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VOCATIONAL EDUCATION AND TRAINING FOR THE FUTURE OF WORK

ESTONIA

CEDEFOP REFERNET THEMATIC PERSPECTIVES

Vocational education and training for the future of work: Estonia

Policy strategies and initiatives to prepare vocational education and training (VET) systems for digitalisation and future of work technologies

REPUBLIC OF ESTONIA
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Table of contents

CHAPTER 1.

Impact of digitalisation in Estonia

Estonia started building the information society about two decades ago, before the people had the internet or digital devices and no digital data were being collected about citizens. Today, 98% of Estonians have a national ID-card and 99% of public services are online with 24/7 access. Estonia has been a pioneer of eGovernance for over 20 years now and has one of the most efficient public sectors per capita globally, mainly due to the availability, accessibility and use of public e-services ([1]).

In the *European Commission Digital Economy and Society Index* (DESI) *2019*, Estonia ranks 8th out of the 28 EU Member States. Estonia continues to perform well in the Digital Public Services dimension and the Human Capital dimension, and has particularly improved in terms of Human Capital, scoring well above the EU average. In previous years, Estonia has scored low in the Integration of Digital Technology, but DESI 2019 indicates improvement in this dimension. The Use of Internet Services remains consistently high in Estonia. Overall, DESI 2019 is showing high performance levels for Estonia across the majority of dimensions, alongside significant improvement in others. The key challenge in the Estonian economy is the Digitalisation of Companies. Due to the structure of the Estonian economy (i.e. more than 130,000 economically-active enterprises, of which only a little more than 180 are large enterprises; a relatively small share of industries with high added value and productivity), companies are still not fully exploiting the opportunities offered by digital technology ([2]).

According to the *International Civil Service Effectiveness (InCiSE) Index*, Estonia is at the top position for digital services, including strong IT policies and investments in IT infrastructure ([3]).

The above is confirmed and further explained by Estonia´s lower position in the *IMD World Digital Competitiveness Ranking*, which measures the capacity and readiness of 63 economies to adopt and explore digital technologies as a key driver for economic transformation in business, government and wider society. Estonia ranks 29th among the 63 countries, scoring high in training and education, technological capital and framework, IT integration and adaptive attitudes – and lower in talent policy, scientific concentration, regulatory framework and business agility.[4]

([1]) https://e-estonia.com/

([2]) https://ec.europa.eu/digital-single-market/en/desi

([3]) https://www.bsg.ox.ac.uk/sites/default/files/2019-04/InCiSE%202019%20Results%20Report.pdf

([4]) https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2019/

Regarding the impact of digitalisation and AI/automation on the Estonian labour market, the estimates differ, and the realisation of possible future scenarios will largely depend on the success of the measures that are being or will be implemented in the interaction of education and research, employment, and economic and digital policy.

According to the Future of Work Report by McKinsey&Co, Estonia is one of the nine Northern European countries that are among the world's most advanced digital economies. Successful digitalisation could create 30,000 new jobs in Estonia (incl. 9% more digital jobs and 24% more jobs in the service sector). Productivity growth will also increase Estonia's international competitiveness, bringing jobs with higher wages and higher levels of self-fulfilment. Non-digitalisation of jobs, on the other hand, threatens to reduce competitiveness, bring along job losses, economic stagnation and 3.4% decrease of Estonia's GDP per capita by 2030. In the framework of the positive scenario, digitalisation does not mean job losses, but rather the creation of new jobs ([5]).

For Estonia to achieve the same high-tech/low-tech ratio in economic structure as Finland by 2025, Estonia's high-tech or knowledge-intensive industry and service sector would need about 30,000 new employees as well as ca 30,000 jobs. At the same time, in the low-tech manufacturing industry there would be over 21,500 jobs and a surplus of workers ([6]).

Based on an Estonian labour market forecast, in 2026 the number of employees will be about the same as in 2017, but there will be an increase in occupations related to ICT, health care and social services, and the number of employees will drop in the fields of public administration, retail trade, agriculture, apparel, the textile and leather industry, and storage and transportation ([7]).

Regardless of the scenario, it is acknowledged that in order for the country to benefit from digitalisation, there is a need to promote ICT careers and studies, raise the quality of higher education in the field, and step up retraining and continuous training of workers with lower levels of qualification, especially for digital skills.

Since 2017, the Estonian Unemployment Fund has provided services aimed at the prevention of unemployment. These services are targeted to employees who need support in changing jobs or maintaining employment due to a lack of skills or skills obsolescence, as well as to employers to support them in finding and training

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([5]) https://www.mckinsey.com/featured-insights/europe/shaping-the-future-of-work-in-europes-nine-digital-front-runner-countries

([6]) https://oska.kutsekoda.ee/wp-content/uploads/2016/04/Tulevikutrendid-1.pdf

([7]) https://oska.kutsekoda.ee/wp-content/uploads/2019/06/Estonian-Labour-Market-Today-and-Tomorrow-2018.pdf

suitably skilled workforce and restructuring their companies. The new services mainly focus on preparing workers for professions that, according to the labour market monitoring and future skills forecasting system OSKA survey, will be of growing importance in the coming years and which already lacks skilled workers.

In conclusion, Estonia is at the forefront of digitalising the public sector and developing e-services. The situation is more complex in the private sector. The effects of digitalisation and automation have not yet taken effect, as these developments are hampered by relatively low wages and the structure and small size of the Estonian economy. In sectors where workers, based on the global experience, could be at greater risk of becoming unemployed due to automation (care services, trade), there is as yet no pressure to automate services due to relatively low wages. The arrival of innovations involving entire economic sectors (e.g. self-driving cars in transportation) in Estonia are delayed by our small economy and peripheral location. Micro and small business employers lack the resources and capacity to develop the skills of their employees.

CHAPTER 2.

VET policy strategies to adapt to digitalisation

Vocational education and training forms an integral part of the Estonian education system and is being developed in conjunction with the other levels and types of education. The following overarching policy strategies address, inter alia, the adaptation of VET to digitalisation:

- **The Estonian Information Society Strategy** (in force until 2020) sets up conditions and an overall framework in terms of legislation and infrastructure, and in two measures also addresses the issue of increasing digital literacy and development of higher ICT skills;
- **The Estonian Lifelong Learning Strategy** (in force until 2020) provides more specific directions regarding the development of VET and digital skills, and establishes the necessary preconditions in terms of educational infrastructure and the competency of educators to prepare learners for digitalisation;
- **The new education strategy 2021–2035** (in process, and will enter into force in 2021);

2.1. Estonian Information Society Strategy 2020

The Estonian Information Society Strategy (or the *Digital Agenda 2020 for Estonia)* aims to increase economic competitiveness, the well-being of people and the efficiency of public administration by creating an environment that facilitates the use of ICT and the development of smart solutions in Estonia. The agenda is under the jurisdiction of The Ministry of Economic Affairs and Communications and focuses on the development of infrastructure (completion of the next generation broadband network available to the majority of the population), public e-services (updating ICT solutions, cross-border expansion and wider use among citizens), data policy (privacy issues), the public sector´s capacity to apply data analytics, and enhancing the competitiveness of the ICT sector (doubling the number of people employed in the ICT sector by promoting careers and studies and raising the quality of IT education) ([8]).

The vision is that in Estonia, the possibilities of information and communications technology (ICT) are used to the full extent in cooperation with the public, private and third sectors ([9]).

([8]) https://www.mkm.ee/sites/default/files/digital_agenda_2020_estonia_engf.pdf

([9]) https://oska.kutsekoda.ee/wp-content/uploads/2016/04/Tulevikutrendid-1.pdf

The measure on increasing digital literacy for improving personal well-being involves actions such as ICT training projects both in formal and informal education, curricula development and promoting the use of ICT in academic and specialty studies.

The measure on the development of higher ICT skills involves actions to create more higher value-adding jobs, including professional development or retraining of people with low or obsolete qualifications; increasing the share of ICT professionals in the total employment spectrum by supporting and promoting ICT studies; supporting acquisition of higher ICT skills within other VET and HE study programmes beyond the ICT field and in other sectors of the economy, in particular in the fields of smart specialisation.

2.2. Estonian Lifelong Learning Strategy

The Estonian Lifelong Learning Strategy ([10]) (LLS) forms the basis on which the government makes its decisions for educational funding over the years 2014-2020 and for the development of programmes supporting the achievement of necessary changes. The goals and measures of LLS are concordant with the national reform programme *Estonia 2020* ([11]), with the Estonian national strategy for sustainable development, *Sustainable Estonia 21*, and with the fulfilment of the education-related goals of the *National Security Concept of the Republic of Estonia*.

The strategy has five strategic goals:

(1) change in the approach to learning;
(2) competent and motivated teachers and school leadership;
(3) concordance of lifelong learning opportunities with the needs of the labour market;
(4) a digital focus in lifelong learning;
(5) equal opportunities and increased participation in lifelong learning.

In the context of vocational education, the following measures address key aspects of digitalisation:

(a) incorporating digital culture into the learning process at all levels of education and in all curricula. This includes the introduction of new directions in pedagogy and the organisation of education that are inspired by technological

([10]) https://www.hm.ee/sites/default/files/estonian_lifelong_strategy.pdf

([11]) https://www.riigikantselei.ee/en/supporting-government/national-reform-programme-estonia-2020

innovation, as well as supporting school leadership, teachers, and learners in using educational technology;

(b) ensuring the availability of digital learning resources to support the objectives and the achievement of the study results outlined in the curricula of VET institutions, including e-textbooks, interactive exercises, open educational resources, teachers' guides, and web-based assessment tools;

(c) providing learners access to a modern digital infrastructure that supports learning, including schools' digital infrastructure and personal digital devices for their studies, which will make the interoperable information systems and services of the State, the local governments, and the schools accessible to all learners;

(d) creating and implementing assessment models for digital competence (for teachers, students, school leaders, adult learners), including the establishment of a grading system for the recognition of achievement.

2.3. New education strategy 2021-2035

The above-mentioned strategies will be valid until 2020 and the majority of the activities in their scope are already in the pipeline. The Ministry of Education and Research, together with partners from education and the labour market sectors, are in the process of developing a new *Education Development Plan for 2021-2035*, which, for the first time, articulates the challenges and potential courses of action directly related to digitalisation.

The strategy is still under development, but it is clear already that it will have a strong focus on the continuous development and updating of skills in lifelong learning and the matching of skills to labour market requirements. In the draft strategy, attention is paid to the ongoing technological developments in the field of artificial intelligence, digitalisation and automation and their impact on teaching, learning and the world of labour. As a part of developing the career services system and helping the learners to analyse their knowledge and skills, digitisation of the educational path of each learner (digital documentation of education history) is planned. Flexible learning paths supported by learning analytics and AI have been mentioned in the vision documents underlying the strategy development. Specific measures to adapt VET to technological challenges and labour market developments will be developed in the coming years.

CHAPTER 3.

VET 4.0 initiatives and programmes

Implementation programmes have been developed to support the achievement of the *Estonian Lifelong Learning Strategy* objectives. Digitalisation in VET is addressed in the *Digital Focus Programme*. The programme is funded from the Estonian state budget, which is supplemented by resources from the EU Social Fund and Regional Development Fund.

3.1. Digital Focus Programme

The Ministry of Education and Research (MoER) ([12]), in cooperation with its partners, implemented the *Digital Focus Programme 2016-2018* and is currently implementing its continuation for 2019-2022 ([13]). Its objective is to devise a comprehensive approach to the development of digital competences and to contribute to the more expedient and effective use of modern digital technology in learning and teaching in all types and levels of education, including VET. The programme involves two measures:

3.1.1. Incorporating a digital culture into the learning process

This measure supports strategic goals 1, 4, and 5 of the *LLS*, with the objective of developing the digital competences of learners and teachers. Teachers will be provided with needs-based training in digital skills. In addition, e-tests designed for use in the theoretical part of the occupational qualification certificate examinations will be piloted.

In early 2016, a digital competence model for students was developed to describe the different subskills of digital competence in accordance with the age of the students. The training of teachers to prepare them for supporting the development of students´ digital competences was provided by the Information Technology Foundation for Education (HITSA) ([14]). The training covers the following topics:

(a) creating digital learning resources;
(b) students with special educational needs;
(c) learning processes in the digital age;

([12]) https://www.hm.ee/en.

([13]) https://www.hm.ee/en/activities/digital-focus

([14]) https://www.hitsa.ee/en

(d) national and international cooperation networks for teachers in the field of digital education;
(e) technology education;
(f) safer Internet.

In 2016-18, 3,940 teachers of general and vocational education (over 10% of all teachers) attended digital skills training and webinars. In addition, teachers and schools can apply for support for their digital development activities from the open applications of the European Social Fund. In order to consolidate and implement the skills and knowledge acquired in trainings in daily activities, HITSA, on behalf of MoER, supported the schools in purchasing digital equipment for teachers and computers necessary for e-assessment.

The e-tests designed for occupational qualification certification are developed by the qualification-awarding institutions in cooperation with the Innove Foundation examination centre. In 2017-18, e-examinations were developed and piloted in six areas.

3.1.2. Creating the conditions for incorporating digital culture into the learning process

This measure supports Strategic Goal 3 of the *LLS*, with the objective of using high-quality digital learning resources for more effective learning and teaching with maximum consideration for the learner's needs. Modern and innovative digital learning resources and e-services will be introduced in general and vocational education to support individual development, creativity and innovativeness in the learner, the acquisition of the necessary digital competences, as well as supporting the general organisation of education. In Estonia, learning resources have mostly been and are being developed on a commercial basis, led by expert groups and publishers. Minimum substantive and technical requirements have been developed to guarantee their quality. Publicly-funded learning resources must, where possible, be distributed with a free license, allowing users to update and upgrade the learning resources and to ensure their longevity.

In order to achieve the goals of the *Digital Focus Program 2016-2018*, it was necessary to map the current state of digital capability of VET institutions. To this end, the Education Information Technology Foundation HITSA, in collaboration with heads of VET schools and educational technologists, adapted the self-assessment model created for general education schools to monitor and assess the digital maturity of VET institutions. Self-assessment can be completed using an e-assessment instrument called DigiPeegel (Digital Mirror). By 2019, all VET schools have undergone the assessment.

In addition, 2016 marked the beginning of the adoption of a support measure, launched by the Ministry of Economic Affairs and Communications, for modernising the network connectivity of schools.

In 2018, by the end of the first programme period, the incorporation of digital culture into education and learning activities was considered complete, but not yet systemised. The activities are continuing during the second programme period, 2019-2022.

3.2. IT Academy for VET

The IT Academy for VET is the main measure of the Digital Focus Programme for supporting the conditions necessary for incorporating a digital culture into the teaching and learning processes in VET. The aim of the initiative is to make IT-related vocational training more responsive to the needs of the labour market. To ensure this, the IT Academy is operationalised in cooperation with the Estonian Association of Information Technology and Telecommunications, higher education institutions offering IT programmes, and businesses. It is supervised by the MoER, and the Ministry of Economic Affairs and Communications.

The Academy contributes to improving the quality of IT education in vocational schools to make IT curricula more attractive to potential students; ensure the quality of the curricula and teaching; and motivate students to continue their studies in applied higher education or undergraduate studies after graduation. The programme helps develop vocational schools into centres of competence through sectoral specialisation to promote and disseminate best practices and thereby raise the level of teaching quality in other schools as well.

The ICT sector in Estonia is constantly growing and, according to the *Vision 2020 for the ICT Sector* strategy of the Estonian Association of Information Technology and Telecommunications (ITL), it is important to double the ICT sector's entire workforce. In order to reach this goal, high-quality education is of key value. Developing curricula in vocational education, applied higher education and undergraduate levels is important, as entrepreneurs report that the teaching in post-primary vocational education is of varying quality, the levels are uneven, and the teaching of IT skills in ICT and adjunct curricula is insufficient to meet the needs of employers. Furthermore, due to their age, the graduates of this level are often lacking in social skills, analytical ability, independence, and in their ability to perceive the broader picture – all necessary for working in ICT.

Therefore, the programme aims to:

(a) increase the number of strong IT specialists who have already specialised in a specific field by the end of basic school;

(b) raise and stabilise the quality levels of curricula and teaching and ensure that students are motivated to carry through with their studies to the end;
(c) create the conditions that encourage graduates to go on studying IT at a higher level of education.

In order to achieve these goals, a four-year curriculum will be created, the first year of which will give the learners an overview of different areas of information technology. After the first year, the students may specialise in one of the two curricula of the ICT curriculum group: *database and network design and administration* or *software and applications development and analysis*. Greater emphasis will be put on preparing graduates for higher education. For this purpose, Estonian, mathematics, and English will be taught to an increasing extent and higher education institutions will be involved via substantive cooperation.

The pilot programme for renewing curricula was launched in the autumn of 2018, and the first three pilot schools were ready to admit student in spring and autumn 2019. The interest in the renewed four-year curriculum was high – the schools planned to admit 150 students but finally allowed 162 to be enrolled. After the pilot programme, it will be possible to use the experience gained to continue updating the curricula in schools that do not participate in the first phase.

The effect of the pilot programme can principally be measured by the share of graduates going on to study at a higher level of education, with the target being 20% of the total number of alumni.

The programme has three major strands:

1) Developing the competences and motivation of teaching and organisational staff

The main problematic issues in vocational schools are the current level of teaching (including in general subjects), an aging teaching staff, the level of use of ICT digital technologies, and the quality of coaching in traineeships, etc., which means it is important to turn attention to increasing the competencies of teaching and organising staff. For that purpose, the pilot programme involves:

(a) developing the competencies of teachers and practitioners involved; training courses and master classes;
(b) traineeships in businesses for teachers;
(c) visits abroad for school teams and teachers and exchanging international experience;
(d) training the next generation of teachers.

2) Developing learning resources

In parallel with updating curricula, the existing learning resources are being improved. According to a study conducted by the Innove Foundation in 2018 for mapping learning resources, ca 25% of the curricula in the *Software and applications development and analysis* curriculum group are covered by digital resources and their quality has been approved as good. The curricula of the *Database and network design and administration* curriculum group are covered in the 50% range, and the quality of the materials has been rated as very good.

The programme evaluates the need for learning resources (teacher guidelines, systematic study materials for learners, theoretical and practical tasks created in collaboration with businesses, simulations, learning games, etc.), and assesses the possibilities for adaptation from general education or translation from English.

3) Curriculum marketing activities

In Estonia, the academic path leading to general upper-secondary education and subsequently university is the predominant one after graduation from basic education - the vocational path being less popular. Therefore, marketing activities and messages about VET opportunities targeting both students and parents are important.

In order to encourage more high-level basic school graduates to opt for ICT studies in VET, different aspects are emphasised in marketing:

(a) studying at a vocational school has the advantage of allowing the student to focus on ICT and not having to spend time on secondary school subjects that do not interest or suit the student;
(b) ICT provides exciting employment prospects;
(c) the studies provide an experience that can be used to make an informed decision on further learning;
(d) the updated curricula have a strong level of teaching in general subjects, including mathematics, Estonian, and English, which lays a solid groundwork to continue studies in applied or academic higher education;
(e) outlining other strengths of the curriculum, including cooperation with businesses and other educational institutions.

Other important aspects of planning and conducting marketing activities include cooperation between schools, involvement of professional associations and the Innove Foundation, and the reputation of VET among the promoters of the activities in the field.

3.3. Digital learning resources in general and vocational education

In 2018, the MoER, in cooperation with its partners, launched *The diversified and high-quality education with digital learning resources* ([15]) programme, funded by the European Social Fund.

The programme involves the modernisation of the learning environment in VET institutions and supporting the creation of diverse digital learning resources (simulators, learning games, software, web applications, etc.) and making them available to learners. These learning resources can be, for example, simulations, learning games, digital applications for improving the efficacy of the work of teachers, software, etc. Private-sector and third-sector organisations can also respond to the calls for tenders and are eligible for grants, to ensure the implementation of the best possible ideas and involvement of the best possible expertise in the activities. The total budget planned for the open calls for applications is €3,800,000. In 2018, the purchase of simulators was supported in 14 VET schools. An example of procurement of simulators for Luua Forestry School and their use for modernising and digitalising forestry education in Estonia, is described in the Annex.

In 2019, the second call for projects under this measure was opened, and 25 new projects (including 6 VET projects) were funded.

3.4. Supporting shared use of modern and innovative learning resources: Klass +

In 2017, the MoER initiated a programme to support a shared use of learning resources ([16]). Open calls for applications were organised at the end of 2017 and in the spring of 2018, and the creation of novel learning opportunities was supported in more than 100 schools.

The objectives of the support measure were to:

(a) create novel learning opportunities in Estonian schools;

(b) make learning more practical;

(c) develop cooperation between schools.

([15]) https://www.riigiteataja.ee/akt/115052018005

([16]) The conditions and procedure for granting structural funding for implementing the *Supporting common use arrangements of modern and innovative learning resources* programme: https://www.riigiteataja.ee/akt/112052017007.

The programme entails supporting the acquisition of equipment and setting up labs, the development of teaching materials, teacher training, and covering the accompanying costs for at least three years.

The programme intends to support the shared use of innovative and modern learning resources that would otherwise be too expensive or impractical to purchase due to their low level of use. While the main objective is to enable vocational and general education schools to make learning more practical and up-to-date, the second important goal of the programme is to encourage cooperation between schools and the dissemination of best practices. By sharing learning resources, best competence meets cost-efficiency.

As the resources in question are new and innovative, attention is paid to the methodologically correct usage. For that, teacher training can be arranged and methodological guidelines for teachers as well as study materials for the students can be developed under the programme. The digital learning resources created in the project must be available free of charge via the e-Koolikott portal ([17]).

The total budget planned for the open calls for applications is €10,000,000. The duration of one project may be up to 60 months and not less than 36 months to ensure the achievement of the desired outcomes. An example of a project - STEAM labs - lead by Tartu Art School is described in the Annex.

In addition to the comprehensive programmes described above, a smaller scale initiative Samsung DigiPass is described in the Annex. It is a training programme for VET students to support meaningful, constructive and innovative use of digital technology.

([17]) https://ekoolikott.ee/

CHAPTER 4.

Adapting to AI and automation

Estonia has a two-fold position when it comes to the potential of applying AI-solutions (*kratts)* ([18]). On the one hand, the high level of digitalisation of the public sector, openness of the Estonians towards novel technologies, and the preparedness of the people to implement them create good preconditions for applying AI. At the same time, in most business sectors the companies need to first carry out the primary-level digitalisation of business processes so that they would have datasets to use AI-applications on. Therefore, the starting points and measures of the public and private sector differ. Awareness of artificial intelligence solutions needs to be raised in both the private and public sectors in order for AI to be considered a viable option in solving business problems.

At the beginning of 2018, an expert group managed by the Ministry of Economic Affairs and Communications and the Government Office was established and a cross-sectional coordination project initiated. The tasks of the expert group were to prepare draft legislation to ensure clarity in the Estonian judicial area and organise the necessary supervision; develop the Estonian artificial intelligence action plan; notify the public about the implementation of AI-solutions (*kratts*) and introduce the possible options (e.g. the website www.kratid.ee, idea gathering, etc.)

The AI taskforce concluded that Estonia should start piloting AI-projects to gain initial feedback and experience and then start planning long-term measures. Although several countries have started to prepare their vision and long-term strategy for artificial intelligence, better understanding of the possibilities and benefits, as well as the dangers and risks of using AI, need to be gained through pilot projects, in order to prepare a more substantial strategy.

Estonia implements an agile strategy-development process, wherein a biannual action plan is initially prepared for 2019-2020 and the long-term AI-strategy will be developed based upon it. In the initial phase, pilot projects are launched, and various measures are applied to find solutions that have the greatest impact on the development of kratts.

Research and development activities and education form the basis for creating and applying kratts in both the public and private sectors. The focus is on the education of additional specialists, support of applied research, and awareness

([18]) Kratts - AI in Estonia. In Estonian mythology, a *kratt* is a magical creature. Essentially, *kratt* was a servant built from hay or old household items. Therefore, the Estonian government uses this character as a metaphor for AI and its complexities.

raising among wider audiences. In order to introduce AI-solutions on a wider scale, funding of R&D needs to be increased (the goal is 1% of GDP), a competitive grant for doctoral candidates needs to be established, and investments into IT need to be increased significantly.

In November 2019, Estonia joined the movement *Elements of AI* – an AI Challenge initiated by a technology company Reaktor and the University of Helsinki with the aim of teaching the basics of AI to at least 1% of the population. The Elements of AI is a MOOC ([19]) – a series of free online courses (in total, 2 ECTS) created to encourage as broad a group of people as possible to learn about the implications of AI and its existing and potential applications. The courses combine theory with practical exercises. Estonian was the third country to join the movement after Finland and Sweden. According to the Estonian project coordinator, more than 220,000 people from more than 110 countries have already participated in the course. Forty percent of the participants are women and 25 percent of the participants are over 45.

One of the major goals of the initiative is to raise public awareness and responsiveness to artificial intelligence by refuting misconceptions about AI and by fostering the understanding how AI solutions already today support and improve the lives of people. The AI Challenge has attracted the interest of 35 Estonian companies, including large industry and technology companies, banks, retail companies, public sector organisations as well as training companies and law firms.

Regarding the need for national training programmes with specific focus on assisting adults whose jobs may be affected by automation, the current Estonian AI action plan does not include the topic of adaptation and social impact related to the implementation of AI (e.g. issues of the labour market and retraining of workers). Estonia's problems are more related to the lack of a suitable labour force and the use of kratts can help to relieve this. In the Estonian context, restructuring of the oil shale energy and the low competitiveness of some sectors where lower added value is created, and where people lose their jobs due to restructuring or job displacement rather than automation, are more relevant.

At the same time, it is acknowledged that the future need for the retraining of employees and, therefore, the promotion of retraining activities (and an increase in funding) by both companies and the state needs to be planned. Currently, information on sectoral needs for labour and skills over the next five to ten years is monitored and provided by the labour market monitoring and future skills forecasting system OSKA. The results of OSKA surveys are used in the planning

([19]) http://www.elementsofai.ee/

of study places, for the prevention of unemployment and in the development of labour market services, etc. There are preliminary ideas for using AI methods (cognitive AI) for the development of comprehensive skills classification, for the analysis of training curricula (including VET programmes) regarding their match or mismatch to the labour market needs. In the development of the Estonian Education Information System, the opportunities to exploit AI for the big data analysis are explored. However, there are no existing initiatives to account for.

Adaptation of training offers to the needs of the labour market, including measures for continuous training and retraining, are being developed by the Ministry of Education and Research and the Ministry of Social Affairs. The Ministry of Economic Affairs and Communications has developed measures to support the digitalisation of industries, including increasing productivity and competitiveness in some sectors and improving employees' skills.

CHAPTER 5.
Conclusion

Digitalisation is one of the main instruments to increase the competitiveness of any field of economic and professional activity. Digital competence enables the acquisition of the skills needed by all citizens for taking an active part in social and economic activities in the 21st century.

At the state and education system level, Estonia has good prerequisites to benefit from digitalisation and opportunities offered by AI. Estonia has been a pioneer of eGovernance for over 20 years now and has the most efficient public sector per capita globally. The Estonian eGovernance system can be considered a role model for many large-scale organisations, and compared to the education or business sector, public administration has made the most progress in digitalisation of and applying AI in its processes. In the next decade, the Estonian Government will invest in upgrading its already distributed information architecture to a system operated by autonomous agents, who might be humans, companies, or algorithms. Estonia will start with automated and proactive service delivery, which leads to an invisible government, a stage where communication between citizens or companies and the government is non-existent or minimised (a concept of government as a service).

Digital focus in education (including VET) is one of the national priorities in Estonia and its implementation is supported by the *Lifelong Learning Strategy* and its Digital Focus programme and VET programmes. The general goal of the digital focus is stated in the *Lifelong Learning Strategy*: to devise a comprehensive approach to the development of digital competence and to contribute to the more expedient and effective use of modern digital technology in learning and teaching processes. It should be borne in mind that while the digital focus is being implemented across several levels of education, it also takes into account the actual needs of the schools and supporting the specificities of vocational training (i.e. obtaining simulators). The biggest challenge is implementing the digital focus in a way that is balanced and needs-based. If a school (or country) creates or procures its own learning resources, it will also see to the organisation of the required training courses, instructional materials for both students and teachers and, if necessary, hardware. The learning resources to be created should be freely available to all learners. The activities and projects described in the examples in this article were launched in 2017 or 2018 and will continue to be carried out throughout 2019-2020.

In the draft education strategy for 2021-2035, attention is paid to the ongoing technological developments in the field of artificial intelligence, digitalisation and

automation and their impact on teaching, learning and the world of labour. Specific measures to adapt VET to technological challenges and labour market developments will be developed in the coming years.

Abbreviations and acronyms

HITSA	Information technology foundation for education
ICT	Information and communication technology
ITL	Estonian association of information technology and telecommunications
LLS	Estonian Lifelong Learning Strategy
MoER	Ministry of Education and Research
STEAM	Science, technology, engineering, art, mathematics
VET	Vocational education and training

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Annex.

The concept for the IT Academy of Vocational Education and the agenda for the years 2018+ have been developed, digital learning resources will be procured, and simulators will be acquired for vocational schools. In 2018, experts at the Innove Foundation mapped the high-quality digital learning resources used in vocational education, and the learning resources are available at the e-Koolikott online environment.

In 2017, the European Social Fund project *Supporting common use arrangements of modern and innovative learning resources* (Classroom+) was developed. Twelve cooperation projects received support in the open applications in 2017 and 24 in 2018. A total of 150 general and vocational schools are involved in the projects.

In 2018, the European Social Fund project *Diversified and high-quality education with digital learning resources* was developed, in which schools could acquire simulators and create digital learning resources. That year, the purchase of simulators was supported in 14 schools.

Teachers and students can be supported by ensuring availability of a sufficient amount of high-quality, tailor-made learning resources that create diversity and new opportunities. While the use of digital solutions in the learning process is becoming increasingly widespread, the methodology for assessing learning outcomes must also adapt accordingly. E-assessment provides schools with more and easier opportunities to put assessment information to good use in developing learning activities, as well as measuring skills and knowledge different from those measured in the past.

Another prerequisite for using digital solutions is good technical readiness of a school's digital infrastructure. In order to ensure that general education schools are technically prepared for incorporating a digital culture into the learning process and the organisation of studies, it is necessary to implement appropriate measures. In 2017, a support measure was completed for the acquisition of a digital tool that supports teacher work and compatibility for e-assessment in basic schools. Within its framework, more than 90% of basic schools evaluated their so-called digital maturity using the Digipeegel ([20]) assessment tool developed by Tallinn university.

([20]) https://digipeegel.ee

Forestry equipment simulators for Luua Forestry School

As a result of the open applications, Luua Forestry School received simulators of forest machines.

The training of forest machine operators can generally be divided into three stages:

(a) learning about the construction of forest machines and the principles of their operation;
(b) learning about forest machine software and practicing working operations by using simulators equipped with special software solutions (to prepare the learner for working with a heavy machine);
(c) practical forest work with real machines in the school's study area and/or in businesses.

Simulator training is a very important part of the entire curriculum, as it helps the learner obtain the proper technique in a secure environment and achieve a performance rate that is close to working with actual machines, which in turn is directly linked to the quality of work and productivity. Learning on simulators helps to significantly reduce the risk of work and safety hazards occurring in later work with real-life machines, as well as the costs of repairing, maintaining, and fuelling machines and potential timber quality defects resulting from unskilled use of machinery.

Thus, employing forest machine simulators makes it possible to:

(a) better support the individual development of each student and to more efficiently combine the simulator-to-forest machine learning arrangements (new simulation systems have been developed to facilitate learning);
(b) introduce into the learning process modern machine learning tools, which work on the basis of software similar to that in heavy forest machines commonly used in Estonia, and which later also allow using applications currently in development by manufacturers;
(c) increase the capacity of practical training on machines commonly used in Estonia (alumni and employers of forest machine specialties have pointed out that the practical skills of graduates should be better and while specialisation and amount of practical training has been increased in new study programmes, it is now necessary to create the corresponding conditions and training environments to support that);
(d) optimise the costs of training forest machine operators. The more simulator practice the students receive, the more effectively will they start working on heavy machines, helping to reduce the maintenance and repair costs of employers.

The purpose of acquiring simulators is to utilise a modern training environment to ensure the availability of a skilled workforce that meets the demands and needs of the labour market and that could be deployed in a short time. In this context, a modern training environment means a more practical one which, with the help of simulators and other learning tools, is well adapted to actual working conditions/situations. The virtual environment in simulator training is safe for the learners and significantly reduces the risks arising from improper working practices. Simulator use simplifies the learning process, makes it more flexible, and takes account of the learner's prior preparation and ability. It also gives teachers the opportunity to be creative in putting together the entire learning process, including the feedback system, with professional and methodological support. For school management, the efficient use of simulators leads to the optimisation of teaching costs.

Through several software programmes, simulators are able to provide students with a variety of situations from real forest environments and differentiate learning with different difficulty levels. This, in turn, allows teachers to set up flexible assessment criteria that take into account the previous experience and motor skills of learners.

Tartu Art School cooperation project 'STEAMlabs'

In 2017, open applications funding was granted to STEAMlabs – a joint project between Tartu Art School (vocational school), Tartu Kristjan Jaak Peterson Gymnasium, and Miina Härma Gymnasium. STEAM (science, technology, engineering, arts, mathematics) labs are created to integrate the learning of natural, technological, and social sciences with 3D modelling, multimedia design, and digital competences. Learning through the STEAM methodology increases the creativity of the students and teachers and the development of innovation, problem-solving skills, and general competences.

In the course of the project, study materials will be developed to support the purposeful use of the labs in the following areas:

(a) linking mathematics with design and arts subjects;
(b) linking natural sciences with design and arts subjects;
(c) linking history with design and arts subjects;
(d) linking IT and technology-related electives with design and arts subjects.

The synergy arises from using 3D and multimedia tools to transfer the learning process of natural sciences and other subjects into the practice of visualisation and model building. In making such connections, the following modes of integration may emerge:

(a) 3D modelling and animation of physics models;
(b) using mathematics and figurative geometry for creating design graphics;
(c) programming and design;
(d) expressions of chemistry, physics, and colour theory in photo processing and multimedia;
(e) applying knowledge of history, art history, and technology in 3D modelling and game development.

The purpose of the project is to modernise and update the teaching modes of general subjects in school curricula in a way that would support the individual and social development of each student and develop the creativity, entrepreneurship, and digital competence of both students and teachers. The project involves:

(a) establishing STEAMlabs (a 3D modelling and animation lab and a multimedia and design graphics lab) that are equipped with modern and innovative learning resources and which are intended for common use between students of different institutions;
(b) developing learning resources where the fields of mathematics, science, technology, and history are integrated with the disciplines of design, design thinking, and team learning;
(c) providing further training for teachers to facilitate the purposeful use of the STEAMlabs and learning resources and to support collaborative lab-based learning.

Creating STEAMlabs and using them for teaching creates synergy between different subjects, fields, teachers, student groups, and levels of education. The project provides an opportunity to contribute to substantive cooperation in developing STEAM subjects, which has so far been hampered by the lack of technological resources available to all parties. The project will create an opportunity for collaboration between vocational schools and upper secondary schools, which will provide a development impetus for both levels of education and ideas for educational innovation.

The labs have been set up and the teacher training courses implemented and learning resources developed to make full use of the labs.

Samsung DigiPass

The Samsung DigiPass ([21]) programme is designed to provide a solution to the problem of youth unemployment in Estonia. Graduates have not been meeting the expectations of the employers and the skills and knowledge provided by the

([21]) http://www.samsungdigipass.ee/ee

schools and education system differ significantly from those in demand in the labour market. Therefore, it is difficult for young people to escape the vicious circle: no work experience – no job, no job – no work experience. The programme supports the objective of 'Incorporating a digital culture into the learning process', a measure of the digital focus programme.

A study conducted under the programme found that nearly 65% of students in vocational schools have been subject to smart device addiction. Over 90% of respondents to the online survey consider smart device addiction to be a significant problem in society. In addition, 66% of all participants thought that smart device addiction is a serious issue in Estonia. According to Mart Laanpere, training manager of the programme, the promoters of the programme are fighting the problem with a positive approach. Instead of spending time on games and social networks, the addiction can also be put to constructive use. Most young people are well versed in using personal digital devices, especially in the context of communication on social media and entertainment. At the same time, the opportunities that modern digital technology offers to them in terms of employment remain undetected for many. The conscious curation of digital identities is not normally taught in schools and the consequences can be severe upon entering the labour market.

In the Samsung DigiPass programme, an innovative and opportunity-rich four-month training programme is offered to 30 vocational school students every year.

The programme is intended for 14-20-year-old students in vocational training and every year 30 students are invited to participate. Three-member teams are eligible to apply and an application must describe the digital competences of each participant and propose an initial problem that will be addressed in the course of the training programme. Ten teams of vocational students are picked out by the programme's panel.

The training programme has been developed by Samsung Electronics Baltics in cooperation with Tallinn University and the Estonian National Youth Council. The training provides the participant with the necessary skills for taking the first steps on their career path – be it a dream job in an IT company, beauty salon, forestry, business, or entertainment. In the course of the programme, each team of participants, along with a mentor, work on a project (prototype) proposed by the team members themselves with the purpose of helping young people in Estonia better prepare for their future job. The programme team has selected nine digital competencies that will be evaluated during the programme with silver or gold badges:

(a) digital collector – collects and organises materials, applications, memories, and contacts;

(b) digital thinker: tags, sorts, and comments on materials;
(c) digital distributor: shares their digital materials with others;
(d) digital creator: creates digital texts, images, videos and music; tells stories and prepares instructions;
(e) digital team member: collaborates, contributes to teamwork, provides leadership if necessary;
(f) digital presenter: looks after their digital image, presents (to the employer) the best version of themselves;
(g) digital security: respects copyrights, avoids risks to privacy, security, and health;
(h) digital problem solver: fixes malfunctioning digital devices, finds solutions to problems;
(i) digital innovator: uses digital devices to do things better, faster, and smarter.

By the end of the project, each participant has a competence-based digital portfolio that gives them an advantage in the labour market.

During the training, participants are coached by professionals and advised by different experts, for example in the field of prototyping and user experience.

The winner of the Samsung DigiPass Programme is awarded a 3-week internship in one of the leading Estonian businesses in their field and the prizes for all participants are provided by Samsung. At the end of the training, the participants receive special digital passports, which can be used to prove the skills and experience acquired to their future employer.

In 2019, Tallinn University plans to release the programme materials and platform for free use to all vocational schools in Estonia. The programme is executed by Tallinn University. Samsung Electronics Baltics, the Estonian National Youth Council, Estonian Qualifications Authority, and MoER are also involved in the planning and conducting of the training.

The Samsung DigiPass Programme started in 2016 and a total of nearly 100 students from nine vocational schools have participated in the project.