Study on the sufficiency of ICT specialists in the Greek labour market

Federation of Hellenic Information Technology & Communications Enterprises (SEPE)

December 2022

Executive Summary

Introduction

The era of digital transformation is here. The COVID-19 pandemic acted as a catalyst for the adoption and consolidation of new digital technologies in every economic and social aspect worldwide. Greece was no exception.

Greece's Information and Communication Technologies (ICT) sector has been experiencing an upward trend in recent years, a fact that is confirmed by a "vote of confidence" by large international companies investing in the country.

At the same time, the digital transformation of both the public sector and businesses has made remarkable progress.

However, one of the most critical issues that arise - globally - in the new digital age is the shortage of ICT specialists. In this context, SEPE, in cooperation with Deloitte, conducted a study to assess the level of ICT specialists sufficiency in Greece.

Objectives of the study

The main objectives of this study are to assess the number of ICT specialists in Greece, to quantify the current and future demand, and determine whether it is satisfied by supply, currently and for the years to come. Ultimately, it provides recommendations that could lead to a further increase of ICT specialists in the Greek labour market.

As part of the study, Deloitte conducted two primary surveys - in the private and public sector, on behalf of SEPE. The goal was to record the opinion of companies and public sector bodies regarding the needs for ICT specialists, their competence, future needs and, problems they may face in the search for suitable personnel.

The results of both the primary surveys and the assessment of the adequacy of the number of ICT specialists in Greece showed that Greece is already experiencing a gap in ICT specialists. If no appropriate measures are taken, this is expected to increase sharply by 2030, a milestone year for the digital path of the European Union, as the "Digital Decade" comes to an end.

Main findings and recommendations

More specifically, the **supply/demand gap** is estimated to reach **~7,000 - 7,500 ICT specialists** per year during 2023 - 2030.

Based on the above, Deloitte, together with a SEPE Working Group, came up with **ten proposed actions** that could contribute to filling the ICT skills gap in Greece. More specifically, the following actions are proposed:

- Attraction & utilization of experts from abroad - through Tech Visas and the establishment of ICT Hubs abroad by Greek ICT companies
- Increase of training programs (bootcamps) on ICT subjects
- Enrichment of curricula of other departments with ICT courses
- Mandatory internships for students & strengthening cooperation between universities and ICT companies
- Further promotion and teaching of ICT subjects & skills in primary & secondary education
- Establishment of New undergraduate ICT programmes / departments
- Establishment of New postgraduate ICT programmes / departments
- Cooperation with foreign universities
- Increasing the employment rate of women in the sector
- Establishment of an Observatory, a permanent mechanism for the study and assessment of ICT skills and needs in Greece.

Based on the above recommended actions, which differ in realization timelines, the gap is expected to be filled from 2029 onwards.

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Transition towards a digital Europe

Transition towards a digital Europe | Introduction

The EU Digital Agenda aims at the digital transition of the Union's economy and society. Meeting these objectives though, comes with significant challenges in terms of ICT human resources.

Towards a digital EU

The role of the pandemic
The COVID-19 pandemic highlighted the significance of the EU's digital transformation. Following this experience, the EU has made green and digital growth the main pillars of its strategy.

Next Generation EU
The EU's economic recovery plan requires Member States to allocate at least 20% of the €672.5 billion Recovery and Resilience Fund to their digital transformation.

Indicative initiatives for the Digital EU
- Digital Services Act
- Digital Markets Act
- European Chips Act
- European Identity Act
- Artificial Intelligence Act
- European Data Act

Indicative objectives

Promoting digitisation via NextGeneration EU

€250 bn.

Development of basic digital skills

80% of Europeans

Investments to strengthen Chips Act *(by 2030)*

€43 bn.

Challenges

ICT specialist shortages
The number of specialists in ICT skills in the EU **is not meeting demand**, thus, creating a **major obstacle** as the **transition to a digital economy** relies on human talent

Difficulties in filling vacancies
58% of companies **experienced difficulties in recruiting ICT specialists**, with common barriers cited the **lack of applications**, the **lack of relevant qualifications** and **higher salary expectations**

International competition
- The **EU, on average, "produces" fewer ICT graduates** than the **US** and **China**
- The EU has **significantly fewer people**, on average, **with basic programming skills** than the **US** and **China**
- **59% of AI researchers** work in the **US**, compared to just **10%** in the **EU**
- The **EU lags behind the** US in ICT experts specialising **in cloud computing, big data analytics,** and **micro-electronics**

Transition towards a digital Europe | Pillars of the EU Digital Compass

Having recognised the challenges in relation to the ICT workforce, the EU has set targets to boost the ICT and digital skills of the general population by 2030, through the Digital Compass.

Objectives per Digital Compass Pillar

Digital skills

- **20 million ICT specialists in 2030** (compared to 8.4 million in 2021 - *CAGR ~10%*)
- Basic digital skills for at least 80 % of the population
- Reducing the digital gender gap in employment

Secure and sustainable digital infrastructures

- Universal access to 5G
- Double EU share in global production of cutting-edge semiconductors
- 10,000 climate-neutral, high-security data edge nodes
- Installation of the first quantum-accelerated computer by 2025

Digital transformation of businesses

- 75% of companies should use cloud computing / artificial intelligence / big data
- Increase EU start-ups and their funding to double the number of EU unicorns
- Achieve a minimum level of digital transformation for 90% of SMEs

Digitalisation of public services

- 100% online availability of key public services
- Online access to medical records by all citizens
- 80% of citizens should use a digital ID

Developments & challenges in the Greek ICT sector

Presentation of the primary survey by SEPE / Deloitte

Developments & challenges in the Greek ICT sector| Positive Developments

The Greek ICT sector is expected to recover rapidly after the pandemic, due to the existing infrastructure, the favourable investment landscape, the growing innovation ecosystem and national planning.

Developed ICT infrastructure

🔒 **ICT access**: Greece ranked 21st in out of a total of 132 countries (Global Innovation Index 2021, while also aiming to reach **94% 5G coverage** by 2026 (was one of the first 3 EU countries to complete the auction process for the operation of 5G)

€ **Software spending**: Greece ranked 10th in computer software spending, as % on GDP (Global Innovation Index 2021)

Favourable Investment Landscape

x3

- In 2021, the ICT sector accounted for **7% of total net FDI** in Greece, **3 times more** than in 2019 (~€330 million). **World leaders** have recently expanded their Greek **operations** (ie, data centers/ digital hubs from **Microsoft**, **Pfizer**, **Deloitte**, etc.) and/or have acquired Greek companies, such as the acquisitions of **WIND** by **United Group** and **Intrasoft** by **Netcompany**
- At the same time, **significant investments** are also made by Greek companies (e.g., Lamda Development in Elliniko)

Innovation led by a Flourishing Start-up Ecosystem

Investment per round, median
(in mil. €)

73%

0,53 (2017-18)
0,75 (2019)
1,65 (2020)
2,74 (2021*)

- In **2021**, Greek startups received increased investment attention, with funding exceeding **€500** m. in total.
- **Participation of international investment funds**, such as CVC Capital Partners, has risen sharply, validating development of the ecosystem.
- Global **industry leaders** have also completed acquisitions of **scaleups**, such as **Softomotive's** by **Microsoft** and **Viva's** by **JP Morgan**.
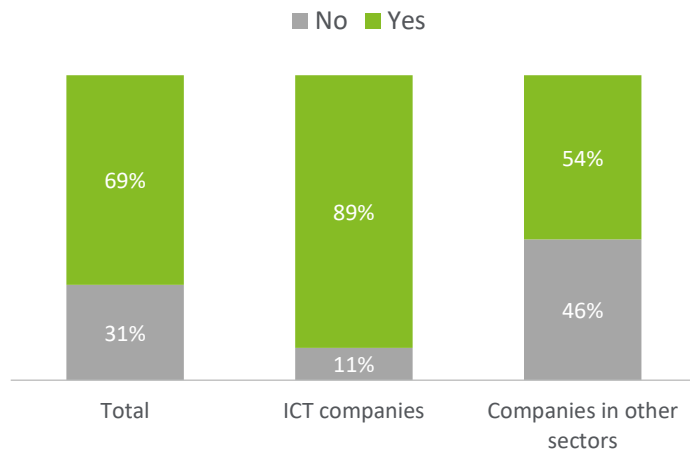
Government Reforms and Incentives

- Through EU's RRF, Greece has launched a **National Recovery & Resilience Plan** (RRP), consisting of **€31 bil.** in grants and loans, to implement a series of investments and reforms, in selected sectors. **More than 25%** of grants is dedicated to **digital transformation**.
- Furthermore, a series of **innovation incentives and mechanisms** have been introduced in the past few years to elevate the attractiveness of Greece as an investing destination, such as **Development Law**, **Strategic Investments**, **R&D Tax deduction**, etc.

Developments & challenges of the Greek ICT sector | Key findings of the primary survey by SEPE/Deloitte

The survey conducted by Deloitte, on behalf of SEPE, confirmed that the vast majority of companies in Greece have vacant positions for ICT specialists, while a significant increase in their needs is expected in the future.

Do you have vacancies in ICT specialist positions in your company right now?

■ No ■ Yes

- Total: Yes 69%, No 31%
- ICT companies: Yes 89%, No 11%
- Companies in other sectors: Yes 54%, No 46%

% of vacant ICT specialists' positions currently in the total number of ICT staff
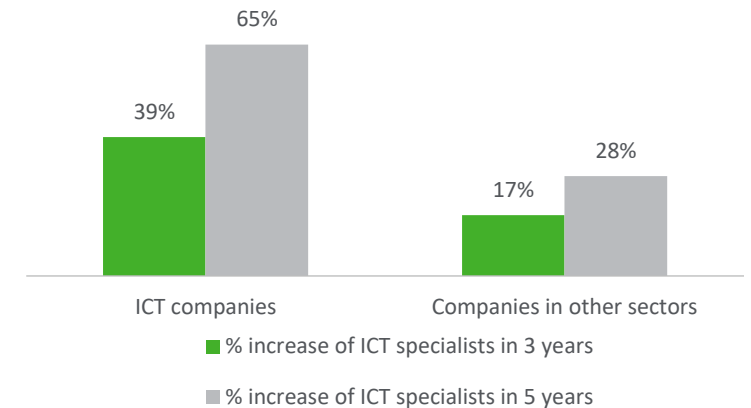
7,8%
% of vacant ICT specialist positions currently in the ICT industry

7,5%
% of vacant ICT specialist posts currently in other sectors

Estimated growth (%) of ICT specialists in the coming years
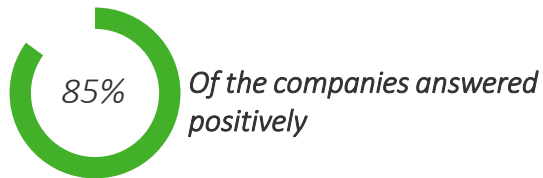*(based on existing number of ICT specialists)*

- ICT companies: 39%, 65%
- Companies in other sectors: 17%, 28%

■ % increase of ICT specialists in 3 years
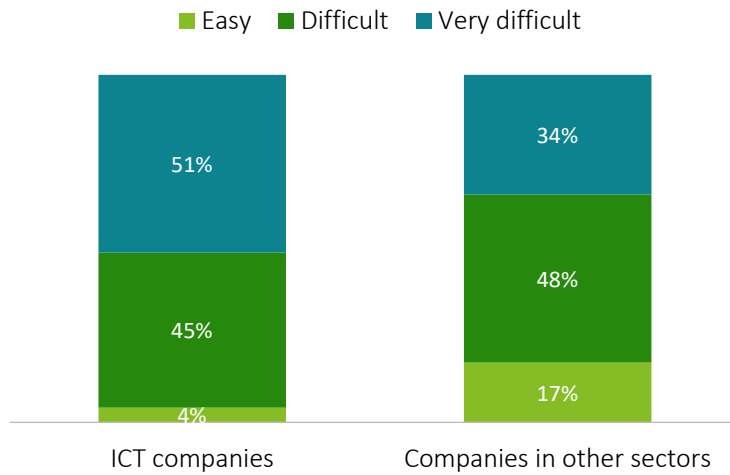■ % increase of ICT specialists in 5 years

Developments & challenges of the Greek ICT sector | Key findings of the primary survey by SEPE/Deloitte

The survey confirmed that companies in Greece face difficulties in recruiting ICT specialists, with the main reasons being insufficient specialisation and the loss of talent abroad (brain drain).
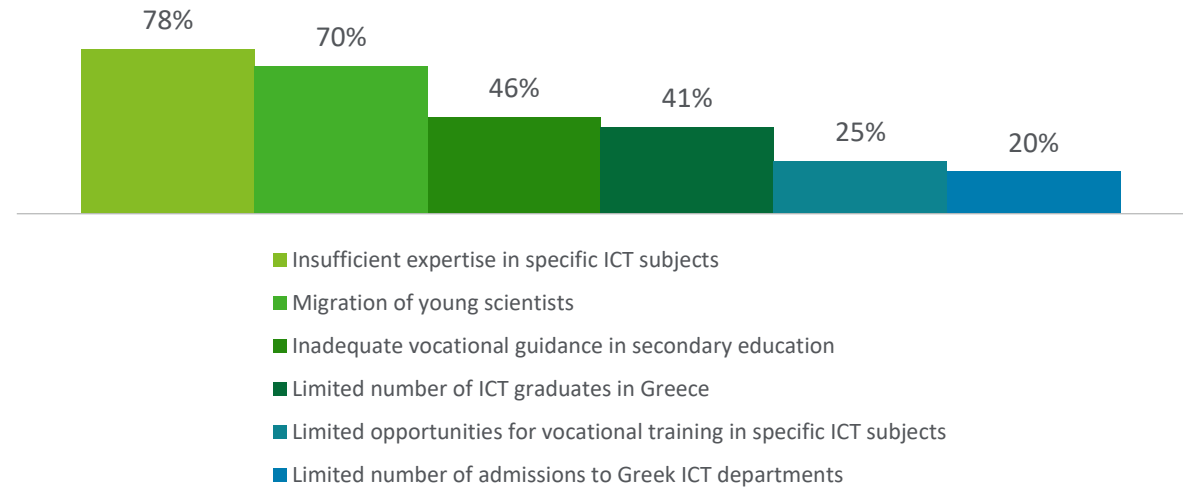
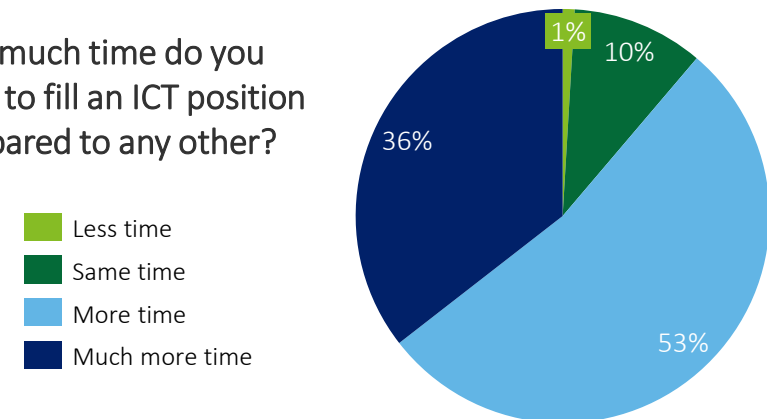## Do you think that the Greek labour market faces a lack of ICT specialists?

85% *Of the companies answered positively*

Degree of ease of finding suitably qualified ICT specialists

■ Easy ■ Difficult ■ Very difficult

ICT companies
- 51%
- 45%
- 4%

Companies in other sectors
- 34%
- 48%
- 17%

Major reasons for the lack of ICT specialists in Greece

- 78%
- 70%
- 46%
- 41%
- 25%
- 20%

■ Insufficient expertise in specific ICT subjects
■ Migration of young scientists
■ Inadequate vocational guidance in secondary education
■ Limited number of ICT graduates in Greece
■ Limited opportunities for vocational training in specific ICT subjects
■ Limited number of admissions to Greek ICT departments

How much time do you need to fill an ICT position compared to any other?

■ Less time
■ Same time
■ More time
■ Much more time

- 1%
- 10%
- 53%
- 36%

Developments & challenges of the Greek ICT sector | Key findings of the primary survey by SEPE/Deloitte

Participating companies rated a high percentage (43%) of graduates' labour market readiness as "moderate", while there is a significant demand for programming and cybersecurity skills.

Assessment of graduates' readiness for labour market integration

- 27%
- 43%
- 24%
- 6%

■ Good - Graduates are productive within <6 months
■ Medium - Graduates are productive within 6-12 months
■ Bad - Graduates are productive within >12 months
■ We do not have a picture of the readiness of graduates of Greek universities

Top-3 specialties in demand in the ICT sector

Now		In the next years	
78%	Programming	85%	Programming
54%	Cybersecurity	65%	Cybersecurity
48%	Information systems architecture	57%	Cloud Management

Top-3 specialties in demand in the rest sectors

Now		In the next years	
52%	Programming	42%	Programming
48%	IT Business Analysis	42%	IT Project Management
48%	IT Project Management	42%	AI / Machine Learning

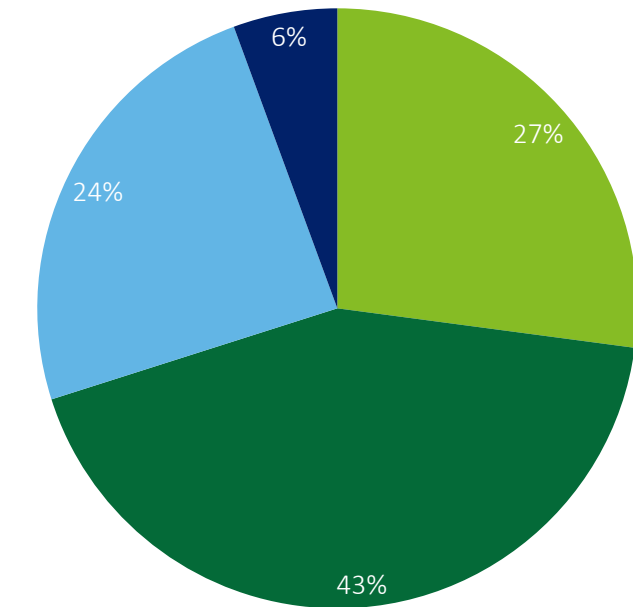**Source**: Primary survey by SEPE/Deloitte, 2022
Note: In the Appendix the main characteristics of the profile of the participating companies is presented

Developments & challenges of the Greek ICT sector | Key findings of the primary survey by SEPE/Deloitte

The questionnaire directed to the Greek Public Sector highlighted the existing needs for ICT specialists, as well as the specialties with the greatest current and future demand with cyber security showing the sharpest projected rise in demand.

Greek Public Sector

Do you currently have a number of vacant ICT specialist positions in your organisation?

36%

64%

Yes   No
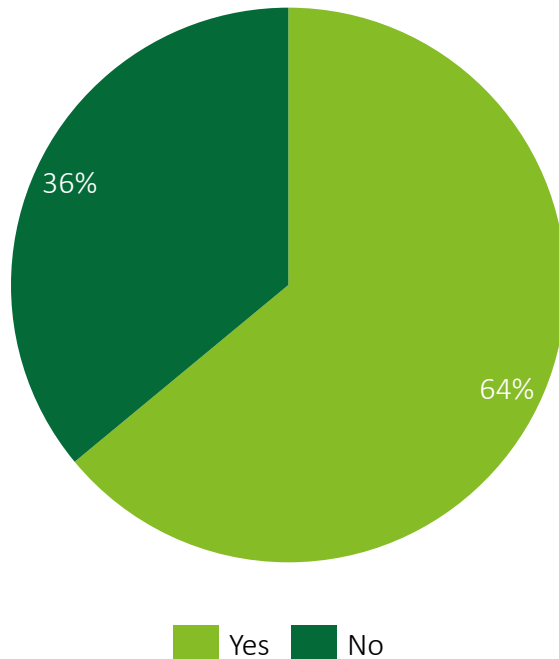
Top-3 specialties in demand in the Public Sector

Now

56% Cybersecurity

52% Programming

48% Analysis/ management/ architecture of information systems & data

In the next years

61% Cybersecurity

52% Analysis/ management/ architecture of information systems & data
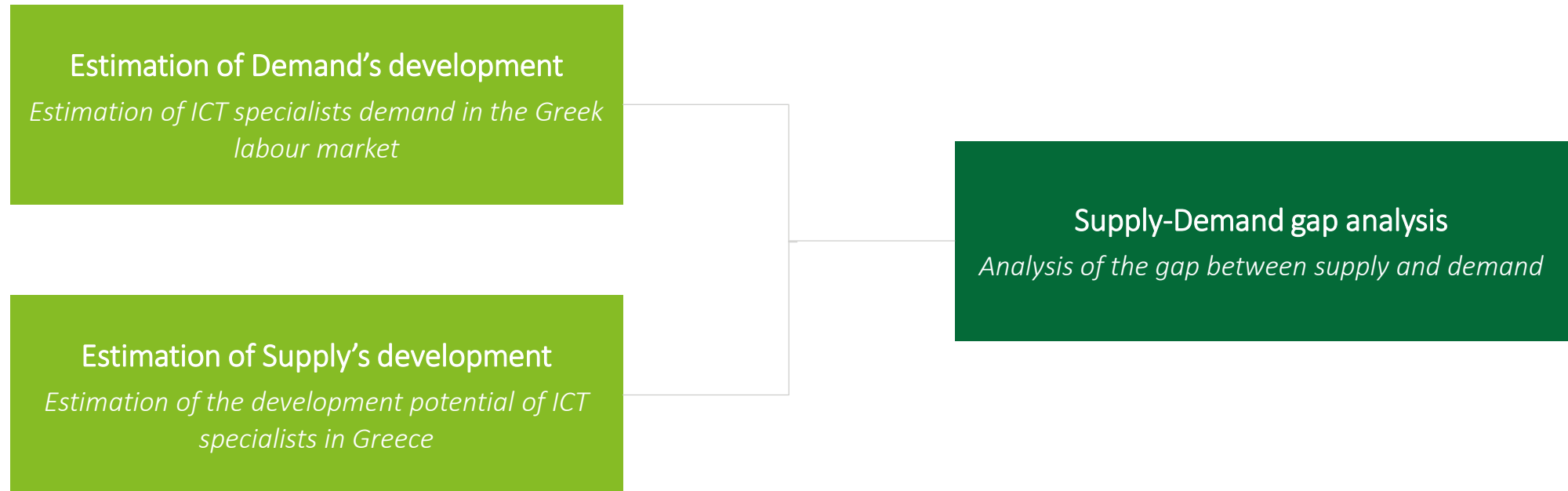
44% Network & telecommunications management/design

Assessment of ICT specialists' sufficiency

Assessment of ICT specialists' sufficiency | Stages of Methodology

The evaluation of ICT specialists' sufficiency in the Greek labour market was based on the expected gap between demand and supply for labour until 2030.

Estimation of Demand's development

Estimation of ICT specialists demand in the Greek labour market

Estimation of Supply's development

Estimation of the development potential of ICT specialists in Greece

Supply-Demand gap analysis
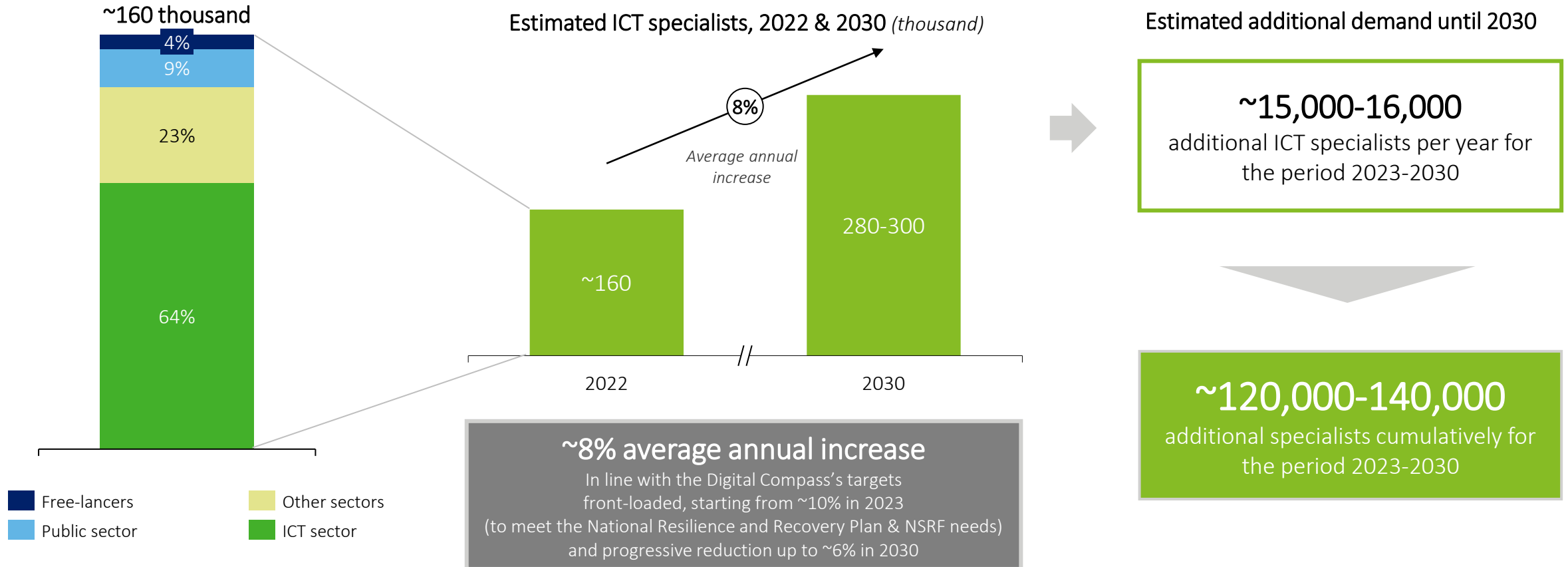
Analysis of the gap between supply and demand

The study refers to human resources with ICT expertise (and not general ICT skills) in various sectors of the economy (and not exclusively within the ICT industry)

Assessment of ICT specialists' sufficiency | Estimation of ICT specialists' demand today & in the future

ICT specialists are currently estimated at 160 thousand, while considering the EU's Digital Compass targets along with the need to support Greece's digital transformation, by 2030 ~280-300 thousand ICT specialists will be needed.
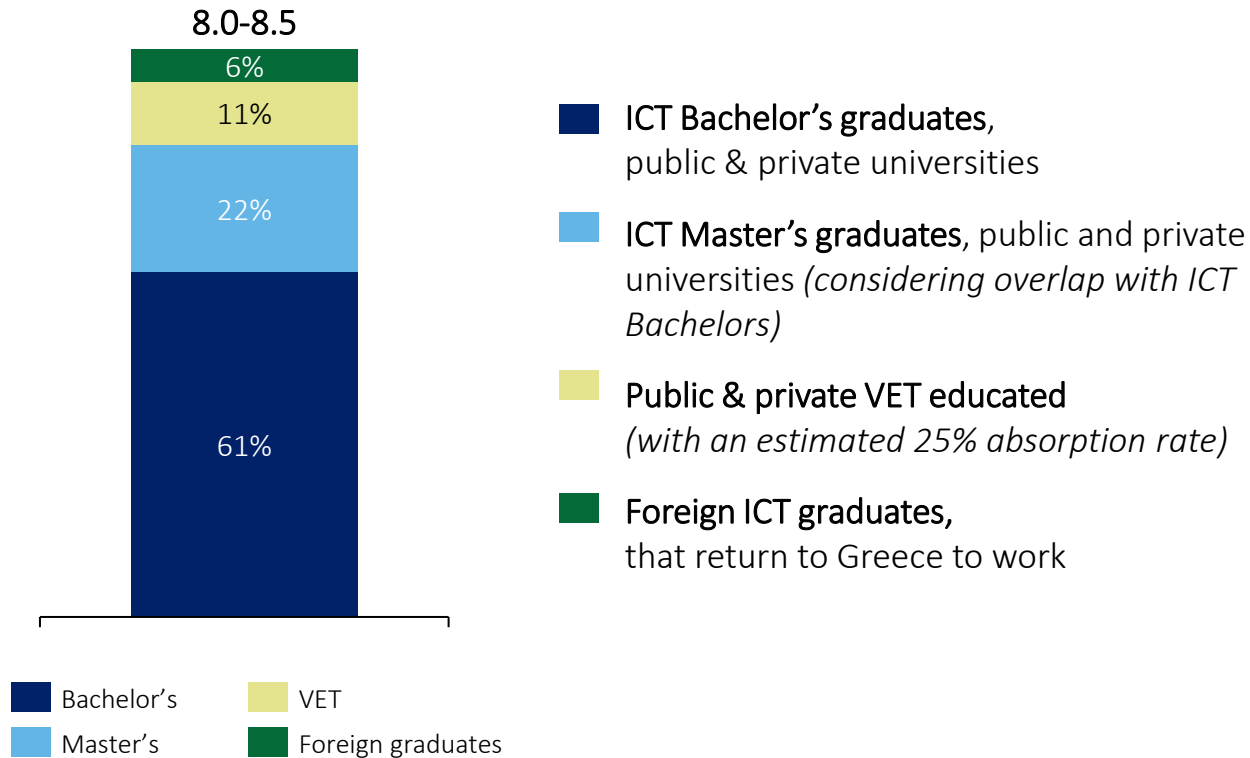
Estimated ICT specialists, 2022

~160 thousand

- 4%
- 9%
- 23%
- 64%

Estimated ICT specialists, 2022 & 2030 *(thousand)*

8%

Average annual increase

~160 (2022)

280-300 (2030)

~8% average annual increase
In line with the Digital Compass's targets front-loaded, starting from ~10% in 2023
(to meet the National Resilience and Recovery Plan & NSRF needs)
and progressive reduction up to ~6% in 2030

Legend:
- Free-lancers
- Public sector
- Other sectors
- ICT sector

Estimated additional demand until 2030

~15,000-16,000
additional ICT specialists per year for the period 2023-2030

~120,000-140,000
additional specialists cumulatively for the period 2023-2030

Sources: Hellenic Statistical Authority, ICAP, Apografi.gov.gr, Research: SEPE, Analysis: Deloitte
Notes: 1. For the ICT companies, it has been calculated that ~40% of the staff are ICT specialists. | 2. For other sectors, it has been calculated that ~2% of the staff, are ICT specialists. | 3. The data that has been used for the Public sector were from apografi.gov.gr for Central Government institutions / Ministries (~4%), while in the broader Public sector, ICT specialists were estimated at 0.5% of the staff. | 4. Among the free-lancers, it has been estimated that the ICT specialists 0.5%. | 5. The figures that are shown are rounded

Based on estimates of the evolution of the graduates' supply from 2023 to 2030, the available supply is expected to reach ~ 8-8.5 thousand per year.

Estimated ICT graduate supply 2022 *(thousand)*

8.0-8.5

6%	
11%	
22%	
61%	

- Bachelor's
- Master's
- VET
- Foreign graduates

■ **ICT Bachelor's graduates,** public & private universities

■ **ICT Master's graduates**, public and private universities *(considering overlap with ICT Bachelors)*

■ **Public & private VET educated** *(with an estimated 25% absorption rate)*

■ **Foreign ICT graduates,** that return to Greece to work

Estimated supply until 2030

~8,000-8,500
ICT specialists supply per year for the period 2023-2030

~64,000-68,000
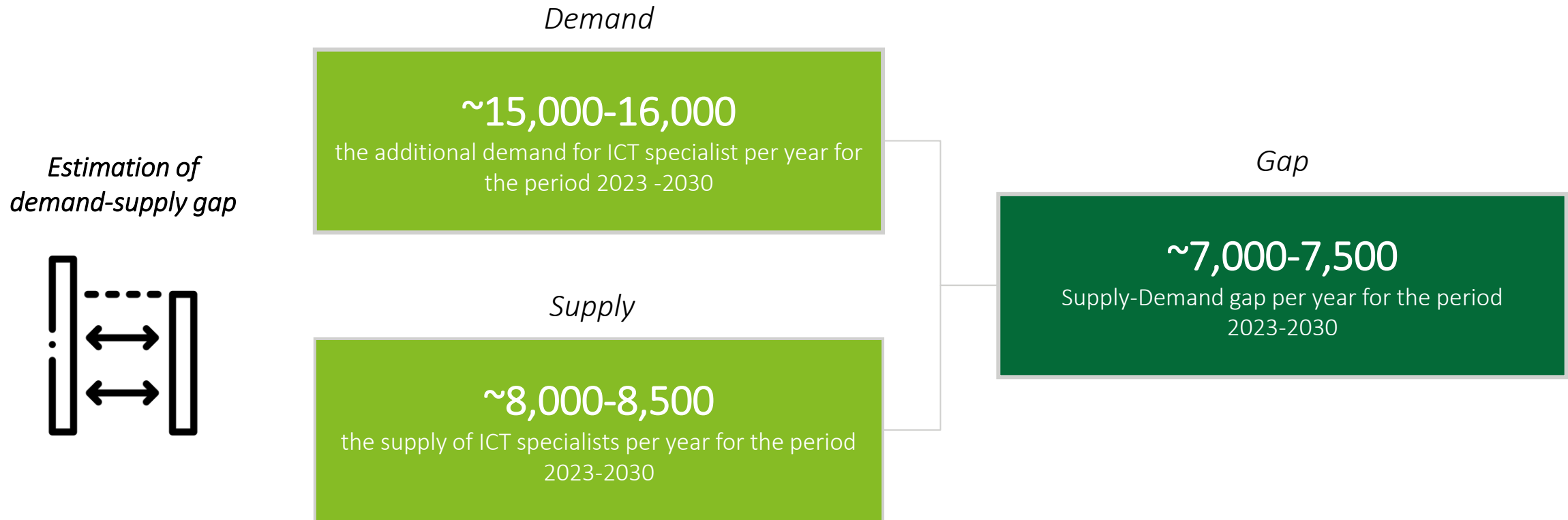ICT specialists supply, cumulatively for the period 2023-2030

Sources:Ministry of Education and Religious Affairs, Hellenic Authority for Higher Education, Analysis: Deloitte
Notes: 1. For 2022, ICT Bachelor's graduates were estimated at 5,000 from public universities (previously 4,700, according to the latest data for 2021). The estimation for 2022 was based on 4-year historical evolution) and 300 from private universities (Ministry of Education and Religious Affairs, Hellenic Authority for Higher Education). The MSc's graduates were calculated after applying 20% overlap (with ICT Bachelor's students) on an estimate of ~2,400 public & private universities graduates (according to Ministry of Education and Religious Affairs data). Finally, a 25% absorption of trainees of vocational education (VET) was taken into account | 2. Finally, the positive influx of foreign ICT graduates was considered until 2030, up to the amount of 250 graduates per year until 2030. | 3. The figures that are shown are rounded.
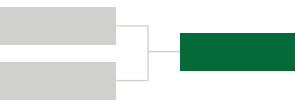
Assessment of ICT specialists' sufficiency | Supply-Demand Gap Analysis

Based on the methodology followed, the estimation of the additional demand, which is not expected to be met by the available supply, is on average ~7-7.5 thousand per year for the period 2023 to 2030

Demand

~15,000-16,000

the additional demand for ICT specialist per year for the period 2023 -2030

Estimation of demand-supply gap

Supply

~8,000-8,500

the supply of ICT specialists per year for the period 2023-2030

Gap

~7,000-7,500

Supply-Demand gap per year for the period 2023-2030

Proposals for the increase of ICT specialists

Proposals for the increase of ICT specialists | Overview of proposed actions

In order to increase the number of ICT specialists in Greece, a set of ten actions is recommended, divided into actions with short-term and long-term impact, including other actions that act as enablers.

Actions with short-term impact

Actions with long-term impact

Other actions (enablers)

Increase of ICT training programmes

Action Description

Currently, a series of university, VET, VTC, and private institution training programmes are being implemented. Co-sponsored training programmes by organizations are also offered, such as DYPA in collaboration with KEDIVIM, VCT and other institutions (e.g. SEPE, ESEE), as well as ISO and EOPPEP certifications. In this context, it is proposed **to further promote ICT training programmes with high demand among the employed and unemployed**, with particular emphasis on public and private institution graduates in the fields of science, mathematics, economics:

- **Central Planning by the Business Associations of each sector** (e.g. SEPE for ICT fields), covering both the private and public sector in terms of the required specialisations.
- **Traineeship opportunity,** 3 months -additional- to theoretical training for the unemployed. For specific, highly targeted fields, the participating companies should commit to providing adequate number of paid internships for the beneficiaries,
- **State funding for certifications** and **recognition of international certifications, by the State**

In this regard, it is proposed to explore the possibility of **providing incentives** from the State to companies to organise more **bootcamps** , which aim to meet their needs.

Notes: VET: Vocational Education and Training , VTC: Vocational Training Centers, DYPA: Public Employment Service, KEDIVIM: Training and Lifelong Learning Centre, ESEE: Hellenic Confederation of Commerce and Entrepreneurship, EOPPEP: National Organization for the Certification of Qualifications & Vocational Guidance

Stakeholders *(indicatively)*

- Target-group: employed & unemployed individuals *(based on criteria)*
- Companies looking for ICT specialists|Universities' KEDIVIM, Private training centers| Ministry of Education/ Labour / Finance

Expected Impact

Low   High

- **Significant coverage of companies' needs**, with **an increase in the number of ICT specialists from other sectors**, suitably trained in ICT specialties with high demand
- **Improving the job readiness** of specialists, **through reskilling** (employees of other branches) **& upskilling** (in ICT), with the aim of **creating new employment prospects.**
- **Strengthening the ecosystem**, by reducing unemployment & and increasing skilled work

Implementation Complexity *(challenges)*

Low   High

- **Cooperation between stakeholders** to determine standards (e.g. responsibilities, timetables)
- **Participation of companies and their commitment** to provide internship positions
- **Coordination & monitoring the implementation** of the recommended actions
- **Attracting beneficiaries from other scientific fields** (e.g. mathematicians, physicists, economists etc.)

Attracting experts from abroad (Tech Visas / ICT Hubs)

📌 Description of the Action

1) Provision of **additional long-stay visas for professional activity in the ICT sector**. In particular, the following visas are proposed:

- **Entry visa for highly qualified or prospective ICT specialists (tech visa)**
  - *Visa duration*: minimum three (3) years, renewable | *Target group & requirements*: ICT specialists (non-EU, from all over the world), based on high professional (highly qualified) and/or academic (high potential) qualifications | *Processing time*: within 2 weeks of submission | *Cost*: up to 150€

- **Entry visa for start-ups**
  - *Visa duration*: at least two (2) years, renewable | *Target group & requirements*: entrepreneurs (non-EU, from all over the world), who want to establish a mature (based on multiple criteria) ICT start-up in Greece | *Processing time*: within 1 month from submission| *Cost*: up to 200€

The following **incentives** are suggested: low taxation, possibility of issuing visas to family members, provision of accommodation (creation of business centres). Incentives could also be provided for workers/ entrepreneurs **within the EU**. This action could be combined with cooperation at university level.

2) **Establishment of "ICT Hubs" in third countries or utilisation of the potential of existing global delivery centres by companies of the Greek ICT sector** for the remote coverage of the needs of their domestic and international activities.

🤝 Stakeholders *(indicatively)*

- Companies seeking for ICT specialists | Ministries of Foreign Affairs / Labour / Finance | Start-ups Evaluation Committee

💎 Expected Impact

Low — High

- **Strengthening** the ICT ecosystem by **promoting start-up entrepreneurship & innovation** in Greece and **creating new employment opportunities**
- **Increase in the number of skilled workforce,** with an **influx of ICT** specialists from abroad
- **Improving the career readiness of ICT** human resources through the **development of know-how** in Greece

⚠️ Implementation complexity *(challenges)*

Low — High

- **Stakeholder collaboration** to define specifications**, project coordination & communication**
- **Mechanism** for evaluating the specialization of applicants, as well as the **establishment & operation of a Committee for the Evaluation** of business plans of start-ups
- **Medium-term** implementation horizon
- **Design of a channel to connect** with the Greek labour market & the Greek business ecosystem

A. New ICT undergraduate programmes & B. New ICT postgraduate programmes

📌 Description of the Actions

Creation of new undergraduate and postgraduate programmes in ICT subjects with high demand in Greece (e.g., Programming, IT Project Management, Cyber Security, etc.), which will be identified jointly between universities and federations representing businesses. The **possibility of reallocation of budget in universities in favour of specialisations with significant shortages** should be explored along with **maximising admission places in existing departments.** More specifically:
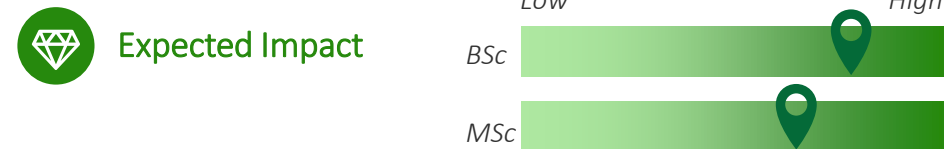
A) **Creation of undergraduate programmes in high-demand ICT subjects** → Considering the Law 4957/2022, the new degree programmes could have a **three-year duration** (6 semesters of theoretical training) and **compulsory internship** (1 additional semester). The **expected impact is anticipated to be high (quantitative) with long-term effects**, given that graduates will be able to enter the labour market within a time horizon of about 4-5 years after the establishment of the departments.

B) **Creation of postgraduate programmes in high-demand ICT subjects** → expected medium (quantitative) short-term impact, as graduates will be able to enter the labour market in about 2 years. Also, the following are proposed: a) the **creation of professional master's degrees**, in cooperation with companies that want to enhance the skills of their employees and b) the **increase of scholarship funding** to postgraduate students, based on criteria (e.g. excellence, financial, social).

In addition, the repatriation of Greek ICT academics, as well as the assessment of the number of university departments in relation to the needs of the Greek labour market are essential.

🤝 Stakeholders *(indicatively)*

- Target group: undergraduate & postgraduate students, company employees
- Companies looking for ICT specialists| Universities | Ministries of Education / Interior / Finance

💎 Expected Impact

Low   High

BSc

MSc

- Supporting faster absorption of undergraduate graduates *(3-year programmes)*
- **Meeting the needs of companies,** with an increase in the number of ICT specialists from ICT graduates, with **medium impact from MSc** and **high impact from BSc**
- **Improving the quality** of studies, through cooperation with ICT federations (e.g. SEPE) for the design and establishment of programmes

⚠ Implementation complexity *(challenges)*

Low   High

BSc

MSc
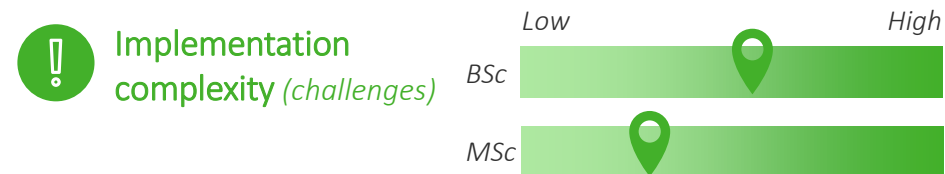
- **Creation of infrastructure** for the establishment of new ICT departments (equipment, staffing, student residences, etc.)
- **Establishment of a communication channel between universities and ICT federations** for defining the programmers' specifications, based on market needs
- **Long-term time horizon of BSc programmes' impact**

Mandatory internship for students & Strengthening the cooperation between Universities & Companies

Action Description

In the context of SEPE's primary research on the sufficiency of ICT specialists in Greece, the need to strengthen cooperation between universities and companies was highlighted. In this direction, the following actions are proposed:

- **Establishment of mandatory 6-month internship for ICT students** (currently in most curricula, internship is an elective course). The internship could be financed through NSRF resources and/or companies' own resources (a *72% intention of companies to self-fund, according to SEPE/Deloitte survey was recorded*). At the same time, as part of the internships, companies could sponsor all or part of students' IT solutions certifications from international companies.

- **Collaboration of companies with academic ecosystems.** Represented by SEPE, companies could collaborate with academic ecosystems, **supporting** e.g. **innovative ideas/solutions in the ICT sector from Greek students** (undergraduate and postgraduate) through the **organization of innovation competitions**, with specific terms and criteria (in the patterns of SEVT's ECOTROPHELIA), and further networking with companies and institutions at national and European level.

- **Strengthening broader cooperation between companies and ICT students**, with the possibility of writing a **thesis** and/or doing **a project** in subject of common interest.

Notes: SEVT: Federation of Greek Food Industries

Stakeholders *(indicatively)*

- Target-group: undergraduate and postgraduate students
- Companies seeking for ICT specialists, SEPE
- Universities (ICT Departments, University Ecosystems, Career offices)

Expected Impact

Low   *High*

- **Strengthening the ecosystem**, through **better connection of students with the labour market**, **promotion** of **research & innovation in universities**, and support of the wider start-up ecosystem
- **Improvement of the quality** of studies for students, as well as their **level of job readiness** for the ICT labour market
- **Further increase the absorption** of the ICT students, although it is already estimated at high levels

Implementation Complexity *(challenges)*

Low   *High*

- **Cooperation between universities and the companies & coordination** for internships positions (companies should commit to offering adequate number of the intern positions and could possibly fund them from their own resources).
- Further **development of innovation and start-up ecosystem in the ICT sector within universities** and **improve their connection** with companies.

Enrichment of other departments' curricula with ICT courses

Action Description

The law N.4957/2022 creates new opportunities for universities, that should be immediately utilised for the purpose –among others- **of strengthening ICT skills in Greece**. Based on the legal framework, it is proposed to enrich the curricula of non-ICT departments with ICT courses. The following could be used for the implementation of the action:

- **ICT Minor Degrees:** Introduction of **minor degrees within ICT departments, in high demand subjects** (e.g. Data Analytics, Big Data, IoT, Cybersecurity), taught (partially of fully) in English. The **impact** is expected to be of **moderate intensity** and be fulfilled in the **medium-term**, as graduates could enter the labour market in approximately 2-3 years, and possibly acquire useful skills for the ICT job market.

- **Utilisation of internal mobility of students :** One academic semester study, in ICT departments. The action is expected to have a **low** *(acquisition of basic or advanced skills)* **short-term** (within each implementation year) **impact**.

- **Inclusion of additional ICT courses in non-ICT departments:** Offering high-demand ICT courses in other departments (e.g in physics, finance), with a positive impact on sectors transitioning to the digital era. Additionally, providing certificates in digital competencies by more departments is suggested. A **longer-term impact** is expected.

Moreover, through this specific action, we expect an increase in the number of graduates, possessing **Certificates in Digital Competencies**.

Stakeholders *(indicatively)*

- Target-group: undergraduate students (or/and foreign students)
- Companies looking for ICT specialists|Universities, Ministry of Education/ Labour / Finance

Expected Impact

Low   High

- **Strengthening**, through the development of ICT skills for non-ICT students, especially those studying STEM subjects(with emphasis on Science, Mathematics, Economics) and combining ICT specialisations with other subjects
- **Possible partial coverage of companies' needs,** by increasing the number of ICT specialists **with non-ICT graduates**
- **Possible attraction of foreign students to acquire ICT minor degrees**, with the potential of future integration into the workforce

Implementation Complexity *(challenges)*

Low   High

- **Medium-term timeline** for implementation
- **Cooperation between departments** & coordination
- **Creation of infrastructure** for the operation of the new programmes (ICT equipment and professors)
- **Involvement of companies** in designing the programmes, to align them with the market needs.
- **English as language of instruction** to attract foreign students

Proposals for the increase of ICT specialists | Recommended actions

Strengthening ICT subjects & skills in primary & secondary education

Action Description

Despite Greece's overall **high performance in ICT teaching at the primary and secondary education** *(according to the EU's report "Informatics education at school in Europe")* there is still room for improvement, based on best practices in other EU countries. The following are proposed:

- **Promoting courses & and highlighting ICT prospects to pupils:** a) **highlighting international trends** and future employment prospects in ICT, through school vocational guidance, **b) Collaborating with NGOs, educators and other institutions** to promote (extracurricular) seminars and learning programmes, c) **modernisation** of teaching methods, e.g by using a **central digital platform** ,with ICT material and further introduction of interactive tools such as games & applications (already announced actions), d) **promoting participation of secondary educational level students in international competitions** (e.g International Olympiad in Informatics, Robocup) following the standards of other countries , e) **coordination** with universities and companies (e.g. through SEPE) for **continuous adaptation** of learning material of technological developments.

- **Upskilling & reskilling of educators:** Given the fact that non-ICT teachers (they were graduates of mathematics, physics) were teaching ICT courses in the past and for the purpose of a continuous upgrading of qualifications, it is proposed to incorporate upskilling & reskilling, **state-funded** programmes, with a **duration of 3-6 months. Cooperation between schools & educational institutions** is required.

Stakeholders

- Target-group: pupils, teachers
- Ministry of Education/ Labour / Finance |Primary/Secondary Education Bodies, Schools, Universities' KEVIDIM, Private operators

Expected Impact

Low — High

- Support through promotion of **future ICT careers** in primary and secondary education (*with a possible future increase in admissions to ICT departments*)
- Improvement of pupils' level of **knowledge and basic ICT skills**
- Improvement of ICT educators' skillset quality, through the possibility of **upskilling and reskilling**

Implementation Complexity *(challenges)*

Low — High

- **Long-term time horizon** of the action's impact
- **Collaboration of stakeholders** for the design & implementation of programmes & other actions
- **Funding** of the upskilling & reskilling programmes
- **Coordination** & **monitoring** of the implementation of actions

Cooperation with foreign countries at university level

📌 Action Description

Starting from the **Erasmus+ program 2021-2027** and, more specifically, the **European Universities** initiative of the EU, Greece could further promote cooperation with countries inside or outside the EU at university level. The following are proposed:

- **Targeted participation in "European Universities" & related actions: a) Stronger presence in "European University Alliances" focusing on the ICT sector** (such as Eut+ – European University of Technology, UNITE! University Network), to attract students and promote research and innovation, through collaborations with businesses, startups, incubators, etc. at EU level, **b) Consolidation of partnerships at the regional level**: establishment of inter-university partnerships with other countries (e.g., Balkans*, Cyprus), aiming at **focused education and absorption of additional human resources** from abroad (e.g., through internships/research in Greece), **c) Participation in joint postgraduate programmes** with other countries (e.g., Erasmus Mundus Joint Masters), **d) Research collaboration** with more technologically advanced countries (USA, Israel, etc.).

- **Student exchange:** further promotion of student exchange **with the EU & partner countries**, with the aim of attracting students from abroad and **connecting them with Greek businesses through internship opportunities** *(Erasmus+ traineeship, etc.)*

  * For this specific action, the supply of ICT specialists should be explored, considering any global ICT Hubs operating in these countries and the availability of resources.

🤝 Stakeholders *(indicatively)*

- Target-group: foreign students *(inside & outside of the EU)*
- Ministry of Education, Greek HEI, foreign Universities *(inside & outside of the EU)* | European institutions: Erasmus+

💎 Expected Impact

Low   *High*

- **Strengthening the ecosystem**, by enhancing collaboration between the academic and business communities and attracting scientists.
- **Improving the quality** of ICT and innovation human resources, through **research partnerships and know-how transfer** from technologically advanced countries (*EU and non-EU*)
- Possible **coverage of companies' needs**, by increasing the number of ICT specialists **from foreign countries**

⚠️ Implementation Complexity *(challenges)*

Low   *High*

- **Collaboration of stakeholders** for the design and implementation of the programme, with the participation of companies, and joint promotion of research and innovation.
- **Medium/long-term implementation timeframe** (partial implementation of the program "European Universities" until 2024).
- **Establishment of a proper control mechanism** for the effective use of the program in Greece.

Increase the employment rate of women in the sector

Action Description

According to the European Institute for Gender Equality, **Greece ranks last among 28 countries** in terms of the Gender Equality Index for 2020, while women ICT specialists in Europe make up only **18% (compared to 82% of men)**. The gap between the two genders in terms of their integration into the ICT job market remains quite high (corresponding to the results of the SEPE survey). This proposal concerns a **horizontal action**, which can be further broken down, among other things, in the following actions:

- **Conducting informative sessions in secondary and even primary secondary education**, by female employees (executives) in the ICT sector and/or teachers, as well as **promoting**, through **school career guidance**, the **employment opportunities for women** in the ICT sector

- **Cooperation of ICT companies and business associations** (e.g. SEPE) with NGOs and other bodies to **promote seminars/programmes for learning new technologies** (e.g. Codegirls), targeted at female pupils / students, female workers in other sectors, etc.

- **Development and expansion of reintegration and retraining programmes for women in the ICT sector**, after maternity leave or periods of unemployment.

- In general, **more dynamic promotion of actions** aimed at women

Stakeholders *(indicatively)*

- Target-group: women *(pupils, university students, working women, unemployed)*
- Companies looking for ICT specialists, SEPE | Ministry of Education, DYPA (Public Employment Service)

Expected Impact

Low　　　　　　　　*High*

- **Dynamic increase in the number of ICT specialists**, through an **increase in the number of women** in the field (based on SEPE research quotas)
- **Strengthening the ecosystem**, through the **empowerment of women and the enhancement of their participation** in the ICT sector, with the possible outcome of **creating new employment prospects**

Implementation Complexity *(challenges)*

Low　　　　　　　　*High*

- **Long-term time horizon of impact** *(the action will start from the secondary education)*
- **Cooperation between the market, the educational system & other stakeholders** for further **organisation and promotion** of information, learning programmes, etc. for women
- **Exploring funding opportunities** to carry out the relevant programmes

Establishment of an Observatory for the study & assessment of ICT skills & needs in Greece

Action Description

The establishment of an Observatory for the study and assessment of ICT skills and needs in Greece is suggested, following the models of other EU countries (e.g. Expert Group on Future Skills Needs in Ireland). The Observatory should be in close cooperation with governmental bodies, in order to establish policies and implement actions to meet the - quantitative and qualitative - needs of the sector. It could be composed of representatives from the Ministries of Education, Labour & Digital Governance from the State side, DYPA, academics in ICT subjects, representatives of the SEPE & other bodies. The main objectives of the Observatory should be the following:

1. Evaluation of the level of digital skills in the Greek labour market
2. Continuous monitoring of the needs for ICT specialists in Greece (*number & specialisation*)
3. Submission of proposals to the State for actions to improve and increase the competence of ICT specialists, e.g. increasing the number of ICT students, providing tax incentives to ICT specialists, and reducing employer contributions for critical ICT specialties
4. Suggestions for better recording of statistical data (e.g. correct way of recording ICT positions in ERGANI, creation of a standard student census by universities, etc.)
5. Calculation of the digital quota for Greek companies
6. Strengthening cooperation between the State, the academic community, SEPE & other bodies
7. Re-evaluation and justification by the Public Sector of the cost per person/month for the budgets of public projects

Stakeholders *(indicatively)*

Ministries of Education / Labour / Digital Governance | Companies looking for ICT specialists, SEPE | Representatives of universities & educational institutions| DYPA

Expected Impact

Low *High*

- Strengthening the ecosystem by directly informing all stakeholders and interested parties about the state of the industry, in order to facilitate a unified approach
- Improving the quality of ICT human resources through co-design of proposals/actions and their relatively faster implementation
- Increasing the number of ICT specialists by recording the actual needs for ICT specialists

Implementation complexity *(challenges)*

Low *High*

- Participation, agreement & cooperation of all stakeholders for the operation of the Observatory
- Ensuring the necessary governance mechanism and infrastructure (staffing, etc.)
- Establishment of a monitoring & control mechanism for the operation of the Observatory, ensuring regular meetings, development of an action guide, as well as identification of problems and proposal of solutions

Bridging the gap

Bridging the gap | Working assumptions & impact

More training programmes, the attraction of talent from abroad, and the introduction of new postgraduate progammes to attract graduates from other disciplines are expected to contribute to the gradual reduction of the shortages.

Working assumptions & impact per proposed action

Increase ICT training programmes – *additional supply ~12 thousand*

Cumulative ~11,500-13,000 trainees by 2030 (*starting from ~350-400 in 2023 to an additional ~2,400-2,700 in 2030*)

- Potential of **2,500 per year** (*0.3% of existing unemployment*) - benchmark Portugal
- Gradual increase in **programme intensity** per year (*from 15% in 2023 to 100% in 2030*)
- Emphasis on **attracting graduates from other disciplines** (*economics, mathematics, other sciences*)

Attracting experts from abroad (Tech Visas / ICT Hubs)– *additional supply ~7 thousand*

Cumulatively ~6,500-7,300 ICT specialists from abroad by 2030 (*starting from ~300 in 2024 to an additional 1,400-1,600 in 2030*)

- Potential of **1,500 per year** (*including tech visas & ICT hubs*) - benchmark Great Britain
- Gradual **increase in effectiveness** of action (*from 20% in 2024 to 100% in 2030*)

New ICT postgraduate programmes– *additional supply ~6.5 thousand*

Cumulatively ~6,000-6,800 new graduates by 2030 (*starting from an additional ~200 in 2024 to an additional ~1,500-1,700 in 2030*)

- Gradually **increase programmes** by 40% by 2030 (*with a gradual approach to the Irish benchmark*)
- Gradual **increase in the capacity of the programmes** per year (*from ~30 to ~50 students by 2030*)
- Emphasis on **attracting graduates from other disciplines** (*economics, mathematics, other sciences*)

Mandatory student internships & strengthening university-company cooperation

- **Improving the quality of studies** for final year students and their **degree of readiness** for the ICT labour market
- Maximising the absorption of ICT graduates by the labour market

Bridging the gap | Working assumptions & impact

The creation of new undergraduate programmes, as well as the enrichment of existing curricula in other scientific fields with ICT courses are some actions that are expected to pay off in the long term.

Working assumptions & impact per proposed action

New ICT postgraduate programmes– *additional supply ~4.5 thousand*	Total of **~4,000-4,500 additional graduates** by 2030 *(starting from ~500 additional in 2024 to ~800-900 additional in 2030)* • Gradual **increase in programmes** by ~20% by 2030 - ~1,000 additional graduates • Reduction of **dropout rate by 5%** per year (from 45% to 40%) for existing & new BSc programmes - ~3,000-3,500 additional graduates
Enrichment of other departments' curricula with ICT courses	• Strengthening the system, through the **development of ICT skills for students in other subjects** (emphasis on science, mathematics, economics) and combining ICT specialisations with other subjects • Increase in the number of graduates holding a **Certificate of Digital Competence**
Strengthening ICT subjects & skills in primary & secondary education	• **Promotion of ICT careers** in primary & secondary education, with a possible future increase in admissions to ICT departments • **Improving the quality of teachers of ICT subjects**, through upskilling & reskilling
Cooperation with foreign countries at university level	• **Improving the quality** of ICT human resources & innovation, **through research partnerships & transfer of know-how** from technologically advanced countries *(within & outside the EU)* • Possible increase in the number of ICT specialists from abroad and/or attracting ICT scientists

Bridging the gap| Working assumptions & impact

The available ICT talent among women needs to be harnessed more dynamically, whereas the creation of a mechanism to study and propose actions to strengthen ICT specialists will ensure future competence.

Working assumptions & impact per proposed action

Increase the employment rate of women in the sector	• Possible increase of ICT specialists from the pool of **unemployed women** *(high female unemployment rates),* while empowering women who have left work for family reasons and reintegrating them into the market • Further **highlighting of the employment prospects** in ICT subjects for women, with a focus on primary and secondary education
Establishment of an Observatory for the assessment of ICT skills & needs	• Strengthening the sufficiency and quality of ICT human resources in Greece, through **continuous monitoring of needs** and **strengthening the dialogue** between the State, universities, companies and other stakeholders • **Coordination** with the State for a **strategic plan & implementation of actions**, such as increasing the number of ICT departments & graduates, possible provision of tax/insurance incentives for critical ICT specialties, review of the average cost of ICT services to the public sector, etc.

Bridging the gap | Estimation of bridging the gap

By implementing the recommended actions, it is estimated that the demand-supply gap will almost be covered annually from 2029 onwards, however, the risks of not covering the gap in the first years of the reference period should be considered.

Estimated gap coverage through recommended actions *(in thousands, %)*

Conclusion

Conclusion

Significant challenges on the sufficiency of ICT specialists in Greece

- Like other EU countries, Greece is expected to see an **increased demand** for ICT specialists in the future
- Given the current projections, a **significant demand-supply gap** is estimated

Potential impact on the economy

- **Digital transformation** is pivotal to ensure the country's competitiveness
- The shortage of ICT specialists could **affect negatively the development of the economy**

Actions to increase capacity

- In order to meet the expected needs for ICT specialists, a **series of actions** are proposed with a **significant** - short or long-term - **impact** on reducing the demand-supply gap

Appendix

Appendix | Profiles of participating companies

42% of the surveyed companies were in the ICT sector, with a significant percentage of ICT specialists in their workforce.
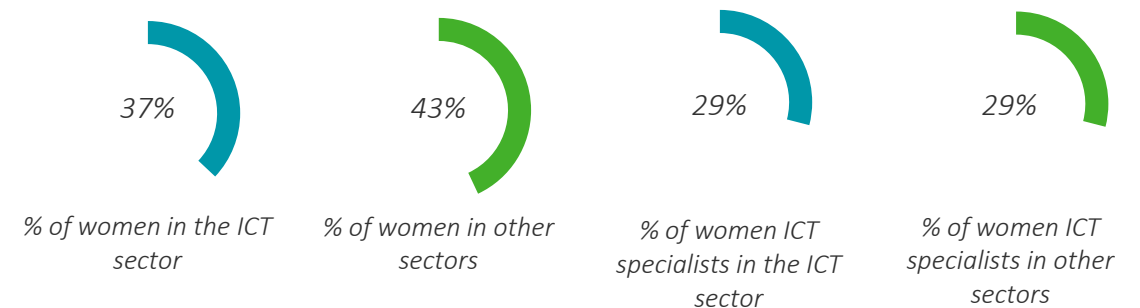
% of responses per sector

Legend:
- ICT Services or/and Goods
- Commerce (general)
- Energy Industry
- Construction Industry
- Manufacturing Industry
- Provision of services
- Financial sector
- Other

Pie chart values: 42%, 11%, 1%, 4%, 12%, 15%, 8%, 7%
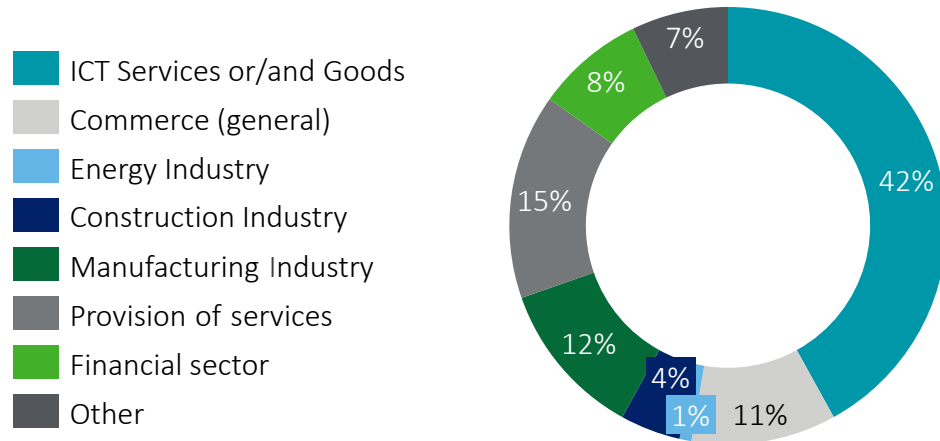
% of ICT specialists in the total number of employees per sector

Bar chart values:
- ICT Services or/and Goods: 38,1%
- Commerce (general): 9,3%
- Energy Industry: 6,7%
- Construction Industry: 2,3%
- Manufacturing Industry: 3,9%
- Provision of services: 16,9%
- Financial sector: 10,8%
- Other: 14,3%

Legend:
- ICT Services or/and Goods
- Commerce (general)
- Energy Industry
- Construction Industry
- Manufacturing Industry
- Provision of services
- Financial sector
- Other

Companies' turnover

Legend:
- Up to €1 million
- €1 mill.- €5 mill.
- €5 mill.- €10 mill.
- €10 mill.- €50 mill
- Over €50 million

Pie chart values: 20%, 13%, 6%, 29%, 31%

% of women in the companies

- 37% — % of women in the ICT sector
- 43% — % of women in other sectors
- 29% — % of women ICT specialists in the ICT sector
- 29% — % of women ICT specialists in other sectors

Appendix | Estimation of gap coverage

Below are detailed calculations of the estimated demand-supply gap as a result of the implementation of the recommended actions.

Estimation of gap coverage as a result of the proposed actions– Baseline scenario *(thousand., %)*

Gap coverage as a result of the 2023-30 actions *(thousand., %)*	2023P	2024P	2025P	2026P	2027P	2028P	2029P	2030P	Total Period
Supply-Demand gap estimation *(per year & in total)*	7.6	7.6	7.6	7.5	7.2	7.2	6.9	6.4	**57.8**
ICT Training programmes	0.4	0.8	1.1	1.5	1.8	2.0	2.3	2.5	12.3
Attraction & utilization of specialists from abroad		0.3	0.6	0.9	1.1	1.2	1.4	1.5	6.9
New postgraduate students *(from new programmes/departments)*		0.2	0.4	0.7	0.9	1.0	1.6	1.6	6.4
New undergraduate students		0.5	0.5	0.5	0.5	0.7	0.8	0.9	4.2
Graduates from new programmes/departments					0.1	0.2	0.3	0.4	*1.0*
Assumption 5% dropout rate reduction (for all undergraduates)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	*3.2*
Gap coverage as a result of the actions *(per year & in total)*	0.4	1.7	2.6	3.5	4.2	4.9	6.0	6.5	**29.8**
% of gap coverage (per year & in total)	*5%*	*22%*	*35%*	*47%*	*58%*	*68%*	*87%*	*100%*	*52%*
Estimation of remaining gap *(per year & in total)*	7.2	5.9	4.9	3.9	3.0	2.3	0.9	0.0	**28.0**

Deloitte.