of Social Rights Action Plan** which promotes the equal opportunity and access to labour markets [41]. The action plan has two targets with activities to positively affect employment, social protection and citizen's skills developments.

1. **At least 78% population aged 20 to 64 should be in employment by 2030.**

Employment rate in EU was in 2019 sitting at 73.1% meanwhile youth inactivity was on 12.6%. Considering that gender inequality (2020 data- 78.3% of men and 66.6% of women were employed), EC mission is to provide early childhood education and care to enhance female employment participation. All while decreasing inactivity by 3.6% among young people. As a focus on jobs in technology grows, the lack of gender diversity still lingers. For example, as of 2020, women only comprised 18.5 percent of the ICT specialist jobs in the EU. Women make up only around 20 percent of those graduating with specialization in ICT subjects furthering the gender gap [42].

2. **At least 60% of adults should participate in training every year.**

As by 2016 data, only 37% of adults were participating in either education or training activities. Among low-skilled adults, only 18% participated. Taking into account that 10.2% of young people left education without return it is highly impacted employment

rate in that age group. On the other hand outdated skills and discriminatory attitudes have been shown to be obstacles to boosting the employment rates of older workers [43]. With both targets, the aim is also for a more inclusive society, making sure that vulnerable population groups are supported and encouraged. Discrimination also plays a role in the low employment rates of people with disabilities and some migrant and ethnic minority groups. The employment rate of people with disabilities remains close to 25% below the average [44].

European Digital Identity Wallets (EUDI) on 3 June 2021, the EC proposed for a regulation [45] amending **Regulation No 910/2014** for a trusted and secure digital identity for all Europeans, including digital identity wallets. Reason for that being, as 3 years had passed since forcing current electronic identification (eID) regulation and only 14 Member States had complied and started using at least one eID scheme [45]. According to the Regulation proposal [45] and evaluation of electronic identification and trust services (eIDAS) functionalities [46] following concerns were highlighted:

- only 59 % of EU residents have access to trusted and secure eID schemes across borders;
- lack of [46]:
    - common legal framework
    - legal certainty
    - rules for liability
- due to the fact that not all technical meeting points ensure connectivity with eIDAS interoperability framework, the cross-border access and interaction between regions is very limited. Resulting that digital public services accessible locally cannot always be reached cross-border level through the eIDAS network [45].

With the use of EUDI [47], EU residents will be able to digitally identify themselves, store, and manage identification information, as well as electronically handle official papers (e.g. driving license, medical prescriptions, diplomas, etc.). Therefore, using EUID

technology will give EU citizens the ability to digitally exchange documents and access online services with EUID authentication.

Electronic Exchange of Social Security Information System (ESSI). EESSI software was launched in 2017 by the EC [48], with the aim to replace paper-based social security information exchange between EU member states. In 2019, first exchange took place between Austria and Slovenia and by now, 2022, all 32 participating countries institutions are able to exchange information electronically.

European Social Security Pass pilot project (ESSPASS). In order to enhance cross-border social security coverage verification and mobile citizens identification as well as authentication, EC has launched pilot project that is currently in the beginning of second phase. Currently citizens who have higher labour mobility, are often facing very time-consuming procedures from identification to understanding legislations in the other member state to complete transactions connected to obtaining attestation for Social Security eligibility [49]. The proposed pilot key features are to improve efficiency of cross-border verification of citizens and enable more convenient solution for labour migration between EU member states for both employers and employees with the help of blockchain infrastructure. This pilot and its results are crucial to help easing the situation directly for citizens as EESSI software is acting solely as message exchange system between social security institutions.

European Digital Strategy 2019-2024 action "Technology that works for people" is one of the crucial aspects as it main goals as well as actions taken to achieve the goals can be seen on the following ***Figure 1***:

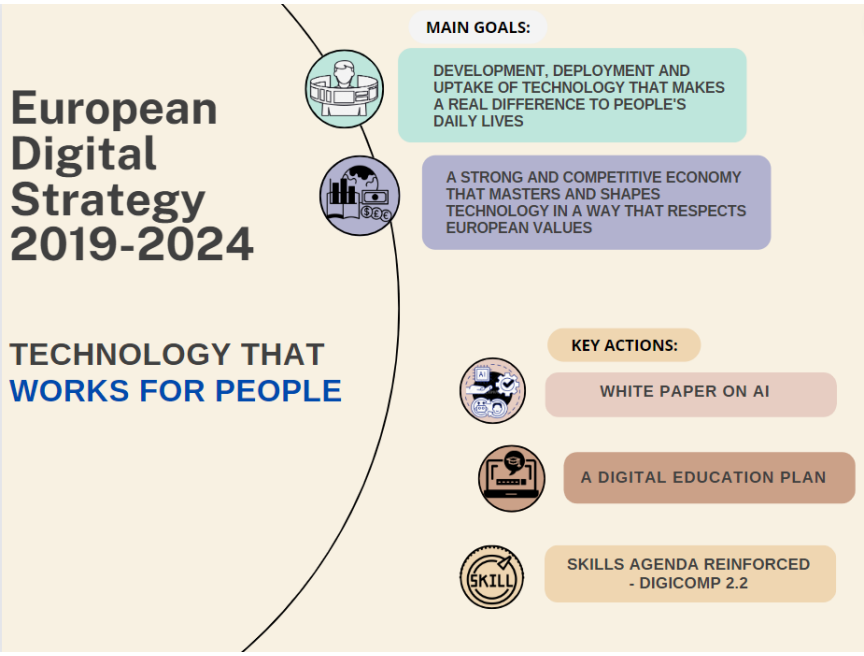


Figure 1 *European Digital Strategy 2019-2024 goals and actions. Information source:* [50]. *Figure created by author*

- **White paper on AI** [51] is package consisting of overview of AI in EU. Moreover, it is comprehensive documentation that consists of measures that addresses issues in relation to creation and usage of AI, while giving insights how to mitigate those risks.

- A **Digital Education Plan** –in order for EU to take both the education provision as well as basic digital literacy to the next level, it needs more hands-on action providing investments and support across all member states [52]. This plan has two major strategic goals:

    - Fostering the development of a high-performing digital education ecosystem;

    - Enhancing digital skills and competences for the digital transformation [52]

  Both of these goals are supporting previously mentioned EU Digital Compass, EU Social Pillar Action Plan and White Paper on AI initiatives as they are key enablers fostering the realisation of their activities. White Paper on AI has mentioned that educating society on AI is important aspect and ethical guidelines of using data and AI will be included in the education ecosystem.

- Skills Agenda reinforced – **The Digital Competence Framework (DigiComp)** is an EU-wide tool [53] to increase individuals' digital skills and competencies, assist political stakeholders in developing and designing educational programs to develop and promote digital competencies for certain target groups.

- Initiative to improve labour conditions of platform workers. By 2021 **Digital Labour Platform** report [54] there are around 600 digital labour platforms in EU, which of 516 were active in March 2021.More than 28 million people in the EU work through these platforms, however, the employment status of these people is often misclassified as "self-employed". This in turn is negatively affecting their labour rights and social protection as self-employed people have

- Reinforced EU governments interoperability strategy. As interoperability is very important aspect of this thesis, the next sub-chapter focuses purely on that topic.

3.3 European Interoperability Framework (EIF)

When talking about cross-border service development, the most important aspect is data exchange and currently there are interesting developments in the field. Technically, interoperability is defined as two separate systems capability to share, understand and use data between each other [55]. EIF draft was first established in 2004 by European Commission (EC) [56] and it was signed by 28 EU member states. The framework is laying down guidelines, recommendations, underlying principles, models and commonly agreed approach to deliver public e-services in EU, reduce isolated digital environments, enhance cross-border collaboration and interaction. Moreover, the EIF consists of concepts of Technical, Semantic, Organizational and Legal Interoperability all of which are needed to take into consideration when designing interoperable system within and across borders [56]. Although in 2017 the EC came out with renewed EIF[1], today the EU-member states still emphasize the importance of strengthening the interoperability between cross-border public sector agencies. Also, according to McBride et al currently

there is a lack of research exploring empirically and comparatively GIDEP's (Government Interoperability and Data Exchange Platforms) [55]. All of this has led to a policy proposal [57] for the development of the Interoperable Europe Act (IEA) across the Union member states. Moreover, the IEA policy would create a better understanding for governments for public e-service provision and enable collaboration, as current EIF is totally optional and up to member states public sector willingness to use. Which in turn has revealed major limits to strengthening EU interoperability cooperation. One of which is also having the appropriate level of IT skills and knowledge available in a one-stop-shop for non-IT experts [57]. Making use of European Interoperability Framework principles are essential for developing interoperable European public services [56]. The Estonian 2030 Digital Agenda has set initiative that focuses on cross-border interoperability promotion and ensuring the compatibility of common solutions across borders [58]. To mention some of the activities planned in the coming years to boost interoperability regionally and internationally:

- development of single state portal [58];
- investing to have regional interoperability with the common EU infrastructure [58];
- establishing a single information space for publishing the digital government development principles [58].

One example of how EU member states can exchange data is through eDelivery [59]. Despite being EU initiative, and enabling electronic data exchange, it has some limitations. As it is implemented within policy domains and is not able to exchange data between private sector or other governmental agencies [60]. However, eDelivery could be one of the potential data exchange providers to enable cross-border PES system developments.

Theoretical concepts of EU frameworks such as the European Interoperability Framework, Digital Agenda, eID etc. are important because the EU has been striving toward a single digital marketplace since 2015. Despite multiple frameworks, there are only a few [46] [61] [47] [57] implementations of cross-border data exchange.

3.4 Intelligent labour market services in Europe

According to the International Labour Organisation (ILO), among 69 countries reviewed in 2020, one third have used AI solutions or data analysis in fundamental PES for both job seekers and employers [62] [63]. Profiling, which derives a statistical probability of a person's long-term unemployment from background data, is one of the most popular domains for data analysis in PES. Additionally, it is important to keep in mind that PES's AI solutions require a human-centered approach and emphasized by [64]. However, there are not many applications of intelligent systems in the labour market field [3]. It is crucial to emphasize that the application of AI to skills intelligence and general skills policy might open up new perspectives. Following ***Figure 2*** will show various information as well as policy/action potentials of big data analysis in skills policy for governments, education and training providers, employers and citizens [17].

Figure 2 *Information and policy potential of big data analysis in skills policy. Information source:* [17]. *Figure created by author*

Despite the fact that AI solutions can vastly increase self-services, at the moment there is a lack of a decent system example from which individuals might readily acquire information on the upskilling and reskilling prospects right away in order to continuously renew and acquire skills on the labour market. There are numerous examples of researchers using AI methods in career recommendation systems mixing traditional recommendation systems such as:

- Content-Based Recommendation [65]

- Collaboration Filtering Recommendation [66]
- Hybrid Based Recommendations
- Knowledge Based Recommendation

With emerging technologies, the important aspect, it to develop more intelligent systems in the PES area. Not many good examples of AI implementation can be seen in the area of PES. Some developments are in the field of helping career consultants – decision support tools and currently Korea is methodologically creating citizen support-tool where individual could have tailored service in the future [3]. This would be the first of its kind to bring together suitable job listings and trainings for the citizen in the public sector service provision.

3.5 Classifications and taxonomies

Occupational Information Network (O*NET)

If talking about international occupational platforms, then O*NET which was first introduced in the late 1990's, replacing previously used Dictionary of Occupational Titles (DOT) is one that lead the way to many international classifications. It is United States open-source online database that is regularly collecting, disseminating and updating data concerning occupations [67].

International Standard Classification of Occupations (ISCO)

One must first gather authentic and trustworthy data on occupations in order to employ information on occupations as well as occupation-based variables in empirical studies. This suggests that researchers must convert intricate occupational data into a system of less or more intricate occupation codes [68]. International Standard Classification of Occupations was first developed in 1958 by ILO and has been revised three times since then (in 1968, 1988 and 2008). Latest version is called ISCO-08 and is providing structured classification of occupational groups that are divided into: occupational groups (4-digit-code), minor groups (3-digit-code), sub-major groups (2-digit-codes) and major groups (1-digit-code). All groups are structured by skill level required for the job and skills specialisation dimensions [69].

The ISCO distinguishes among four skill levels:

- major group 2 covers occupations that typically require an academic degree (International Standard Classification of Education (ISCED) levels 6, 7, and 8).
- Major group 3 occupations usually require ISCED level 5
- Major groups 4–8 include occupations that require ISCED levels 2 and 3 (Vocational training)
- Major group 9 comprises unskilled occupations, i.e., occupations that do not require any formal vocational training (ISCED level 1).
- Major groups "0" (military occupations) and "1" (managerial occupations) are an exception insofar as they do not imply any specific educational requirement, but might include occupations at different skill levels.

European Multilingual classification of Skills, Competencies, and Occupations (ESCO)

To date, skills matching for the EU labour market is still very much resource intensive, requiring additional help or consultation in using such services, filling in the CV-s, or manually going through relevant advertisements. In such services, finding relevant learning opportunities (vocational training or educational courses) is typically even harder. ESCO was first developed in 2017 [70] [71] is multilingual European classification that operates as a taxonomy, describing, identifying and sorting professional relevant EU labour market occupations and skills. ESCO is categorised into three pillars: occupations; knowledge, skills and competences and qualifications pillars [72]. In the current dictionary there are around 3008 occupations and accordingly to the occupations, around 13890 skills linked. The framework is translated into 28 languages and its main aim is to provide "common language" on professions and skills to encourage job mobility across EU. Difference between ISCO-08 and ESCO is that while ISCO-08 provides top four level occupations then ESCO provides the fifth and lower levels. Comparison between two can be seen on the ***Figure 3*** and ***Figure 4***.

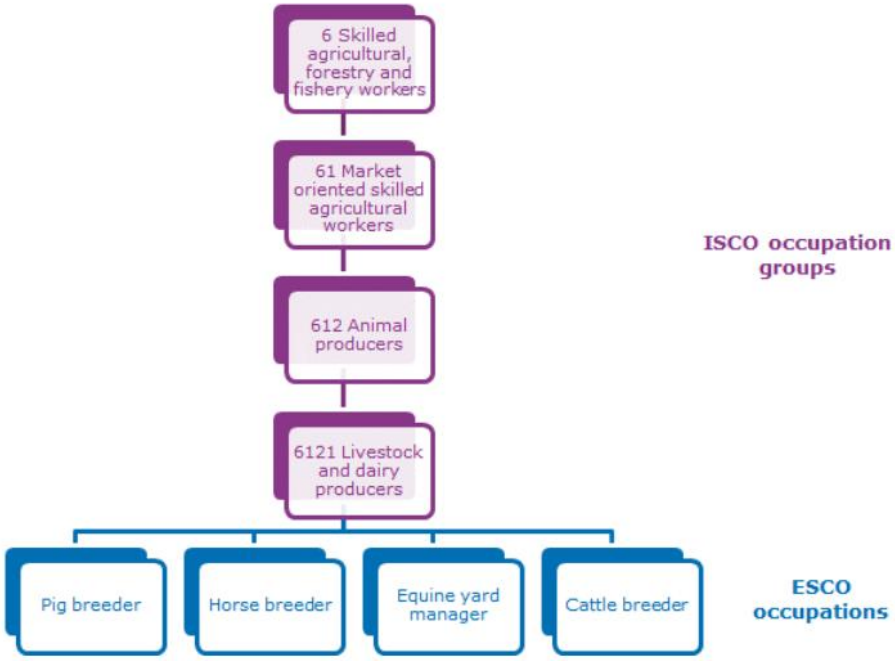


Figure 3 I*SCO-08 and ESCO difference. Source:* [72]

Moreover, the primary hierarchy of the ESCO system can be seen on the ***Figure 4***, explaining the hierarchy of the occupations as it is going on the lower levels. First level (with purple) describes previously mentioned ISCO-08 major group 9 occupations **Waiters**. With blue are marked next levels which are describing different levels of waiters, this specification is part of ESCO taxonomy.

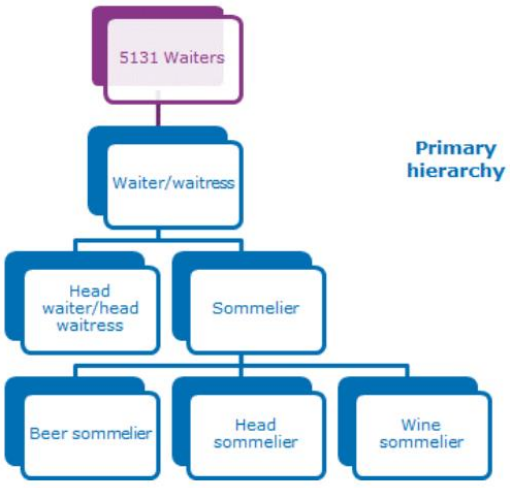


Figure 4 *Primary hierarchy. Source:* [72]

One example of how to cooperate is to create seamless cross-border labour mobility opportunities in neighbouring countries. The usage of ESCO on the European level is

tightly incorporated into the European Employment Services (EURES) network which facilitates the exchange of labour market data among its members [71].

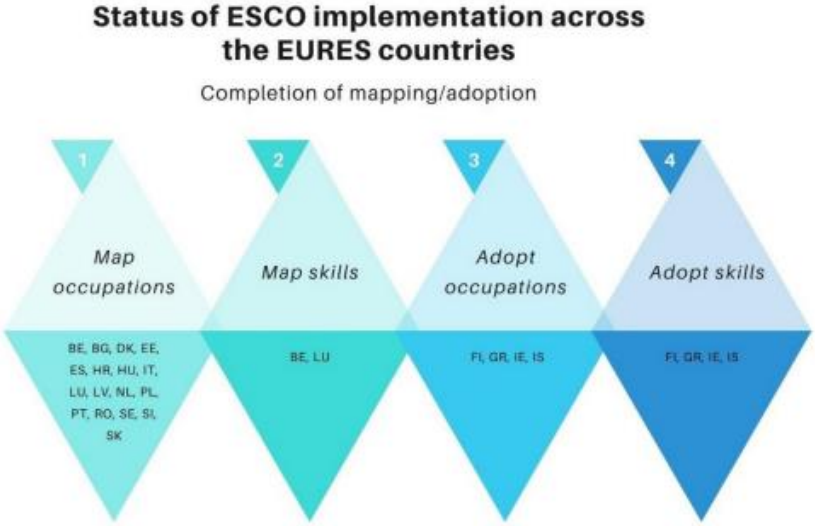


Figure 5 *Status of ESCO implementation. Source:* [71]

In the ***Figure 5*** it can be seen that Estonia (EE) has mapped occupations. By information obtained from [73] by 2023 the Estonian National Qualifications will map out and develop further Estonian ESCO skills and they will be part of skills description information system. Meaning that currently there are ongoing pilots to implement skills from ESCO classification. According to EU EURES report, Finland (FI) has also mapped occupations, but additionally adopted occupations as well as adopted skills [71].

Taking into consideration that EU regulation 2016/589 [74] that all 28 EU member states have to use ESCO taxonomy in their public services by 2021, the current level of mapping and adoption in EU member states has been slow. However, ESCO standardisation and data mapping and harmonisation is also needed, because the countries currently use different tools based on a same framework (ISCO-08).

4 Public employment services in Estonia and Finland

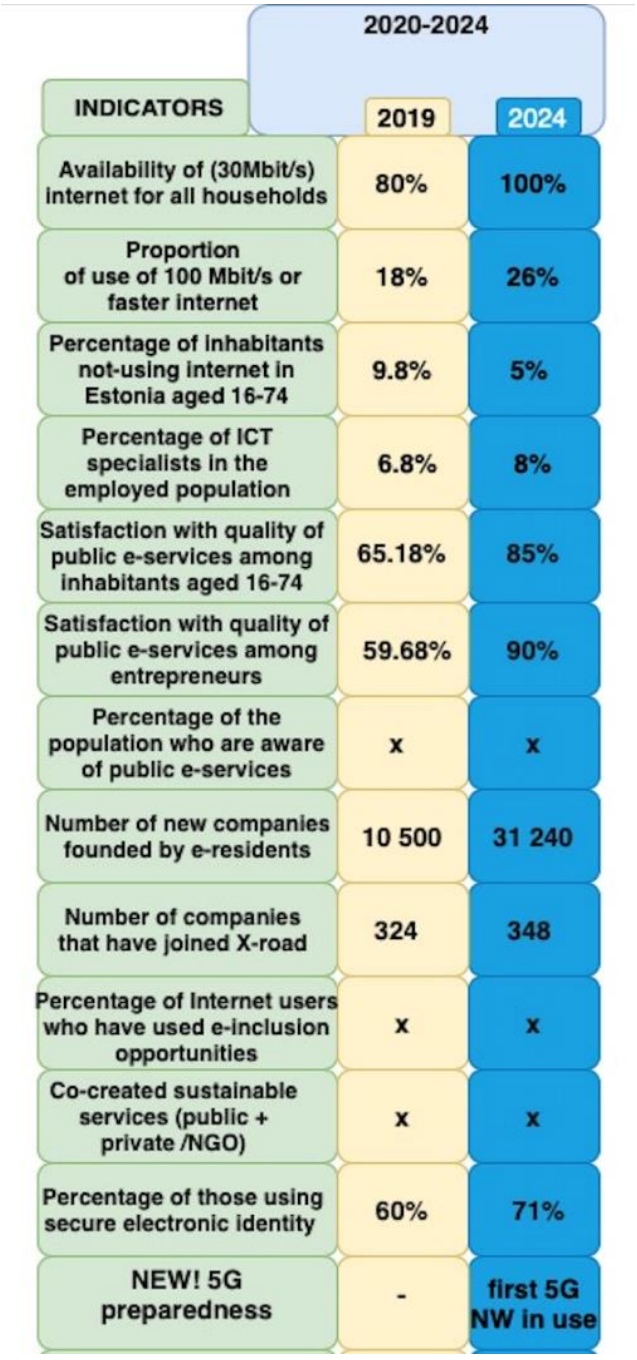
The aim of this chapter is to present public employment services in Estonia and Finland and relevant developments regarding digitalisation.

4.1 Estonia

According to eGovernment Benchmark 2022 [76], Estonian Digital Public administration performances across policy priorities are over the EU27 average. During last years, Estonia adopted many legislations with main aim to support interoperability, digital transformation and be accordance with Estonian and European Digital Agenda for 2030. Some of the important guidelines are as follows:

Open Data Directive – aim was to adopt EU Directive 2019/1024 [77] on open data and the re-use of public sector information [78].

The Estonian Digital Agenda for 2030 and subsequently, the program: "*E-government and telecommunications market development program 2021-2024"* is an infrastructure that considers technological trends and the needs of the population, works in the interests of both the public and private sectors, enabling productivity growth in both sectors. The higher goal is to use ICT to support the increase of economic competitiveness and human well-being, as well as the efficiency of public administration. This is very closely supporting European Digital Strategy 2019-2024 goals of development of technology that supports human daily lives as well as competitive economies. Moreover, the main aim of one of the actions (*4. Development of ICT skills*) is to continuously develop digital literacy so that the (digital) gap in society does not arise or deepen - so that all Estonians have sufficient awareness and skills to use their ICT to ensure their quality of life and well-being, use public services, etc. This action clearly shows the interconnection between the EU Skills Agenda and how to work on it on a national level. A necessary prerequisite for the use of e-solutions is people's awareness of the opportunities and threats of the information society, including the skills to protect oneself from threats. The activities of the program include increasing the well-being of the Estonian population through ICT skills and increasing competitiveness in the labour market through the education of ICT specialists, for example by supporting the development of data sciences and IT law curricula and funding studies. (Indicators: decrease the percentage of inhabitants who are not using the Internet; higher percentage of ICT specialists in the employed population etc.) However, the most important challenge the program itself is tackling with is an overarching issue is the sustainability of e-government, which stems from the ongoing underfunding and development over the years, as well as the underfunding of cyber security. Main indicators and goals can be seen on the following ***Figure 6.***



INDICATORS	2020-2024	
	2019	2024
Availability of (30Mbit/s) internet for all households	80%	100%
Proportion of use of 100 Mbit/s or faster internet	18%	26%
Percentage of inhabitants not-using internet in Estonia aged 16-74	9.8%	5%
Percentage of ICT specialists in the employed population	6.8%	8%
Satisfaction with quality of public e-services among inhabitants aged 16-74	65.18%	85%
Satisfaction with quality of public e-services among entrepreneurs	59.68%	90%
Percentage of the population who are aware of public e-services	x	x
Number of new companies founded by e-residents	10 500	31 240
Number of companies that have joined X-road	324	348
Percentage of Internet users who have used e-inclusion opportunities	x	x
Co-created sustainable services (public + private /NGO)	x	x
Percentage of those using secure electronic identity	60%	71%
NEW! 5G preparedness	-	first 5G NW in use

Figure 6 *"E-government and telecommunication market development plan 2021-2024"indicators from 2029 and vision for 2024*

4.1.1 Estonian unemployment

Estonian unemployment data is coming directly from the Estonian Open Data portal. Current data shows that in Estonia the registered unemployment rate is around 7.4% (48 422 people) [79], whereas it varies widely depending on the regions; higher rate is in Valga county (10.2%) and East-Viru county (10.8%) and lowest in the Hiiu county

(2.9%). Also, the age is an important variable, as 66.8% of unemployed are in the age group between 25-54 years old, 19.9% are 55+ years old and 13.3% belong to the 16-24 years age group. The public sector often offers its employees extrinsic motivators such as job security, favourable pension systems, and good opportunities for professional development (Perry & Hondeghem, 2008). By the Estonian National Audit report [80], most of Estonian teachers, police officers, family physicians and rescue workers are nearly in their pension years. Public service provision is very tightly connected to the demographic situation (ageing population, lack of experts) and also to public service reforms. The problem is that across Estonia it is hard to provide service with the same level of quality and the issue is not about money or physical resources but about human resources. The ageing population is a big problem. Essential public services are important and they are also more complex as the e-service might only solve the problem in the bigger cities. It goes without saying that regardless of residence, public services need high quality and availability for citizens, unfortunately in some rural areas this is a growing problem as the rural areas are not as attractive (possibilities in the job market, infrastructure, transportation and overall opportunities for leisure and wellbeing). The last idea is also supported by the regional unemployment rates as rural areas have more unemployed citizens.

To meet society's expectations of service quality, just community and co-creation between PPP is not enough and even Estonian National Audit [81] has highlighted many bottlenecks. The main findings from what the labour market needs in the upcoming years are that there is a deepening need for healthcare professionals and caregivers as well as teachers. Also, job offers mediated in Estonian PES systems have been declining this year, meaning that there are currently 3405 [12] vacancies, compared to 9800 vacancies mediated in March 2022.

In Estonia, labour market services are guided by one governmental employment agency called Estonian Unemployment Insurance Fund (EUIF).

4.1.1.1 Estonian Unemployment Insurance Fund (EUIF)

EUIF was founded in 2001 to administer unemployment insurance benefits. Since May 2019, it has also been responsible for offering labour market services that aid unemployed citizens in locating new employment prospects. As a quasi-governmental organization, the EUIF functions as a public legal entity. Although it operates independently of the

government, it does so in accordance with a mission and set of guidelines established by the Estonian Ministry of Social Affairs. The EUIF is the sole organization in Estonia that provides registered jobless persons with unemployment insurance benefits while also assisting them by providing a range of services to help them succeed in the workforce.

<table>
<tr><th colspan="2">The key responsibilities of the EUIF</th></tr>
<tr><td colspan="2">Provision of Active Labour Market Measures (ALMPs)
Payment of unemployment and work ability benefits and compensations
Work capability assessment</td></tr>
<tr><th colspan="2">The EUIF strategic goals for the upcoming years</th></tr>
<tr><td>Reducing unemployment and the duration of unemployment and supporting sustainable development</td><td>Supporting structural changes in the economy</td></tr>
<tr><td>Increasing labour supply</td><td>Increasing cost-effectiveness</td></tr>
</table>

Although, the EUIF as governmental organization is working relatively well, it has many shortcomings, because it is also, as many EU countries currently bringing together job offer and job seeker via tool which is based on an ISCO-08 framework.

4.2 Finland

4.2.1 Unemployment services in Finland

Unemployment in Finland is around 6.9% by October data obtained from Employment and Economic Development Offices and municipalities in Finland [24]. The lack of labour availability has been an issue for a long time in Finland, and recently, due to Covid-19 virus, things have gotten even worse. The country as a whole suffers from a labour shortage in the health and social services sector, and the expansion of the ICT industry is constrained by the lack of competent people [20]. Due to effects seen of the unavailability of labour, the Ministry of Economic Affairs and Employment of Finland has started shifting to work-based immigration enhancement. Which in turn mean that

current employment services need upgrading to allow for a more flexible labour migration.

The Employment and Economic Development Office (TE-offices)

TE-Offices (also called Te-Palvelut, Te-Toimisto) are regional Finnish labour market organisations where people can register as unemployed jobseekers, apply for vocational labour market trainings and get support for finding a job. Currently there are 15 regional TE offices in Finland. Since May 2, 2022 the TE Offices went over from traditional service provision to Nordic labour market service model. This service model is offering a more individually tailored customer service for the citizens and jobseekers have to apply on their own initiative. Usually the PES is notifying the citizen when interesting job offer comes to the market but as of this year, Finnish jobseekers have to act as active jobseekers and apply minimum at 4 jobs each month. If they fail to do that and neglect their employment plan then it will affect their unemployment benefit payments. In the ***Table 3*** the main differences between traditional and Nordic labour market service model are explained.

Table 3 *Main differences between previous and current labour market service model. Source:* [82] [83]

Previous labour market service model	**Nordic labour market service model[1]**
Initial interview after two weeks of applying as job seeker	Initial interview within in 5 days from the start of the job search
Meeting with officials after every 3 months	Meeting with officials once every two weeks for first three months of job search
Only responding to job offers sent by TE office	Obligation to apply for 4 desired job offers each month
Strict cancellation of unemployment benefit payment when jobseeker misses deadline	First time making a mistake the office contacts jobseeker with kind reminder to send necessary updates, second time making a mistake, seven-day grace period follows.
Compensation will be lost for 90-days.	Compensation will be lost for 45 days

Although Finnish Employment Minister [84] finds the Nordic model good for activating citizens on their job search and increase the employment and improve regional vitality. Still, many labour market experts [85] [82] neglect whether this will solve the issue of how many open positions are available on the market as well as if the TE offices will be able to conduct all promised interviews with jobseekers. Also, as the focus is on short-time unemployed, question remains, how the offices will manage to help long-time unemployed people in the regions. Currently only 8% are covered by employment services (out of more than 100 000 people) who have been without work more than a year [85] [82].

Kela

Kela is the Finnish life-event e-service provider covering social insurance institution responsibilities that provides social security coverage for Finnish residents and Finnish people living abroad. Kela is responsible for offering various services, which can be seen in the ***Figure 7*** below.

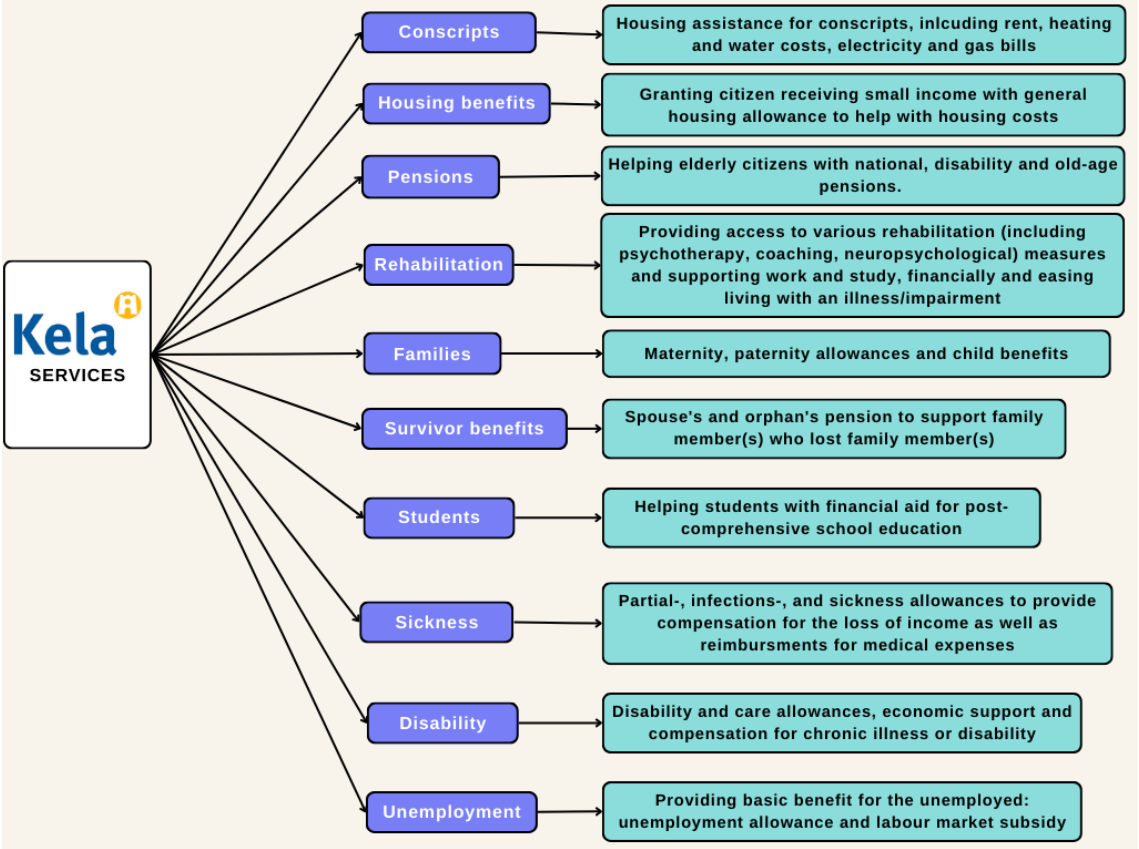


Figure 7 *Kela services. Information source: Kela website. Figure created by author*

KEHA

KEHA Centre contribute to the implementation of the performance objectives of ELY centres (Centre for Economic Development, Transport and the Environment) and TE offices in Finland by organising and producing joint development and management services. The main aim of ELY centres (15 total Centres across Finland) is fostering regional competitiveness, wellbeing and sustainable development and steers and supervises TE offices work as seen on the ***Figure 8***.

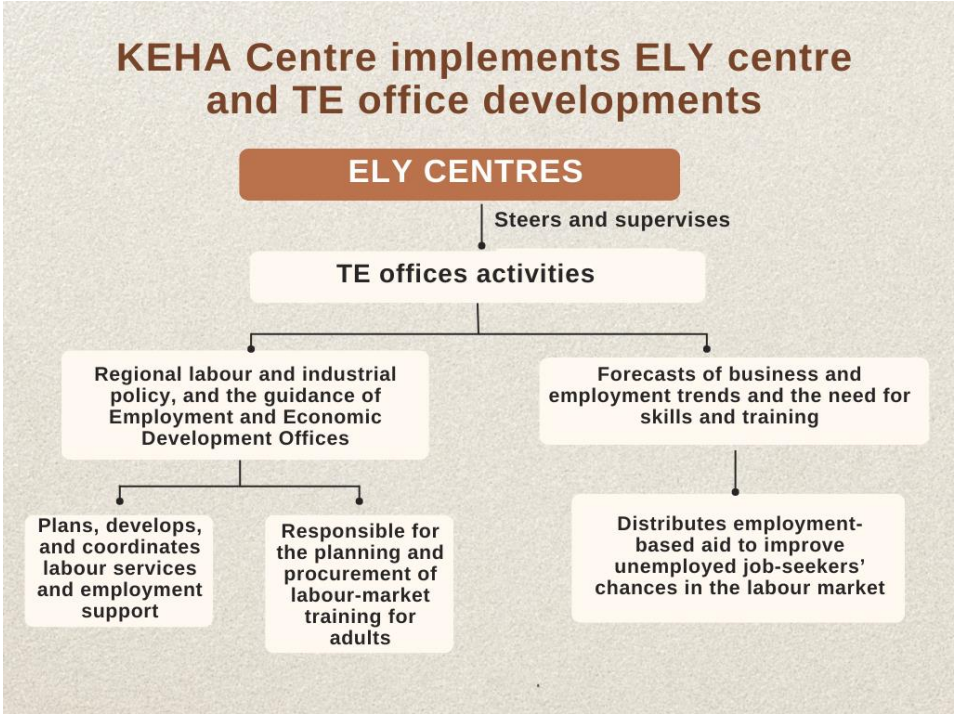


Figure 8 *ELY centre responsibilities. Information source: ELY centres website. Figure created by author*

KEHA Centre and Operational Development Unit is responsible for maintaining and developing the occupational data of jobseekers and vacancies registered in TE offices. As an implementer of the national classification they assure that the collected data meets the requirements of the Statistics Finland. The national coordination offices (NCOs) are responsible for the application of the EURES-regulation. In Finland, NCO consists of two parties, The Ministry of Economic Affairs and Employment and KEHA Centre. The ministry is responsible for the strategy and high-level issues and in KEHA centre they get down to practicalities. In Finland the implementation of ESCO was carried out by KEHA Centre. The next sentences are citations from the 2021 published study by Finland´s Prime Minister's Office: "*Occupational classifications were originally developed for statistical purposes, and for this reason each occupation can fall only into one category.*

In the ongoing fraction of society and economy, the classifications of the industrial era can no longer describe well enough the reality of everyday working life. The development of information infrastructure of a today's society requires therefore more foresight methods for predicting the needs for the future. Statistical data and labour market data are collected and organised inevitably with the help of existing and historically developed classifications but at the same time, it is necessary to foresee what types of information classifications will be needed in the future. It will be important in the development of infrastructures for labour market information, how the concept competence will be understood and classified in the future [86]*."*

4.3 Current cross-border cooperation

The Estonian and Finland have some cooperation between labour market organisations. One of the ways how the cooperation works is through the network of EURES (European Employment Services). EURES is a cooperation network formed by PES to facilitate employment mobility among EU countries including both jobseeker's migration and employer's recruitment activities. The objective of the EURES network is to facilitate the free movement of workers within the European Economic Area (EEA) where the 28 members of the European Union operate together with Norway, Liechtenstein and Iceland and additionally with Switzerland. However, currently, job seekers turn to the internet for information on career opportunities. Private websites are among the most popular sites and EURES, which is funded by the European Commission, is included. Moreover, Estonian and Finnish EURES teams cooperate on recruitment projects. EURES have over 3.7 million job listings across Europe, but usage rates vary drastically between member states. For example, there are over half a million job vacancies on the platform from France and Germany, but around 87 from Italy [87]. On the same platform there are around 1800 vacancies from Estonia, but over 26 000 from Finland [87]. Although a valuable platform, EURES does not currently offer intelligent skill matching, training recommendations or career planning functionalities.

Europass which is EU-wide support framework consisting of tools and information on training and labour market providers has great potential to help citizens on their career path. However, the user interface and accessibility are very complicated. Taking look into

the system there is a lot of information in theory, but as a citizen the information in practise is not easily accessible.

TE offices and EUIF exchange information and change data. However, the main tool for information exchange is EESSI [48]. AS-IS data exchange between EUIF and TE offices can be seen in the ***Figure 9***. Before EESSI the social security information between Estonia and Finland was exchanged by mail (on paper). The overall information exchanged between the TE offices and the EUIF consists of:

- data about the insurance period of the person (the EUIF confirms the period fulfilled in Estonia and enquires about the fulfilled period abroad);
- the confirmation of data from the Estonian population register (the place of residence, data of underaged children) that is necessary for Finland if the person applies for benefits or subsidies;
- data of wages received by people (exchanged once a year, interest to exchange data on a monthly basis in the future);
- data of benefits and subsidies received by certain people and
- other data that might affect the benefits and subsidies paid by Estonian and Finnish organisations.

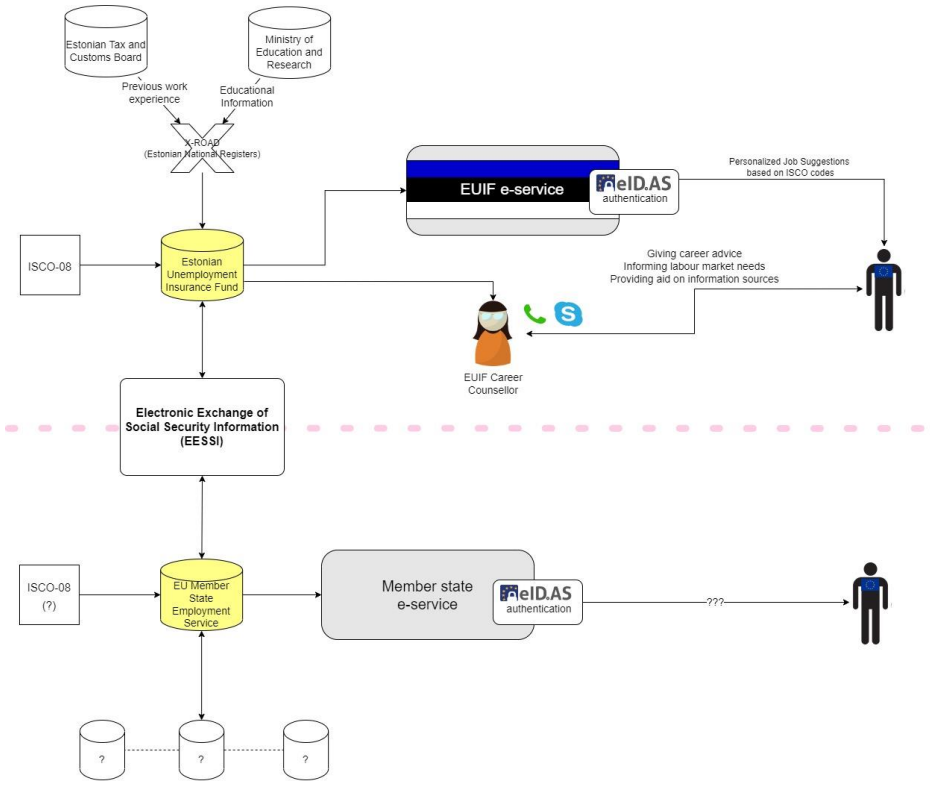


Figure 9 AS-IS cross-border communication

Estonia and Finland also exchange data at a national level, where both country's population registry is connected digitally via x-road [75].

On the other hand, Estonian National Audit Office did an analysis and overview [88] of the Estonian Unemployment and Insurance Fund (EUIF) upskilling training courses provision for citizens and discovered that there are many shortcomings. For example, there are very many training providers, most of whose costs will be covered by EUIF, but the quality of trainings, as well as skills acquired from trainings, are often unclear. National Audit found out that there is no supervision of what happens with the unemployed citizens after completing the training program and if in case they find a job in the field, there is a clear correlation between participating in the training and adequately finding a new job with the help of new skills acquired from training [88].

Regional initiatives highlight the prioritization of cross-border job integration and mobility in the public sector. Local governments and organizations have policies and indicators to fulfil, so they must act on feedback and prepare for future trends in the labour market, emphasizing the importance of digital transformation and making use of more

intelligent systems. However, according to Urquidi and Ortega the PES policies are very reluctant to find solutions for better integration opportunities for migrating jobseekers, not even considering whether jobseekers are high-,medium-, or low-skilled [18]. Moreover, the labour migration is very relevant topic between Finland and Estonia as there are currently over 50 000 citizens living and working regularly in Finland, which indicates high level cross-border labour migration. There are already some previous projects in the field to learn from, e.g. in 2017, Estonia and Latvia created the "*Promotion of Cross-border Labour Market Integration and Employment"* initiative between the Valka-Valga region for promoting cross-border job placement and increasing mobility [89].

By OECD statistics [90] in July 2022, unemployment rate in the world was back to pre Covid-19-crisis levels in 24 countries out of 32, and only in Estonia and Finland the rate was above that level by more than 0.5 percentage points. Also, by the same report, long-term unemployment due to challenges imposed by Covid-19 restrictions, increased. That was because of Covid-19 lockdowns many jobseekers were pushed into “inactive jobseeker” status as they were unable to search for new jobs on the market. Challenges were varying from not having access to technology or not having access to an e-service that would provide enough support when looking for a new job opportunity [90].

On the national level, Finland has various e-services in place, where citizens can register as a jobseeker, search for job and training opportunities, find help with different supports etc. However, since 2021 spring, the whole social and welfare (including labour market) service provision is undergoing reform called TEservices2024, which means the service provision responsibility will go from government level to the regional municipality level [91]. The main idea is to bring employment services closer to the citizens and provide more needs-based services and support system for local labour markets. However, by 2021 interviews and survey with various project coordinators of implementing this trial of reform have brought out some serious setbacks: customer data at TE office was not able to be accessed by municipality systems, transfer did not have joint-planning between TE office and municipalities and customers who were moved between systems, did not have up-to-date employment plan. One example brought out by Helsinki head of immigration and employment affairs, Ilkka Haahtela, was that over 50 000 unemployed people in Helsinki, at the capital of Finland remained floating in the registries and were

not forwarded to local municipality to get needed personal guidance and access to employment services. Considering that currently Finland is also restructuring the whole health and social services with new reform (where public healthcare and social welfare services will go from municipalities under counties responsibility) which in turn has put major pressure on local governments. This all including the economic, electricity and refugee crisis, is definitely making situation currently very difficult for the Finnish local municipalities.

5 Findings and results of the running case

This chapter presents the results and their analysis. The data collected from primary and secondary data collection was processed and analysed. Thematic analysis was performed to understand the main important themes. Through interviews with stakeholders and using secondary data sources, author was able to conduct a thematic analysis of results.

The NVivo analysis of results and find codes from interviews, resulted in finding four main themes and sub-themes that can be seen on following ***Figure 10***

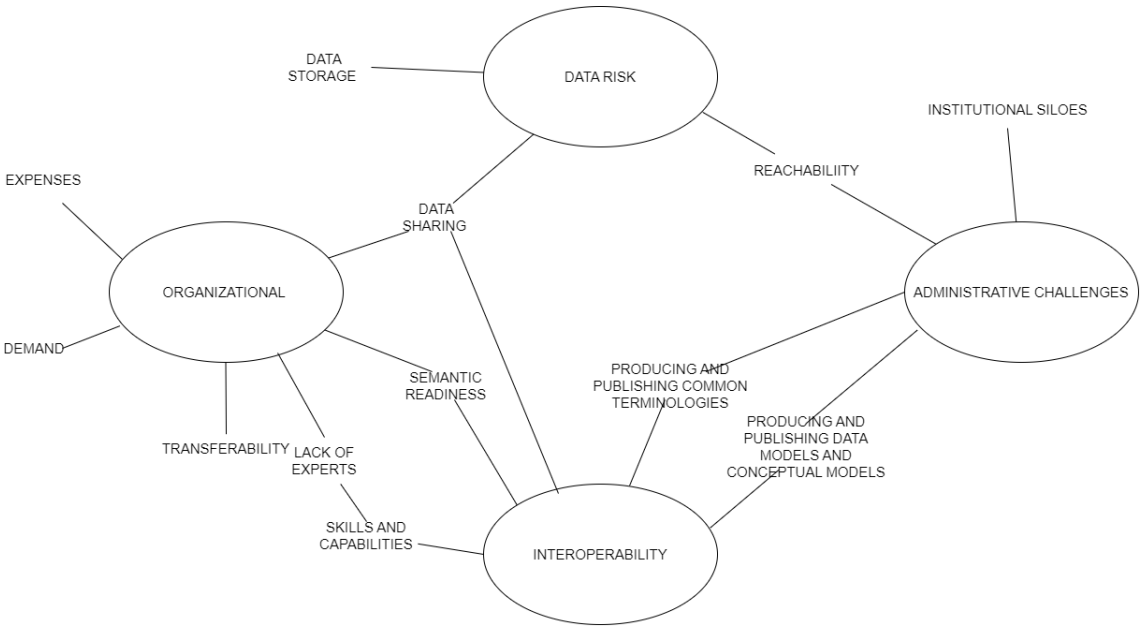


Figure 10 *Thematic map*

5.1.1 Administrative challenges to enable local and cross-border intelligent public employment services

This sub-section is aimed at answering *SRQ1: What are the administrative challenges when creating intelligent public employment service.* The interview questions were targeted to understand what are the main themes hindering development in the field of administration.

Following challenges were mentioned:

- Reachability
- Institutional Siloes

Table 4 *Administrative challenges. Source: Author*

Challenge	Description
Reachability	1. Identification of target groups (Interviewees 1,4) 2. Legislations are lagging behind as public digital services concentrate on reachability and clarity and so everybody needs to be kind of considered. E.g. can you use the service if you have a bad eyesight or bad hearing or stuff like that? (Interviewees 2,4) 3. They're concentrating only on the surface, authorities that are not able to function or do things just because they are in that position, and they do not have specific laws (author comment: laws). (Interviewees 1,2,3,4) 4. Example: Drafting administrative law regarding automatic decision making. What is automatic automated decision making? Basically, not AI based yet but anyway that you could have some algorithm or some kind of rules that just make decisions on behalf of the authorities, so basically data system-based decisions and the tax administration has used this kind of approach for

	20 years already. Recently legislation draft started that would actually allow this. (Interviewee 3)
Institutional Siloes	1. Silo issue - changing something means it would require all these different ministries to actually come together and put their heads together and sit down and look at the laws. That just doesn't happen in our culture at the moment

5.1.2 Organizational challenges to develop intelligent public employment services

This sub-section aims to answer on the *SRQ2: What are the organizational challenges when creating intelligent public employment service?* Moreover, it touched on the sub-themes of data sharing, lack of experts, and transferability. When asking the field experts, which are the most important topics they could bring out considering the organizational changes required in their own region and cross-border context, to enable intelligent employment service, the main challenges that came out were:

- Lack of experts
- Transferability

Table 5 *Organizational challenges. Source: Author*

Type of challenge	Description
Lack of experts	1. Not having enough educated decision makers on these topics (Interviewees 1,5) 2. Not understanding data economy terms. They should really be watered down for the everyday person. (Interviewees 1,2,5) 3. If there's an overall approach like the Digital Compass. It's probably will end more like an

	inventory and To Do List than actual things to happen.
Transferability	1. The transference of knowledge regarding approaches and methods for labour market poses barriers (Interviewee 3,4) 2. Generally, the application of AI is well understood by data scientists and academics in this domain. Although awareness of AI is increasing, there is a societal lack of practical knowledge about AI in the public sector. (Interviewee 1,2,4) 3. The main challenge is to take care transferring AI knowledge in an understandable way to non-scientific communities and make research outcomes available to share knowledge between countries. (Focus-group interview) 4. Identification of legal differences between EU member states (Interviewee 3)

5.1.3 Current cross-border service provision: enablers and challenges to match data between countries

Aim of this sub-section is to find answers to *SRQ3: What are enablers and challenges to match data between countries in order to guarantee interoperability for cross-border data exchange?*

5.1.3.1 Challenges

It is important to discover the regional readiness for intelligent public employment service adoption, on the other hand, challenges and issues must be addressed. Some interviewees pointed out that currently even many ministries are not sharing data, meaning that institutions and systems are siloed. Field expert pointed out that in Finland, there are some government level developments in regards interoperability and cross-border data

exchange, but they are not widely used. According to that, Finland has guidelines as well as supporting platform [92] for semantic interoperability, which is part of EIF guidelines for regional implementation, however, the toolset is not widely used.

Main issues pointed out:

- Data
- Readiness

Table 6 *Challenges of current cross-border service provision. Source: Author*

Type of Issue	Description
Data	1. Toolset is not in use yet, but it's on the agenda of the Minister of Finance, to try to persuade the different ministries, at least to start to market the tool (Interviewee 3) 2. Siloed institutions and systems - There should be one, one additional ministry domestically that will have the power and knows answers- how to provide information for services, because in current silos everybody's looking at their own perspective upon you (Interviewees 1,2,6) 3. Data not exchanged (Interviewee 1) 4. Privacy of data - Organizations and officials tend to more guard their data than share it (Interviewees 1,2,3,5,6) 5. Data storage measures (All interviewees) 6. Too many laws regulating data exchange (All interviewees) 7. Not many laws and legislations entered into force yet, but are in the European Parliament under review. 8. When it comes to the actual information about the applicant there we would rather like to follow the EU core vocabularies developed by Interoperable Europe, these are not standards

	because they are not in in, they're not developed in, in standardization or organizations as CEN or ISO. But they are quite close to data standards in that that field (Interviewee 3) 9. Currently domestically, data is not exchanged between institutions (Interviewee 3)
Readiness	1. Bottom level of domain knowledge on the domestic market – have to acquire new skills, capabilities and new ways technologically, for instance, to share information to enable new kinds of service processes (Interviewees 3,5,6) 2. Identification/authentication – currently there are under development many solutions that would ease EU citizen registration, identification and authentication (Interviewees 1,2,3) 3. Public institutions are not sure whether there is public interest in these services (Interviewee 2) 4. Missing business perspective - we don't do it this because there's technology, but we do this because there's a need for the information (Interviewees 2,4,6) 5. previous experiences in regards to creating technologically excellent services that nobody uses (Interviewees 3,5,6)

5.1.3.2 Enablers

All experts understood the concepts of interoperability and data exchange procedures. Main findings can be seen in the following table 7.

Table 7 *Enablers of current cross-border service provision. Source: Author*

Type of enabler	Description

Data	1. Making use of existing EU data models, when collecting data on applicants. (Interviewees 2,4,5) 2. When it comes to the actual information about the applicant there we would rather like to follow the EU core vocabularies developed by Interoperable Europe, these are not standards because they are not in in, they're not developed in, in standardization or organizations as CEN or ISO. But they are quite close to data standards in that that field. 3. Distributed ledger system is a solution to protect data, to avoid tampering and to provide trustworthiness of the data that we put in. (Interviewee 6) 4. In case the data is inaccurate at the source, there are two cases, the data is not accurate at the source or there is possible false data injection. In the other case, there is possibility to protect data, because we have the right data on blockchain and can compare received data and whether if it's the right one. (Interviewee 6) 5. And with this, we also reply to some legal issues. So, on high level there is in the GDPR the possibility to correct decisions to rollback certain false information. With this way one can roll back, and remove some data, is helping to correct the trained model by going back (Interviewee 6)
Readiness	1. Semantic readiness- creation of a tool set for the public sector organizations to create common understanding about the information that they have stored in their data silos (Interviewees 3,5) 2. Producing and publishing common terminologies (Interviewees 3,4,5,6)

	3. Producing and publishing conceptual models and data models and all kinds of building blocks, then building of concrete interfaces between these systems (Interviewees 3,4,5,6) 4. Based on legislation, we have an information management and data governments act, that basically requires public sector organizations authorities to start to like make inventories of their data and publish. Information in this sense and start to create interoperable interfaces and also enable data sharing (Interviewees 1,2,3)

5.1.4 Overall situation using international classifications in Finland and Estonia

The skills and competencies classifications in Estonia and Finland are mapped, but are using different approach to the same occupational framework (ISCO-08). Even though the countries use the same frameworks, the data is scattered between different institutions making the local communication complicated and putting definite limitations to cross-border communication. Author asked from Finnish KEHA experts about the current service provision and whether Finland has adopted ESCO taxonomy, and the experts answered: "*The situation regarding the adoption of ESCO in PES Finland is excellent. PES Finland has already adopted ESCO classification for both Job Vacancies and CV:s. We also use ESCO skills in our systems. We are ready to adopt the new ESCO-version 1.1. The deadline for implementation was June 2021 but few member countries met the deadline*". Whether there are other labour market services using classifications, experts answered accordingly: "*Besides TE Offices, Statistics Finland is responsible for collecting data files on society and promoting the use of ISCO-based national classification of occupations. All public authorities in Finland use a defined classification of occupations. Occupational classifications are widely used by the private sector as well."* Other expert pointed out, that "*The Finnish Ministry of Economic Affairs and Employment has this new kind of job site that has the smart matching capability and they are using the ESCO standard."*

6 Discussion and Recommendations

In this chapter the author will provide reflection of outcomes through Discussion as well as Recommendations with future prospect of the conducted research.

6.1 Discussion

Main Research Question (MRQ): **How can Public Employment Service provision be advanced with raised focus on interoperability and technologies involving artificial intelligence?**

The state of the art gave overview of existing standards, rules, AI-methods and currently available public employment services in two of the EU member states. Emerging technologies and supporting legislations have enabled EU member states develop more intelligent systems to support citizens and enhance cross-border communication. However, it came into light that on Pan-EU level, there is a complete lack of legislations and regulations on AI and distributed ledger technologies. Meaning that although regions are developing intelligent systems that are using data, there is still no clear neutral definition between member states when it comes to AI systems. On the other hand, taking into consideration EU Member States feedback on EIF and on what level currently public sector institutions are communicating on international level, then it imposes major challenges. Moreover, if the citizens would like to migrate to another country for career path change, whether on study or employment purposes, then the public sector services might need more proactive approach. Nevertheless, considering EU target for Single Digital Market, empirical findings indicate that in regards human-centred intelligent system development, other regions are taking lead (e.g. Korea, Singapore).

As there is no standardised understanding of occupations and skills it is in relation negatively impacting cross-border and regional labour migration and retraining opportunities. To offer services that correspond to recent technological possibilities and are tailored to citizens' needs, it is necessary to collaborate. One of the interesting discoveries from in-depth interviews was that one of the experts who participated in similar project this thesis is giving input to, discovered that one of the reasons their project failed was because schools don't have unified ways of curriculum description available. Meaning that in order to synthesise data between different institutions (curriculums and

learning outcomes from universities and job listings from employers) data needs to be restructured to be more harmonised in order to be comparable and find connections: *"Currently universities have all separate descriptions of their curriculums and learning outcomes. However, this text is not comparable with available job listings."* This means that in order to harmonise data between PES systems, additional changes in current education system needs to be considered. This is needed that both qualifications and skills acquired from studies would be comparable with PES system job offers.

SRQ1: What are the administrative challenges when creating intelligent public employment service?

On administration level, there were few challenges mentioned. One of them was reachability. On government level it is important to create services where everyone is involved so this is why the public service innovations take longer than usually. First all of the target groups must be considered as well as vulnerable groups who, when talking about using intelligent PES systems, might have limited access to technology or even electricity. Main finding was the institutional siloes (different ministries not communicating) is the one thing hindering service development. Experts pointed out that currently administratively it is very hard to make decisions as ministries are not collaborating enough. Also, experts pointed out and raised concern, that in case there is some bigger EU initiative to follow, it probably will not be fully utilised.

SRQ2: What are the organizational challenges when creating intelligent public employment service?

There were many organizational issues mentioned, one of the most popular answer was lack of experts. Findings from the Estonian national audit report [80] is also supporting the mentioned issues in relation to lack of experts. As these issues were also related to the ageing population, there is a lot of work politically that governments locally and on cross-border levels needs to consider to strive for improving prospects of digital single market. "*I think there should be one, one additional ministry in Finland that would be kind of a cross silo ministry having the power and answer- how to provide information for services, because in current silos everybody's looking at their own perspective upon you."* Experts pointed out that currently administratively it is very hard to make decisions as ministries are not collaborating enough. Also, experts pointed out and raised concern, that in case

there is some bigger EU initiative to follow, it probably not be fully utilised, but will be more like a to-do list. This all raises big concerns that in case we would like to see bigger changes in current services, more educated decision-makers are needed to avoid stigmatism as advancing world needs more intelligent systems. On the other hand, also, initiatives must be fully implemented to see their impact as just ticking the boxes will not bring desired outcomes. Also, from empirical findings, as ESCO is missing united mapping, there is no holistic view and consistency between internally in public institutions as well as between regions. Meaning that currently EU member states are not able to communicate in united language as not all have fully implemented EC guidelines.

SRQ3: What are enablers and challenges to match data between countries in order to guarantee interoperability for cross-border data exchange?

As based on state of the art and research results, semantically both in Estonia and Finland there are available prerequisites and they are already exchanging data across borders. Still interoperability issues were one of the most common issues when talking about cross-border communication. Also, eID evaluation [46] that found out many weaklings in current eIDAS solution in regards interoperability that means that authentication etc. might be working locally but not enabling cross-border communication and data exchange with other EU Member states. On the other hand, there are developed solutions like eDelivery, but there are currently very few use cases and eDelivery component implementation is quite resource intensive. There are technical descriptions available but these are understandable only for IT specialists, meaning that either Policy Domain Owners, Software Providers or Service Providers would be able to integrate the system to their backend [93]. This in turn is making the eDelivery concept very hard to understand for regular citizens and might be reason not a single interviewee mentioned this solution.

As there are also been many news on implementation of cross-border interaction between Finnish and Estonian registries, author had opportunity to ask structure of current data being exchanged and experts gave insights, that there are ongoing developments in that field. Although from news we can hear that data is being exchanged on daily basis, the data is missing specific structure.

As the answers were inconsistent, the author decided to additionally investigate how the current TE offices are operating and how the EU citizen can access and use their PES system. Results can be seen on the ***Figure 12*** attached in Annex 2 can be seen that information is fragmented, resulting in scattered frameworks and data siloed between different employment institutions. As an EU citizen there is no convenient way to register oneself as a jobseeker in Finland and also additional limitations to access became a light. On one hand, TE offices promise EU citizens that they are able to use online services fully. Although the identification and authentication with eIDAS worked, author as EU citizen, did not have actual access to online services.

6.2 Recommendations

In order to advance Public Employment Service provision with raised focus on interoperability and technologies involving artificial intelligence, it is important to consider both the enablers and challenges to match data between countries in order to guarantee interoperability for cross-border data exchange.

While the focus is to enable more data exchange then for that there are already existing initiatives in place supporting the implementation. However, on administrative and organisational level, there has to be enough public officials with sufficient level of digital skills and literacy to implement these solutions. For that EU has been investing and will be supporting the member states more to be able to provide needed basic to advanced skills for all citizens who are interested in acquiring them. This is also time for universities and other retraining institutions to take the lead and support public employment services. As in order to harmonise data between PES systems, additional changes in current education system needs to be considered that from grass-root level until to job listings, all data sets are unified. This in turn enables comparing the available job listings and retraining opportunities, as all qualifications and skills are unified and will be able to analysed by intelligent system.

Tackling the organizational challenges when creating intelligent public employment services means that institutions should avoid working in siloes. This in turn enables more collaboration and understanding what each department is working on. If the idea is to develop intelligent PES system, it does not mean that only ministry of social affairs or ministry of employment should work on. It needs additional help from ministry of

economic affairs (responsible for Digital Agenda 2030 implementation and supervision) and ministry of foreign affairs as labour market is already bypassed the provision of service on domestic level but it goes beyond borders.

When tackling the administrative challenges when creating intelligent public employment service, one way is to produce common data models and concepts. This way all institutions are talking in the same language when it comes to either standards or guidelines on data exchange. This also enables interoperability and could ease sharing best practises.

As the European Skills, Competence and Occupation (ESCO) classification standards could be the primary data source for development and training of intelligent system, the project goes beyond just project partner countries. ESCO is translated into 28 EU member state languages, enabling the potential to create country-specific public employment service pilots for all member-states. The approach is to unify classification and agree on consistent formats, and as a result, the data exchange and service provision for the citizens will be regionally and transnationally improved, potentially reducing skills mismatch on a pan-EU level. Author has created possible TO-BE model (***Figure 11***) on how the data exchange between two-member states could possibly take place using nationally mapped out ESCO taxonomy and eDelivery access points between existing e-services.

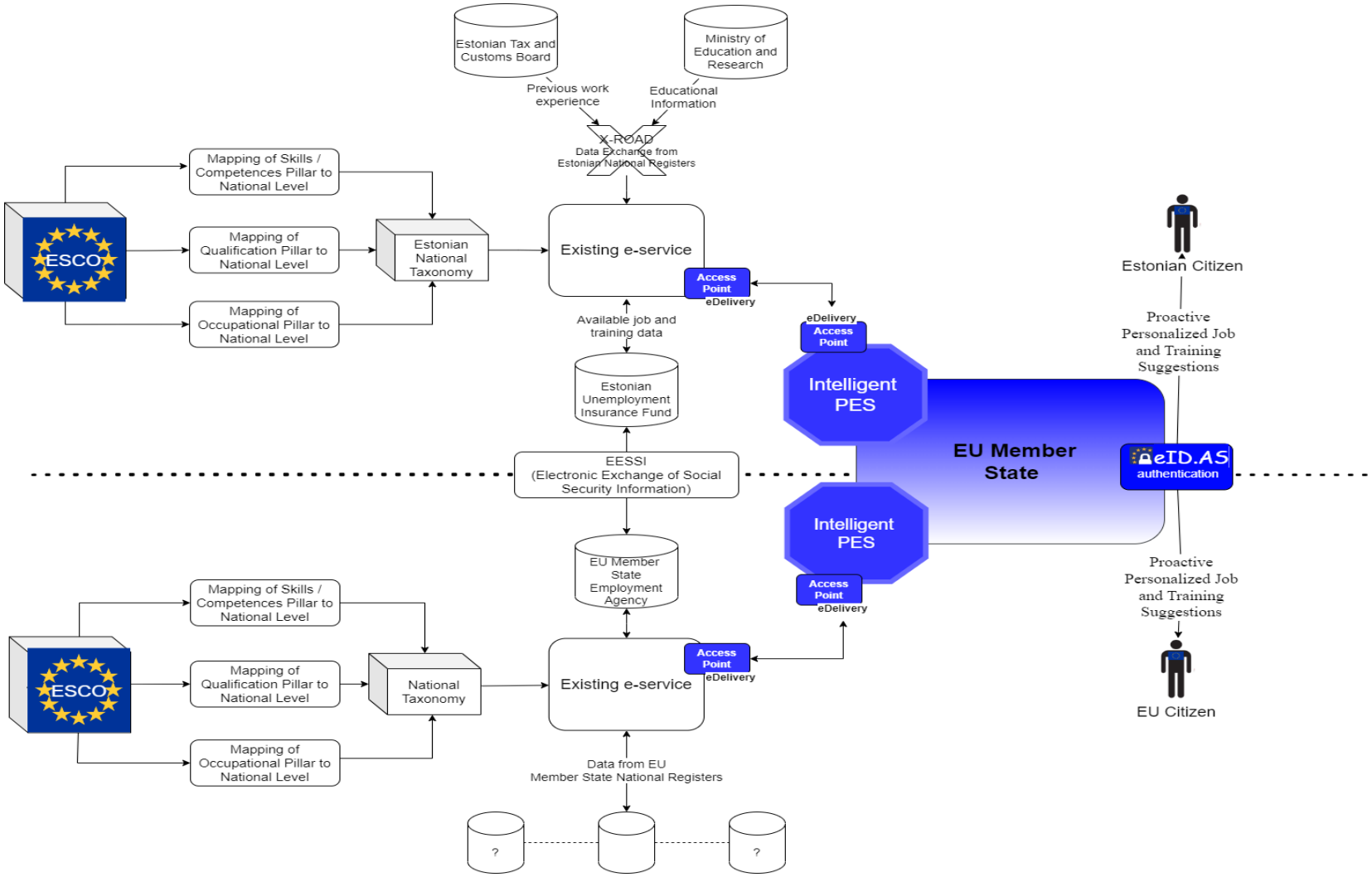


Figure 11 *TO-BE possibilities of data exchange between EU PES using intelligent system. Source: Author*

7 Conclusion

This thesis research purpose was to analyse current situation in the national and transnational employment markets and derive recommendations in order to create intelligent citizen-centric public employment service that goes beyond borders. Based on the state of the art and outcomes, the two-member states have all prerequisites and potential to create more intelligent public employment services. However, considering the qualitative results, there are many challenges before cross-border collaboration is able to start. Despite the enabling factors from administrative and organizational perspective, there are many hindering factors and one of the most crucial being the governmental siloes. If the aim is to create more collaborative solutions, the institutions need to cooperate and communicate on both domestic and transnational level. This could also enable better overall cooperation to share best practises and major challenges that could show positive impact and foster advancements.

While the goal is to enhance job and upskilling recommendations, while supporting data exchange between organizations in the public and private sector, using unified and translated ESCO taxonomy could be the key. However, to activate more citizens and various target groups, one opportunity could be matching ESCO skills and occupational classifications with citizens' previous education and work experience to recommend jobs and training opportunities. This will build a more citizen-centric system with wider career opportunities for end-users to help find employment and training opportunities for all ages in the work force which will help improve public service provision and alleviate inefficiency in the labour market. As cross-border dimension in European PES area is increasingly crucial, the outcomes of this research including administrative and organisational aspects can be used for reaching intelligent labour market services that is scalable.

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Appendix 2 Interview questions

1. Please describe shortly your current position and assignments in … (organization stakeholder was representing)?

2. What is the aim of (…)? / *Organisation/project interviewee is representing*

3. What are the main challenges related to implementing intelligent public employment service?

4. Is there a need for adjustments in administration to take intelligent public employment services to next level (cross-border)?

5. Do you think there is possibility to have cross-border collaboration with Estonia?

    a. If yes, could you specify in what sectors?

6. Can you bring some examples, what international data classifications and standards are used to match data between countries in order to enable interoperability for cross-border data exchange?

7. To what magnitude are adjustments in administrative system required to be able to offer intelligent service provision?

8. If at all, what adjustments should take place organizationally in Finland to be able to offer intelligent public employment service?

9. Can you bring out some different examples of existing cross-border interoperability solutions and ongoing initiatives for digital public service provision?

10. How would you evaluate efficiency and necessity of the existing cross-border interoperability solutions and ongoing initiatives for the digital public service provision in your area?

11. Which are the deficits you have identified so far in existing solutions and initiatives?

12. Can you describe the current process between citizen and … when the citizen is employed?

13. How is cross-border data structured when exchanged between Estonian - Finland population register/tax authorities?

Appendix 3 Current concept model of TE-office service provision

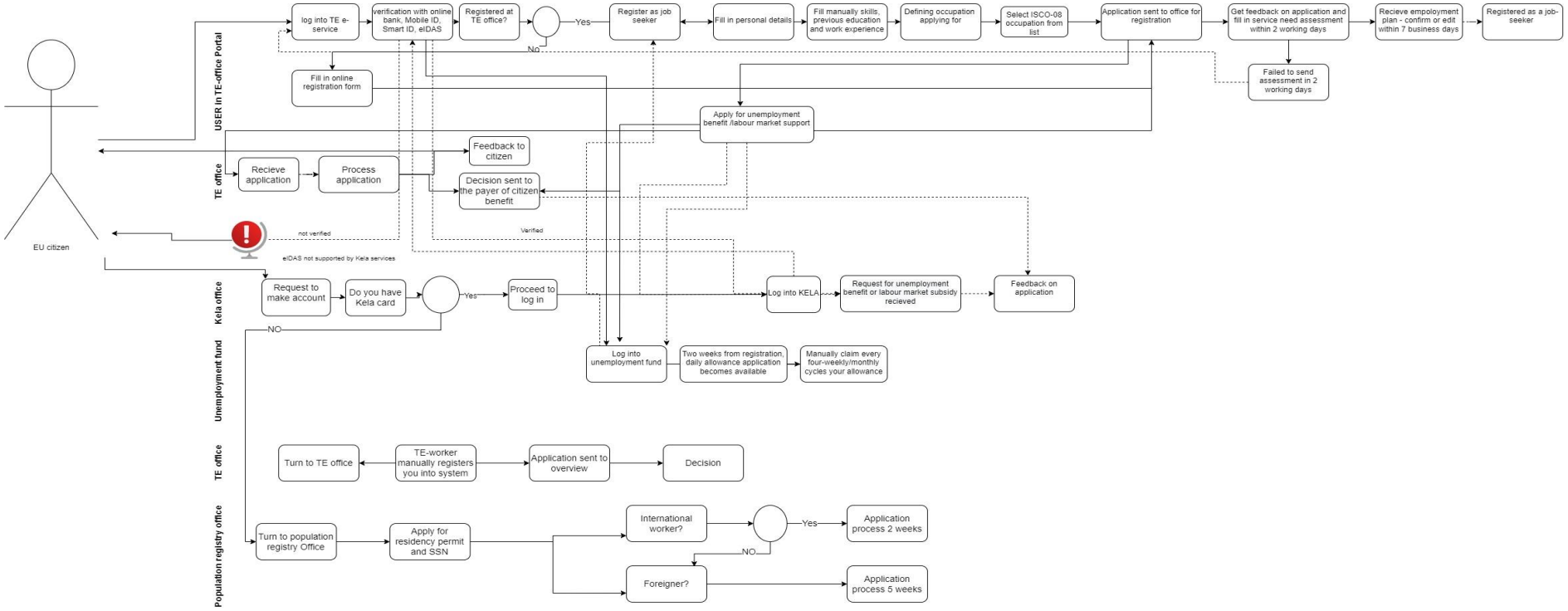

Figure 12 *AS-IS current concept model of service provision by TE-offices for EU citizen*