

# MONITORING PROGRESS IN NATIONAL INITIATIVES ON DIGITISING INDUSTRY

Country report

*Estonia*

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## Summary

Estonia is a leader in digital public services, e-government and private use of the internet and a forerunner of digitalisation in health care policy. According to the Digital Economy and Society Index (DESI), Estonia ranks 9<sup>th</sup> in 2018 among the Member States of the European Union (EU). Over the period of 2013-2017, Estonia improved its performance in line with the EU average and in 2018, Estonia progressed but more slowly than the EU average. Estonia achieves good results in terms of human capital, the usage of internet services by citizens, and sending e-invoices. However, there is room for improvement regarding the integration of digital technologies in the economy. Estonia scores below the EU average in terms of usage of social media, the integration of digital technology, selling online to other EU countries and e-commerce turnover. Estonia has a small and open economy which depends on foreign markets. Its economic growth increased significantly and the economy was one of the fastest growing economies in the EU in 2017.

National plans and initiatives regarding the digitalisation are developed and implemented under the umbrella of one ministry in the fields of information society and entrepreneurship and innovation. The Estonian Government regards the digitalisation of industry as one of the means to increase the competitiveness of Estonian enterprises, their productivity and support the development of research-intensive industry. At least 147.2 million EUR have been invested across different national initiatives and support mechanisms. There is no separate strategic document on the digitalisation of the industry in Estonia. However, in 2017, the Estonian government published the Green Paper on Industrial Policy, that is the first holistic attempt to analyse the challenges the industries are facing and to propose relevant solutions. In the same year, new policy measures aimed to support specifically the digitalisation of industry were planned under the ICT development programme. In 2018, the government approved the updated version of the Digital Agenda 2020 for Estonia that was launched in 2014 to create an environment that facilitates the use of ICT and the development of smart solutions in Estonia in general.

There is a range of policy measures aimed to boost innovation capacity of Estonian companies, including digital diagnostics, an enterprise development programme and technology competence centres (Pillars 2 and 3 of the Digitising European Industry - DEI). Several projects that support the digitalisation of the industry regarding the use of such key technologies like digital innovation hubs, cybersecurity, robotics, big data artificial intelligence etc. are realised through various initiatives supported by the Estonian Research Council and the European Union's research and innovation programme Horizon 2020. Policy measures to support the development of digital skills (Pillar 5 of the DEI) were launched mostly in relation to the Digital Agenda 2020 and, as of January 2019, comprise 11 projects. To adapt the regulatory framework to the digital age (Pillar 4 of the DEI), an expert group has been launched in 2018 with the aim of preparing a bill to allow the use of fully autonomous information systems in all areas of life.

As most of initiatives were launched in the period 2016–2018, it is still early to assess the outputs and outcomes of these initiatives. It could be assumed that Estonia's national initiatives and other relevant projects cover well the different DEI pillars, except for pillar 4 (regulation), where only one specific initiative pertains to one of the key technologies connected to the digitalisation of the industry.

Table 1 presents an overview of the main initiatives identified, that will be further detailed in this report. Table 2 presents a short SWOT analysis of Estonia on the digitalisation of the industry.

**Table 1: Overview of initiatives**

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Green Paper on Industrial Policy	2017	Sectoral initiative	Industrial policies	All industries	N/A	All	None
ICT development programme	2017	Sectoral initiative	Sectoral initiative	Manufacturing/Industry	N/A	All	5.6 million EUR (100% national government)
Digital Agenda 2020	2014	Development Plan	Development Plan	Not clearly fields of society (at least except ICT in health care and business)	N/A	All	Estimated budget 223.04 million EUR (mixed sources; shares are not specified)
Digital diagnostics	2018	Pillars 2	Analysis support	Manufacturing/Industry (specifically: manufacturing and mining industries)	N/A	Companies with sales revenue >200 thousand EUR	4.3 million EUR (100% national government) (2.1 million EUR starting from 2019)
Enterprise Development Programme	2016	Pillars 2&3	Support for enterprise development. All in one programme: grants, advisory service, coaching, consulting, diagnostics, trainings.	Manufacturing industry (industrial enterprises that have been operating for at least 3 years (as of date of registration) with a minimum of 8 employees and that have obtained first experiences in export or have increased their sales each year by 10% on average); smart specialisation fields in Estonia	N/A	All types (at least three operating years and at least eight employees)	73 million EUR (100% from European Regional Development Fund) of which 25 million EUR for digitalisation
Technology Competence Centres	2004	Pillar 2	Competence centre	Growth areas of smart specialisations in Estonia	N/A	All types	40 million EUR (100% European Regional Development Fund) for the centres' operation period of 2015–2022
Industry 2030 platform	2018	Pillar 4	National working groups	All industries	N/A	All	N/A

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Expert group on fully autonomous information systems	2018	Pillar 4	National working groups	All fields of society	N/A	N/A	N/A
Programme "Choose IT!"	2017	Pillar 5	Adult retraining programme	All economic fields	N/A	All	1,419,522.48 EUR (85% European Social Fund; 15% co-financing by Estonian Government)
Digital literacy training for industry employees	2017	Pillar 5	Basic ICT skills training for employees	All industry fields (trainings will be delivered to 3,000 industry employees, of which at least 60% work in the forestry and wood industries or in the machinery and metal industries)	N/A	All	450,000 EUR (85% European Social Fund; 15% co-financing by Estonian Government)
Foreign recruitment grant (part of the project 'Bringing 2,000 foreign ICT specialists to Estonia')	2018	Pillar 5	Support of hiring from abroad	All economic fields	N/A	All	4 million EUR (100% national government)
Industry loan	2018	Support mechanism	Loan	Processing industry, mining industry, production, transfer and distribution of electrical energy and waste processing and disposal, investing into machines and devices	N/A	All	6 million EUR for 2018-2020 (national government up to 100% and equity of KredEx)
Startup Estonia	2011	Support mechanism	Ecosystem development	All economic fields	N/A	Start-ups	7 million EUR, 2014-2020 (European Regional Development Fund)
Innovation voucher	2009	Support mechanism	Innovation voucher	All economic fields	All	SMEs	4 million EUR (2014-2020), financed by the European Regional Development Fund

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Development voucher	2015	Support mechanism	Innovation voucher	All economic fields	All	SMEs	6 million EUR (2014–2020), financed by the European Regional Development Fund

**Table 2: SWOT of Estonia on digitalisation**

<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• Estonia is one of the leaders in Europe<sup>1</sup> in digitising public services, including the field of health care policy.</li> <li>• Estonia's citizens are well-skilled in the use of digital technologies and are keen users of a variety of internet services.<sup>2</sup></li> <li>• Estonia's strong performance in ICT start-ups is primarily attributable to the full employment of its ICT workforce. In addition, the share of its ICT sector in total gross domestic product (GDP) underpins the high result for this dimension.<sup>3</sup></li> <li>• Estonian entrepreneurial culture has undergone a positive development; compared to 2015, more skilled workers consider starting a business to be a desirable career choice.<sup>4</sup></li> </ul>	<p><b>Weaknesses:</b></p> <ul style="list-style-type: none"> <li>• The key challenge in the Estonian economy remains the digitisation of companies.<sup>5</sup> Although most companies use automated data exchange for receiving orders from customers and use two or more social media platforms, e-commerce in companies could be improved.<sup>6</sup></li> <li>• Regarding connectivity, fixed broadband coverage is very low (partially compensated by mobile coverage), as is the take-up of ultrafast broadband.<sup>7</sup></li> <li>• Estonia's performance in the supply and demand of digital skills shows significant room for improvement because of poor ICT skills among employees.<sup>8</sup></li> <li>• A substantial number of companies encounter problems finding skilled employees.<sup>9</sup></li> <li>• Lack of awareness and knowledge of necessity to take up digital technologies and their benefits among managers/owners of companies.</li> <li>• Lack of corporate strategic planning.</li> </ul>
<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>• In the period of 2016–2018, the national government has launched different initiatives to support the digitalisation of the industry.</li> <li>• A flexible working model of the expert group 'Industry 2030 platform' who could launch new measures and update the existing measures that support the digitalisation of the industry.</li> </ul>	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>• The regulatory framework in Estonia still needs to be reviewed and adapted to the digital age.</li> <li>• Many pillar-specific initiatives have been launched only within the last year. Their real impact still needs to be seen.</li> <li>• Lack of use cases, success stories and lighthouse projects contributes to making companies slow to embrace digital technologies.</li> </ul>

# 1 General context

The objective of this report is to analyse the current status of national initiatives on digitising industry in Estonia. The analysis has been conducted against the background of the Digitising European Industry (DEI), which was the first industry-focused initiative of the Digital Single Market launched by the European Commission in 2016.

Similar country reports will be produced for each of the 28 European Union (EU) Member States. These national reports allow to:

- Monitor the development of national initiatives on digitising industry;
- Compare different national approaches; and
- Identify best practices of national initiatives.

Monitoring and reporting back on the development of the existing national initiatives is an important element of the DEI initiative, and this report should be seen as one part of it.

For more details about the DEI and our methodological approach for the country report, please consult the document attached.

## 1.1 Economic context and status on digitisation

### *General economic context*

Estonia has a small and open economy which depends on foreign markets. Economic growth in Estonia increased significantly and the Estonian economy was one of the fastest growing economies in the EU in 2017.<sup>10</sup> Despite the local labour shortage and intense wage pressure, Estonia's gross domestic product (GDP) grew by 4.9% in 2017<sup>11</sup> (1.9% and 3.5% in 2015 and 2016 respectively). In 2017, the value added in manufacturing, the largest economic activity, increased by 3.9%, and the largest contributor to GDP growth was construction with a 17.8% growth of value added, contributing to almost a fifth (0.9%) of the GDP growth.<sup>12</sup> Renting and operating of own or leased real estate and support activities for transportation had been the leading sectors in the Estonian economy in terms of value creation throughout the period 2009–2016, while electric power generation, transmission and distribution produced more value added than support activities for transportation in 2017.<sup>13</sup>

The economy of Estonia is currently running at full steam and there is a shortage of available resources.<sup>14</sup> Therefore, it is claimed that any further rapid growth in the economy will be hindered by supply-side limits such as difficulties in finding labour and technical limits on the use of equipment.<sup>15</sup> Constant shortage in labour and production capacity for a long time, pressure on prices and wages to rise excessively fast would harm the competitiveness of the exporting sector of Estonia and could limit the long-term capacity for growth.<sup>16</sup> It is predicted that demand-side factors, particularly the growth in foreign demand, will weaken in the period 2019-2021.<sup>17</sup> The strong domestic market will support the Estonian economy in the years ahead as private consumption and investment are growing faster than the economy as a whole.<sup>18</sup>

In 2017, the industry (except construction) had a share of the gross value added (GVA) of 20.6%, which is above the EU average of 19.6%.<sup>19</sup> In 2016, the biggest share of the turnover was generated in the manufacture of wood and products of wood (17%), the manufacture of food



products (13%) and the manufacture of computers, electronic and optical products (14%).<sup>20</sup> Manufacturing in Estonia is largely oriented towards export markets, its sales to non-residents amounted to 62% in 2016.<sup>21</sup> Moreover, the large share of intermediate goods in imports shows that Estonia's manufacturing industry is dependent on imported components.<sup>22</sup> As relatively more people work in manufacturing in Estonia than in Latvia and Lithuania, and productivity is lower in manufacturing than in other branches of the Estonian economy, there is pressure to reduce employment in branches of the economy with low productivity and there are quite a lot of low productivity jobs in Estonia that could disappear in the coming years, also because of faster wage growth.<sup>23</sup>

The investment rate of the Estonian economy is still one of the highest in the EU, but the lack of interest from companies in investing has left the rate substantially lower than it was 10-15 years ago, which could limit the long-term growth in the economy.<sup>24</sup> Moreover, investment is needed to increase production capacity.<sup>25</sup>

### **Status of digitisation**

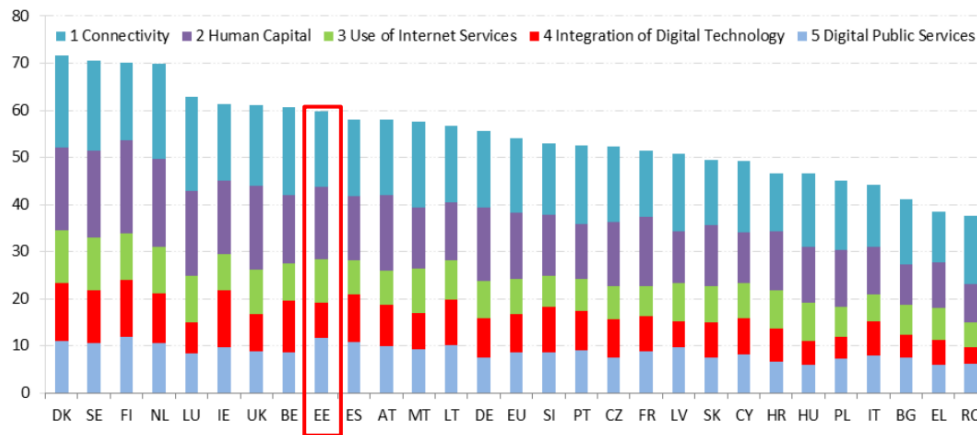
Estonia is known worldwide as a pioneer in digitalisation, being a leader in digital public services, e-government, private use of the internet and a forerunner of digitalisation in health care policy.<sup>26</sup> A technology-friendly culture and extensive digitalisation of the society have become a branding mechanism for the Estonian state.<sup>27</sup> However, there is room for improvement regarding the integration of digital technologies in the economy.<sup>28 29</sup> Thus, Estonia is well prepared to benefit from the increasing digitalisation both economically and socially that might be hindered by the structural polarisation in the Estonian society (rich and poor, young and old, rural and urban, but also Estonian and non-Estonian).<sup>30</sup> Moreover, one of the business associations interviewed alleged that non-locals as owners of industrial companies might be regarded as one of the impediments to digitalisation as they are more reluctant to allow local product development.

According to the DESI data, Estonia ranks 9th in 2018 (see Figure 1), one place lower compared to 2017. Over the period of 2013-2017, Estonia improved its performance in line with the EU average. In 2018, Estonia progressed but more slowly than the EU average. Estonia achieves good results in terms of human capital and the usage of internet services by citizens (both indicators above the EU average). While Estonia ranks 4th among the EU countries regarding sending e-invoices, it only ranks 24th in terms of usage of social media. When it comes to the integration of digital technology, Estonia scores below the EU average. Estonia performs poorly in terms of selling online to other EU countries (15th) and e-commerce turnover (14th); both indicators are below the EU average.

In terms of fostering conditions that enable digital transformation (that include digital infrastructure, investments and access to finance, supply and demand of digital skills, e-leadership, and entrepreneurial culture), Estonia is on the same level as the EU average (see Figure 2). However, regarding the outcomes from the integration of digital technology and changes in the ICT (information and communication technology) start-up environment, Estonia performs poorly and ranks 20th (see Figure 3). It is claimed that the main challenges are poor ICT skills among employees, a shortage of skilled employees, and low level of digital transformation in companies.<sup>31</sup>

The figure below presents the position of Estonia in the Digital Economy and Society Index (DESI).

**Figure 1: Digital Economy and Society Index (DESI) 2018 ranking**



Source: Digital Economy and Society Index (DESI) 2018. Country Report Estonia<sup>32</sup>

However, Estonia is ranked just above EU average in the Digital Transformation Enablers' Index (DTEI) and below EU average in the Digital Technology Integration Index.

According to the World Economic Forum's Readiness for the Future of Production Report 2018, Estonia's main drivers of future production are its institutional framework and its level of technology and innovation, as presented in the figure below.

**Figure 2: Estonia readiness for future production**

Readiness Overall Assessment				
<b>Drivers of Production</b>				<b>6.0</b>
Driver	Weighting	Rank	Score /10	
Technology & Innovation	20%	24th	<b>5.8</b>	
Human Capital	20%	20th	<b>6.5</b>	
Global Trade & Investment	20%	35th	<b>5.8</b>	
Institutional Framework	20%	20th	<b>7.3</b>	
Sustainable Resources	5%	52nd	<b>6.2</b>	
Demand Environment	15%	74th	<b>3.9</b>	
<b>Structure of Production</b>				<b>5.8</b>
Structure	Weighting	Rank	Score /10	
Complexity	60%	23rd	<b>7.4</b>	
Scale	40%	70th	<b>3.3</b>	

Source: World Economic Forum, Readiness for the Future of Production Report 2018

General economic and digital indicators for Estonia are summarised in Table 3.

**Table 3: General economic and digital indicators for Estonia**

	% GDP from industry	% GDP growth	DESI position – and change	DESI sub-indicators Human Capital, Use of Internet, Integration of Digital Technology in 2018
Estonia	21.1% (2017)	4.9% (2018)	9th (2018), one rank decreased compared to 2017	<ul style="list-style-type: none"> <li>• Human Capital: 10th (one rank less than 2017)</li> <li>• Use of Internet Services: 8th (two ranks less than 2017)</li> <li>• Integration of Digital Technology: 19th (one rank improved compared to 2017)</li> </ul>

## 1.2 National strategy on digitising industry

National plans and initiatives regarding the digitalisation are developed and implemented under the umbrella of one ministry in the fields of information society and entrepreneurship and innovation. The Estonian Government regards the digitalisation of industry as one of the means to increase the competitiveness of Estonian enterprises, their productivity and support the development of research-intensive industry. Estonia does not have a strategy document on digitising industry. Digitising industry is part of the Green Paper on Industrial Policy<sup>33</sup> where it is presented under one of the areas of development for the Estonian industry sector ‘Digitising industry value chains’. It was published in 2017 and this is the first industrial policy base document in Estonia<sup>34</sup>. The document describes the challenges in digitising industry and positioning in value chains, also possible actions to digitise the industry and move towards higher-value-added activities in value chains.

Though it is claimed in the Green Paper on Industrial Policy that Estonian industrial policy contributes to smart specialisation in growth areas (information and communication technology (ICT) horizontally through other sectors; health technologies and services; enhancement of resources)<sup>35</sup> and cooperation networks and digitalisation support programmes are to be developed with consideration of characteristics of smart specialisation industrial sectors, the industrial policy does not contain any specific element that directly connects measures of digitising industry with the smart specialisation approach. Alternatively, policy measures created within the framework of the smart specialisation approach (e.g. the measure ‘Applied research in smart specialisation growth areas’<sup>36</sup>) could be considered as complimentary policy measures to support the digitalisation of industrial companies.

Digitising industry is one of the projects of the ICT development programme<sup>37</sup> announced in 2017. The ICT development programme includes only new and additional measures and contains the description of actions and budget. Other active measures that support digitising industry (e.g. digital diagnostics) were developed separately, mostly departing from the objectives set in the Estonian Entrepreneurship Growth Strategy 2014-2020<sup>38</sup>. As the ICT development programme sets a specific framework of actions to be implemented, it could be regarded as one of the main documents for digitising industry in Estonia.

As ICT has become the main tool for increasing competitiveness in every field of the economy and life, the Information Society Development Plan Until 2020 (or Digital Agenda 2020 for Estonia) was launched to create an environment that facilitates the use of ICT and the development of smart solutions in Estonia in general.<sup>39</sup> The document sets out various objectives and also

measures and actions to achieve these objectives. The Digital Agenda 2020 was updated in November 2018.<sup>40</sup>

The three abovementioned documents are described in Table 4.

**Table 4: Overview of national strategies to digitise the industry in Estonia**

Name	Green Paper on Industrial Policy	ICT development programme	Digital Agenda 2020 <sup>41 42</sup>
Type	Industrial policies	Sectoral initiative	Development plan
Starting date	2017	2017	2014 <sup>43</sup> (updated in 2018)
Objective	To map the main challenges of industry in Estonia and propose possible solutions based on literature review and expert groups' assessments.	To enhance the development of e-Estonia and solve the biggest challenges facing both the IT sector and the Estonian economy through focusing on project ideas with high economic or social impacts.	To create an environment that facilitates the use of ICT and the development of smart solutions in Estonia in general. The ultimate goal is to increase the economic competitiveness, the well-being of people and the efficiency of public administration.
Ministry/ministries in charge (website, contact person)	Ministry of Economic Affairs and Communications <a href="https://www.mkm.ee/">https://www.mkm.ee/</a>	Ministry of Economic Affairs and Communications <a href="https://www.mkm.ee/">https://www.mkm.ee/</a>	Ministry of Economic Affairs and Communications <a href="https://www.mkm.ee/">https://www.mkm.ee/</a>
Scope of the strategy/action plan	This is an umbrella document for defining industry problems and for proposing possible policy options, that should be followed by separate analyses in respective sectors to understand the sector-specific problem and to develop potential solutions.	The ICT development programme 2017 includes only new and additional measures. 1. Alleviating the labour shortage of the ICT sector by facilitating the involvement of the external labour force and supporting ICT higher education; 2. Increasing the productivity of the Estonian economy by supporting the digitisation of the industry; and 3. Supporting the visibility of e-Estonia through leveraging the e-Residency programme.	The development plan sets out various measures and actions within two sub-areas: information society development and ensuring cybersecurity.
Measures included in the strategy/action plan	The challenges are defined in the four following fields: digitalisation of the industry and in value chains; cooperation between research and development (R&D) agencies and nascent entrepreneurship; financing investments in the industry; labour demand; and natural resources and infrastructure in the value chain of the industrial sector. Regarding the digitalisation of the industry, the following possible solutions are proposed: industry digitalisation and automatisisation support programme; fostering business-to-business collaboration, including collaborative projects between business and R&D	Regarding digitising industry: (1) the main activities are conducting digitalisation and automation analyses (4.3 million EUR): training for analysts; creating a digital and systematised analysis system; carrying out digitisation analyses: (2) awareness raising (0.2 million EUR); (3) development and financing of digitalisation pilot solutions (1.1 million EUR) - to carry out collaborative projects to help create real, operational digital solutions in industry (the aim is to develop and fund up to 10 pilot projects). Based on the constant analysis, new measures could be introduced after the approval of the Industry 2030 expert group. The latest changes in the funding were made in 2019 (see chapter 2.1).	Measures are specified for each field of both sub-areas. For the information society development: development of communications and connections, smarter governance, better ICT skills, greater awareness of e-Estonia in the world. For ensuring cybersecurity: resilient digital society, development of business and R&D in cybersecurity, Estonia's international position in cybersecurity is strong, improvement of people's awareness, literacy and supply of workforce in cybersecurity. The following directions are set for the development of ICT skills: 1. Promoting the acquisition of basic ICT skills in secondary schools (among both pupils and teachers).

Name	Green Paper on Industrial Policy	ICT development programme	Digital Agenda 2020 <sup>41 42</sup>
	<p>agencies; enhancing communication between the public and private sectors when planning policies; and using the e-government image to increase industry export opportunities.</p>		<ol style="list-style-type: none"> <li>2. Supporting the acquisition of basic ICT skills among adult internet non-users.</li> <li>3. Raising public awareness of the opportunities and dangers of the information society.</li> <li>4. Expanding opportunities for raising the share of ICT professionals in total employment.</li> <li>5. Supporting the acquisition of higher ICT skills in other vocational and higher education disciplines and in other economic sectors.</li> <li>6. Supporting the development of research fields in the field of ICT and increasing the volume of related research (including in non-ICT disciplines).</li> </ol> <p>Each abovementioned direction contains general descriptions of relevant initiatives. For example, one of the two initiatives for the second direction is 'ICT-based skills training and training for trainers are offered'.</p>
<p>Overall funding and distribution by volume and source of funding (public/private, EU/national)</p>	<p>No central funding for the possible initiatives provided. Initiatives are financed based on a separate implementation plan each year.</p>	<p>EUR 8 million for the whole ICT development programme for the period 2018–2020, out of which 5.6 million for digitising industry. Source of funding: National Government.</p>	<p>Estimated budget is 223.04 million EUR (mixed sources; shares are not specified)</p>

### ***Impacts, challenges and perceptions***

Industries are quite aware of the Green Paper on Industrial Policy. As it does not include any specific plan and represents an umbrella document for industrial policy, industries perceive its usefulness not on a high level, only 3.5 (on a scale from 1 to 5, 1 being low and 5 being high; based on grades submitted by four associations). However, industries regard the document as the first approach towards the industry holistically. They appreciate that representatives of companies were involved in discussing challenges for the industry together. Though the challenges and possible solutions were described to modernise and increase the competitiveness of companies, industries claim that the document is fragmented and there is a lack of a common message from the manufacturing industry. For example, manufacturing companies did not find a common ground on the issue of excise duty imposed on packaging.

Through the actions set in the ICT development programme, public funds are directed towards supporting the digitalisation of Estonian industrial sectors with the aim of making effective changes. As the ICT development programme was announced in 2017, it is early to assess its impact. One of the planned actions to develop and finance digitalisation pilot solutions is under development as of January 2019. One of the actions under the ICT development programme is the introduction of an expert group, that is further discussed under Pillar 4 in Section 3.2. One of the interviewees stated that the limited budget allocated to digitising industry within the ICT development programme might not be enough to bring about important changes.

It is necessary to highlight that several projects that support the digitalisation of the industry regarding the use of such key technologies like digital innovation hubs<sup>44</sup>, cybersecurity, robotics, big data artificial intelligence etc. are realised through various initiatives that do not focus on digitalisation of the industry (e.g. the activity '[Support for applied research in smart specialisation growth areas](#)' approved by the Minister of Education and Research), also through the European Union's research and innovation programme Horizon 2020<sup>45</sup>. Organisations in cooperation with international partners submit applications directly on a competitive basis, and in case of the Horizon 2020, the decisions are made without consulting with the national government. One of the interviewees pointed out that there is a need to differentiate the aims of Digital Innovation Hubs, clusters, competence centres and testbeds in Horizon 2020 regulations more clearly. Moreover, according to one of the interviews, the investments from the EU programmes and the national strategies and priorities could be better aligned.

### **1.3 EU cooperation in the field of digitising industry initiatives**

The Estonian Ministry of Economic Affairs and Communications is a lead partner of the [Interreg Baltic Sea Region](#) project named DIGINNO, which runs from 2017 till 2020. According to the description of the project on its [webpage](#), the project helps speed up the Baltic Sea region's transition to a single digital market by developing an active cross-sectoral Baltic Sea Region industry digitalisation community. The project compiles a company digitalisation toolkit for SMEs to increase innovation capacity of industrial SMEs by showcasing digitalisation opportunities and benefits and providing a practical toolkit to guide them through the process. It also show-cases models of government to business (G2B) cross-border e-services with recommendations for policy makers for developing better cross-border G2B services.

Moreover, Estonia is part of the Coordinated Plan on Artificial Intelligence.<sup>46</sup> Estonia joined the European Blockchain Partnership that will support the delivery of cross-border digital public

services, with the highest standards of security and privacy.<sup>47</sup> Estonia is part of the Public Authorities Board of the [ECSEL joint undertaking](#).

## 2 Other policy support to digitising industry

### 2.1 Boosting innovation capacity

Table 5 presents an overview of the main initiatives to boost innovation capacity (pillars 2 and 3 of the DEI). In addition to the main policy measures mentioned in the table below, there are several other initiatives that support the digitalisation of industries. They include the services provided by Enterprise Estonia: short training of industry digitalisation, seminars on solutions for industry digitalisation, idea days and development weekends, and Norway Grants Green ICT programme 2014-2021.<sup>48</sup>

Moreover, a research infrastructure project Smart Industry Centre (SmartIC) was created in 2017 to coordinate research activities and to manage infrastructure labs to support the industry in digitalisation, and it lasts for two years and a half (2017–2019).<sup>49 50 51</sup> SmartIC is funded from the financing measure “[Support for research infrastructure of national importance on the basis of a roadmap](#)” through the European Regional Development Fund.<sup>52</sup> It represents one of the four Digital Innovation Hubs in Estonia.<sup>53</sup> The project brings together the dispersed structures of smart manufacturing research and development (R&D) at Tallinn University of Technology and the Estonian University of Life Sciences for mechanics, engineering, automation, mechatronics, materials science, technology and information technology.<sup>54</sup>

There are several support measures provided by the Estonian Research Council that contribute to the digitalisation of the industry. For example, ‘[Support for Research Infrastructures of National Importance](#)’, that supported the Smart Industry Centre and ‘[Applied research in smart specialisation growth areas](#)’.

One of the initiatives of the ICT development programme is to develop and finance digitalisation pilot solutions.<sup>55</sup> The measure is under development as of January 2019. It would support three or four industrial companies in Estonia carry out full digitalisation and automation with the aim of creating pilot solutions in Estonia that would serve as an example for other companies.<sup>56</sup>



**Table 5: National initiatives to boost innovation capacity**

Name	Digital diagnostics	Enterprise Development Programme	Technology Competence Centres (hereinafter TCC) (Applied Research Centres)
Type	Analysis support	Support for enterprise development. All in one programme: grants, advisory service, coaching, consulting service, diagnostics, trainings.	Competence centre
Starting date	2018 (starting from 01 October 2018 <sup>57</sup> )	2016	2004 <sup>58</sup>
Objective	To increase the awareness and integration of digital technologies and automation solutions in the manufacturing and mining industry.	The enterprise development programme is directed to enhance strategic planning activities in the manufacturing sector. The enterprise development programme supports the company's deliberate development, innovation and product development, and better planning. Each company participating in the programme will bring new or substantially upgraded products and services that are more cost-effective than before. Goals: to increase the number of companies who are ready to invest more, to pay higher wages to their employees, to make higher profits and to strengthen their competitiveness on foreign markets.	The objective for supporting TCCs is to increase and improve availability of R&D, technology development and innovation for companies in the growth areas of smart specialisations. <sup>59</sup>
Relevant for Pillar 2 <sup>60</sup> or Pillar 3 <sup>61</sup> or both	Pillar 2	Pillars 2 and 3	Pillar 2
Short description	The measure aims at supporting the development of digital diagnostics for digitisation and automation of the manufacturing and mining industries. Self-financing of the company is at least 30%.	The enterprise development programme aims to support well-thought-out development, improved action planning, innovation implementation and product development. A development plan might include actions connected to the use of digital solutions. In the course of the development programme, each participating enterprise will launch new	TCCs conduct research in the areas that are necessary for companies to conduct product development. The results of the research projects are used by companies to bring new products and services to the market. TCCs have infrastructure, research staff and sectoral expertise for implementing the R&D projects. Activities that are supported: R&D

Name	Digital diagnostics	Enterprise Development Programme	Technology Competence Centres (hereinafter TCC) (Applied Research Centres)
		<p>products and services that are more profitable than their predecessors. The enterprise development programme consists of three stages: 1. Identifying the enterprise's ambition and readiness for change; 2. Preparing the development plan; 3. Implementing the development plan. Participation in the programme is not limited to applying for and receiving financial aid, the programme is focused on determining the enterprise's strategic views and compiling a long-term plan; each enterprise is approached individually.</p> <p>The third phase of the Enterprise development programme is opened for grant applications. The call is opened for all small and medium size enterprises who have finalized the second phase of the development programme and have their development plan approved by Enterprise Estonia. The maximum size of the grant is 500,000 EUR per enterprise. The grant could be used for several activities and one of them is the development of process that might include the digitalisation of enterprise's process. Another possible action is to purchase equipment needed for manufacturing a new product (up to 200,000 EUR), and it might pertain to the digitalisation of the production process.</p> <p>In case of grant application: small enterprises can receive a grant that makes up 45% of the project cost; medium-sized enterprises can receive a grant that makes up 35% of the</p>	<p>activities of the TCC (conducting preliminary studies needed to begin applied research and product development projects, conducting of applied research and product development) and increasing TCC capability (conducting the personnel development activities of the TCC, including training of the TCC's staff related to research and engineering technical management and application of the personnel involved in increasing the TCC's management capacity; development of the capability of planning and conducting of R&amp;D activities of the TCC; development and conducting of the sales and marketing activities of the TCC, including conducting of market research, target market advisory services and participation in contact events, compilation of the marketing strategy of TCC; conducting of activities related to preliminary protection of intellectual property rights of TCC in SMEs; outsourcing of advisory services and services supporting innovation of TCC from SMEs).<sup>62</sup></p>

Name	Digital diagnostics	Enterprise Development Programme	Technology Centres (hereinafter TCC) (Applied Research Centres)
		project cost; large enterprises can receive a grant that makes up 25% of the project cost.	
Granting organisation	Enterprise Estonia	Enterprise Estonia	Enterprise Estonia
Participating organisations	Diagnostics providers (automation and ICT companies)	Consultancy services	Companies registered in the Estonian Business Register whose main activity is conducting research in the areas that are necessary for companies to conduct product development. <sup>63</sup>
Sectors targeted	Manufacturing/Industry (specifically: manufacturing and mining industries)	Manufacturing industry (industrial enterprises that have been operating for at least three years (as of date of registration) with a minimum of eight employees and that have obtained first experiences in export or have increased their sales each year by 10% on average); smart specialisation fields in Estonia	Growth areas of smart specialisations in Estonia
Technologies targeted	N/A	N/A	N/A
Funding (split by private/public and national/EU), state period/annual funding	4.3 million EUR (100% national government), 2018–2020 (2.1 million EUR starting from 2019)	73 million EUR (100% from European Regional Development Fund), 2016–2023 (2023 - the last year for eligible costs) of which 25 million EUR are used for digitalisation	The programme has a budget of 40 million EUR <sup>64</sup> for the centres' operation period of 2015–2022 <sup>65</sup> and is financed by the European Regional Development Fund <sup>66</sup> .
Current status of initiatives	Two projects were supported in 2018 <sup>67</sup> and four in 2019 as of 20.01.2019 <sup>68</sup>	For example, 49 projects (each as a separate stage of the programme) were supported in 2017 <sup>69</sup> , 67 in 2018 <sup>70</sup> and one in 2019 as of 20.01.2019 <sup>71</sup>	Applications of six centres were approved in 2015; the amount of financial support is 35,977,208.88 EUR. <sup>72</sup>

### **Impacts, challenges and perceptions**

Digital diagnostics (est *digidiagnostika*), provided for by the ICT development programme, is a measure that is regarded by one of the associations as a step forward in the digitalisation of the industry. Based on the results of digital diagnostics, enterprises start to understand that technologies should be deployed to increase efficiency and productivity. The benefits of the measure are not acknowledged by companies' managers who focus on day-to-day production and operations of a business instead of strategic planning. As it was introduced in 2018, there is no impact analysis of them available.

As a follow-up action, an investment support measure "Support for digital technologies, automation and robots in manufacturing and mining industries" (est *toetus digitaalsete tehnoloogiate, automatiseerimise ning robotite kasutamisele töötlevas tööstuses ja mäetööstuses*) will take effect on 1 June 2019. The measure is aimed at mitigating the risks of digitalisation, automation and transition to robotics in manufacturing and mining industries by supporting the implementation of digital and robot solutions. The duration is 18 months until 31 December 2020. The budget of both support measures (digital diagnostics and the new one) is planned to be 5.3 million EUR: 2.1 million EUR for digital diagnostics, 3 million EUR for the new support measure, and 0.2 million EUR for awareness raising.

The Enterprise Development Programme (est *ettevõtte arenguprogramm*) was launched in 2016 to contribute to fulfilling the objectives of the Estonian Research and Development and Innovation Strategy 2014-2020 "Knowledge-based Estonia", the Estonian Entrepreneurship Growth Strategy 2014–2020, and the Operational Programme for Cohesion Policy Funding 2014-2020. There is no publicly available analysis of its impact both either in general or specifically regarding the digitalisation of the industry. Its success could be indirectly assessed based on its active use by companies (see the number of supported projects in Table 5). It was reported that a total of 50 companies in the amount of 13.89 million EUR were supported in 2017, and by the end of 2017, 84 companies were implementing development plans, and 55 companies worked out a development plan.<sup>73</sup> One of the associations consulted implied that the programme supports companies' long-term growth because from the point of view of another associations, it forces companies to make a long-term strategic plan. Thus, the Enterprise Development Programme, especially its first stage when the enterprise's ambition and readiness for change are identified could be regarded as a factor affecting strategic thinking and planning. However, some associations expressed reservations about the effectiveness of the measure. It was argued that rather large companies could manage to pass all stages of the programme.

Based on the consultation with business associations, it might be assumed that digital diagnostics are less known compared to the 'Enterprise Development Programme' that provides a broader range of services. Low awareness and thus lower level of use pertain to non-manufacturing industries. Those who are aware of the policy measures assess their usefulness positively.

The effectiveness of government initiatives in supporting ICT innovation could be demonstrated indirectly. Due to the constant support of digital transformation in the public sector, there is an international widespread awareness of e-Estonia. Moreover, despite the small size of the Estonian economy, there is a number of internationally successful companies that originate from Estonia: e.g. Cleveron, Skeleton, and Transferwise.

The industry perception of the level of innovation in digital industries is quite high in case of non-ICT sectors (3.6 on a scale from 1 to 5, 1 being low and 5 being high; based on grades submitted

by four associations) taken into consideration that in case of ICT sectors it equals 4. As it is mentioned in Section 1.1, the integration of digital technologies in the economy is still low, which is reflected in the level of ICT spending (as percentage of GDP) in Estonia: 2.4% in 2015 around the OECD average (2.3%).

According to industry associations, the key opportunities in Estonia related to the take-up of digital technologies are:

- Increasing efficiency of production;
- Maintaining competitiveness;
- Ensuring the provision of products and services, and their quality;
- Moving forward in the value chain;
- Extending value chains and joining new ones;
- Accompanying SMEs on their way to digitalisation;
- Creating new more flexible working models;
- Helping to decrease the need for labour resources in quantitative terms;
- Using labour resources more efficiently and increasing employees' income.

These key opportunities are in line with the vision of the public sector for whom the digitalisation of the industry creates opportunities for companies to better integrate into global value chains and to increase the competitiveness of non-ICT sectors by increasing the production efficiency and value for customers.

The key challenges and barriers in Estonia related to the take-up of digital technologies according to industry associations are mainly:

- Lack of awareness and knowledge of necessity to take up digital technologies and their benefits;
- Lack of corporate strategic planning;
- The high cost of new technologies, especially for small companies;
- Low investment capacity;
- Investments in digital technologies do not always seem to be rentable for small companies;
- Shortage of skilled labour;
- Low salaries to attract skilled labour from other EU countries and the annual immigration quota that limits the number of employees that could be employed from the third countries;
- High level of bureaucracy associated with services provided by Enterprise Estonia;
- Low level of cross-company data sharing because of low awareness of managers, also absence of a will to buy a license used for sharing data and databases;
- Estonia is rather a country of subcontracting, and reluctance of foreign owners to develop local engineering centres for product development.

Similarly to industry associations, limited knowledge base and innovation capacities are perceived as barriers by the public sector. In addition, lack of use cases, success stories and lighthouse projects contribute to making companies slow to embrace digital technologies.

## 2.2 Regulatory framework for digital age

No specific regulations, either pertaining to cybersecurity or free flow of data, are considered as part of the regulatory framework for the digitalisation of the industry in Estonia. Table 6 presents two main initiatives related to a digital regulatory framework (Pillar 4 of the DEI). If Industry 2030 platform is one of the initiatives within the ICT development programme, another expert group is launched for a limited period with the aim of preparing a bill to allow the use of fully autonomous information systems in all areas of life.

**Table 6: Main initiatives under Pillar 4**

Name	Industry 2030 platform	Expert group on fully autonomous information systems
Type	National working groups	National working groups
Starting date	2018	2018
Objective	To increase the added value of the manufacturing industry to EU average by 2030.	To prepare a bill to allow the use of kratts, i.e. fully autonomous information systems, in all areas of life and to ensure the clarity of the judicial area as well as required supervision. <sup>74 75</sup> Also to develop an artificial intelligence strategy for Estonia, which will describe the most useful types of kratts and their use in both the public and private sector as well as measures for promoting the implementation of kratts. <sup>76 77</sup>
Short description	Platform 2030 is a bottom up approach for collecting incentives from the stakeholders (expert groups) and delivering these to the decision makers.	The Government Office and the Ministry of Economic Affairs and Communications launched a cross-sectoral project to analyse and prepare the implementation of artificial intelligences, or so-called kratts, as well as develop a test environment in Estonia. <sup>78</sup> The expert group comprises state authorities, universities, companies, and independent experts, and its term is April 2019. <sup>79</sup>
Sectors targeted	All industries	All fields of society

### ***Impacts, challenges and perceptions***

The 'Industry 2030 platform' is one of the actions under the ICT development programme. It has two levels: national working groups in various sectors (e.g. labour force and skills, internationalisation, smart production etc.) and an expert group which consists of representatives of various industrial sectors, ICT sector, public sector, research and education.<sup>80 81</sup> The expert group could adapt the activities or create new ones according to the changing context. As a representative of one of professional associations stated in the interview, this policymaking platform enables flexibility and fast decision-making process in supporting the digitalisation of industrial sectors.

As perceived by the Ministry of Economic Affairs and Communications, the development of the legal area for artificial intelligence could contribute to the digital revolution of the industry and attract new investments and innovation activity to Estonia.<sup>82</sup> The expert group on fully

autonomous information systems could be regarded as the single clear example of attempts to improve the regulatory framework particularly in connection to digitalisation. As such, the perception of the extent of the improvement of the regulatory framework differs significantly between the interviewed representatives of industry associations: from 'not relevant' to 'much better'. According to the assessment of the representatives of industry associations, the regulatory framework applying in Estonia is rather fit for the digital age (4 on a scale from 1 to 5, 1 being low and 5 being high; based on grades submitted by five associations).

As one of the interviewees claimed, the government has not made plans to transform IT security rules to support the digitisation of the industry because Estonian IT policy (also IT security) is focused on the public sector. Based on the public sector, the government creates an IT infrastructure that is used by all public organisations and all types of businesses.

The regulatory barriers which impede the ability of companies to innovate and make use of digital technologies could be sector-specific. For one of industry associations, the main barrier is the establishment of the price of the service that is provided by its members. One of the cross-sectoral barriers is the immigration quota that limits the number of aliens who can settle in Estonia and unstable tax environment.

### **2.3 Skills development**

There are in total 11 active projects connected to the Digital Agenda 2020. Two main initiatives out of 11 ('Programme "Choose IT!"' and 'Digital literacy training for industry employees') and another one ('Foreign recruitment grant') are presented in Table 7. The selected initiatives are those that directly contribute to the development of ICT skills of the labour force. If the first two measures in the table pertain to the skills of local people, then the third one tries to increase the supply of the labour force by supporting the recruitment of foreigners.

**Table 7: Main initiatives to develop digital skills**

Name	Programme "Choose IT!"	Digital literacy training for industry employees	Foreign recruitment grant (part of the project 'Bringing 2,000 foreign ICT specialists to Estonia')
Type	Adult retraining programme	Basic ICT skills training for employees	Support of hiring from abroad
Starting date	2017	2017	2018
Objective	To increase the supply of ICT specialists in Estonia to alleviate the shortage of ICT specialists. The major goal of the project is to create a continuing education model based on practical learning that meets the needs of software development ICT companies, and to pilot an advanced training model for training ICT professionals that will allow the developed model to be extended to further training of other ICT professionals.	By providing ICT-based training, to create prerequisites for the development of the Estonian industrial sector and the increase of added value, particularly to support industrial digitisation. Another aim is to increase the awareness amongst managers of industrial enterprises about the value of digitalisation.	To encourage foreign recruitment to positions in the fields of ICT and science and engineering
Short description	This is an adult retraining programme, aimed at piloting new form of training and giving the participants initial basics of the software developer. Training lasts for 3.5 months.	The goal of the training is to enable participants to acquire digital literacy to work effectively with the technology. This pertains to 3,000 employees in industry enterprises. Another part of the initiative is to raise awareness of industry enterprises' managers about the role of skills and knowledge of innovative solutions to create value added.	The foreign recruitment grant is aimed at supporting recruitment of foreign ICT specialists, starting from 23 March 2019 also science and engineering specialists to help alleviate shortage of top specialists. The grant can partially compensate for expenses related to foreign recruitment, if they indicate that an ICT or science and engineering specialist from abroad (from the European Union or third countries) has stayed in Estonia to work here. Activities may include: sharing job advertisements and introducing the employer in foreign portals; financing language courses; adaptation, accommodation and migration expenses (airline tickets, rent, etc.); visit to get acquainted with the country; additional work by an HR manager or a colleague to support adaptation, etc. The amount of the grant per one recruited top specialist is EUR 3,000 (before 23 March 2019 it was EUR 2,000).
Granting organisation	Ministry of Economic Affairs and Communications	Ministry of Economic Affairs and Communications	Enterprise Estonia



Name	Programme "Choose IT!"	Digital literacy training for industry employees	Foreign recruitment grant (part of the project 'Bringing 2,000 foreign ICT specialists to Estonia')
Participating organisations	Services provided by private companies BCS Koolitus and IT Koolitus. Developed in cooperation with the Estonian Association of Information Technology and Telecommunications and IT companies.	Services provided by the private company IT Koolituskeskuse OÜ in cooperation with the Estonian Employers' Confederation.	-
Sectors targeted	All economic fields	All industry fields (trainings will be delivered to 3,000 industry employees, of which at least 60% work in the forestry and wood industries or in the machinery and metal industries)	All economic fields
Funding (split by private/public and national/EU), state period/annual funding	1,419,522.48 EUR (85% European Social Fund, 15% co-financing by Estonian Government), 2017–2020	450,000 EUR (85% European Social Fund, 15% co-financing by Estonian Government), 2017–2020	4 million EUR (100% national government), 2018–2020
Current status of initiatives	145 employees from 37 companies in total have benefitted from the initiative by the end of 2018	296 employees from 27 companies in total have benefitted from the initiative by the end of 2018	67 grants (19 companies) in 2018 <sup>83</sup> and four grants (three companies) in 2019 <sup>84</sup> as of 21.01.2019

### **Impacts, challenges and perceptions**

Based on the feedback from the industry associations, the following strengths of the programme “Choose IT!” (est „Vali IT!“) were identified: it increases the IT competence of the company; intensive learning process; graduates’ fast entering the labour market; people from other areas give the IT company a better understanding of the customer desire; a good model that can be copied to other areas. The fact that the trainee should quit the job in order to join the programme was considered as a strength as it allows the trainee to focus their attention on the studies. Nevertheless, it might demotivate those who cannot afford a temporary loss of income. However, a representative of one of the industry associations mentioned that there is no need to look for IT specialists through this programme because the IT services in most companies are subcontracted. Another association claimed that there are not enough human resources to supervise interns.

In 2017, 60% of Estonian population had at least basic or above basic digital skills. Digital literacy training for industry employees (est *digitaalse kirjaoskuse baaskoolituse tööstussektori töötajatele*) provides basic IT skills. Therefore, some representatives of industry associations found that the training should develop professional IT skills needed for companies. However, considering the needs of the target group, this policy measure fulfils its objective to provide basic digital literacy to industry employees.

As the foreign recruitment grant (est *välisvärbamise toetus*) is aimed to encourage foreign recruitment to positions in the ICT field (starting from 23 March 2019 also in science and engineering), it could be assumed that this measure contributes to the digitalisation of the industry through increasing the number of ICT professionals for ICT companies who provide relevant services to industries. This is reflected in the statistic of the use of the measure. As of 11 January 2019, only one manufacturing company applied and received the grant. As some of the interviewees claimed, there are sectors where companies have not used this policy measure. Moreover, a representative of one of industry associations asserted that because of the small size of the grant (EUR 2,000 until 23 March 2019) and the bureaucracy associated with the application and reporting, a majority of companies do not try to apply for the grant. This measure is not perceived as highly useful (2.75 on a scale from 1 to 5, 1 being low and 5 being high; based on grades submitted by four associations) as companies in Estonia experiencing a significant shortage of ICT specialists do not recruit employees from abroad only because of financial support.

The initiatives described above were launched in 2017/2018. To analyse the development of ICT skills, the government set four indicators to measure the effectiveness of all initiatives connected to the Digital Agenda 2020 altogether<sup>85</sup>:

1. Share of internet non-users among 16 to 74 year olds in Estonia. Starting point: 18% (2013) %; medium term: 10% (2018); target level: 5% (2020).
2. Share of people among 16 to 74 year olds having used e-commerce. Starting point: 49% (2014; EU average 45%) %; medium term: 61.3% (2017; EU average 62% 2017); target level: EU average in 2020 (2020).
3. Share of ICT professionals in total employment. Starting point: 4.9% (2013); medium term: 6.8% (2017); target level: 8% (2020).
4. Share of top professionals in total employment. Starting point: 9.3% (2014); medium term: 10.8% (2017); target level: 12% (2020).

Moreover, the number of persons employed with ICT specialist skills increased between 2015 and 2017, however, the share of enterprises that provided training to their personnel to develop and/or upgrade their ICT skills, was stable during the same period.<sup>86</sup>

## 2.4 Support mechanisms

### Industry loan

Industry loan (*est tööstuslaen*) helps to increase the self-financing of the enterprise if a bank loan or leasing is used for an investment.<sup>87</sup> The intended purpose of the loan is investments in tangible and intangible assets (such as digital technologies) and the related direct costs in connection with the expansion of the activity of the enterprise, diversification of production or reorganisation of the production process.<sup>88</sup> Industry loan (max 2 million EUR per project, but not more than 40% of the project cost<sup>89</sup>) is designed for export-oriented enterprises<sup>90</sup>. The industry loan (active from starting from 20 June 2018<sup>91</sup>) is a developed version of previously known technology loan (the main difference is allowing to make investments also in intangible assets, e.g. software). The total equity and self-financing of the company should be at least 50% of the applied industry loan amount.<sup>92</sup> It is granted by SA KredEx and issued by several Estonian banks. Its targeted sectors are processing industry, mining industry, production, transfer and distribution of electrical energy and waste processing and disposal, investing into machines and devices. The budget is 6 million EUR (national government up to 100% and equity of KredEx), 2018–2020.<sup>93</sup> An industry loan is regarded by the associations as a means to help the companies to overcome a market failure and to make necessary investments.

### Startup Estonia

The aim of the policy measure 'Startup Estonia' (being implemented from 2011<sup>94</sup>) is to strengthen Estonia's start-up ecosystem, contributing to different development programmes, the objective of which is to enhance the knowledge and skills of startup-entrepreneurs, improve the funding of their companies and eliminate regulatory bottlenecks.<sup>95</sup> Start-up ecosystem is the environment where companies creating or using digitalisation solutions are emerging and developing. The measure is financed from the European Regional Development Fund with 7 million EUR during 2014–2020.<sup>96 97</sup>

### Innovation voucher

The measure of innovation voucher (*est innovatsiooniosak*) was launched in 2009<sup>98</sup> and it supports the creation of first-time contacts between entrepreneurs and innovation service providers<sup>99</sup>. It enables a small and medium-sized entrepreneur who is cooperating with a higher education institute, test laboratory, or intellectual property experts, to develop innovative solutions for development obstacles, carry out tests with new materials, gather knowledge on technologies, conduct studies in intellectual property databases etc.<sup>100</sup> Each enterprise's innovation needs are specific and might pertain to digitalisation. The budget is 4 million EUR for the period 2014–2020 (supported starting from 2015<sup>101</sup>) and is financed by the European Regional Development Fund.<sup>102 103</sup>

### Development voucher

The policy measure of development voucher (*est arendusosak*) was launched in 2015<sup>104</sup> with the aim of continuing and increasing cooperation between entrepreneurs and external innovation

partners<sup>105</sup>. The target group are small and medium-sized enterprises whose development ideas need advanced professional know-how from specialists in order to be implemented.<sup>106</sup> The development voucher is essentially a supporting measure for preliminary research that should enable the entrepreneur to gain comprehensive knowledge on whether their development idea has the potential necessary for continuing the development process in other stages.<sup>107</sup> Development ideas could be related to digitalisation. The budget of the measure is 6 million EUR<sup>108</sup> for the period 2014–2020<sup>109</sup> (support starting from 2015<sup>110</sup>) and is financed by the European Regional Development Fund<sup>111</sup>.

Finally, a foreign recruitment grant aiming to encourage the recruitment of foreign professionals is described in Section 2.3 as it is specific to pillar 5.

### 3 Conclusions

The following table provides an overview how the different digitalisation initiatives implemented in Estonia have been funded. The funding of both digital diagnostics and developing and financing of digitalisation pilot solutions is presented departing from the new budget in 2019.

**Table 8: Breakdown for the financing of the initiatives**

	Pillar 2	Pillar 3	Pillar 4	Pillar 5
	Digital Innovation for all	Partnerships and industrial platforms	Regulatory framework for digital age	Preparing for digital future (skills)
Digital diagnostics	2.1 million EUR			
Technology Competence Centres	40 million EUR			
Enterprise Development Programme	73 million EUR (of which 25 million EUR for digitalisation)			
Industry 2030 platform			N/A	
Expert group on fully autonomous information systems			N/A	
Programme “Choose IT!”				1,419,522.48 EUR
Digital literacy training for industry employees				0.45 million EUR
Foreign recruitment grant				4 million EUR
Other support initiatives across pillars (not presented as separate measures): 1. Awareness raising activities; <sup>112</sup> 2. Development and financing of digitalisation pilot solutions; <sup>113</sup> 3. Other active projects to improve digital skills. <sup>114</sup>	1. 0.2 million EUR; 2. 3 million EUR; 3. N/A			
Industry loan	6 million EUR (2018-2020)			
Startup Estonia	7 million EUR (2014-2020)			
Innovation voucher	4 million EUR (2014-2020)			
Development voucher	6 million EUR (2014-2020)			
<b>Total spending</b>	<b>At least 147.2 million EUR</b>			

One should take the overview of the funding of all initiatives in Table 8 critically as not all relevant initiatives concerning the digitalisation of the industry are presented in the report and some of them are created not only to support the digitalisation of the industry. For example, the budget of the policy measure 'Enterprise Development Programme' amounts to ca 50% out of the indicated total spending 147.2 million EUR, but it should be noted that 25 million EUR of this programme is specifically dedicated to digitalisation.

Estonia is a leader in digital public services, e-government and private use of the internet and a forerunner of digitalisation in health care policy. A technology-friendly culture and extensive digitalisation of the society have become a branding mechanism for the Estonian state. However, there is room for improvement regarding the integration of digital technologies in the economy.

According to the DESI data, Estonia ranks 9th among the EU Member States in 2018. Estonia achieves good results in terms of human capital, the usage of internet services by citizens, and sending e-invoices. But Estonia scores below the EU average in terms of usage of social media, the integration of digital technology, selling online to other EU countries and e-commerce turnover. In terms of fostering conditions that enable digital transformation, Estonia is on the same level as the EU average. However, regarding the outcomes from the integration of digital technology and changes in the ICT start-up environment, Estonia performs poorly and ranks 20th. The main challenges are poor ICT skills among employees, a shortage of skilled employees, and low level of digital transformation in companies.

There is no separate strategic document on the digitalisation of the industry in Estonia. However, in 2017, the Estonian government published the Green Paper on Industrial Policy, that is the first holistic attempt to analyse the challenges the industries are facing and to propose relevant solutions. In the same year, new policy measures aimed to support specifically the digitalisation of industry were planned under the ICT development programme. In 2018, the government approved the updated version of the Digital Agenda 2020 for Estonia that was launched in 2014 to create an environment that facilitates the use of ICT and the development of smart solutions in Estonia in general. To support the digitalisation process in companies, the Estonian government has been launching a number of initiatives for several years. However, the major part of them, under pillars 2 and 3 particularly, were launched in the period 2016–2018. The Industry 2030 platform is one of the initiatives within the ICT development programme. It is a bottom up approach for collecting incentives from the stakeholders and delivering these to the decision makers (see Box 1).

### Box 1: Good practice

#### “Industry 2030 platform”

The ‘Industry 2030 platform’, also called productivity expert group, was launched in 2018 and is one of the actions under the ICT development programme. It has two levels: national working groups in various sectors (e.g. labour force and skills, internationalisation, smart production etc.) and an expert group which consists of representatives of various industrial sectors, ICT sector, public sector, research and education. The aim is to increase the added value of the manufacturing industry to EU average by 2030 by supervising the implementation of the initiatives and if necessary, adapting the activities or create new ones according to the changing context. As a representative of one of professional associations stated in the interview, this policymaking platform enables flexibility and fast decision-making process in supporting the digitalisation of industrial sectors. This initiative allows to hear the voice of industry in planning and implementing activities. The expert group held three meetings in 2018 on the topics of future industry development, the role of digitalisation in achieving higher competitive advantages; the representatives of industry provided feedback to the present policy measures and generated new ideas to further support the digitalisation of industry.<sup>115 116</sup>

Table 9 provides a general overview of the main digitalisation initiatives implemented in Estonia across Pillars, the level of take-up and perception of their impacts as well as the overall progress Estonia has made so far in regard to the digitalisation of the industry. Table 9 shows that the initiatives in pillars 2 and 3 are designed to contribute to focused areas of the economy. However, two out of three policy measures under pillar 5 address all economic fields, they contribute to the fulfilment of vacant ICT positions. Despite a varied perception of usefulness of initiatives of different pillars (initiatives under pillar 2 and 3 are perceived as rather useful, under pillar 5 not enough useful, and there is a mixed perception regarding the regulatory framework), the outcomes of the initiatives are perceived as being effective (grades range from 3.5 to 4 on a 5-point grading scale). As most of initiatives were launched in the period 2016–2018, it is still early to assess the outputs and outcomes of these initiatives.

To conclude, Estonia’s national initiatives and other relevant projects cover well different DEI pillars, except for pillar 4 (regulation), where only one specific initiative pertains to one of the key technologies connected to the digitalisation of the industry.

**Table 9: Total input-output overview**

		Pillar 2		Pillar 3		Pillar 4		Pillar 5	
		Digital Innovation for all		Partnerships and industrial platforms		Regulatory framework for digital age		Preparing for digital future (skills)	
Application	Name of key initiatives (start dates in brackets)	(a) Digital diagnostics (2018), (b) Enterprise Development Programme (2016), (c) technology competence centres (2004)		Industry 2030 platform (2018), Expert group on fully autonomous information systems (2018)		(a) Programme “Choose IT!” (2017), (b) Digital literacy training for industry employees (2017), (c) Foreign recruitment grant (2018)			
	Funding (total amount and period)	(a) 2.1 million EUR for 2018–2020, (b) 73 million EUR for 2016–2023, (c) 40 million EUR for 2015–2022				(a) ca 1.4 million EUR for 2017–2020, (b) 0.45 million EUR for 2017–2020, (c) 4 million EUR for 2018–2020			
	Industries addressed	(a) Manufacturing and mining industries, (b) Manufacturing industry and smart specialisation fields in Estonia, (c) growth areas of smart specialisations in Estonia		All		(a) All economic fields, (b) All industry fields (trainings will be delivered to 3,000 industry employees, of which at least 60% work in the forestry and wood industries or in the machinery and metal industries), (a) All economic fields			
	EU programme involved	ERDF		No		ESF			
Usage	Perception of initiative	Government support is considered as rather useful (3.5/5) for digital transformation		The extent of the improvement of the regulatory framework is perceived quite differently across stakeholders		The government initiatives on digital skills are perceived as not useful enough (2.75/5)			
	Take-up	4 DIHs		N/A		N/A			
Outcomes	Perception of outcomes	The level of take-up of digital technologies is perceived as rather good (3.6/5)		The level of innovation in digital industries is perceived as quite good (4/5)		The regulatory framework is perceived to be quite fit for the digital age (4/5)		The required skills and labour resources are considered to be rather available to enable digitisation (3.5/5)	
	Outcome metrics	ICT spending as a percentage of GDP: 2.4% in 2015 (OECD average 2.3%). DESI rank: 9 <sup>th</sup> in 2018 (8 <sup>th</sup> in 2017),		Between 2015 and 2017, total capex spending in Estonia increased by 16%. The number of start-ups increased from 400 to 550.		The number of people employed with ICT specialist skills increased by 30% between 2015 and 2017. In the same period, the share of enterprises providing training to develop ICT skills fell from 14% (2015) to 13% (2017).			
	Change in outcomes	From 2017 to 2018, the DESI position of Estonia fell from the 8 <sup>th</sup> to the 9 <sup>th</sup> rank in general and improved from the 20 <sup>th</sup> to the 19 <sup>th</sup> rank regarding the integration of digital technology.							
End-goal	Productivity growth	The real labour productivity per person employed in Estonia increased by 3.2% in 2016 and 2.1% in 2017.							
Summary		Estonia launched a number of initiatives with focus on pillars 2, 3, and 5, those that are directly connected to the digitalisation of industry in the period 2016–2018. Estonia is focusing on both providing a direct support to analyse the digitalisation needs and developing ICT skills of people.							

## ANNEX 1 List of stakeholders interviewed

Type of stakeholder	Name of organisation
Government representative	Ministry of Economic Affairs and Communications
Government representative	Ministry of Economic Affairs and Communications
Government representative	Ministry of Economic Affairs and Communications
Government representative	Ministry of Economic Affairs and Communications
Industry association	Estonian Chamber of Commerce and Industry
Industry association	Estonian Association of Information Technology and Telecommunications
Industry association	Estonian Association of Information Technology and Telecommunications
Industry association	Anonymised
Industry association	Estonian Water Works Association
Industry association	Anonymised

## ENDNOTES



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