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Foreword

Welcome to Engineering 2018, the first in a series of reports by Engineers Ireland tracking developments in the engineering profession in Ireland. The series of reports will assess progress in engineering employment, perspectives and education in Ireland.

This report demonstrates the exceptionally high levels of trust in engineers, who are regarded as highly competent professionals. Rigorously trained and creative engineers are vital to achieving a knowledge-based sustainable future for Ireland. Behind every design-led engineered solution are communities and families that benefit.

As the economic recovery takes hold, engineers are in high demand with job opportunities and salaries increasing significantly in recent years. It is an exciting career in a sector that offers jobs and salary progression. It is also positive to note the modest increases in the numbers of engineering students. It is important to retain that student awareness, interest and certainty, and sustain it into the future.

Engineering 2018 is paired with one of Engineers Ireland's other main policy communications The State of Ireland, an independent expert-led assessment of Ireland's infrastructure. These two reports together recognise the importance of engineering education and professional development to the delivery of infrastructure and technology. Now, more than ever, we need to encourage more young people to study engineering.



In pursuance of our mission (below), we hope that this and future Engineering reports will help to stimulate discussion on the development of the engineering profession, the impact of engineering on society and the education of the future generations of engineers.

A stylized, handwritten signature in black ink that reads "Caroline Spillane".

Caroline Spillane
Director General

February 2018

Engineers Ireland mission statement

Engineers Ireland is an organisation that enables the engineering community to progress their professional development, make an impact on society and encourage and educate the future generations of engineers.

Executive summary

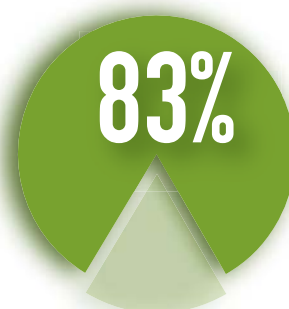
Engineering 2018 is a new barometer for the engineering profession in Ireland, capturing trends in engineering employment, perspectives and education. The report is based primarily on three bespoke surveys conducted between October 2017 and February 2018 with qualified engineers, engineering employers and the general public. This information is complemented by the analysis of data collected by government agencies and other organisations. A set of 10 key performance indicators for the profession has been developed and the results are shown overleaf.

Engineering is a diverse profession with engineers working in a variety of sectors, particularly manufacturing, ICT and construction. The public places exceptionally high levels of confidence in the engineering profession, with 90% saying they trust engineers. The public regards engineers as highly competent, applying expertise in their daily work, and essential to reduce risks to public health and safety.

The economic recession was a challenging time for engineering, but the industry has bounced back in recent years and is now prospering. Engineering employers experienced particularly strong business growth in 2017 and 83% recruited engineers. These employers are anticipating a similarly good year in 2018 and are planning to recruit further. In fact, businesses are concerned that there is an inadequate supply of engineering skills to meet their needs in the medium term.

There is wide public acceptance that there are plenty of jobs in the engineering sector in Ireland today and that engineering is a rewarding career choice for young people. Indeed, the demand for engineering talent has seen graduate engineer salaries increase by 11% in the past four years to €31,000. Meanwhile, employers continue to value the Chartered Engineer title awarded by Engineers Ireland which recognises professional expertise, leadership and ethical practice.

Our economy needs engineers and engineering skills. The number of students starting third level engineering courses in Ireland has been increasing in recent years, albeit slowly. In 2016/17, 3% more students enrolled in an engineering course at third level than in the previous academic year. The number of engineering graduates also rose by 3% in the past year. However, if, as a country, we are to overcome skills shortages in the medium term, we must encourage many more young people to choose careers in engineering. In this context, one of the biggest challenges facing the profession is bridging the gender gap and promoting a more diverse and inclusive workforce.



Engineering employers who **recruited engineers** last year

Indicator 1 Pg: 7



Engineers are **highly competent** professionals

Indicator 4 Pg: 13

Leaving Certificate higher level **STEM** sittings

84,087

Indicator 7 Pg: 21

€31,000

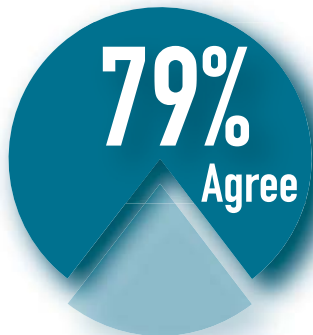
Median salary, Engineer with **1-2 years' experience**

Indicator 2 Pg: 9

Median salary, Chartered Engineer with **11-15 years' experience**

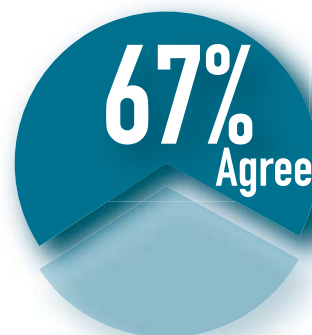
€62,500

Indicator 3 Pg: 10



Engineering is a **rewarding career** choice for **young people**

Indicator 5 Pg: 14



There are **plenty** of **engineering jobs** in **Ireland**

Indicator 6 Pg: 14

6,132

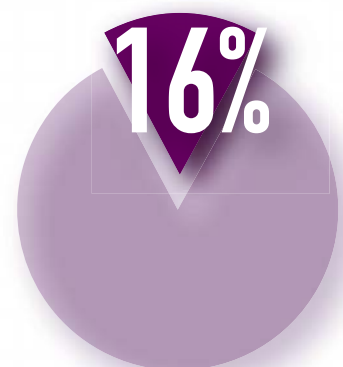
Graduates from **undergraduate** courses

Indicator 8 Pg: 23

Graduates from **postgraduate** courses

1,589

Indicator 9 Pg: 26



Percentage of **engineering graduates** who are **women**

Indicator 10 Pg: 32

Employment

Public perspectives

Education

Introduction

The importance of skills: Innovation, industry and infrastructure

The last number of years in Ireland have brought significant change to our environment, society and economy. Unemployment and emigration have been falling as jobs and investment have been rising. However, the country faces incredibly serious challenges relating to housing, health, climate action and Brexit. To reinforce the economic recovery and to overcome these challenges, Government policy centres on the importance of skills to innovation, industry and infrastructure.

Major strategies such as Innovation 2020, Enterprise 2025, the National Skills Strategy and the Action Plan for Jobs emphasise the importance of skills to inward investment, export opportunities and sustainable long-term growth. Also, the €116 billion National Development Plan 2018-2027 (as part of Project Ireland 2040) commits to the delivery of an ambitious programme of infrastructure to transform the country over the next 10 years. It is of paramount importance that the country has the necessary capital infrastructure to meet economic demands within the coming years as well as the skilled labour force to create and fill the jobs of the future.

Science, Technology, Engineering & Maths (STEM)

Government has identified STEM as one of the most important sets of skills for the country's future progression and prosperity. Following the work of the STEM Education Review Group, chaired by Prof. Brian MacCraith, a STEM Education Policy Statement 2017-2026 and Implementation Plan was launched to increase the uptake and diversity in STEM. These subjects are vital not only for economic development, but also for addressing global challenges, such as climate change, and to informing public decision-making in our democracy.

Engineers Ireland is a leading advocate for STEM education, STEM career pathways and public engagement with engineering for many years, coordinating the STEPS programme. Funded under Science Foundation Ireland's Discover programme Call, STEPS aims to inspire the next generation of STEM professionals. As the voice of the engineering profession in Ireland, Engineers Ireland focuses on the promotion and development of all disciplines of engineering.

Engineering 2018

Engineering is transforming how we live, work and study. From life-saving biomedical technology to energy-efficient housing, engineers are developing innovative solutions for the benefit of society. The purpose of Engineering 2018 is to measure, analyse and learn from significant trends in the engineering profession in Ireland. The data contained herein will be useful not only for engineers, but also for those considering entering our profession, for industry, for educational institutions and for Government policy.

The report is based on three bespoke surveys conducted between October 2017 and February 2018 with: (i) 245 engineering employers, (ii) 2,271 qualified engineers, and (iii) 1,000 people representative of the general public. This information is complemented by summaries of data collected by other organisations such as the Central Statistics Office, Higher Education Authority and State Examinations Commission.

A new set of broad engineering disciplines is used throughout the report:

- Chemical & Process (Chem)
- Civil & Building (Civil)
- Electrical & Electronic (Elec)
- Information & Communications Technology (ICT)
- Mechanical & Manufacturing (Mech)
- Other / General (Other)

While these broad disciplines are not all-encompassing, they enable the alignment of survey data and data collected by other organisations for the purposes of analysis.

The report is structured as follows: Section 2, Employment, examines employment rates, industrial sectors, recruitment and salaries; Section 3, Perspectives, outlines the opinions of the public, employers and qualified engineers on trust, skills and opportunities; Section 4, Education, presents data on STEM and engineering education from Junior Certificate to postgraduate studies and apprenticeships. The concluding section of the report summarises the key emerging trends in the engineering profession in Ireland.

Engineering employment

2.1 Engineering as an occupation

Engineering is a highly diversified profession with a wide range of specialisms emerging as new technologies, business models and engineering challenges develop. At the same time, many engineers are working between disciplines or as part of multi-disciplinary teams. While this makes for exciting and dynamic engineering careers, it can be difficult to measure employment trends in the profession. In this context, the census of population conducted every five years, provides some useful information.

As part of analysing census returns, the Central Statistics Office (CSO) codes job titles into an array of occupations, including 'civil engineer' and 'electrical engineer'. Other occupational codes are broader and the list of occupations also includes 'engineers not elsewhere classified (n.e.c.)'. For the purposes of this report, as mentioned in Section 1, Engineers Ireland has grouped these engineering occupations into six broad disciplines. In the Appendix, you can see exactly how we have categorised each of the census engineering occupations.

According to Census 2016, there are 42,771 engineers in the Republic of Ireland and Table 1 shows the breakdown for each of the broad disciplines of engineering. This total number of engineers is certainly a significant underestimate (our survey work suggests there could be up to 95,000) and is a result of many engineers filling in job titles which do not include the term 'engineer' or a related term. Many engineers also work in management, education and other industries which are otherwise coded by the CSO. Nevertheless, these data provide useful insights into employment trends in the engineering profession.

Table 1 Engineering Census occupations and employment rates by broad discipline [based on CSO]

Broad discipline	Occupation			Employment rate		
	2011	2016	5 year trend	2011	2016	5 year trend
Chemical & Process	4,365	4,840	+10%	94%	97%	+3pp
Civil & Building	6,575	7,427	+12%	85%	96%	+11pp
Mechanical & Manufacturing	7,692	8,333	+8%	89%	96%	+7pp
Electrical & Electronic	6,952	7,143	+3%	87%	94%	+7pp
ICT	9,083	8,513	-7%	90%	94%	+4pp
Other/General	5,396	6,515	+17%	92%	97%	+5pp
Total	40,063	42,771	+6%	89%	95%	+6pp

Also shown in Table 1 is the employment rate for each of the broad disciplines. Overall, 95% engineers were employed at the time of the census in April 2016. This represented an increase of six percentage points from 89% in 2011. During this time, employment grew in all of the broad disciplines and there was particularly strong employment growth in Civil & Building Engineering which rose from an employment rate of 85% to 96%. Employment is now very strong in all of the broad engineering disciplines, ranging from 94-97%.

Just as engineers' careers are diverse, so too are the industries in which they work. Table 2 provides an overview proportion of each broad engineering discipline employed by the major industrial sectors. Overall, the manufacturing industry is the largest, employing 30% of all engineers – unsurprisingly, almost half of Mechanical & Manufacturing Engineers (47%) work in this industry. One complicating factor is the 'professional, scientific and technical activities' sector which captures a large portion of engineering consultancy, particularly by Civil & Building Engineers.

Table 2 Industry by broad discipline (%) [based on CSO]

Industry	Chem	Civil	Mech	Elec	ICT	Other	All
Manufacturing	77	6	47	32	10	35	30
Information and communication	4	2	7	9	66	8	18
Professional, scientific and technical activities	10	34	15	15	3	22	17
Construction	1	29	10	14	3	5	11
Public administration and defence	0.2	16	1	1	1	9	5
Electricity, gas, steam and air conditioning supply	0.7	2	2	10	2	6	4
Other	8	11	18	18	16	17	16
Total	100	100	100	100	100	100	100

2.2 Geographic distribution

Engineers in Ireland tend to be found in the five cities and the surrounding areas: 58% engineers are based in Dublin, Cork, Galway, Limerick and Waterford cities and counties (Table 3). There is a particular concentration of ICT Engineers (38%) in Dublin City and County. These geographic trends are not dissimilar to the overall employment distribution (and economic activity) in Ireland which remains too focused on the Greater Dublin Area. The National Planning Framework, supported by Engineers Ireland, envisages a rebalancing of jobs and population in the country over the next 20 years.

Table 3 Engineers by location and broad discipline (%) [based on CSO]

	Chem	Civil	Mech	Elec	ICT	Other	All
Dublin City and County	21	26	24	29	38	30	29
Cork City and County	22	14	16	14	11	17	15
Galway City and County	12	8	8	5	4	7	7
Limerick City and County	6	4	6	8	4	4	5
Waterford City and County	2	2	2	2	2	3	2
Leinster (excl. Dublin)	20	25	24	26	25	23	24
Munster (excl. Cork, Limerick & Waterford)	9	8	8	8	7	8	8
Connacht (excl. Galway)	6	8	5	4	5	6	6
Ulster	2	6	6	5	4	4	5
State	100	100	100	100	100	100	100

2.3. Gender gap in industry

A running theme in this report is the measurement of the extent of the gender gap in the engineering profession. This information will assist Engineers Ireland and other campaigners to promote equality and diversity by identifying priority areas for reform. Overall, just 12% of the engineering profession are women, a ratio of 8 men to every woman (Table 4). There has been no measurable progress in this regard over the past five years. The broad discipline with the highest proportion of women is Chemical & Process Engineering while proportionately the fewest women are to be found in Electrical & Electronic Engineering. A comparison of the gender gaps in employment and education is carried out in Section 4.

Table 4 Women in each broad discipline [based on CSO]

Broad discipline	2011	2016	5 year trend
Chemical & Process	28%	30%	+2pp
Civil & Building	9%	9%	n/c
Mechanical & Manufacturing	7%	8%	+1pp
Electrical & Electronic	5%	4%	-1pp
ICT	10%	7%	-3pp
Other/General	18%	20%	+2pp
All engineers	12%	12%	n/c

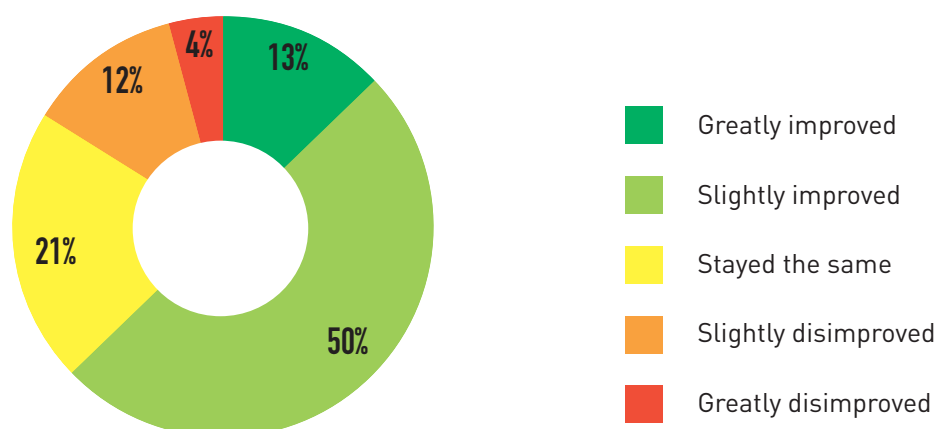
pp = percentage points; n/c = no change

2.4. Recruitment

In the first of the Engineering 2018 surveys, Engineers Ireland approached engineering employers to learn about employment conditions, financial performance and recruitment trends. 245 employers responded, representing small (1-50 employees), medium (51-200 employees) and large businesses (200+ employees) across the disciplines of engineering. Take a look at the Appendix for the survey method and sample.

Engineering employers in Ireland had a good year in 2017. 63% of them told us that their financial position greatly improved or slightly improved during those 12 months when compared to 2016. Meanwhile, just 16% felt that their position has disimproved (Figure 1). This year of improving finances led to strong recruitment in the sector: 83% engineering employers hired at least one engineer in 2017 (Table 5). Recruitment was particularly strong for medium-sized engineering businesses, every one of which grew their workforce last year. Engineers with 3-5 years' experience are in particularly high demand.

Figure 1 Change in financial position in 2017



83%

Engineering employers who
recruited engineers
last year



Table 5 Employers who hired at least one engineer in 2017 (%)

Grade of engineer	Small business	Medium business	Large business	All engineering employers
Apprentices	11	41	48	34
Engineering Technicians	21	57	59	45
Graduate Engineers	18	65	68	50
Engineers (3-5 years' experience)	28	67	66	53
Chartered/Engineers (5+ years' experience)	28	63	66	52
Any engineers	68	100	86	83

Small business (1-50 employees), medium business (51-200 employees), large business (200+ employees)

Turning to the year ahead, 78% engineering employers told us that they expect their financial position to greatly improve or slightly improve in 2018 (Figure 2). This level of confidence in the engineering sector is manifesting in similarly high expectations for recruitment as 83% employers are planning to recruit at least one engineer in 2018 (Table 6). There is a strong demand for graduate engineers with 58% all engineering employers and 76% medium-sized businesses looking to hire from this cohort. Chartered Engineers are also highly sought after, particularly by medium and large engineering businesses.

Figure 2 Expected change in financial position in 2018

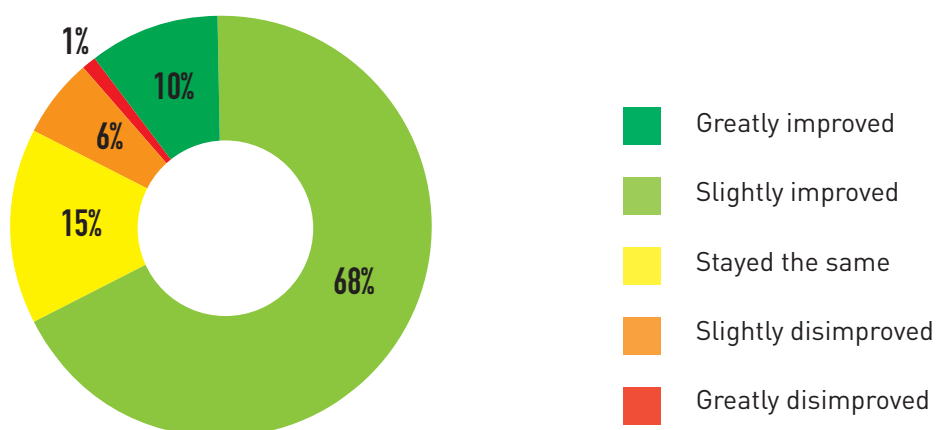


Table 6 Employers planning to hire at least one engineer in 2018 (%)

Grade of engineer	Small business	Medium business	Large business	All engineering employers
Apprentices	13	37	46	32
Engineering Technicians	32	50	60	48
Graduate Engineers	35	76	68	58
Engineers (3-5 years' experience)	36	59	58	51
Chartered/Engineers (5+ years' experience)	25	65	63	50
Any engineers	75	94	84	83

Small business (1-50 employees), medium business (51-200 employees), large business (200+ employees)

2.5.Salaries

In the second Engineering 2018 survey, we asked the Engineers Ireland membership about the levels of remuneration and benefits in the profession. 2,271 engineers responded and the survey method and characteristics of the sample are provided in the Appendix. The last Engineers Ireland Salary Survey was conducted in 2014 (using a similar approach) and our members expressed a strong interest in data on changes in salaries since then. The tables which follow show median salaries.

Note

The median is the number in the middle when a list of numbers is sorted from lowest to highest. Half of all engineers earn more than the median salary; half of all engineers earn less than the median salary.

A graduate engineer can expect to earn €31,000 in 1-2 years after graduation (Table 7). This salary will increase steadily with experience (Figure 3) and engineers with 11-15 years' experience today earn €60,000. The majority of engineers with more than 30 years of experience currently earn more than €90,000. Since 2014, salaries have been increasing in the profession, particularly for younger engineers. Today's graduate engineer can expect to start on a salary that is €3,000 higher (11%) than her/his counterpart in 2014. More senior engineers have also experienced increased remuneration.

Table 7 Median salary by years of experience in 2014 and 2018

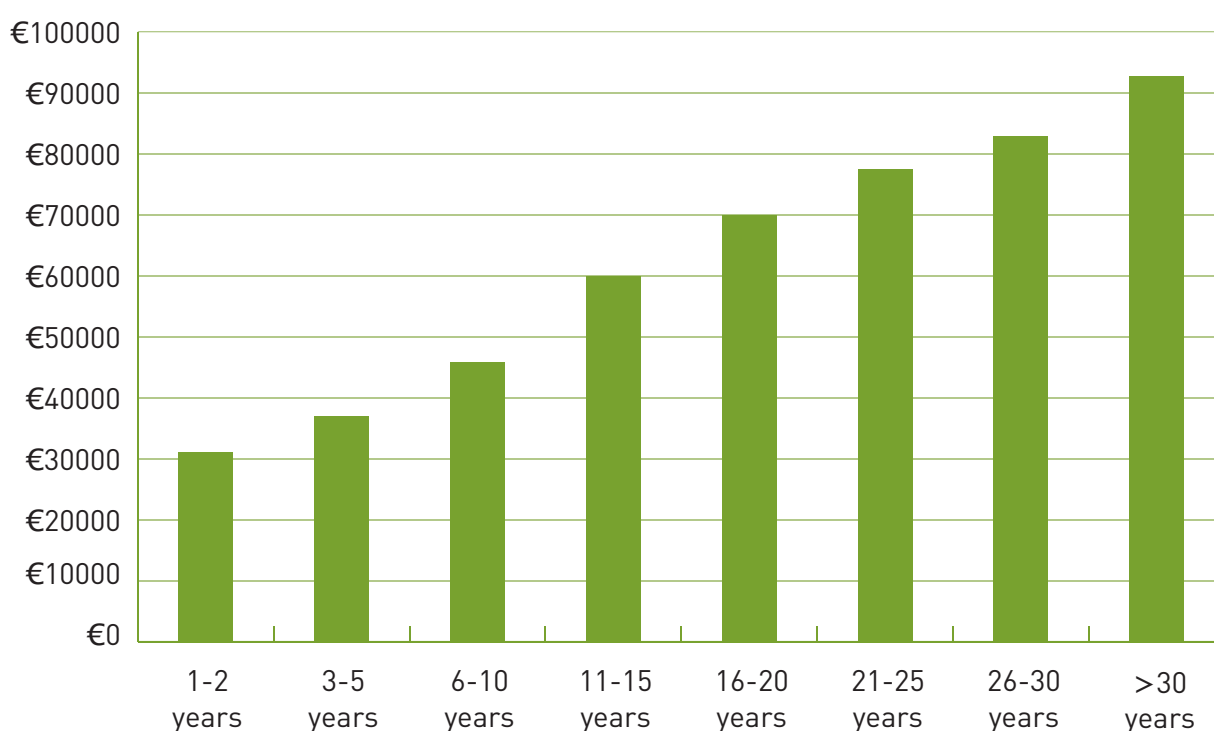
Experience	2014	2018	4 year trend
1-2 years	€28,000	€31,000	+11%
3-5 years	€33,000	€37,000	+12%
6-10 years	€43,000	€45,750	+6%
11-15 years	€58,000	€60,000	+3%
16-20 years	€63,000	€70,000	+11%
21-25 years	€73,000	€77,500	+6%
26-30 years	€78,000	€82,900	+6%
>30 years	€81,000	€92,750	+15%

€31,000

Median salary, Engineer
with 1-2 years'
experience



Figure 3 Median salary by years of experience in 2018



Engineers Ireland awards registered professional titles such as 'Chartered Engineer' and 'Fellow', recognising the achievements of our members. Achieving the title of Chartered Engineer is a seal of approval that the engineer has developed ability beyond that achieved in academic formation to that of a professional practitioner. It is also a mark of commitment to the continuing professional development of professional expertise and ethical practice.

Engineers require a period of four years of Initial Professional Development before they can acquire the Chartered title. Later in their career, Chartered Engineers may apply for the title of Fellow of Engineers Ireland, a prestigious honour which recognises leadership and seniority in the engineering profession. To be eligible to acquire the title of Fellow, the engineer must be chartered for at least five years (or possess, for a period of at least 10 years, an equivalent standard of qualifications and experience).

The value of the professional titles of Chartered Engineer and Fellow is recognised through increased remuneration. A Chartered Engineers can expect to earn approximately €3,000-5,000 per year more than an untitled engineer with the same number of years of experience. While the typical untitled engineer with 11-15 years' experience earns €59,000, a Chartered Engineer who graduates in the same year typically earns €62,500 (Table 8). It takes more than 20 years of experience before this salary gap closes. At this point, Chartered Engineers who become Fellows of Engineers Ireland can expect to earn an additional €10,000-15,000 per year.

Table 8 Median salary by years of experience and Engineers Ireland membership grade / professional title

Experience	Member	Chartered Member	Fellow
1-2 years	€31,000	-	-
3-5 years	€37,000	-	-
6-10 years	€44,750	€48,000	-
11-15 years	€59,000	€62,500	-
16-20 years	€66,500	€71,500	-
21-25 years	€78,000	€78,000	€88,000
26-30 years	€87,000	€81,500	€93,000
>30 years	€86,750	€88,000	€101,500

€62,500

Median salary,
Chartered Engineer with
11-15 years' experience



Note

A full Engineers Ireland Salary Survey 2018 report is available to Engineers Ireland members and can be downloaded from the members' area of www.engineersireland.ie. This report includes detailed analysis of salaries and other benefits (pensions, bonuses etc.) according to engineering discipline, employment sector and much more.



Engineering perspectives

3.1 Trust in the profession

For the final Engineering 2018 survey, we commissioned Behaviour & Attitudes (market research company) to undertake a face-to-face poll with 1,000 members of the public and representative of the Irish population aged 16 years old and over (see Appendix for methodological information). We were interested to learn about the general public's perspectives on the engineering profession and how these perspectives compare with feedback from our members.

In the first question put to the public, we sought to benchmark the levels of trust placed in engineers against trust in other professional groups. This built on research carried out by the Medical Council of Ireland's 'Survey of Public Attitudes to Doctor's Professionalism' whose methodology we replicated. We asked members of the public two questions:

1. Highly competent professionals need to be able to apply expertise in their daily work. Which of the following professions do you consider to be highly competent?
2. Can you please tell me if you trust each of the professions listed to tell the truth or not?

The results demonstrate the exceptionally high levels of trust in the engineering profession. 91% adults think that engineers are highly competent, that they are able to apply expertise in their daily work. Furthermore, 90% adults trust engineers to tell the truth. Of the 10 professions listed, only doctors are more trusted (Figure 4).

We believe that one of the reasons why the public holds such high levels of confidence in engineers is the role the profession plays in public health and safety. When we put this to the public, 77% adults agreed that engineers are essential to reduce risks to public health and safety (only 3% disagreed). Agreement was strongest among those with young children in the household (81%) and those over 65 years old (80%). This view was shared by almost all engineers in our member survey (Figure 5).

Figure 4 Engineers are essential to reduce risks to public health and safety (Engineers & Public)

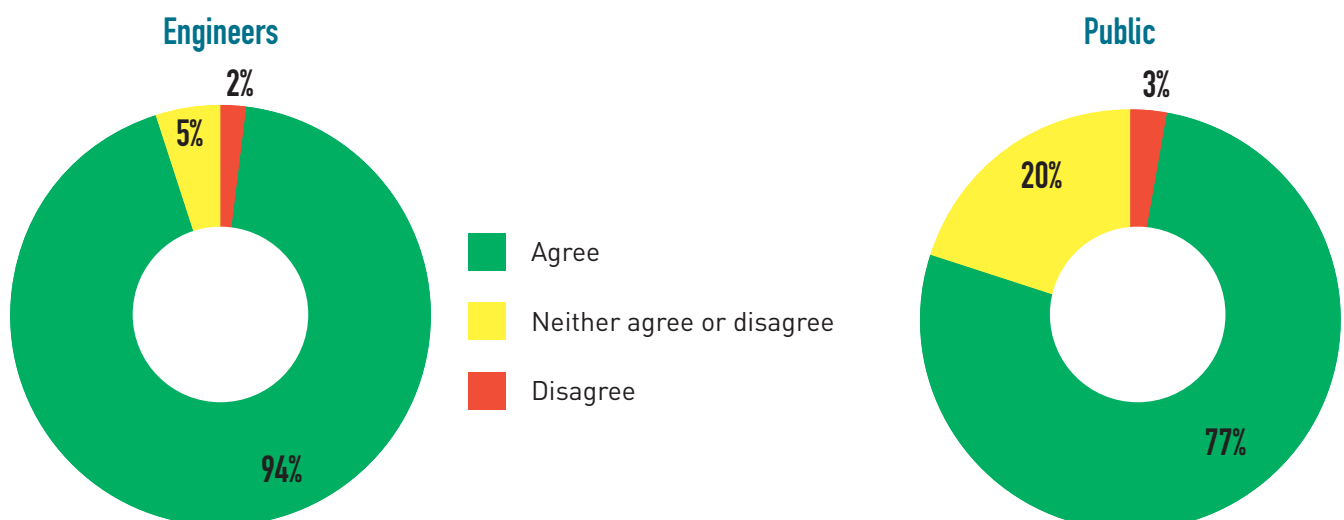
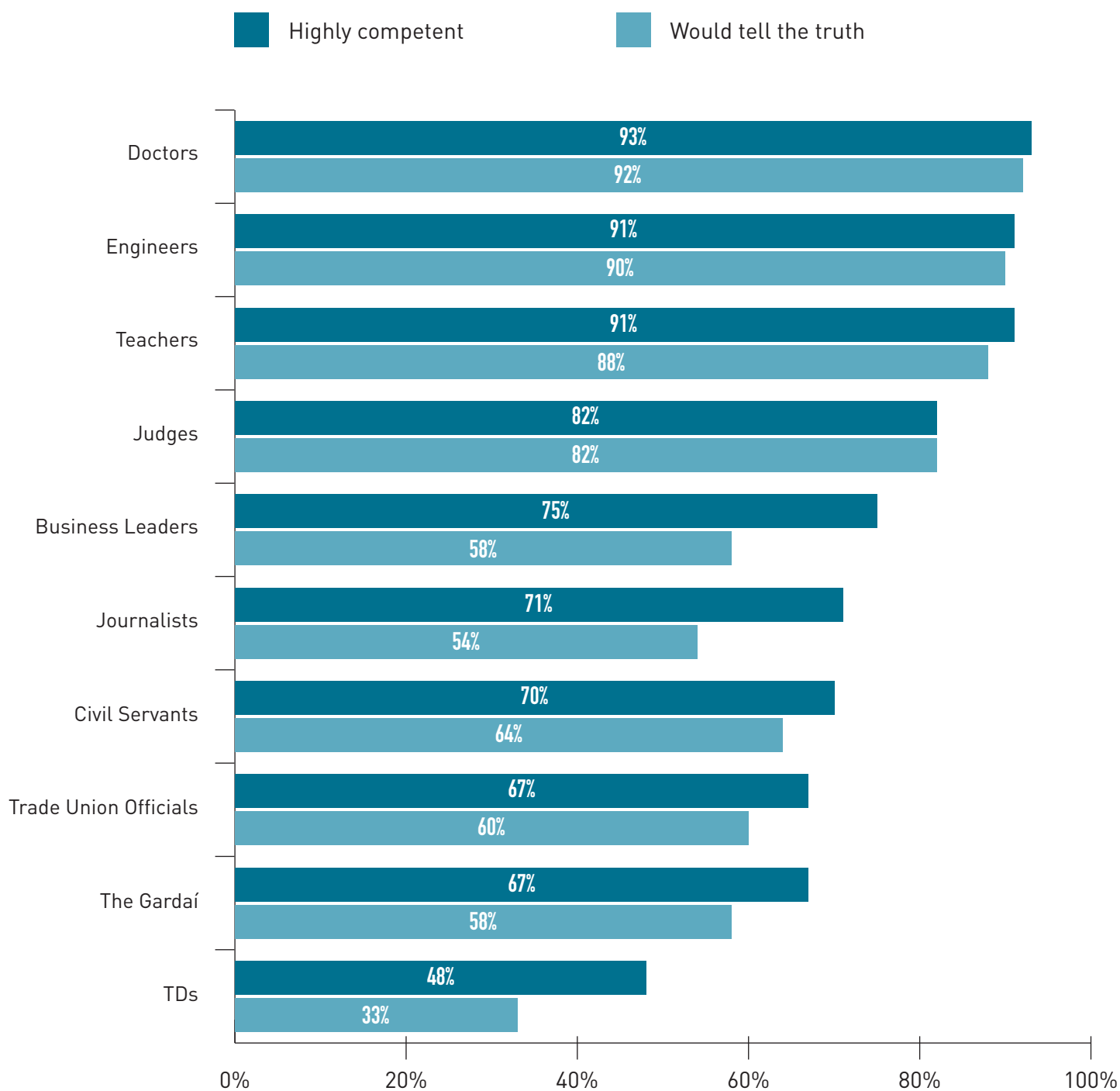


Figure 5 Public trust in the competence and truthfulness of various professions



91%
Agree

Engineers are
highly competent
professionals



3.2 Careers and opportunities

We were also interested in the public perspectives on engineering careers and opportunities. When asked whether engineering is a rewarding career choice for young people, the vast majority (79%) agreed (Figure 6). There was particularly strong agreement among 25-34 year olds, almost half (49%) of whom agreed strongly. The public also believe that there are plenty of job opportunities in the Engineering sector in Ireland (67% agree), shown in Figure 10. This is a remarkable improvement on a similar poll conducted by Engineers Ireland in 2015 (see Appendix) when only 22% adults thought that there were plenty of job opportunities. Engineers, seeing the industry first-hand, are even more positive about employment opportunities.

Figure 6 Engineering is a rewarding career choice for young people (Public)

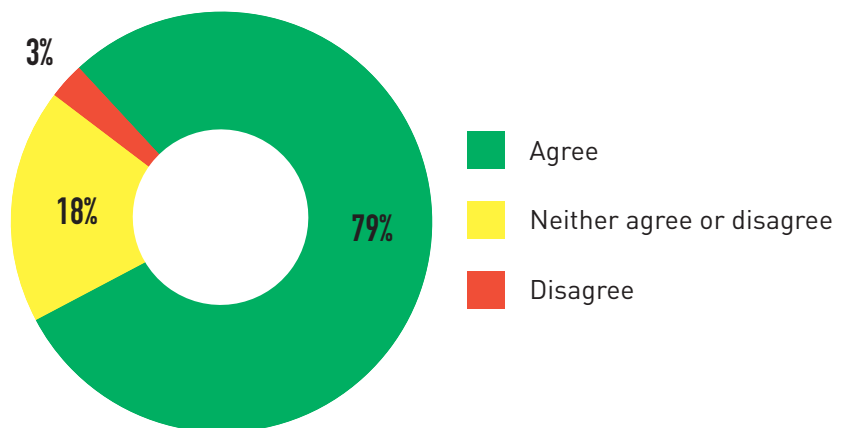
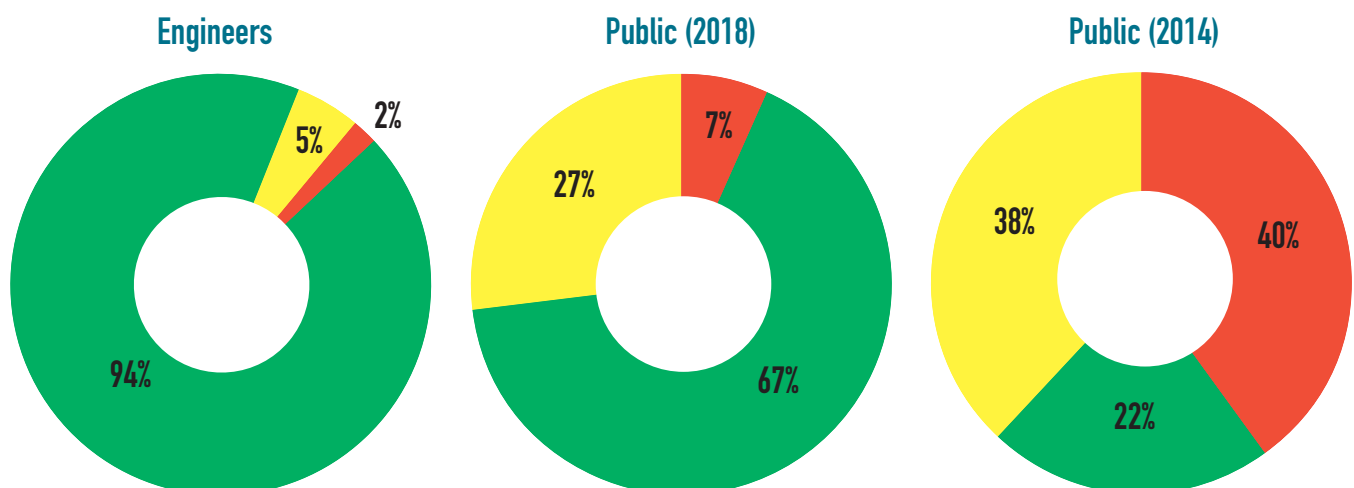


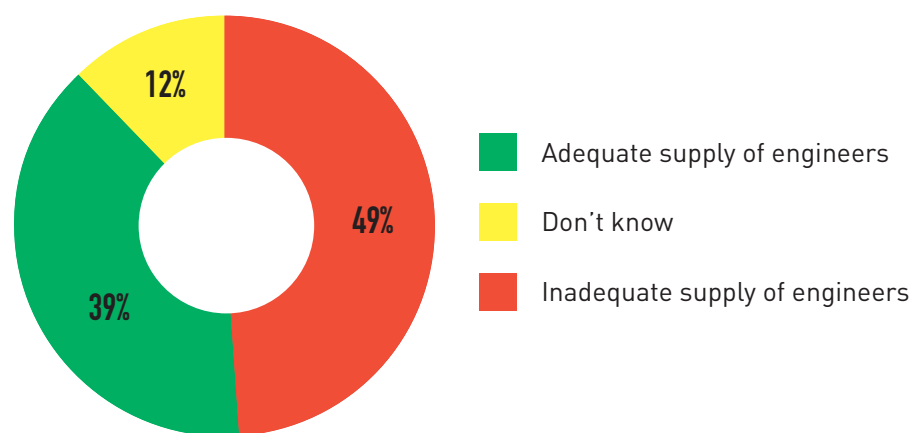
Figure 7 There are plenty of job opportunities in the engineering sector in Ireland (Engineers & Public)



3.3 Skills

As noted in Section 1, there is now substantial evidence that skills shortages are emerging in the Irish engineering sector. While this means that there are plenty of job opportunities for engineering graduates, skills shortages are restricting business growth, competitiveness and the delivery of key projects. We asked engineering employers whether they believe that there is an adequate supply of engineers with the necessary skills to meet their organisation's needs in the medium term. Excluding those who didn't know, the majority said that there is an inadequate supply of engineers (Figure 8).

Figure 8 Supply of engineers to meet employers' needs in the medium term



When we asked the employers what kind of skills they considered important, they responded that the 'soft skills', such as communication, are just as important as – if not more important than – the core technical competences. 95% or more engineering employers highly value skills such as teamwork and collaboration, effective verbal communication and effective written communication (Figure 9). It is interesting to note that business-oriented skills such as business acumen and entrepreneurial skills received a low importance rating. In the context of Brexit, it is perhaps concerning that of the 13 listed skills, the importance of foreign language capability was ranked the lowest.

To ensure their organisation has the skills and expertise to undertake future projects, almost half of employers (47%) have been investing in reskilling current employees or collaborating with educational institutions (Figure 10). Comparatively few employers have been offering apprenticeships and – as shown in Table 6 – those who have been taking on apprentices tend to be larger businesses.

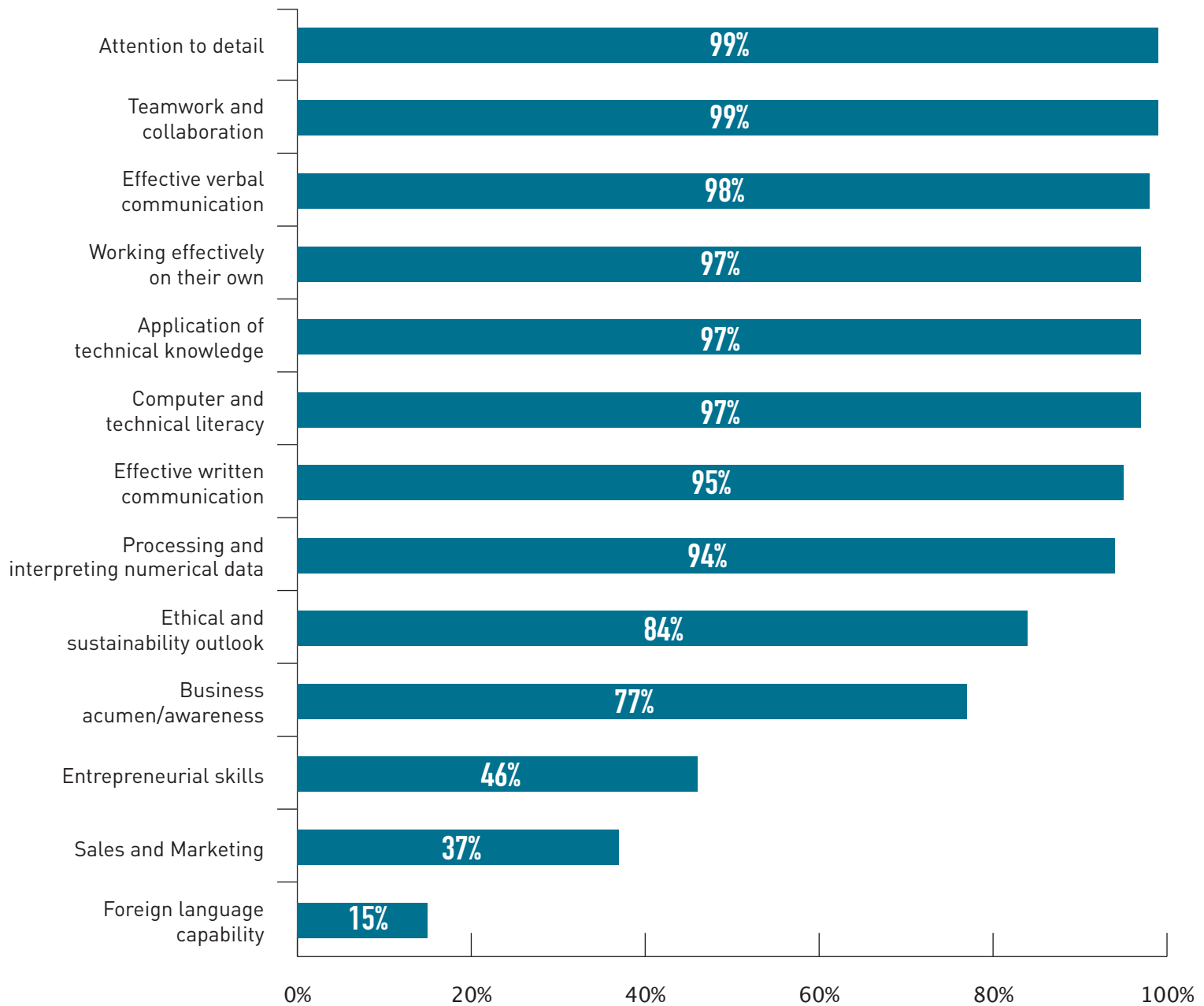
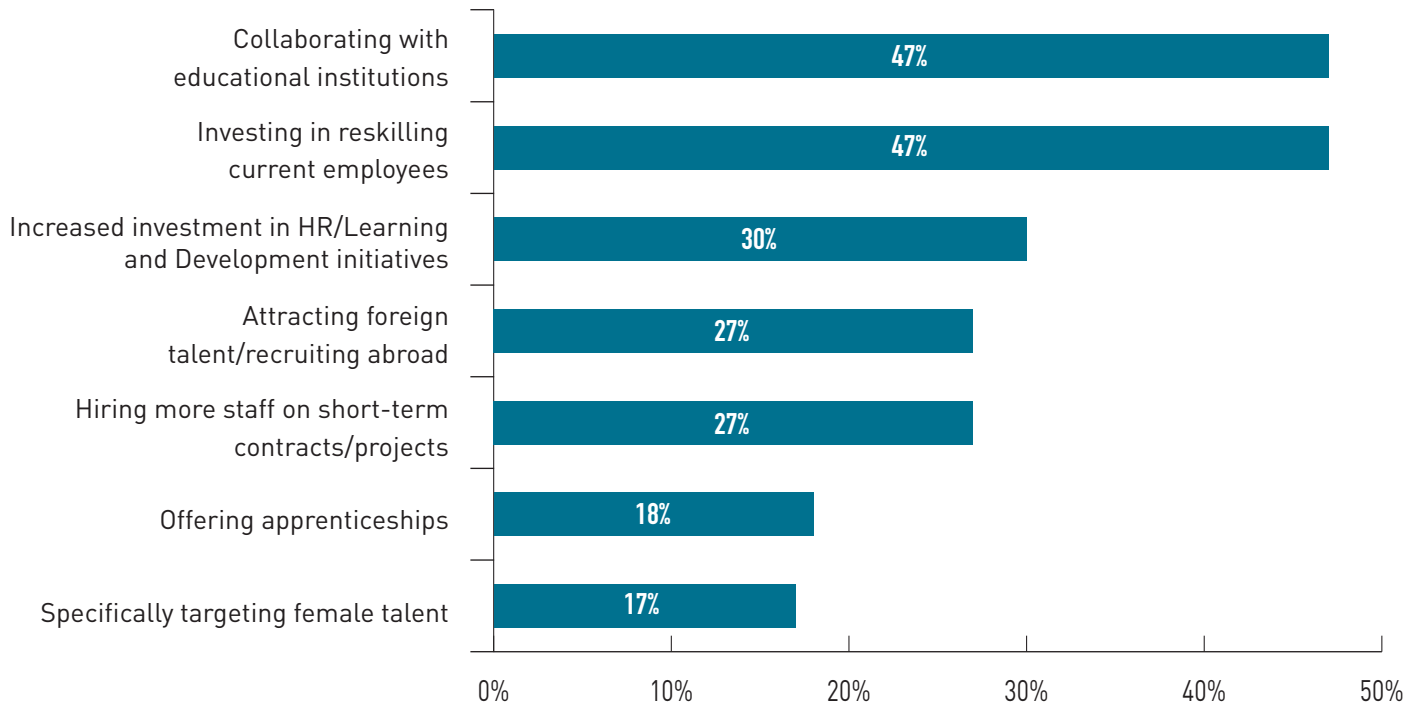
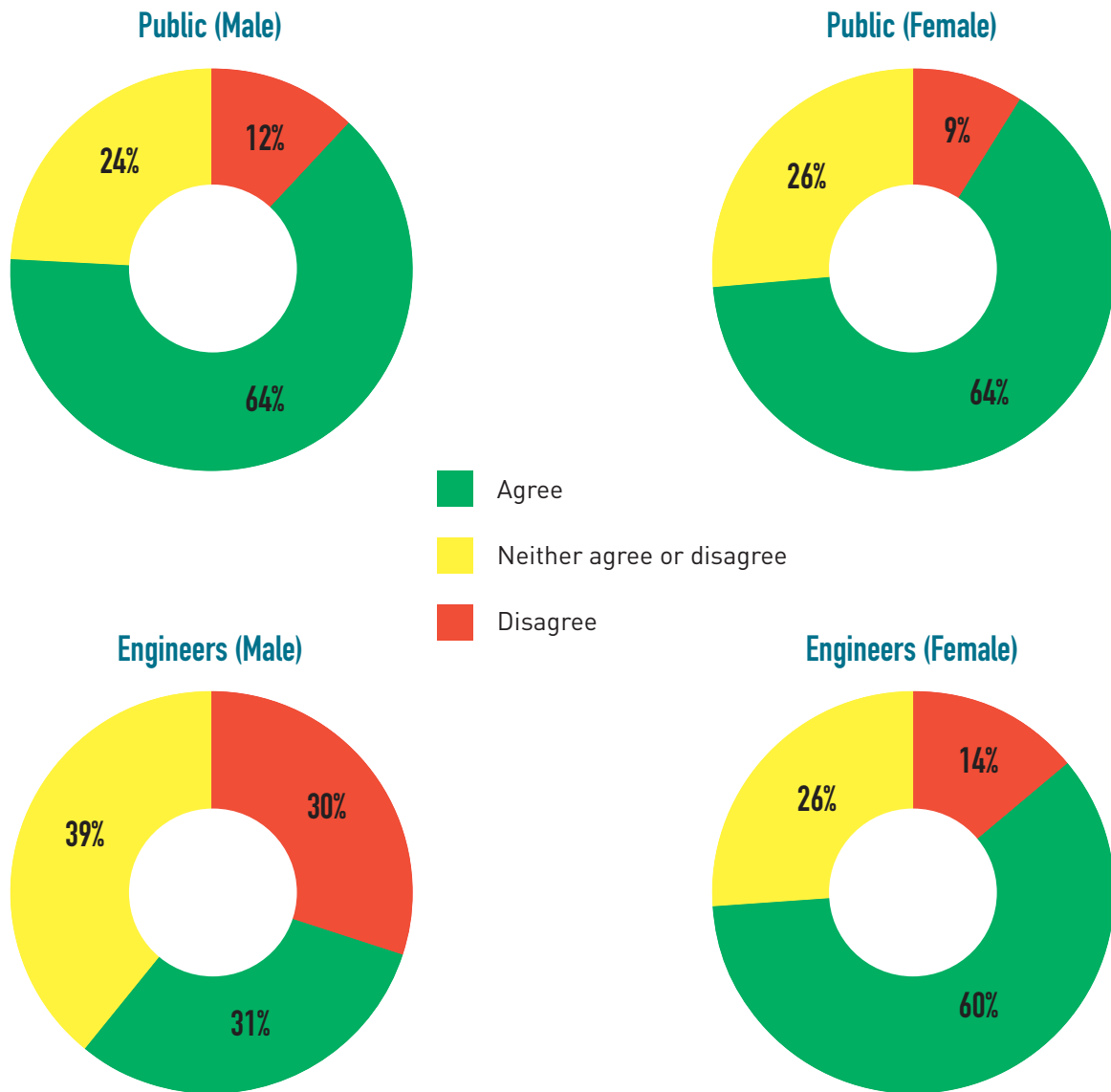
Figure 9 Skills rated as important by engineering employers

Figure 10 Initiatives taken by employers to overcome skills shortages

3.4. Equal opportunities?

The public believes that the engineering sector currently has better opportunities for men than it does for women. There was no significant difference between the men and women who responded to the public survey as 64% agreed that engineering does not offer equal opportunities. A similar proportion of female engineers (60%) agree, however, male engineers are roughly split on the issue: 31% agreed that there are better opportunities for men, 30% disagreed and 39% neither agreed nor disagreed.

Very few employers have been specifically targeting female talent to overcome skills shortages (Figure 10). Indeed, these results show that female engineers feel that they are not given equal opportunities within the sector. Women remain an untapped resource in engineering and if the overall number of people entering the sector is to increase, recruitment and upskilling campaigns will need to target women, in particular. Increasing the number of women in engineering (and encouraging a more diverse workforce more generally) is a challenge for the entire profession and must be a key driver for engineering education, from primary to third level.

Figure 11 The engineering sector currently has better opportunities for men than it does for women

Engineering education

4.1. Junior Certificate

As outlined in Section 1, Engineers Ireland is a leading advocate for STEM education, inspiring curiosity, exploration, creativity and problem-solving in children from an early age. For the purposes of this report, our analysis of engineering education begins at the Junior Certificate level. Data on the number of students sitting exams in each Junior Certificate subject are provided by the State Examinations Commission (SEC). In the past five years, the total number of STEM sittings at higher level has increased by 16% (Table 9), outstripping the overall increase in Junior Certificate sittings of 5%. There has been particularly strong growth in the number of students taking higher level mathematics, an increase of one-quarter since 2012.

Table 9 Number of students sitting higher level STEM subjects for the Junior Certificate

Subject	2012	2013	2014	2015	2016	2017	Year-on-year	5 year trend
Science	39,990	42,423	42,821	42,658	43,898	45,708	+4%	+14%
Mathematics	27,913	30,500	32,041	32,535	32,830	34,822	+6%	+25%
Material Technology	12,673	13,280	13,487	13,271	13,636	14,142	+4%	+12%
Technical Graphics	8,271	9,207	8,953	8,655	8,684	8,912	+3%	+8%
Metalwork	5,946	6,300	6,373	6,409	6,257	6,229	-0.4%	+5%
Technology	2,557	2,589	2,830	2,852	3,154	3,163	+0.3%	+24%
Total STEM sittings	97,350	104,299	106,505	106,380	108,459	112,976	+4%	+16%

Table 10 Number of students sitting ordinary level STEM subjects for the Junior Certificate

Subject	2012	2013	2014	2015	2016	2017	Year-on-year	5 year trend
Mathematics	25,945	24,687	24,047	22,856	23,781	23,570	-1%	-9%
Science	12,615	11,488	11,936	11,632	11,573	11,499	-1%	-9%
Technical Graphics	3,733	3,357	3,396	3,046	3,247	3,500	+8%	-6%
Material Technology	3,102	2,883	2,977	2,874	2,745	2,941	+7%	-5%
Metalwork	1,793	1,543	1,507	1,575	1,630	1,590	-3%	-11%
Technology	469	368	393	406	422	413	-2%	-12%
Total STEM sittings	47,657	44,326	44,256	42,389	43,398	43,513	+0.3%	-9%

4.2 Leaving Certificate

Turning to the Leaving Certificate, it is very positive to note that the number of students sitting exams in STEM subjects increased by 5% in the past year. Results, again obtained from the SEC, show that approximately 1,500, 1200 and 500 additional students sat higher level papers in biology, maths and chemistry, respectively (representing increases of 6%, 7% and 8%). Indeed, the number of students taking the higher level paper has increased year-on-year for all 11 STEM subjects – with the exception of applied mathematics – and the five-year trend is very positive (Table 11). During this time, there was a marginal increase (0.1%) in the total number of students sitting the Leaving Certificate to 58,543.

Table 11 Number of students sitting higher level STEM subjects for the Leaving Certificate [based on SEC]

Subject	2012	2013	2014	2015	2016	2017	Year-on-year	5 year trend
Biology	22,740	23,433	24,442	25,595	25,211	26,684	+6%	+17%
Mathematics	11,131	13,014	14,326	14,691	15,198	16,395	+8%	+47%
Chemistry	6,705	6,757	7,226	7,533	7,658	8,162	+7%	+22%
Construction Studies	6,577	6,572	6,847	6,877	7,087	7,451	+5%	+13%
Agricultural Science	5,587	5,951	6,329	6,067	6,269	6,376	+2%	+14%
Physics	4,753	4,832	5,399	5,764	6,003	6,271	+5%	+32%
Engineering*	3,819	3,742	4,172	4,408	4,489	4,586	+2%	+20%
Design & Communication	3,807	4,017	4,097	4,192	4,350	4,445	+2%	+17%
Applied Mathematics	1,344	1,470	1,569	1,729	1,917	1,869	-3%	+39%
Technology	769	944	983	1,168	1,244	1,367	+10%	+78%
Physics & Chemistry	309	330	361	437	439	481	+10%	+56%
Total STEM sittings	67,541	71,062	75,751	78,461	79,865	84,087	+5%	+25%

84,087

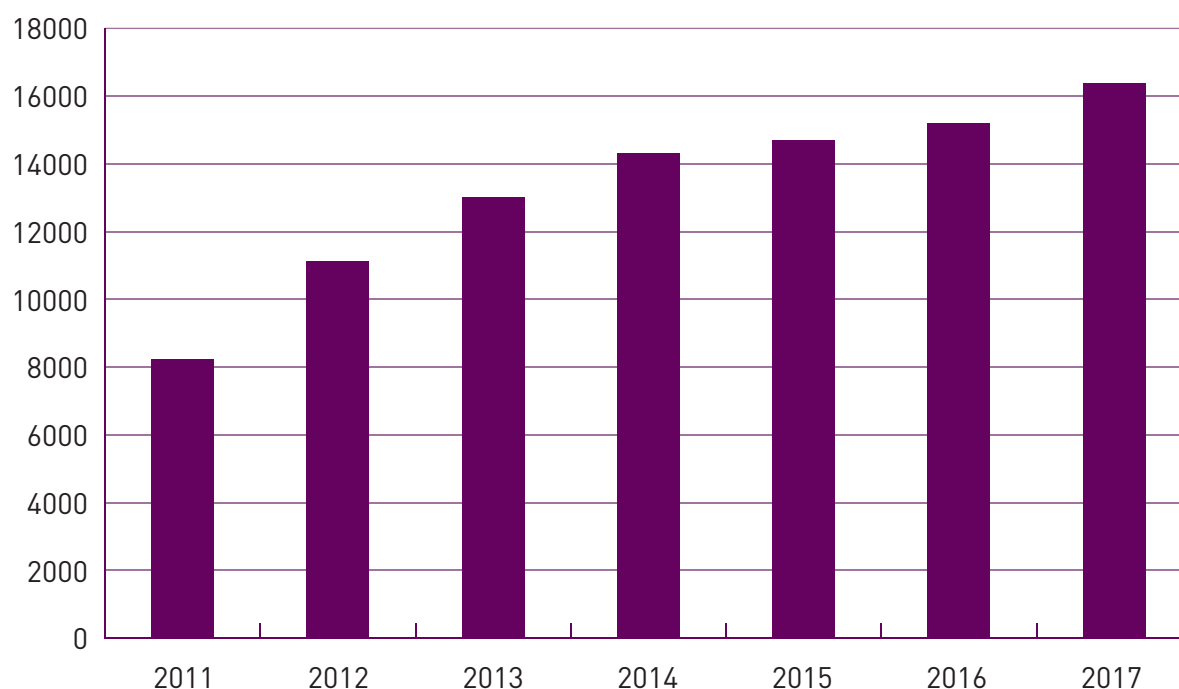
Leaving Certificate
higher level
STEM sittings



Note

The Leaving Certificate subject 'engineering' is the study of a range of mechanical engineering materials, processes and technological applications. It is not a requirement for entry to engineering at third level, which is much broader in scope.

The most encouraging trend at Leaving Certificate is the increase in the number of students studying higher level mathematics which has doubled since 2011 (Figure 12). Today, more than one-third of mathematics students study the subject at higher level, up from 18% in 2011. This steady increase follows the introduction of 25 bonus CAO points for those who achieve a D (H6) grade or better at higher level. The mathematics curriculum was also reformed during this period.

Figure 12 Number of students sitting higher level mathematics for the Leaving Certificate

While the growing number of students studying STEM subjects is very positive, it should be noted that there was a considerable increase in higher level participation rates across almost all subjects with corresponding decreases at ordinary level (Table 12). The reformed grading system now awards a student achieving a result of 30-39% (H7 grade, previously known as an 'E' grade) at higher level with CAO points. This was not previously the case and appears to have encouraged more students to opt for higher level papers.

Table 12 Number of students sitting ordinary level STEM subjects for the Leaving Certificate [based on SEC]

Subject	2012	2013	2014	2015	2016	2017	Year-on-year trend	5 year trend
Mathematics	33,917	32,165	32,428	33,266	32,549	32,334	-1%	-5%
Biology	7,801	8,064	8,514	8,269	8,890	7,608	-14%	-3%
Physics	1,620	1,616	1,778	1,744	1,750	1,314	-25%	-19%
Chemistry	1,381	1,399	1,378	1,405	1,431	1,306	-9%	-5%
Construction Studies	1,631	1,541	1,562	1,392	1,466	1,299	-11%	-20%
Agricultural Science	1,302	1,463	1,597	1,605	1,624	1,284	-21%	-1%
Design & Communication	1,406	1,334	1,257	1,170	1,173	1,130	-4%	-20%
Engineering	1,018	1,139	1,031	968	890	689	-23%	-32%
Technology	155	130	119	160	171	160	-6%	+3%
Physics & Chemistry	96	93	105	115	140	110	-21%	+15%
Applied Mathematics	146	129	137	190	172	100	-42%	-32%
Total STEM sittings	50,473	49,073	49,906	50,284	50,256	47,334	-6%	-9%

4.3 Higher education: Undergraduate level

A wide range of engineering-related courses are offered at third level in universities and institutes of technology. Engineers Ireland accredits over 100 engineering programmes, subjecting each to a rigorous process of evaluation (see www.engineersireland.ie for more information). The Higher Education Authority (HEA) collects statistics on higher education student entry, enrolment and graduation. The HEA uses 20 different codes for statistics on engineering-related courses.

For the purposes of this report, Engineers Ireland has grouped these engineering courses into the same six broad disciplines used in Section 2. In the Appendix, you can see exactly how we have categorised each of the HEA engineering codes. A minor complication arises in the analysis of five-year trends due to the HEA classification of ICT courses before 2014. Therefore, five-year trends are expressed excluding ICT courses.

Graduates from undergraduate courses

In 2016 (latest available data), there were 6,132 engineering graduates from undergraduate courses (including from universities and institutes of technology). This represents a 3% increase in the past year and a rise of 4% since 2011 (Table 13). However, these aggregate statistics mask some underlying trends (Figure 13). Between 2011 and 2016, the number of Civil & Building Engineering graduates fell by 45% to 937. Meanwhile, the number of Mechanical & Manufacturing Engineering graduates rose by 45% to 1,405. The vast majority of engineering graduates achieved either an ordinary degree (Level 7) or an honours degree (Level 8), see Figure 14.

Table 13 Graduates from undergraduate courses [based on HEA]

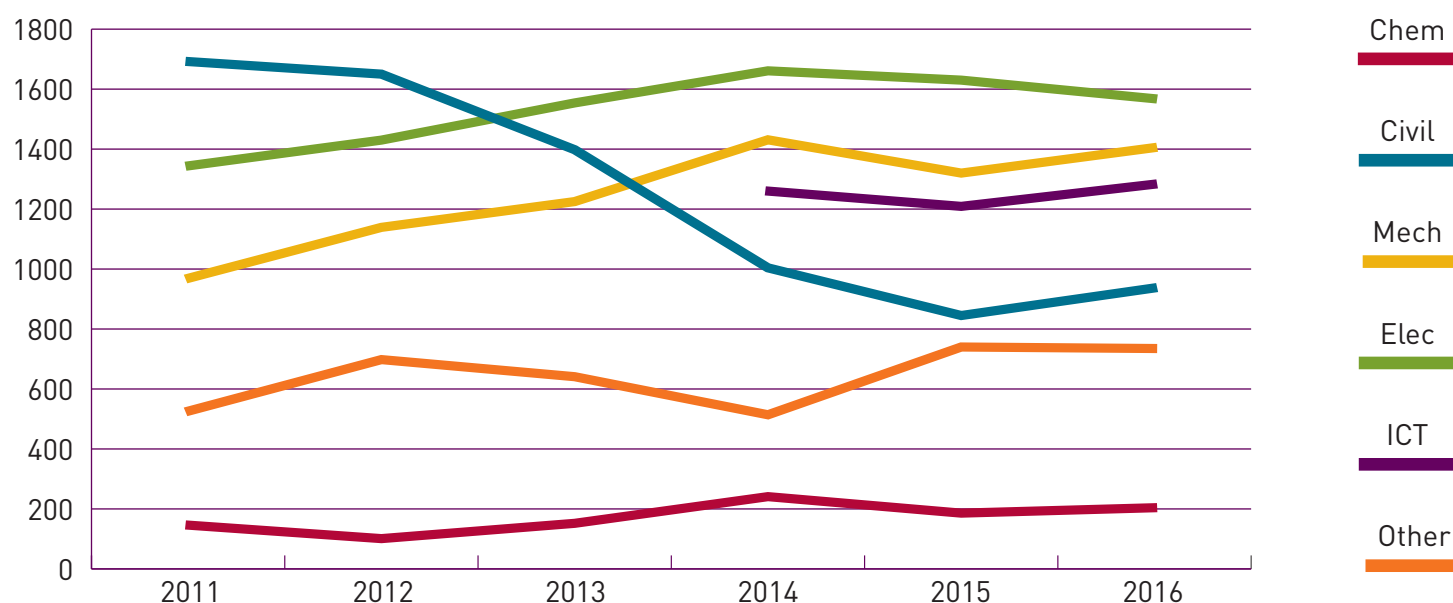
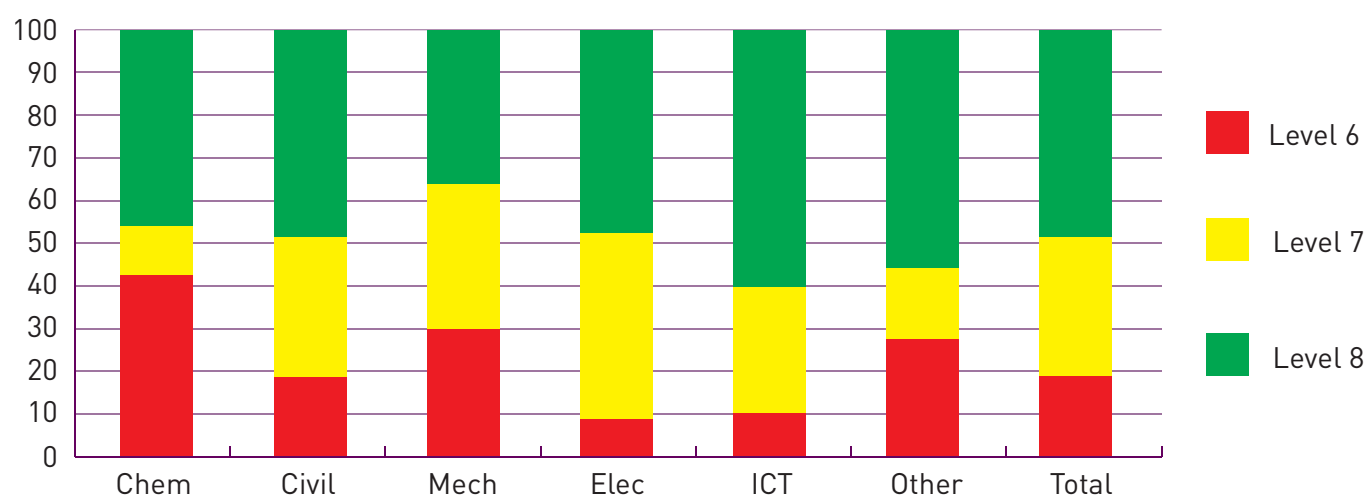
Broad discipline	2011	2012	2013	2014	2015	2016	Year-on-year trend	5 year trend
Chemical & Process	146	101	152	241	186	204	+10%	+40%
Civil & Building	1,692	1,650	1,398	1,004	845	937	+11%	-45%
Mechanical & Manufacturing	969	1,139	1,225	1,431	1,320	1,405	+6%	+45%
Electrical & Electronic	1,344	1,430	1,554	1,661	1,630	1,568	-4%	+17%
ICT*	n/a	n/a	n/a	1,260	1,209	1,283	+6%	n/a
Other/General	526	698	641	514	740	735	-1%	+40%
Total	n/a	n/a	n/a	6,111	5,930	6,132	+3%	n/a
Excluding ICT	4,677	5,018	4,970	4,851	4,721	4,849	+3%	+4%

*Different classification system used for ICT before 2014

6,132

Graduates from
undergraduate
courses



Figure 13 Graduates from undergraduate courses by broad discipline**Figure 14** 2016 graduates from undergraduate courses by qualification level

New entrants to undergraduate courses

The number of students entering undergraduate engineering courses for the 2016/17 academic year increased by 3% over the previous year to 5,581 (Table 14). While this figure (excluding ICT) is lower now than in 2011, there has been positive growth in the past three years. There has been particularly strong growth in Civil & Building Engineering (40%) and Chemical & Process Engineering (89%, albeit from a low base) courses since 2011. Meanwhile, there are 21% fewer students entering Electrical & Electronic Engineering courses (Figure 15).

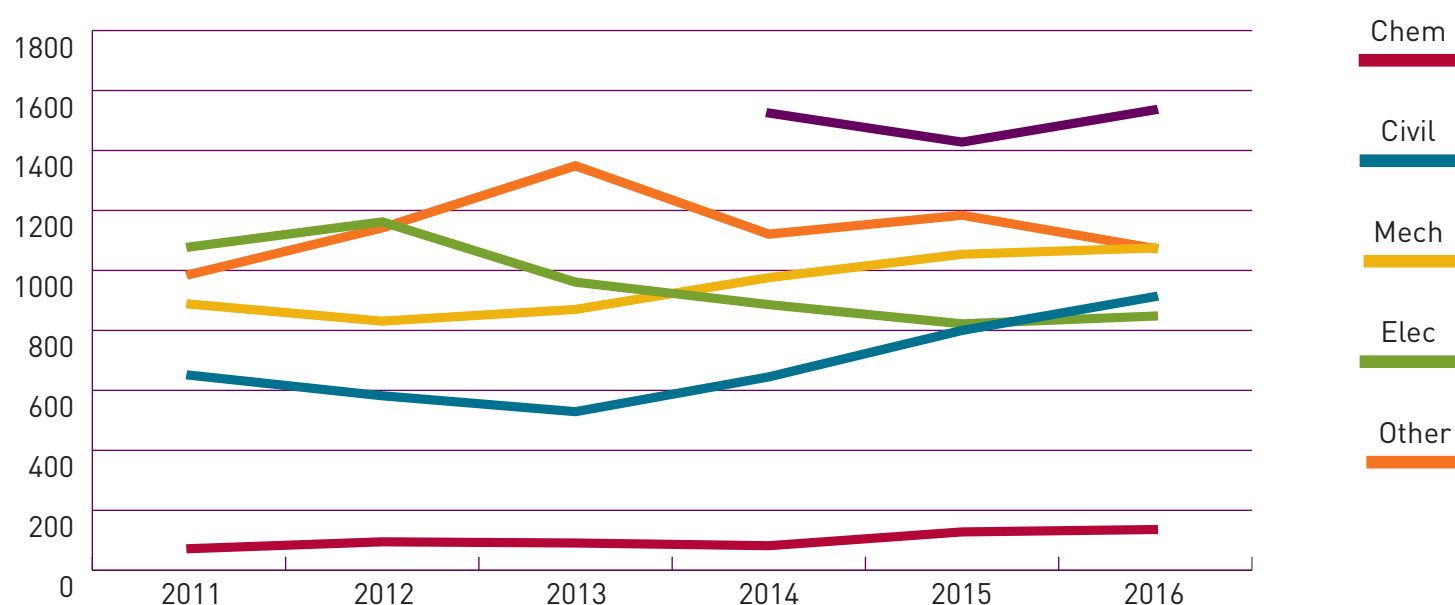
Note

To gain entry to third level, second level students indicate their course preferences to the Central Applications Office (CAO). The CAO uses 17 categories for courses, including 'Engineering/Technology' and 'Built Environment'. These unfortunately do not match HEA categories and, as CAO data are limited to preferences for broad categories, this report focuses on the more detailed HEA data.

Table 14 New entrants to undergraduate courses [based on HEA]

Broad discipline	2011	2012	2013	2014	2015	2016	Year-on-year	5 year trend
Chemical & Process	72	95	91	82	128	136	+6%	+89%
Civil & Building	651	582	529	645	800	913	+14%	+40%
Mechanical & Manufacturing	888	831	870	976	1,054	1,075	+2%	+21%
Electrical & Electronic	1,078	1,162	961	886	822	848	+3%	-21%
ICT*	n/a	n/a	n/a	1,525	1,428	1,536	+8%	n/a
Other/General	986	1,142	1,349	1,121	1,184	1,073	-9%	+9%
Total	n/a	n/a	n/a	5,235	5,416	5,581	+3%	n/a
Excluding ICT	4,158	4,447	4,363	3,710	3,988	4,045	+1%	-3%

*Different classification system used for ICT before 2014

Figure 15 New entrants to undergraduate courses by broad discipline

4.4. Higher education: Postgraduate level

At the postgraduate level, the number of engineering graduates has increased by 2% in the past year to 1,589 (Table 15). A large proportion of engineering postgraduates studied ICT (646) and other/general courses (334). The growing segment of other/general postgraduates (up 17% since 2011, Figure 16) may be a reflection of the number research degrees or specialised taught courses inadequately categorised by the HEA. Postgraduate courses are generally taught programmes (delivered and assessed in taught modules) or research programmes (based on more independent and detailed research). While the vast majority of engineering postgraduates complete taught programmes, approximately 50% of those in the other/general category complete research masters or PhDs (Figure 17).

Table 15 Graduates from postgraduate courses [based on HEA]

Broad discipline	2011	2012	2013	2014	2015	2016	Year-on-year	5 year trend
Chemical & Process	152	113	148	200	211	161	-24%	+6%
Civil & Building	136	133	148	179	149	138	-7%	+2%
Mechanical & Manufacturing	87	52	57	83	71	122	+72%	+40%
Electrical & Electronic	305	204	199	170	167	188	+13%	-38%
ICT*	n/a	n/a	n/a	688	713	646	-9%	n/a
Other/General	286	233	291	280	253	334	+32%	+17%
Total	n/a	n/a	n/a	1,600	1,564	1,589	+2%	n/a
Excluding ICT	966	735	843	912	851	943	+11%	-2%

*Different classification system used for ICT before 2014

1,589

Graduates from
postgraduate
courses



Figure 16 Graduates from postgraduate courses by broad discipline (excluding ICT)

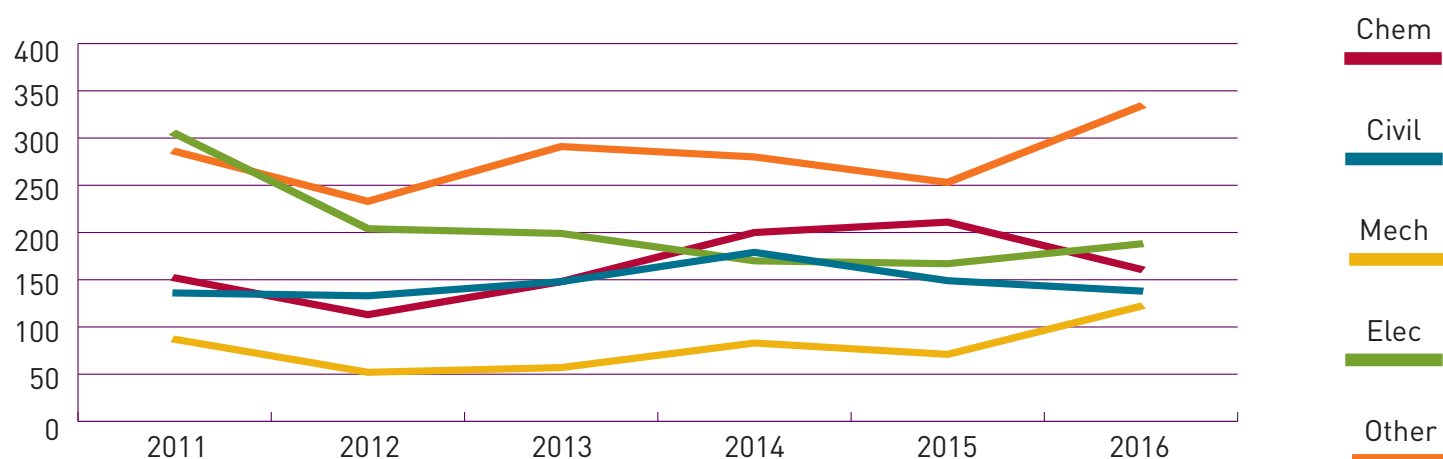
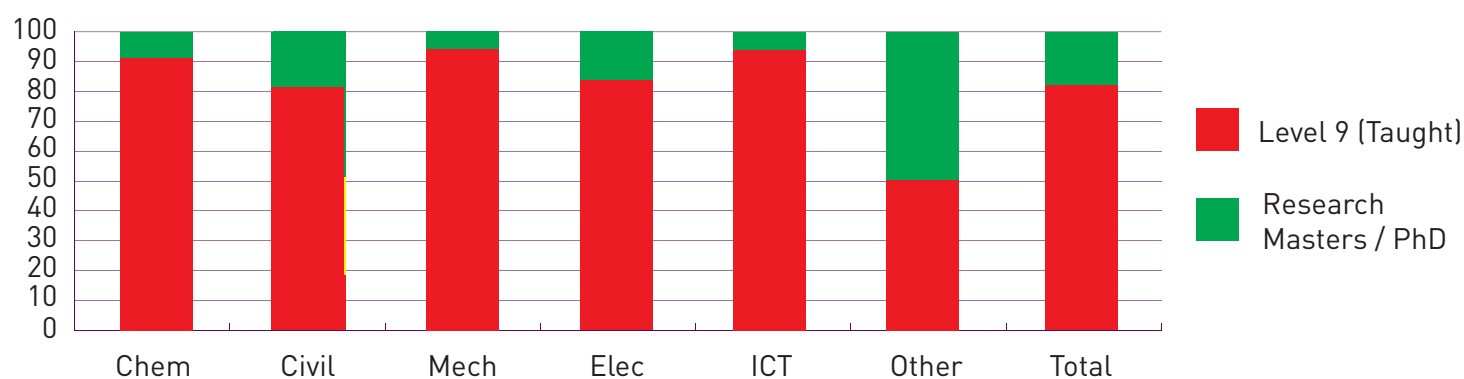


Figure 17 2016 graduates from postgraduate courses by qualification level



4.5 Higher education: Total enrolment

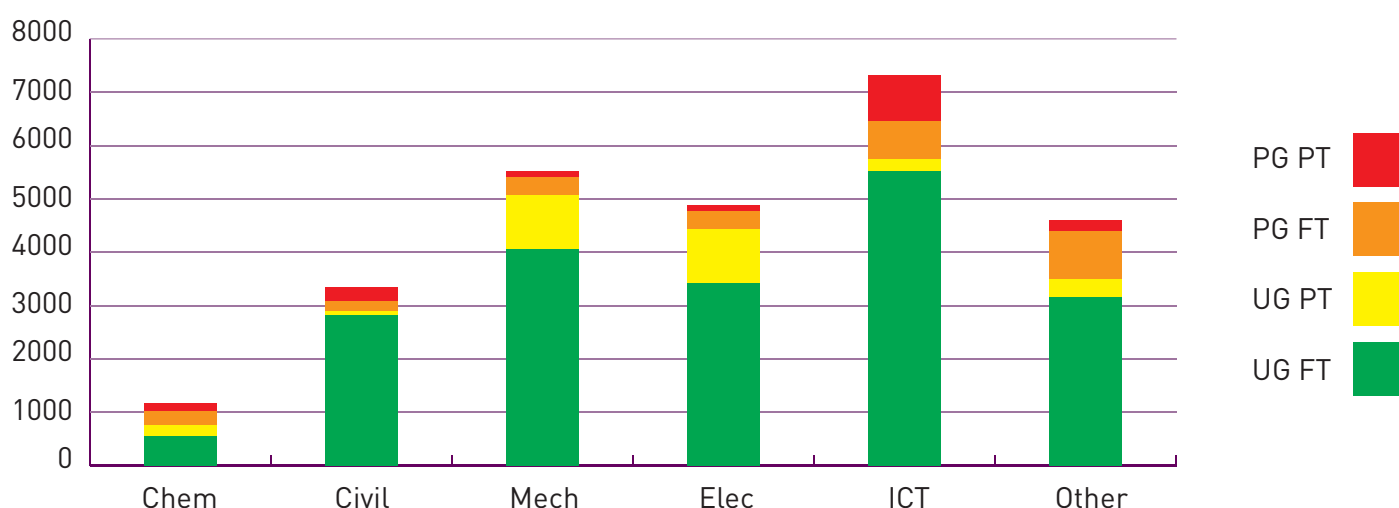
The total number of engineering students enrolled in higher education has been relatively stable in recent years at between 26,000 and 27,000 (Table 16). Given the upsurge in demand for engineers evidenced throughout this report, these figures may suggest the continuation of skills shortages. In line with the trends in the numbers of entrants and graduates, there has been strong growth in the total enrolment of Chemical & Process Engineers (43%) and Mechanical & Manufacturing Engineers (29%). However, the enrolment of Civil & Building Engineers has yet to stabilise, falling 10% in the past year and 27% since 2011. Figure 18 shows the breakdown of engineering enrolment by part-time and full-time students as well as course level and broad discipline. Mechanical & Manufacturing Engineers and undertake the most part-time undergraduate courses and ICT Engineers are most likely to study postgraduate courses on a part-time basis.

Table 16 Total enrolment in engineering courses [based on HEA]

Broad discipline	2011	2012	2013	2014	2015	2016	Year-on-year	5 year trend
Chemical & Process	820	917	1,057	1,036	961	1,174	+22%	+43%
Civil & Building	4,556	3,766	3,143	3,422	3,667	3,307	-10%	-27%
Mechanical & Manufacturing	4,241	4,263	4,601	5,269	5,390	5,457	+1%	+29%
Electrical & Electronic	5,357	5,283	5,162	5,334	5,033	4,874	-3%	-9%
ICT*	n/a	n/a	n/a	7,220	6,566	7,330	+12%	n/a
Other/General	4,086	4,471	4,905	4,342	4,443	4,602	+4%	+13%
Total	n/a	n/a	n/a	26,623	26,060	26,744	+3%	n/a
Excluding ICT	19,060	18,700	18,868	19,403	19,494	19,414	-0.4%	+2%

*Different classification system used for ICT before 2014

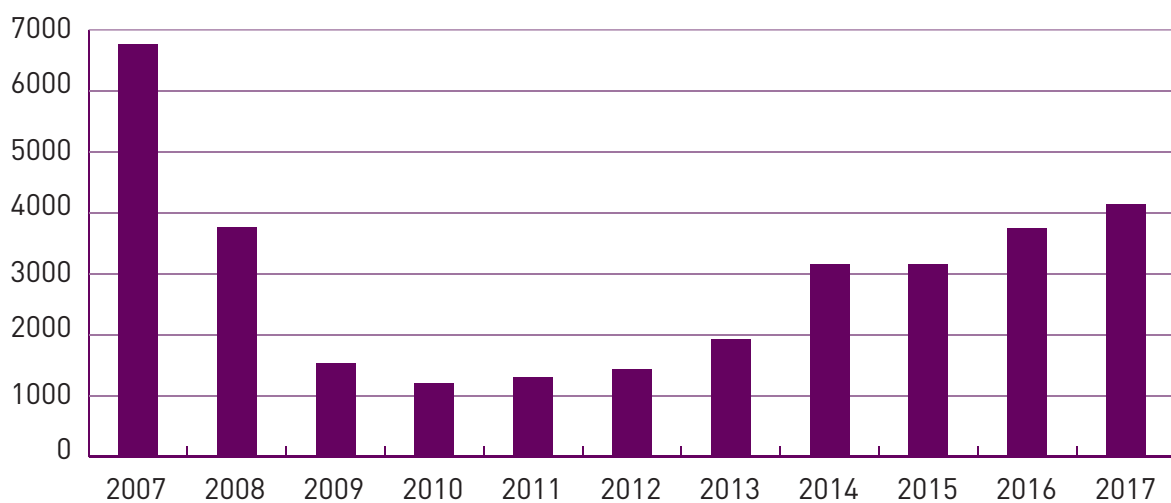
Figure 18 2016 enrolment of undergraduates (UG) and postgraduates (PG), full-time (FT) and part-time (PT)



4.6. Apprenticeships

The number of craft apprentices in Ireland declined dramatically during the economic recession. Data provided by the Further Education and Training Authority (SOLAS) and the Department of Education & Skills shows that the number of new apprentices registering each year fell from 6,763 in 2007 to a low of 1,204 in 2010. New registrations have since increased to 4,147 in 2017 (Figure 19). While these apprentices do not qualify as engineers, many become engineering technicians or progress to study engineering. More importantly, apprentices play a vital role in the wider engineering and construction sector and the decline in apprentice registrations is a key component of skills shortages in the sector.

Figure 19 Apprentice annual registrations [based on SOLAS]



The total population of apprentices has increased by 9% in the past year and by 81% in the past five years. There are now 11,273 apprentices (Table 17). There has been particularly strong growth in apprenticeships relating to plumbing, carpentry, electrical and mechanics.

A new approach to apprenticeships (as highlighted in Section 1) has resulted in the development of consortium-led apprenticeships and five of these apprenticeships were launched in 2017: Insurance Practice, Industrial Electrical Engineering, Polymer Processing Engineering, Manufacturing Technology and Manufacturing Engineering. 114 new apprentices have taken up these courses. Engineers Ireland has supported proposals to develop further apprenticeships as part of calls organised by SOLAS in the past year. New apprenticeship schemes are expected to be launched later in 2018.

Table 17 Total apprentice population [based on SOLAS]

Apprenticeship	2012	2013	2014	2015	2016	2017
Construction						
Brick and Stonelaying	85	54	53	54	87	100
Cabinet Making	35	10	4	5	3	3
Carpentry and Joinery	716	406	471	657	882	962
Floor and Wall Tiling	7	4	2	1	-	-
Painting and Decorating	69	37	33	40	51	58
Pipefitting	-	-	-	34	60	75
Plastering	63	40	28	34	39	53
Plumbing	688	604	779	798	1,034	1,152
Stonecutting and Stonemasonry	-	-	16	28	27	30
Wood Manufacturing and Finishing	29	42	51	84	128	127
Wood Machinist	2	-	-	-	-	-
Electrical						
Aircraft Mechanics	113	124	136	132	146	140
Electrical	1,785	1,622	2,033	2,491	3,410	3,823
Electrical Instrumentation	82	102	163	211	260	275
Electronic Security Systems	37	35	35	48	61	87
Instrumentation	17	17	25	28	30	35
Refrigeration	134	130	160	189	239	257
Engineering						
Farriery	31	23	20	20	15	17
Industrial Insulation	10	11	16	28	31	34
Mechanical Automation & Maintenance Fitting	359	395	480	527	578	587
Metal Fabrication	321	365	441	552	618	655
Sheet Metalworking	44	43	58	81	94	115
Toolmaking	127	184	218	233	244	245
Motor						
Agricultural Mechanics	89	98	112	140	148	157
Construction Plant Fitting	127	147	166	199	215	225
Heavy Vehicle Mechanics	286	277	344	429	470	481
Motor Mechanics	808	815	932	1,130	1,264	1,288
Vehicle Body Repairs	133	103	114	118	152	159
Printing & Paper						
Print Media	24	23	23	26	19	19
Printing	2	-	-	-	-	-
Bookbinding	-	-	-	-	-	-
Consortium-led (introduced 2017)						
Industrial Electrical Engineering	-	-	-	-	-	12
Manufacturing Engineering (Level 6)	-	-	-	-	-	9
Manufacturing Engineering (Level 7)	-	-	-	-	-	7
Polymer Processing Technology	-	-	-	-	-	16
Insurance Practice	-	-	-	-	-	70
Total	6,223	5,711	6,913	8,317	10,305	11,273

4.7 Gender gap in education

As noted in Section 3, bridging the gender gap must be a key driver in engineering and wider STEM education. In this light, it is very positive to note that women now comprise the majority of students who sit Junior Certificate higher level papers in both science and mathematics (51%). Overall, at Junior Certificate level, 41% higher level STEM subject sittings are by female students, an increase of one percentage point in the past year (Table 18). For the Leaving Certificate, 43% higher level STEM sittings are by female students, again an increase of one percentage point in the past year (Table 19). However, this proportion is skewed by the number of female students taking higher level biology (62%) and chemistry (57%). Meanwhile, just 28% higher level physics students are women.

Table 18 Gender gap in Junior Certificate higher level STEM sittings in 2017 [based on SEC]

Subject	%Women	Higher level		%Women	Ordinary level	
		Year-on-year	5 year trend		Year-on-year	5 year trend
Science	51%	n/c	n/c	41%	-1pp	n/c
Mathematics	51%	+1pp	+1pp	47%	-1pp	-1pp
Material Technology	16%	+1pp	+5pp	20%	n/c	+1pp
Technical Graphics	18%	+3pp	+5pp	15%	n/c	-1pp
Metalwork	9%	+1pp	+2pp	13%	-2pp	-3pp
Technology	18%	-1pp	-1pp	21%	n/c	-9pp
All STEM subjects	41%	+1pp	+2pp	40%	-1pp	-1pp

pp = percentage points; n/c = no change

Table 19 Gender gap in Leaving Certificate higher level STEM sittings in 2017 [based on SEC]

Subject	%Women	Higher level		%Women	Ordinary level	
		Year-on-year	5 year trend		Year-on-year	5 year trend
Biology	62%	n/c	n/c	53%	-1pp	-4pp
Mathematics	47%	n/c	+1pp	52%	n/c	+1pp
Chemistry	57%	+1pp	+2pp	44%	-5pp	-4pp
Construction studies	10%	+1pp	+4pp	10%	+1pp	+2pp
Agricultural science	43%	+1pp	+2pp	29%	+3pp	-1pp
Physics	28%	+2pp	+1pp	18%	+1pp	-1pp
Engineering*	6%	+1pp	+1pp	7%	-2pp	+1pp
Design & comm.	14%	+2pp	+3pp	9%	-3pp	+1pp
Applied mathematics	26%	+3pp	+3pp	24%	+7pp	-12pp
Technology	18%	+1pp	-1pp	17%	+5pp	-4pp
Physics & chemistry	41%	-4pp	-2pp	36%	+9pp	+6pp
All STEM subjects	43%	+1pp	+1pp	47%	n/c	+1pp

pp = percentage points; n/c = no change

Note

The Leaving Certificate subject 'engineering' is the study of a range of mechanical engineering materials, processes and technological applications. It is not a requirement for entry to engineering at third level, which is much broader in scope.

There has been some, albeit small, progress in closing the gender gap in engineering education at third level. Since 2011, the percentage of students entering engineering courses who are women has increased by three percentage points, from 9% to 12%. There has been a similar increase among engineering graduates, 16% of whom are women (Table 20). Nevertheless, an extraordinary gender gap remains and is restricting the growth of the engineering profession and its potential to deliver for society. Chemical & Process Engineering education remains the closest discipline to gender parity (despite recent backslides), while the largest gender gap can be found Civil & Building Engineering and Electrical & Electronic Engineering education. Finally, the largest challenge for the profession in terms of bridging the gender gap is among apprentices, just 0.3% of whom (33 of 10,305) are women.

Table 20 Percentage of students who are women at various stages of engineering education

	2011	2012	2013	2014	2015	2016	Year- on-year	5 year trend
Entrants								
Chemical & Process	53%	50%	39%	52%	45%	34%	-11pp	-19pp
Civil & Building	5%	5%	5%	5%	6%	7%	+1pp	+2pp
Mechanical & Manufacturing	4%	3%	3%	5%	6%	8%	+2pp	+4pp
Electrical & Electronic	6%	8%	6%	6%	8%	8%	n/c	+2pp
ICT	14%	14%	15%	16%	13%	12%	-1pp	-2pp
Other/General	14%	15%	14%	17%	20%	20%	n/c	+6pp
Total	9%	10%	10%	12%	12%	12%	n/c	+3pp
Graduates								
Chemical & Process	43%	36%	39%	42%	46%	40%	-6pp	-3pp
Civil & Building	10%	8%	9%	11%	9%	10%	+1pp	n/c
Mechanical & Manufacturing	6%	5%	9%	9%	10%	15%	+5pp	+9pp
Electrical & Electronic	9%	7%	8%	8%	8%	10%	+2pp	+1pp
ICT	28%	27%	22%	20%	20%	19%	-1pp	-9pp
Other/General	16%	15%	16%	17%	20%	19%	-1pp	+3pp
Total	13%	11%	12%	14%	15%	16%	+1pp	+3pp
Apprentices								
Total	0.4%	0.5%	0.5%	0.4%	0.3%	0.3%	n/c	-0.1pp

pp = percentage points; n/c = no change

16%

Percentage of
engineering graduates
who are women





Conclusion

Engineers work in a wide variety of disciplines, sectors and locations, each making an important contribution to public health, wellbeing and prosperity. Engineers Ireland is the professional body for engineers across the island of Ireland and we focus on the promotion and development of all disciplines of engineering, working collaboratively with industry, educational institutions, state bodies and the civil service.

The datasets contained in this Engineering 2018 report shine a light on indicative trends in engineering employment, perspectives and education. Understanding these trends will help us to advocate for the engineering profession and to enable the profession to make an even greater positive impact on society. These trends also hold important lessons for industry, educational institutions, state bodies and the civil service who will be instrumental in overcoming skills shortages and delivering the latest products, projects and services.

Trend 1: Engineers in high demand

The economic recession was a challenging time for engineering, but the industry has bounced back in recent years and is now prospering. This is evident across all of the major sectors of the economy in which engineers work, including manufacturing, ICT and construction. Engineering employers experienced particularly strong business growth in 2017 and 83% recruited engineers. These employers are anticipating a similarly good year in 2018 and are planning to recruit further.

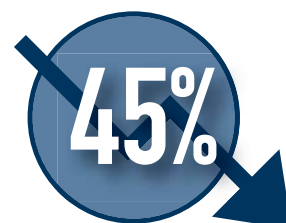
The high level of demand for engineers has seen graduate engineer salaries increase by 11% in the past four years to €31,000. Engineering salaries have been increasing steadily with experience and the majority of engineers with more than 30 years of experience can expect to earn more than €90,000. Meanwhile, employers continue to value the Chartered Engineer title awarded by Engineers Ireland (which recognises professional expertise, leadership and ethical practice) such that Chartered Engineers earn €3,000-5,000 more per year than their untitled peers with the same number of years of experience.

Trend 2: Skills shortages threaten a growing sector

There have been modest increases in the numbers of students entering engineering courses, enrolled on engineering courses and graduating from engineering courses (all up 3% in the year to 2016/17). However, engineering businesses are very concerned that there is an inadequate supply of engineering skills to meet their needs in the medium term. Ireland's development as a 'global innovation leader', with inward investment, export opportunities and sustainable long-term growth, will hinge on the further development of engineering skills in key industrial sectors such as manufacturing and ICT.



Graduate engineer salaries increased by 11%
in the past four years



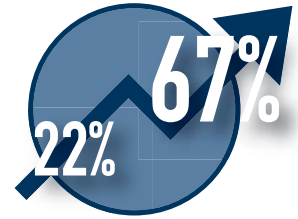
Civil & Building Engineering graduate numbers are down 45% in the past five years

In the context of the €116 billion National Development Plan 2018-2027 and upswing in housing construction, there are also major concerns regarding a shortage of Civil & Building Engineering graduates, the numbers of which are down 45% in the past five years. Highly skilled professionals such as these are needed for the delivery of energy-efficient buildings, clean water supplies and sustainable transport. In general, without a sufficient supply of engineering talent, it will not be possible to provide crucial products, projects and services.

Trend 3: Opportunities to build on public confidence

The public places exceptionally high levels of confidence in the engineering profession, with 90% saying they trust engineers. Engineers are considered to be highly competent professionals who are able to apply expertise in their daily work. We believe that one of the reasons why the public holds such high levels of confidence in engineers is the role the profession plays in public health and safety. 77% adults agreed that engineers are essential to reduce risks to public health and safety, and agreement was particularly strong among those with young children in the household and those over 65 years old.

Building on this public confidence will be an important part of advocating for the engineering profession and promoting engineering as a career choice. For example, the economic recession dented public confidence in employability in engineering which undoubtedly influenced young people's career choices. Today, there is widespread public confidence in engineering employment (67% agreeing that there are plenty of jobs in the sector in Ireland, compared to just 22% four years ago). Moreover, the vast majority of adults also believe that engineering is a rewarding career choice for young people.



67% agree there are **plenty of jobs** in the sector in Ireland, **compared to** just **22%** four years ago

Trend 4: Bridging the gender gap must be a priority

Most of society's biggest challenges will require interdisciplinary solutions and the combined mind power of women and men working together. The engineering profession must therefore bridge the gender gap and promote a more diverse and inclusive workforce. Currently, female engineers and the general public remain unconvinced that there are equal opportunities for men and women in the engineering sector. Women remain an untapped resource and, if the overall number of people entering the profession is to rise, increasing the number of women in engineering education must be a priority. There have been some very positive developments in this regard in the Junior Certificate, where last year the majority of those taking higher level science and mathematics were girls.

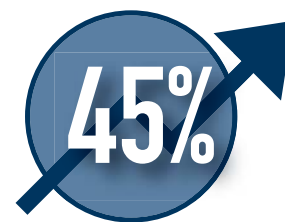


60% of female engineers agree that the **engineering sector** currently has **better opportunities for men**

Trend 5: Engineers Ireland STEPS programme remains crucial

To promote engineering as a career choice, especially to young girls, the continued work of the Engineers Ireland STEPS programme will be crucial. Funded under Science Foundation Ireland's Discover programme Call, STEPS sparks enthusiasm for engineering and STEM among young people with the aim of growing the number of students taking engineering and other STEM courses at third level. In 2017, 92,500 students, teachers and parents directly interacted with an engineer role model through STEPS.

The annual Engineers Week festival of engineering has been growing from strength to strength. In 2017, the STEPS-supported week of activities recorded a massive 45% year-on-year increase in participation, encompassing 63,254 people, 786 events and 177 organisations. The audience included primary and second-level students, teachers, parents, industry and the general public nationwide. Meanwhile, Engineering Your Future introduces transition year students to the exciting and diverse world of engineering through immersive week-long experiences on higher education campuses throughout the country.



45% year-on-year
increase in participation
in Engineers Week
to **63,254** people

Mar fhocal scoir (Finally)

A new set of broad engineering disciplines was developed for the purposes of this report: Chemical & Process, Civil & Building, Electrical & Electronic, Information & Communications Technology, Mechanical & Manufacturing and Other / General. While this system of classification is not all-encompassing (particularly in light of trends towards both specialisation and interdisciplinarity), it has greatly assisted the interpretation of data collected by other organisations, such as the CSO and HEA.

The responses to the surveys conducted in the preparation of this report suggest the willingness of engineers, employers and the general public to engage in a dialogue on the development of the engineering profession and the education of the future generations of engineers. Engineers Ireland will continue to stimulate a public discussion on these topics, communicating the growing importance of our profession to society. If you would like to take part in this work, contact us today.



Appendix. Methodological notes

Data sources

- Census 2016 Profile 11 – Employment, Occupations and Industry was published by the Central Statistics Office (CSO) on 14th December 2017. Available at: www.cso.ie
- Junior Certificate 2017 results were released by the State Examinations Commission on 13th September 2017. Available at: www.examinations.ie
- Leaving Certificate 2017 results were released by the State Examinations Commission on 16th August 2017. Available at: www.examinations.ie
- Data for higher education new entrants, enrolment and graduates were published by the Higher Education Authority (HEA) on 1st March 2017. Available at: www.hea.ie
- Apprenticeships registration data was published by the Further Education and Training Authority (SOLAS) on 4th July 2017. Available at: www.solas.ie

New broad engineering disciplines and reclassifying CSO and HEA data

For the purposes of this report, a new set of broad discipline codes has been developed:

- Chemical & Process (Chem)
- Civil & Building (Civil)
- Electrical & Electronic (Elec)
- Information & Communications Technology (ICT)
- Mechanical & Manufacturing (Mech)
- Other / General (Other)

The five-yearly Census of Population uses 10 occupation codes for engineers. Table A1 shows how these codes have been grouped to form the new broad disciplines. As noted in Section 2, the total number of engineers listed in Table A1 is underestimate which is a results of the classification of engineers under other occupation codes.

The five-yearly Census of Population uses 10 occupation codes for engineers. Table A1 shows how these codes have been grouped to form the new broad disciplines. As noted in Section 2, the total number of engineers listed in Table A1 is underestimate which is a results of the classification of engineers under other occupation codes.

Table A1 Engineering as an occupation as listed on Census [based on CSO data]

Census occupation	2011	2016	5 year trend	New code
Civil engineers	6,575	7,427	+12%	Civil
Mechanical engineers	4,094	4,172	+2%	Mech
Electrical engineers	6,952	7,143	+3%	Elec
Design and development engineers	2,160	2,749	+21%	Mech
Production and process engineers	2,619	2,796	+6%	Chem
Quality control and planning engineers	1,746	2,044	+15%	Chem
Air-conditioning and refrigeration engineers	1,438	1,412	-2%	Mech
Telecommunications engineers	5,734	4,553	-26%	ICT
IT engineers	3,349	3,960	+15%	ICT
Engineering professionals n.e.c.	5,396	6,515	+17%	Other
Total	40,063	42,771	+6%	

*Different classification system used for ICT before 2014

The HEA collects statistics on student enrolment, progression and graduation and uses the International Standard Classification of Education (ISCED). The grouping of these ISCED categories into the new broad discipline codes is set out in Table A2.

Table A2 Reclassifying courses into new broad discipline codes [based on HEA data]

ISCED name	ISCED code	New code	2016 graduates
Software and applications development	0613	ICT	1,397
Electronics and automation	0714	Elec	1,226
Building and civil engineering	0732	Civil	1,075
Engineering not elsewhere classified	0710	Other	1,021
Mechanics and metal trades	0715	Mech	735
Computer use	0611	ICT	532
Electricity and energy	0713	Elec	530
Manufacturing and processing	0720	Mech	455
Chemical engineering and processes	0711	Chem	365
Motor vehicles, ships and aircraft	0716	Mech	337
Environmental protection technology	0712	Other	48

Employer survey

The engineering employer survey was conducted online between 18-26 October 2017. A link to the survey was emailed to Engineers Ireland corporate partners and other affiliated businesses and contacts. There were 245 useable responses, of which 35% were small businesses (1-50 employees), 38% were medium-sized businesses (51-200 employees) and 27% were large businesses (201+ employees). The main fields of engineering in which responding employers operated was as follows: 41% Civil & Building, 19% Mechanical & Manufacturing, 18% other/general, 17% Electrical & Electronic, 3% ICT and 2% Chemical & Process. Of the people responding to the survey, 50% worked in management/HR, 45% worked as engineers and 5% held other positions.

Engineers Ireland member survey

The Engineers Ireland member survey was conducted online between 10-24 January 2018. A link to the survey was emailed to members of Engineers Ireland and posted in the Engineers Ireland Official Group on LinkedIn. There were 2271 useable responses, of which 87% were men and 12% were women. The breakdown of the sample according to experience was: 1-2 years (4%), 3-5 years (10%), 6-10 years (19%), 11-15 years (20%), 16-20 years (14%), 21-25 years (12%), 26-30 years (9%) and 30+ years (12%). The breakdown of the sample according to membership type / professional title was: untitled Member (50%), Chartered Engineer (44%) and Fellow (6%). A full Engineers Ireland Salary Survey 2018 report is available to Engineers Ireland members and can be downloaded from the members' area of www.engineersireland.ie.

Public survey

The public survey was conducted face-to-face by Behaviour & Attitudes between 19 January and 1 February 2018. 1,000 adults (aged 16 and over), statistically representative of the adult population in Ireland (in terms of age, gender, region and socio-economic class), were polled at randomly-chosen sampling points.

Notes

[illegible]

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