Shaping the future of work in Europe’s 9 digital front-runner countries

Country Appendix: Estonia

McKinsey & Company | October, 2017

Disclaimer

The results presented in this document, are based on an independent report by McKinsey & Company.

The report draws on a body of existing and ongoing research at McKinsey Global Institute, including the institute’s analytical framework to estimate automation potential and an enterprise survey of firms integrating new technologies in their business processes.

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Our intention is to provide a thorough fact base to discuss and brainstorm actions for the Future of Work

ACTIONS FOR THE FUTURE OF WORK

Deep dive **by sectors, skills and education**, in order to better target actions

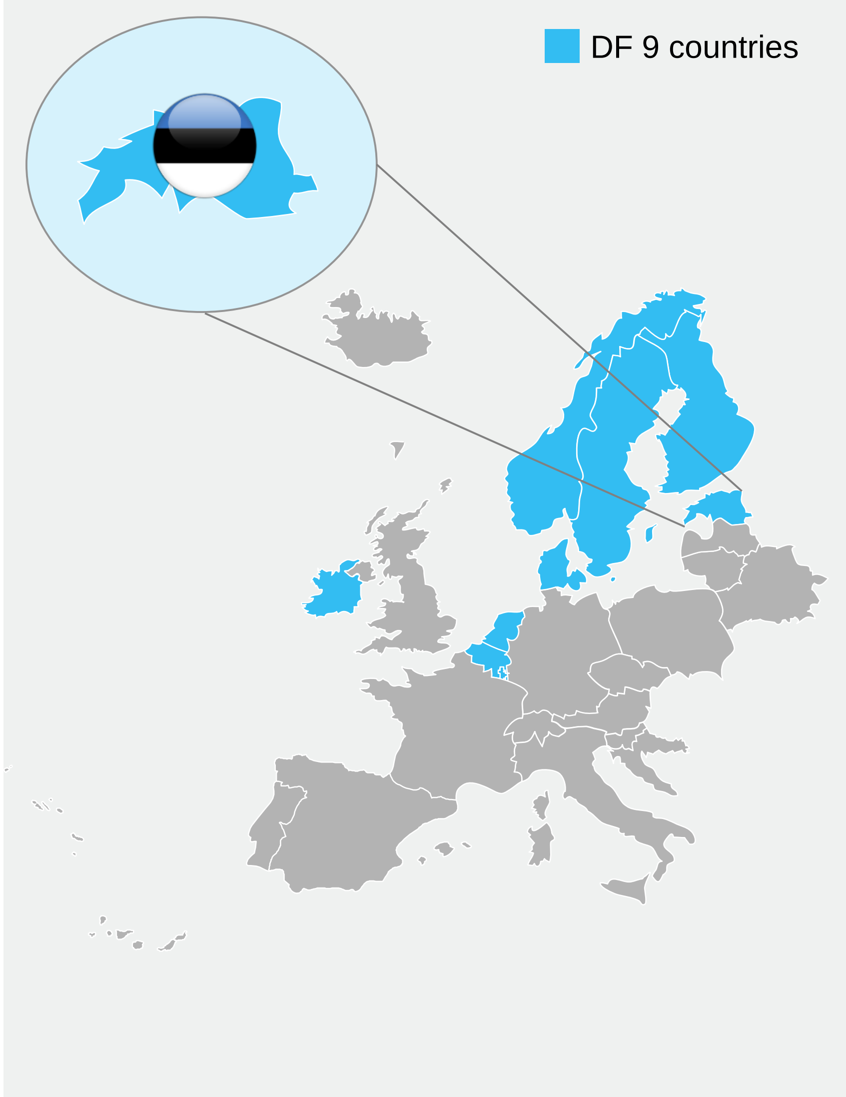
Provide a **solid fact base** on the **automation potential**, **pace of adoption** and matching tasks to new technological capabilities

Simulate full economic system: Not only automation efficiency, **but economic gain,** and hence, **net impact on jobs and skills**

Discuss and **brainstorm** on better-informed **possible actions** for the **future of work**

1 Background

The economy of Estonia at a glance

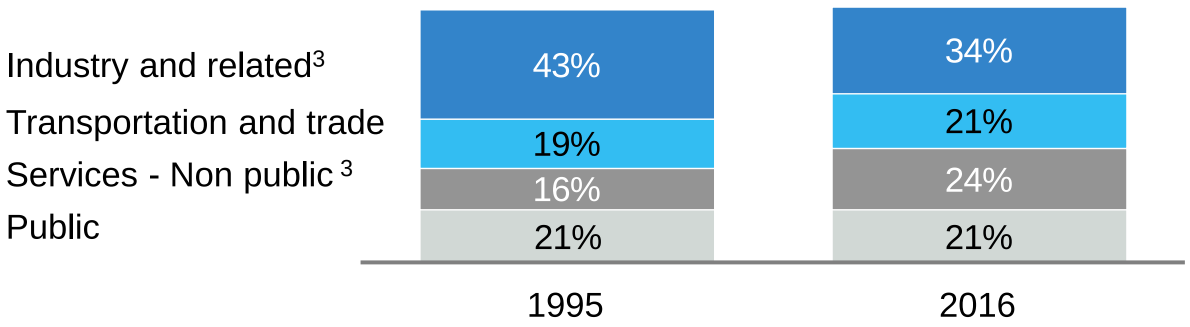


Economy development in 1990-2016: Slowing productivity

- GDP: **~ 20bn EUR** (2016)
- GDP growth[2]: **3.7%** (1990 – 2016) / GDP/capita growth[2]: **4.3%** (1990 – 2016)
- Historic labor productivity growth[2]: **0.9%** (2010–'16), **4.0%** (2000–'10), **3.5%** (1990–'00)
- Export fraction of GDP: **80%** (2016)
- Population: **~ 1.3m** (2016) / Employee base: **~ 0.6m** (2016)

Employment development 1995-2016: Shift to public and services sectors

Percentage of labor force, 2016



Digital economy: A digital leader in Europe

- Digital share to GDP: **~2bn EUR** / **~8%** of economy (2016)
- Digital share to employment: **~45,000 jobs** / **~7%** of labor force (2016)

1 DF9 consists of Belgium, Denmark, Estonia, Finland, Ireland, Luxembourg, Netherlands, Norway and Sweden
2 GDP growth is defined as the compounded annual growth rate from 1990 to 2016. Productivity growth rate is defined as the compounded annual growth rate in GDP pr. employee from 1990 to 2016
3 Industry and related contain: Primary, Utilities, Construction and manufacturing. Service – Non public contain: Hotels, Restaurants, Financial services, Professional services and Other services

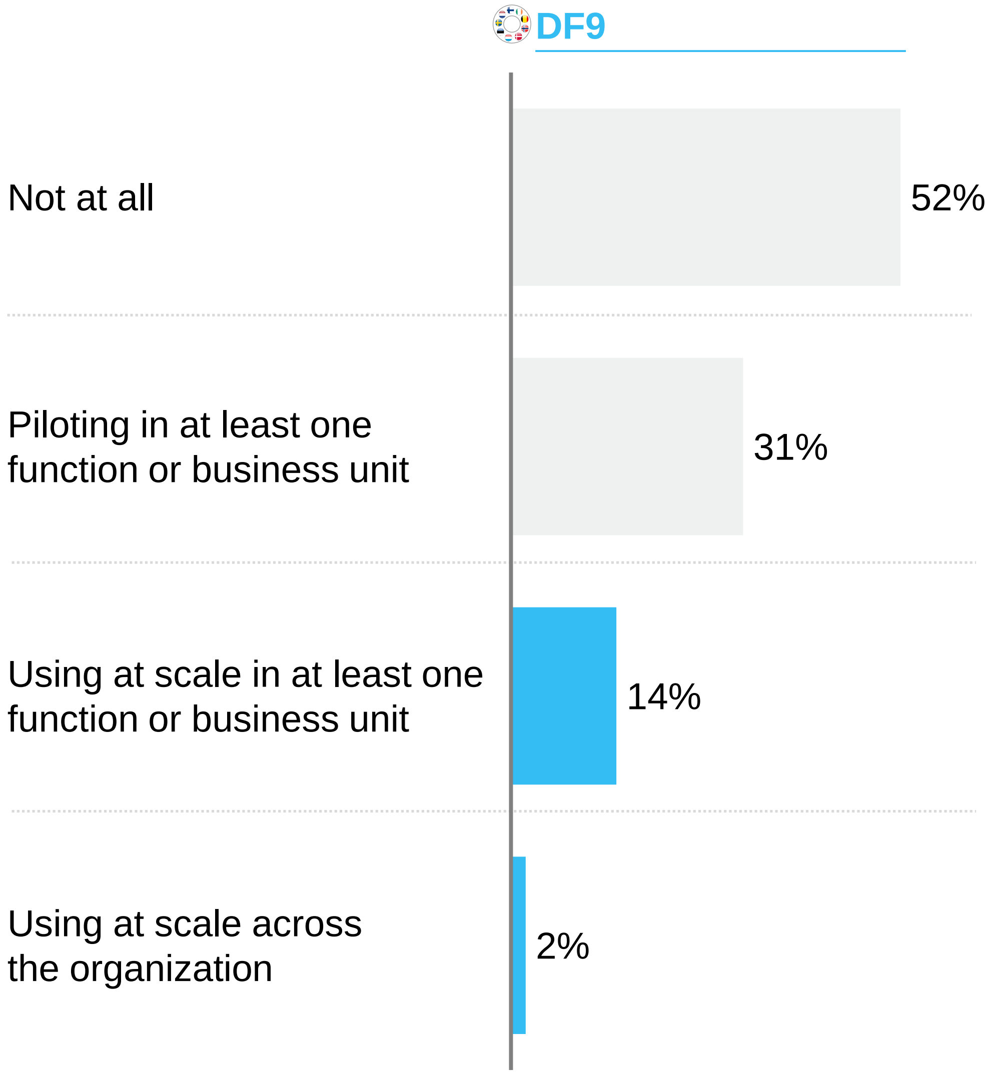
SOURCE: OECD, Eurostat, National Statistics Agency, McKinsey analysis

Estonian companies and government take notice

New technology examples

Computer Vision	Companies that build **technology that process and analyze images** to derive information and recognize objects from them
Language	Companies that build algorithms that **process human language input** and convert it into understandable representations and that process sound clips of human speech and derive meaning from them
Machine Learning	Companies that **build algorithms and platforms** that operate based on their learnings from existing data (e.g., detecting fraud in banking or identifying top retail leads)
Robotics	**Robots** that can learn from their experience and **assist humans or act autonomously** based on the conditions of their environment (e.g., autonomous vehicles)
Virtual Assistants	Software **agents that perform** everyday **tasks and services** for an individual based on feedback and commands

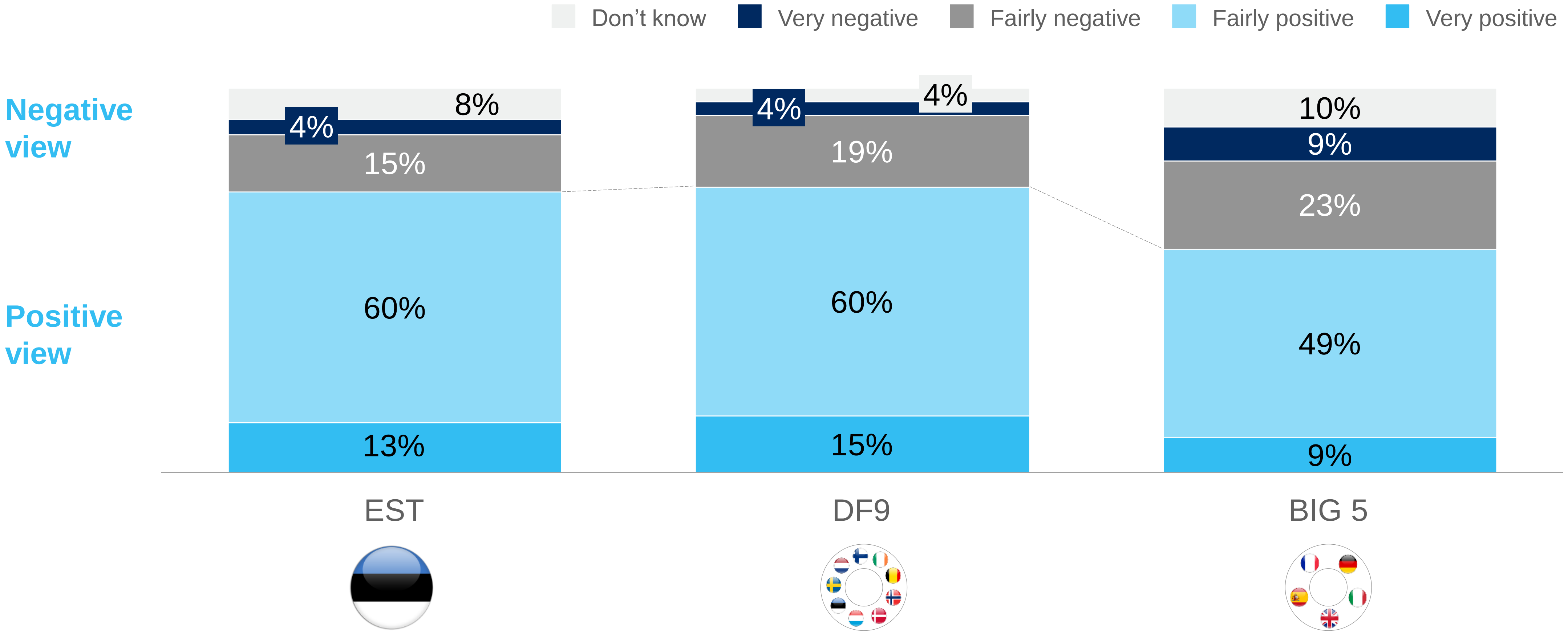
Company adoption, %



Source: McKinsey Digital Global Survey 2017; McKinsey

Estonian citizens have a positive view on the new wave of automation

View of robots and artificial intelligence in EU28
% or respondents, N=27,901



Source: EU Commission (2017); Digital Economy and Society Index 2017, European Commission; McKinsey

2 Key findings

Three crucial findings…

Automation and AI can be **important source of productivity growth** going forward –**adding to previous set of digital technologies**

Do not be afraid – labor markets should be resilient even at same wage trajectory as recent past

A **different economic and employment structure** in the making:

- Digital contribution to GDP will be twice larger than to date
- Skills moving out of routine tasks to creativity, interactions, problem-solving tasks
- 30,000 new jobs that did not exist before

SOURCE: McKinsey analysis

… and three key implications

Embrace and innovate - do not resist new digital technologies of automation and AI

Actively manage the transition – besides low innovation from automation, friction may create risk of unemployment,

Engage the full society - as automation will accelerate the pace of change, and touch all sectors, all occupations and skills (albeit with different intensity)

SOURCE: McKinsey analysis

Automation has the potential to rebuild a major growth path, and within a resilient labor market

Estimated, 2016-2030

High intensity of job creation

Slow adoption

Fast adoption

Low intensity of job creation

Midpoint scenario

GDP/capita growth: +1.8%

Net employ-ment impact: +1.6%

- **Jobs replaced:** -13%
- **New digital jobs:** +5%
- **New non-digital jobs:** +10%

Automation innovator

GDP/capita growth: +3.1%

Net employment impact: +5.9%

- Jobs replaced: -27%
- New digital jobs: +9%
- New non-digital jobs: +24%

Automation resistant

GDP/capita growth: +0.9%

Net employment impact: -0.4%

- Jobs replaced: -2%
- New digital jobs: +1%
- New non-digital jobs: +1%

Note: Simulation based on:

- Constant wages
- No major internal competition
- No friction

Source: Eurostat, McKinsey analysis

AI-based automation has the potential to relaunch a growth platform for Estonia

Sensitivity: (..)

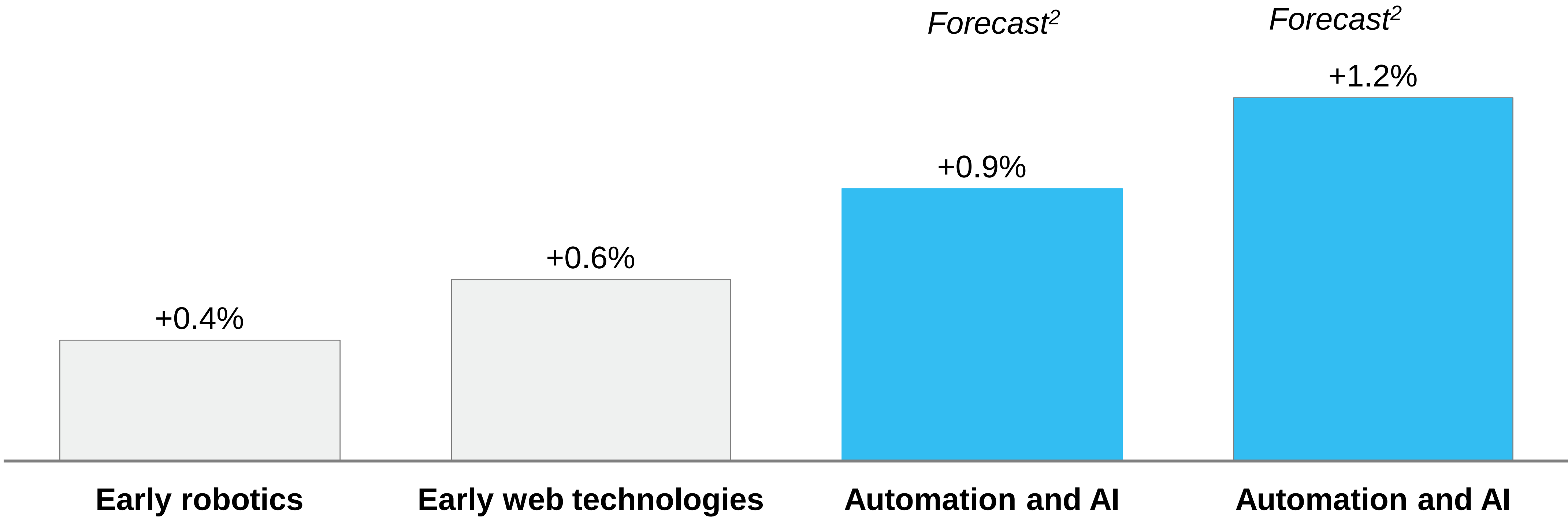
Economic impact	Historic trend 1990-2016	Baseline without digital and automation 2016-2030	Estonia with automation[2] 2016-2030	DF9 with automation[2] 2016-2030
GDP growth (p.a.)	3.7%	0.5%	1.5% (±1.0PP)	2.3%
GDP per capita growth (p.a.)	4.3%	0.9%	1.8% (±1.0PP)	1.9%
Labor productivity growth (p.a.)	4.0%	1.1%	2.0% (±0.9PP)	2.2%
Productivity growth driven by technology (p.a.)	1.0%	0.3%	0.9% (±0.9PP)	1.2%

1 Skill inequality is defined as percentage point difference in unemployment rate between high skilled and medium/low skilled
2 Midpoint scenario

Source: OECD, UN, Eurostat, McKinsey analysis

Automation technologies have the potential to turbocharge productivity

GDP growth impact[1], percent per annum



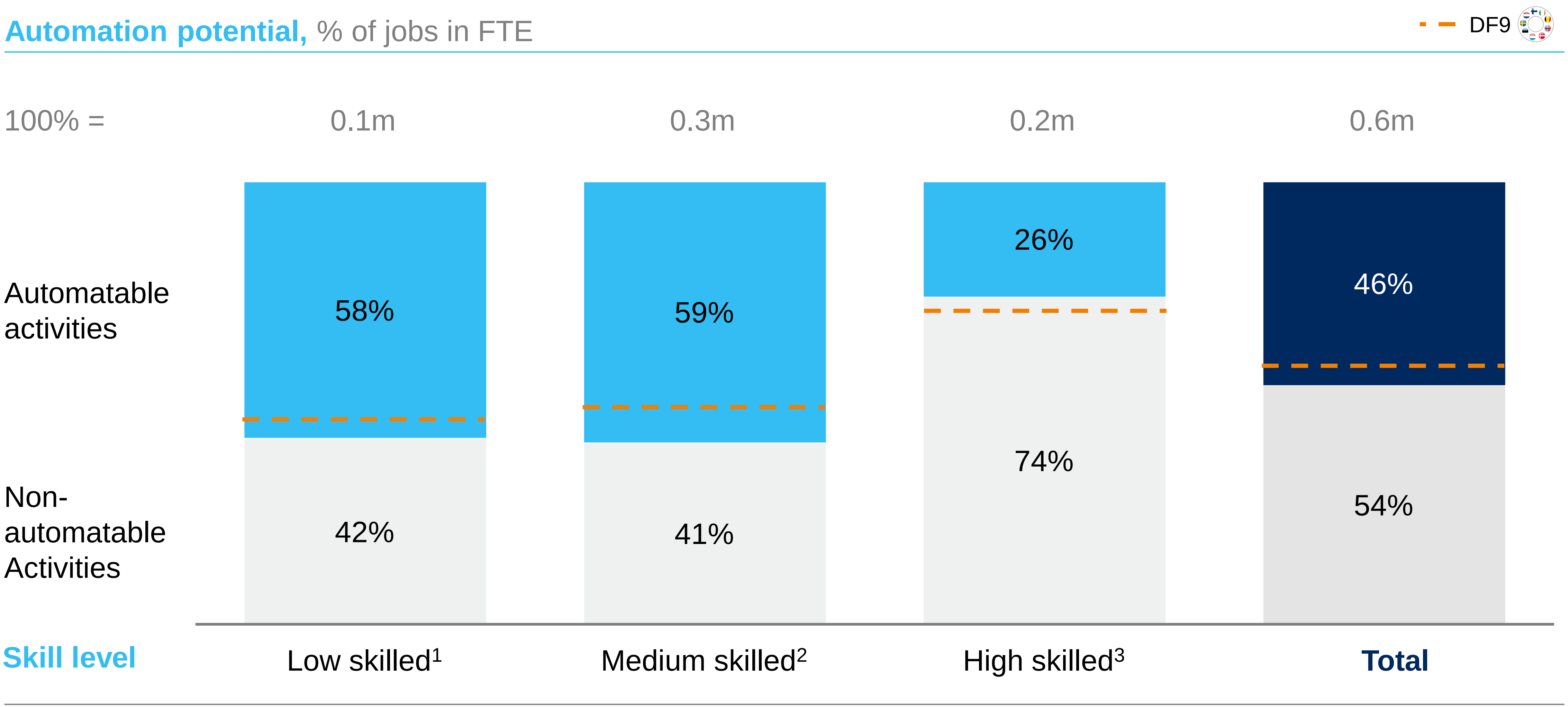
Scope	Worldwide	27 EU countries	Estonia	DF countries
Period	1993-2007	2004-2008	2016-2030	2016-2030
Contribution to GDP growth	~16%	~40%	~60-70%	~60-70%

1 Impacted through improved labor productivity
2 Midpoint scenario

Source: ITIF (Nov 28, 2016), Graetz & Michaels (2015), Evangelista et. al. (2014), McKinsey analysis

3 Automation potential

46% of tasks could be automated, and impacting as much low as medium education skill level



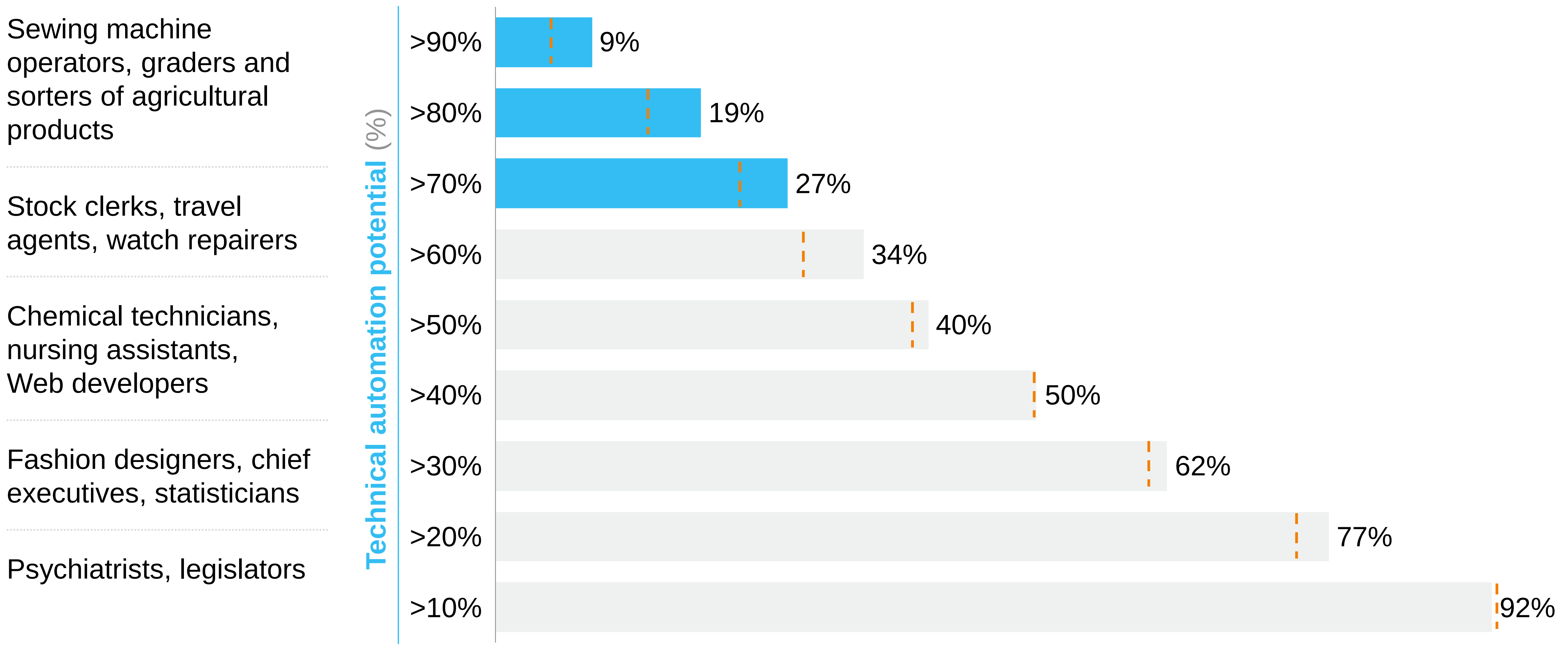
1Less than primary, primary and lower secondary (levels 0-2)
2 Upper secondary and post-secondary non-tertiary (levels 3 and 4)
3 Short-cycle tertiary, bachelor or equivalent, master or equivalent and doctoral or equivalent (levels 5-8)

SOURCE: Eurostat, McKinsey analysis

Less than 30% of existing jobs are at major risk of substitution

Example occupations
2016

Cumulative share of employees[1]
Percent, 100% = 0.6 million



1 We define automation potential according to the work activities that can be automated by adapting currently demonstrated technology

Source: McKinsey Global Institute

Automation potential varies across sectors

- Fraction of working hours likely to lead to job category loss
- Fraction of working hours likely to lead to job reorganization

Sector	Automation potential, Percent[1]	Share of working hours
Manufacturing	64%	20%
Transportation	60%	7%
Primary	54%	4%
Construction	51%	7%
Hotels and restaurant	50%	3%
Utilities	48%	2%
Trade	46%	16%
Other services	41%	1%
ICT	40%	3%
Professional services administration	39%	9%
Financial services	36%	2%
Human health and social services	36%	7%
Arts and entertainment	34%	2%
Public	34%	7%
Education	26%	11%
Total	46%	100%

While some jobs could be displaced by automation, most jobs will be complimented by new technology

1 We define automation potential by the work activities that can be automated by adapting currently demonstrated technology

Source: National statistics, McKinsey analysis

4 A resilient labor market

Automation will still feature resilient labor markets (midpoint scenario)

Change in employment from technology, millions employees 2016-2030

(…) Percent of job base

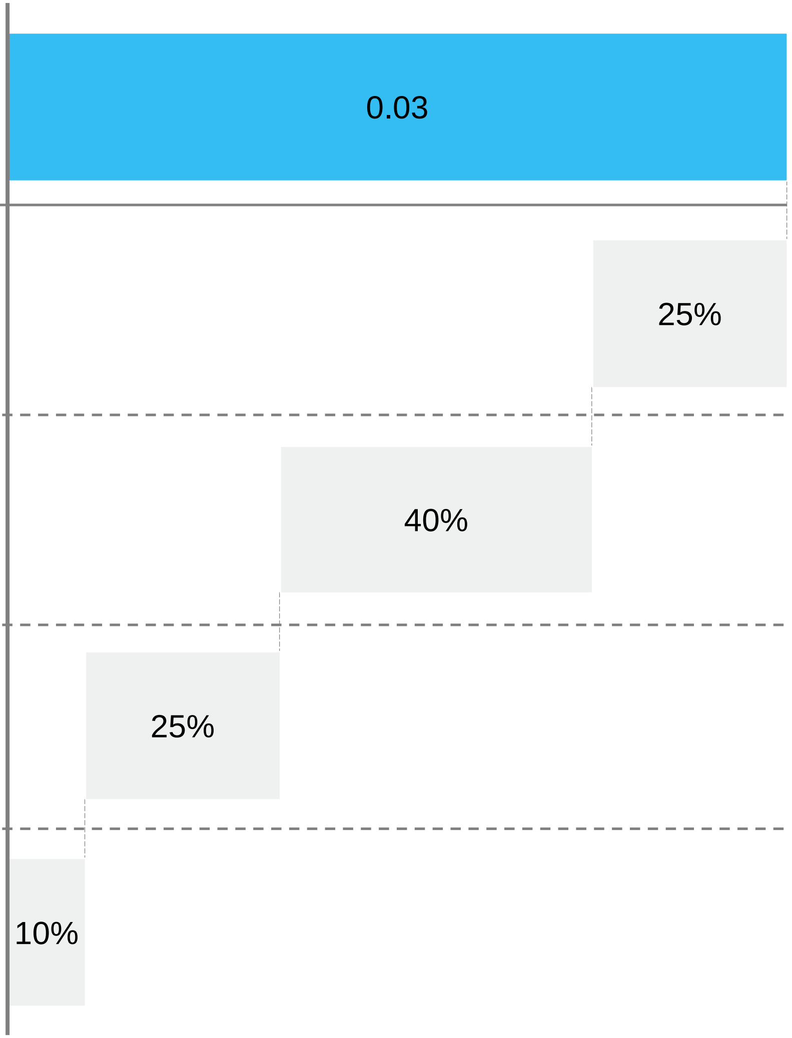
Driver of demand	Description	Estonia		Digital Frontrunners	
Jobs replaced by automation	Jobs replaced by automation	-0.07	~-13%	-4.4	~-16%
+ New jobs created by automation	New jobs related directly to creating and using automation, e.g. jobs related to robot manufacturing	+0.03	~5%	+1.6	~6%
+ Jobs created by higher productivity	Second order effects from increased productivity, leading to investments in new growth, which leads to new jobs	+0.05	~10%	+3.0	~11%
= Net effect on future labor demand		0.01	~2%	0.2	~1%

Source : McKinsey analysis

30,000 jobs in new categories can be created

New jobs created by automation	Impact on employment
Total new jobs created by automation technology	▪ Of the ~0.08 million jobs created, **~0.03 million will be created directly linked to automation technology**, ▪ **These jobs can be categorized in four overall job types**, with the split calibrated based on projected growth rates of similar occupations
1 **Creators & Suppliers**	▪ In order to automate, **the underlying technology must be produced and supplied** ▪ This technology can be a mix of robots and software ▪ Examples of **new occupations include future robots manufacturing** and software development
2 **Enablers**	▪ Ecosystems will form around **maximizing the value added from new technology** ▪ Major themes includes collecting, accessing and securing data, e.g. in **new occupations related to Internet of Things, Cloud Services and Cyber security**
3 **Utilizers**	▪ Automation adopters will seek to **maximize the value generated** by the technology, driving **new occupations related to Big Data and Advanced Analytics** ▪ In addition, existing jobs related to maintaining the technology will increase in demand
4 **Other directly related jobs**	▪ A range of jobs will rise in demand including e.g., **legislators, lawyers and ethicists**, but in new occupations **focused specifically on technology**

Potential increase in labor demand[1]
2030, Mio FTE, percent



1 Breakdown calibrated based on relative projected growth rates from US Bureau of Labor Statistics

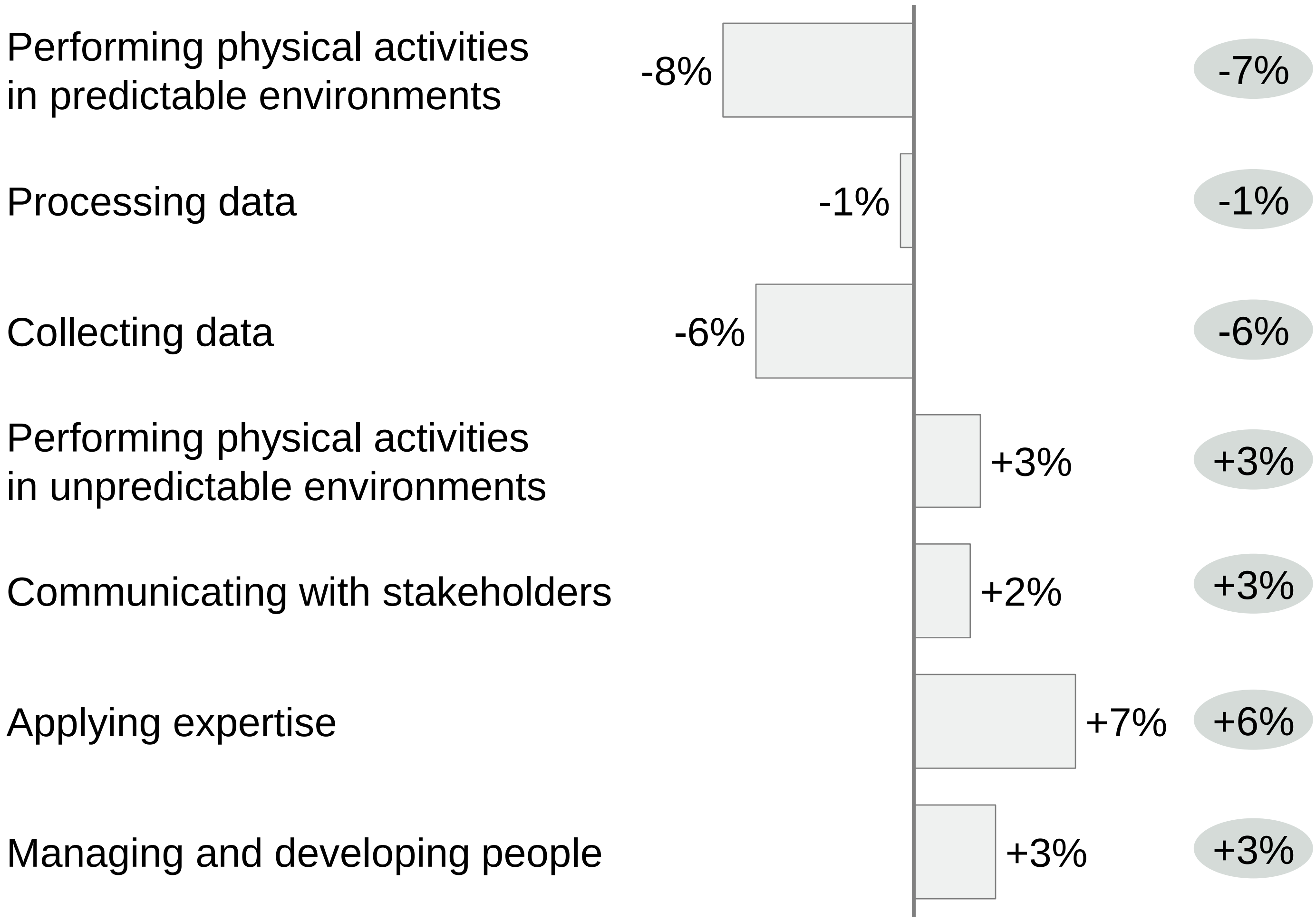
SOURCE : Lin (2009), McKinsey Global Institute, McKinsey

Change in activity and education mix to harder-to-automate activities

.. Digital frontrunners

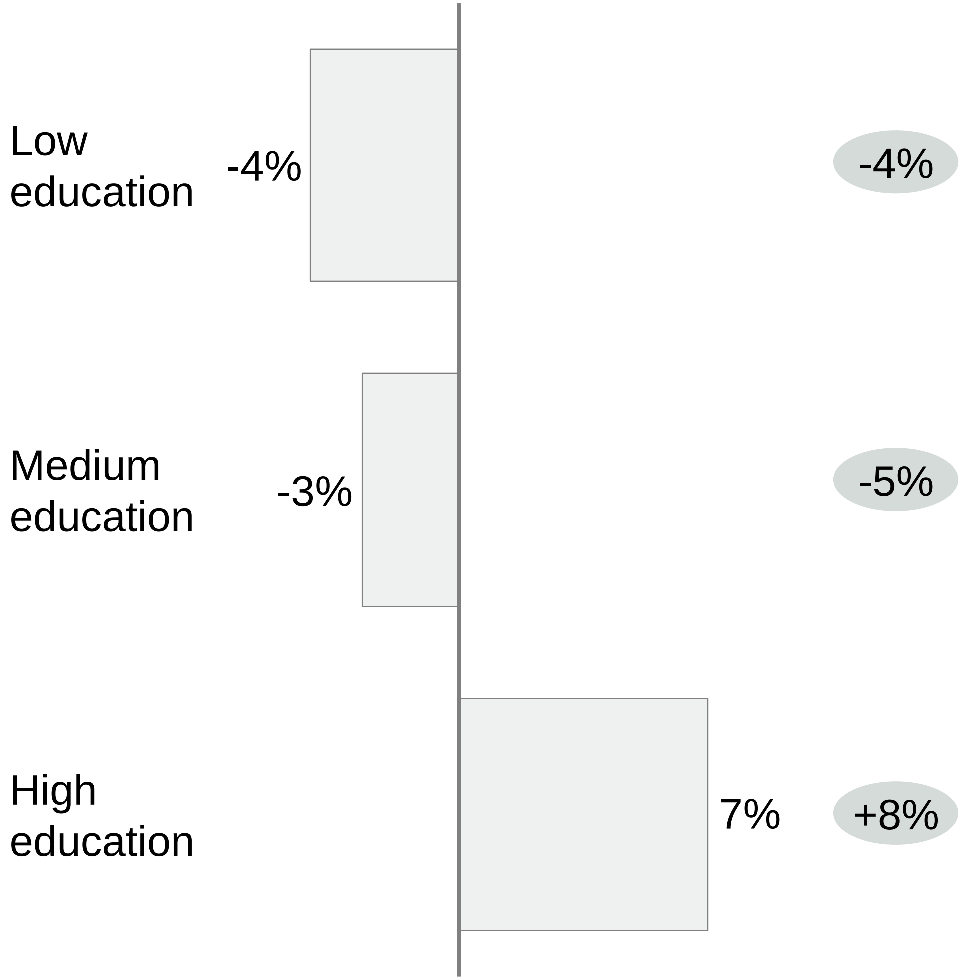
Activity composition: Change towards hard-to-automate activities

Change in percentage points, FTE time, 2016 to 2030



Education mix: Increased demand for high-educated workers

Change in percentage points, FTE time, 2016 to 2030



Source: McKinsey analysis

5 Support the transition

Skill gaps for some of the most affected occupations

Significant skill gap[2] | Large skill gap | Medium skill gap | Small skill gap | No skill gap

Occupation groups in job type 1	Percentage of employees	Examples	Skill evaluation[1]: Basic skills	Tech. skills	Problem solving	Process skills	Social skills
Office and admin. support	10%	▪ Financial clerks ▪ Office support workers	No skill gap	No skill gap	No skill gap	Medium skill gap	Medium skill gap
Food prep.	2%	▪ Serving workers ▪ Food preparation workers	Small skill gap	Large skill gap	No skill gap	Small skill gap	Small skill gap
Transportation	10%	▪ Vehicle operators	Medium skill gap	Medium skill gap	Small skill gap	Medium skill gap	Small skill gap
Construction and Extraction	6%	▪ Construction trades workers	Large skill gap	Large skill gap	Small skill gap	Large skill gap	Medium skill gap
Production	12%	▪ Metal workers ▪ Plant operators	Large skill gap	Medium skill gap	Medium skill gap	Medium skill gap	Small skill gap
Installation and repair	4%	▪ Vehicle mechanics	Large skill gap	Large skill gap	Medium skill gap	Medium skill gap	Small skill gap
Farming, fishing, and forestry	2%	▪ Agricultural workers	Large skill gap	Large skill gap	Medium skill gap	Medium skill gap	Small skill gap

1 Skill evaluation based on OECD PIACC database – Gap defined as deviation from average employee
2 Skill gap is defined as difference in skill level between occupations with likely job loss and hard to automate occupations

SOURCE: OECD PIACC database, McKinsey MGI model, McKinsey analysis

A possible agenda for stakeholders in Estonia

Stakeholders:: § Policy makers   Public-private collaboration

Strategies	Priorities	Stakeholder
1 Work to maintain digital front-runner digital leadership status	1. Initiate and invest in new infrastructure	§
	2. Remove barriers to adoption	§
2 Support local AI and automation ecosystems	3. Lead by example in the public sector	§
	4. Encourage local experiments and local talents	
	5. Foster public R&D	§
3 Educate and train for the future of work	6. Reorient curricula towards the future of work	§
	7. Promote automation technologies for new forms of learning	
	8. Emphasize lifelong learning in higher education	§
	9. Provide for on-the-job training and digital apprenticeships	
4 Support worker transition	10. Experiment with social models to support worker transition	§
	11. Assess flexibility in adjusting hours worked per week	
5 Shape the global policy framework	12. Support the development of AI ecosystems	