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amazon future engineer

Mapping the Careers of the Future in the United Kingdom, France and Germany



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Introduction

Gallup has partnered with Amazon Future Engineer, Amazon's childhood-to-career programme to bring Careers of the Future and Computer Science literacy to young people with a focus on students historically underrepresented in technology, to create the Careers of the Future Index (CFI).

The public database aims to provide teens, young adults and their advisers with transparent and useful data about the economic prospects of careers in the United Kingdom, France and Germany — and to inform educational and other stakeholders looking to invest in young adults' career pathways.

The CFI utilises national occupational classifications to provide a summary measure of the economic prospects of each career. The CFI combines the most recent career-level data on four key job attributes: income; job growth over the previous six or seven years; job vacancies per worker; and capacity to withstand automation. A more detailed description of the methods used to construct the index is provided in the background section of this report on [Page 39](#).

The goal is to highlight careers that both pay well and are likely to be available to applicants now and in the future. The CFI provides scores ranging from 1 to 100 for hundreds of occupations in each country. Higher scores on the CFI generally indicate higher pay, a high and growing level of job openings and/or better prospects that the job will remain a viable option in the face of changes in technology. This study also examines top careers for which most workers do not have a bachelor's degree or comparable level of education, as well as top IT careers. IT jobs are associated with new technologies and innovation, such as machine learning and artificial intelligence, and likely will have expanded opportunities for well-paying jobs in the future.

The economic viability of specific occupations according to the CFI is compared with the occupation's popularity with secondary-school students. The career interests of 15-year-old students are calculated using data from the Programme for International Student Assessment (PISA), part of the Organisation for Economic Co-operation and Development (OECD). As part of its background data collection for the PISA exam, the OECD asked respondents, "What kind of job do you expect to have when you are about 30 years old?" Framed this way, the career question taps into not only students' personal interests, but also their beliefs about what is possible. Data on career preferences are analysed separately for boys and girls in each country, and the popularity of career clusters in management, engineering, computer science, healthcare, teaching and sport is compared with the viability of careers in these broad categories for each country.



Executive Summary

United Kingdom

Marketing, information technology and financial directors tie with chief executive officers, generally, as ranking highest in the CFI in the United Kingdom. However, none of these careers appear in students' top career choices.

U.K. youth's preferred careers tend to have relatively high CFI scores, particularly among boys, suggesting solid career-goal alignment even with the top U.K. jobs covering a diverse number of fields. Six of boys' top 10 careers have CFI scores of 75 or higher, while four of the top 10 careers identified by girls rank that high. Boys name engineering and software careers among their top careers, but girls do not.

About four in 10 U.K. teens are unable to name a career they would like to have at the age of 30. Those who speak a language other than English at home (66%) are twice as likely as English speakers to (33%) not be able to mention a preferred career.

The most popular careers are not those with the highest CFI. Careers in sport, healthcare and law have lower CFI rankings than careers in management, engineering or information technology.



France



More than 35% of French 15-year-olds are unable to name a career they imagine themselves having in 15 years. Among the most popular career choices, just four of girls' top 10 choices and three of boys' top 10 choices have CFI job scores of 75 or higher, suggesting a misalignment or incomplete knowledge of promising careers of the future.

Ten of the French careers with the highest CFI scores are engineering-related jobs. In fact, in the past 12 months, 30% of job vacancies in France have mentioned the need for IT skills, such as coding, programming, software or design. We estimate that these represent 3.3 million job vacancies advertised during the year-long period.

Overall, French youth are more likely to imagine themselves working in healthcare and law than engineering, management or information technology, yet the latter score higher on the CFI index than the former. French boys do rank engineering among their top 10 career choices, but their most preferred jobs — armed forces officers and athletes — have middling CFI scores. Most of French girls' top careers are in the medical field, with two — medical doctor and psychologist — having high CFI scores, while French girls do not list engineering careers among their top 10 career choices.

The French jobs with the highest CFI scores are air traffic controllers, financial market executives, engineers and executives in building and public works, and engineers and executives in mechanics and metalworking.



Germany



Half of the highest scoring jobs in Germany, and six of seven with a maximum CFI score of 100, are management positions in various fields, including in medicine and technology. Management jobs as a category do not rank highly in young people's career expectations.

However, their ranking shows that the combination of promising sector selection, and the "future skills" that allow one to rise to management (e.g., analytical thinking, problem-solving and leadership qualities) can offer career paths that rank highly in the CFI.

About half of German 15-year-olds (49%) do not have a clear career goal in mind when imagining their future self at the age of 30. Many more German teens who do not speak German at home (59%, compared with 31% who speak German at home) cannot identify a preferred future career.

German girls are more likely than German boys to name high ranking CFI jobs as their top careers — six of girls' top 10 most popular career choices and four of boys' top 10 choices have CFI job scores ranking in the top quarter of jobs. The top three preferred careers for German girls — doctor, psychologist and teacher — have high CFI scores of 86 or above, suggesting their most preferred career choices align well with future job prospects in those fields. None of their preferred careers have technology angles.

Two of German boys' four most desired careers, auto mechanic and agricultural/industrial machine mechanic, have CFI scores in the 20s, suggesting many German boys' career goals do not align to promising future careers.

The average career in information technology or management ranks in the top quintile of the CFI score (84 for both). These career viability rankings exceed those for careers in law, healthcare or sport, despite being less popular among German youth.



Cross-Country Comparisons

Alongside the CFI career trends based on labour data, the international PISA data illustrate how well today's students' future job preferences align with their likely future job prospects.

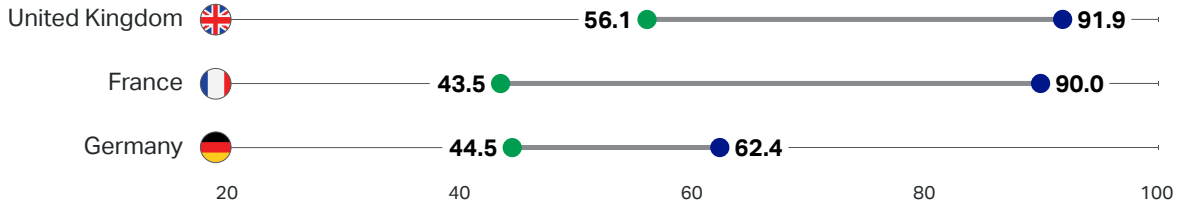
- 1** Critically, a large portion of 15-year-olds in the U.K., France and Germany not only overlook high-scoring careers, but **at least four in 10 in each country cannot envision what career they might have at the age of 30.**
- 2** **Students with high scores on the PISA are more likely to name a career than those with low scores.** This indicates a need to encourage youth — and particularly lower academic achievers — to begin thinking about their future jobs and for educators and employers to find ways to expose young people to high CFI careers that will be available to them as adults.
- 3** **Doctors, lawyers, athletes and teachers dominate the top career mentions** from students, which indicates these careers are most top-of-mind for students. While doctors and lawyers are high-scoring careers, athletes are consistently low-scoring careers.
- 4** **Other top scoring careers outside of doctors and lawyers are rarely mentioned by students,** including professions in IT, management and finance as well as aviation-related roles such as pilots. This suggests a disconnect between what students envision for their future career and the top careers in their country by pay, growth, vacancies and capacity to withstand automation.
- 5** **Various occupations in the IT industry are present in the top career lists in all three countries** as well, including IT business analysts, programmers and software developers. Note that because this analysis is based on the most recent nationally available statistics, some of the newest job categories in disruptive technologies like AI are not singled out in the data.
- 6** Almost all of the top 20 scoring jobs — all 20 in France and the U.K. and all but one in Germany — **require the equivalent of a bachelor's degree or higher.** However, there are jobs that do not require university education with relatively high CFI scores in all countries, particularly in trades such as construction, production and manufacturing.
- 7** In the fields of engineering, healthcare, information technology, law, management and teaching, **there are large gaps between student interest and economic viability based on CFI score.** The largest gaps are seen in engineering and management (higher CFI scores, lower interest) and sport (lower CFI scores, higher interest).

Careers of the Future Index (CFI) Score, Compared With 15-Year-Olds' Career Preferences, by Country and Occupational Category

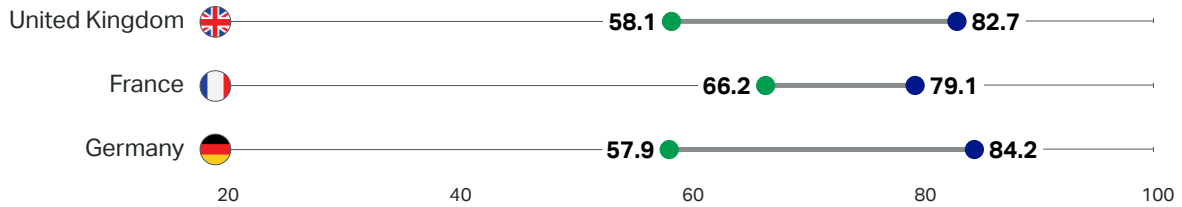
Data points reflect average centile ranking. Where the CFI score is significantly higher than the student ranking, it indicates students' lack of interest in a rewarding future career.

● Student popularity ● Careers of the Future score

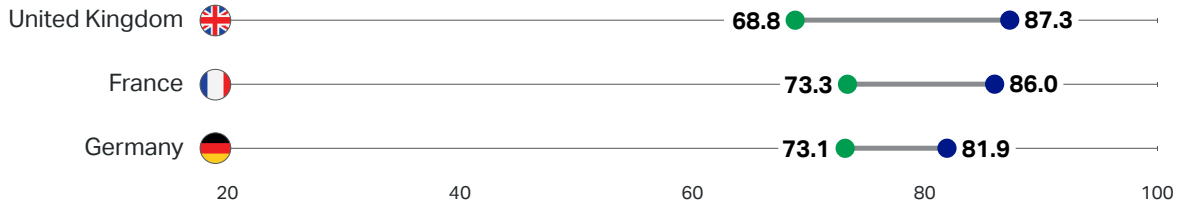
Engineering careers



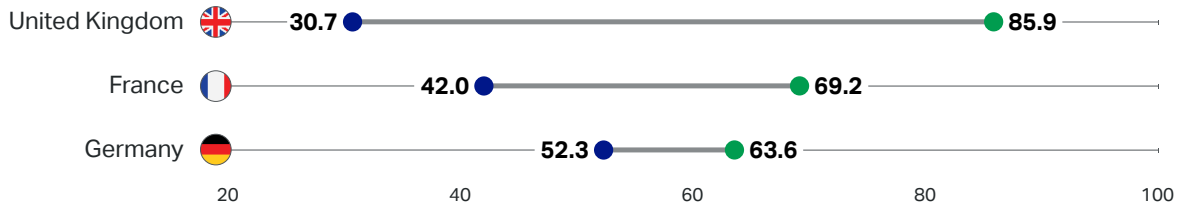
Information technology careers



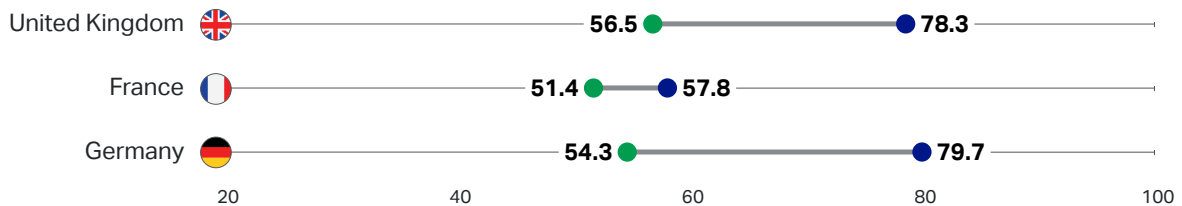
Law



Sport



Teaching



CFI score is weighted by the number of jobs in each detailed occupation within the larger category.

Background & Methods

Background

Choosing a career is a complex decision. It involves, among other things, personal and cultural interests, a sense of alignment with one's abilities, and many practical considerations. These considerations may include whether the career pays well enough to sustain a family at a comfortable standard of living, whether jobs are readily available, whether job prospects are shrinking or expanding and whether the tasks performed in the jobs have the capacity to withstand automation in the coming years. Prospective entrants must also consider the educational requirements for the career, including the likely time and effort associated with pursuing the necessary acquisition of skills, academic degree or related credentials.

The primary goal of the Careers of the Future Index (CFI) is to provide teens, young adults and their advisers with empirically supported guidance about the economic prospects of careers in the United Kingdom, France and Germany. A secondary goal is to understand which careers are promising but less understood by students.

The CFI is constructed using best-practice methods, reliable sources and full transparency. It allows users the flexibility to analyse the data in different ways, depending on how much they value pay, job growth, job vacancies and capacity to withstand automation as factors in determining viable career paths. See the methodology section on [Page 35](#) for more details about the CFI database construction. Click the links to view the full database of careers in [France](#), [Germany](#) and the [United Kingdom](#).

Amazon Future Engineer commissioned the CFI and has published a similar [report and jobs database for the United States](#).



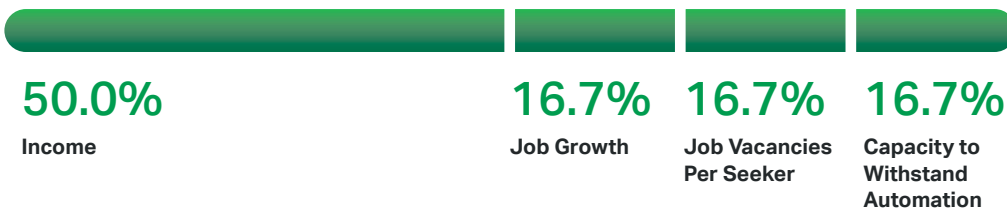
Brief Methodology

In constructing the CFI, the highest weight (50% of the total) is given to income. Income is often considered the primary goal of work in modern society. It has been widely established that income is an important driver of job satisfaction.¹ A high income is also predictive of better physical health and subjective wellbeing, and the most common stated goal of students who pursue higher education.²

Though important, income is not the sole indicator of job quality or career opportunity. A high-paying career with no vacancies cannot provide employment, and a high-paying job for which there is no market demand may be eliminated, along with its income. The other index elements pertain more directly to job availability (number of positions), and the capacity to withstand automation or job growth.

There is no right or wrong way to determine the relative weights of each job characteristic, and the elements are somewhat overlapping. Jobs that are difficult to automate have a higher capacity to withstand automation and are therefore more likely to have future job growth and vacancies. No matter how high-paying a job is, job vacancies are needed for new entrants, and positive job growth trends make it more likely that vacancies today will be followed by vacancies in the future. For these reasons, one-third of the 50% index weight (about 16.7%) was assigned to each of these three components.

CFI Characteristic Weighting



- 1 Rothwell, Jonathan and Steve Crabtree, "Not Just a Job: New Evidence on the Quality of Work in the United States", Gallup 2019, <https://www.gallup.com/education/267590/great-jobs-lumina-gates-omidyar-gallup-report-2019.aspx>
- 2 Diego-Rosell, Pablo, Robert Tortora and James Bird. "International determinants of subjective well-being: Living in a subjectively material world." *Journal of Happiness studies* 19 (2018): 123-143; Gallup "The State of Higher Education 2022 Report," <https://www.gallup.com/analytics/391829/state-of-higher-education-2022.aspx>; Chetty R, Stepner M, Abraham S, et al. The Association Between Income and Life Expectancy in the United States, 2001-2014. *JAMA*. 2016;315(16):1750-1766. doi:10.1001/jama.2016.4226



United Kingdom

Best-Scoring Jobs Overall

Four jobs in the United Kingdom have the maximum CFI score: marketing, sales and advertising directors; chief executive officers and senior officials; information technology directors; and financial managers and directors.

Because of the way jobs are classified in the U.K., "executive" and "director" are highlighted as promising job roles, even though they correspond to a level of advancement and not an industry path. So, employees who distinguish themselves in a chosen field, such as information technology, marketing, advertising or finance, are successful business entrepreneurs, or have skills that lend themselves to upper management positions, can ascend to some of the best future jobs in the U.K.

While the top jobs span a range of industrial sectors, IT and finance jobs are the most plentiful among the CFI top 20. As of 2022, the information technology field included close to half a million highly rated careers in the U.K. across the three career types in that field that ranked in the top 20 U.K. jobs of the future: IT directors, programmers and software developers and IT business analysts, architects and system designers.





Top Careers in U.K., Based on CFI Score

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Median Annual Pay (GBP)	Number of Jobs (2022)
1	Marketing, sales and advertising directors	100	£74,224	173,000
2	Chief executives and senior officials	100	£72,621	83,000
3	Information technology directors	100	£68,912	35,000
4	Financial managers and directors	100	£58,079	344,000
5	Public relations and communications directors	99	£65,703	10,000
6	Elected officers and representatives	99	£67,026	NA
7	Aircraft pilots and air traffic controllers	99	£66,144	10,000
8	Electrical engineers	99	£50,539	39,000
9	Functional managers and directors (not elsewhere classified)	98	£56,972	71,000
10	Programmers and software development professionals	98	£44,559	296,000
11	Senior police officers	98	£59,141	NA
12	Senior officers in fire, ambulance, prison and related services	98	£57,179	NA
13	Head teachers and principals	97	£64,304	54,000
14	Specialist medical practitioners	97	£64,026	139,000
15	Research and development (R&D) managers	97	£48,242	61,000
16	IT business analysts, architects and systems designers	97	£49,845	132,000
17	Civil engineers	96	£43,767	62,000
18	Chartered architectural technologists, planning officers and consultants	96	£33,946	15,000
19	Barristers and judges	96	£46,830	15,000
20	Professional/chartered company secretaries	96	£41,257	NA

IT careers are highlighted in bold.

NA indicates where the U.K.'s ONS suppressed estimates with a coefficient of variation greater than 20% on quality grounds. The coefficient of variation of 20% has a confidence interval of approximately 40% of the estimate and is considered unreliable. Estimates are also suppressed when there is a risk of disclosure of individual employees or employers.



Best-Scoring Jobs for Which Most Workers Do Not Have a Bachelor's Degree

While all of the top 20 U.K. jobs according to the CFI require the equivalent of a bachelor's degree, job seekers who do not have nor wish to obtain a higher degree can still find jobs that promise to be rewarding in the future. Production and process engineers, health and safety managers/officers, electronics engineers, construction project managers and related professionals, and residential, day and domiciliary care managers and proprietors are the top-ranking jobs that generally do not require a bachelor's degree.

Many of the other top roles for non-university-educated workers involve some type of management position, such as construction supervisor, production manager and property manager. Non-management positions on the list include electronics engineers, accountants, quality assurance and regulatory personnel, police officers and firemen.

Best Careers in Which Most Workers Do Not Have an Academic Credential

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Median Annual Pay (GBP)	Number of Jobs (2022)
31	Production and process engineers	93	£41,202	54,000
34	Health and safety managers and officers	92	£37,081	51,000
41	Construction project managers and related professionals	91	£37,760	28,000
45	Residential, day and domiciliary care managers and proprietors	90	£37,626	45,000
46	Electronics engineers	89	£48,134	13,000
47	Production managers and directors in construction	89	£46,678	87,000
49	Production managers and directors in mining and energy	89	£45,000	NA
50	Chartered and certified accountants	88	£41,185	99,000
53	Managers in transport and distribution	88	£39,912	55,000
54	Business, research and administrative professionals [†]	87	£47,664	68,000
57	Quality assurance and regulatory professionals	87	£41,014	91,000
62	Social services managers and directors	85	£38,025	11,000
67	Police officers (sergeant and below)	84	£43,867	302,000
78	Brokers	81	£35,431	12,000
79	Natural and social science professionals [†]	81	£40,863	34,000
80	Production managers and directors in manufacturing	81	£41,545	541,000
81	Construction and building trades supervisors	81	£38,391	51,000
85	Fire service officers (watch manager and below)	80	£35,821	63,000
90	Property, housing and estate managers	79	£35,834	84,000
95	Protective service associate professionals [†]	77	£35,462	24,000

[†]Indicates not elsewhere classified.



IT Jobs in the U.K.

Over the past year, about a quarter of U.K. job vacancies mentioned the need for some IT skills, such as programming or engineering. These represent an estimated 3.1 million vacancies. The top-scoring IT careers show a range of CFI scores, from 100 for IT directors to 50 for IT operations technicians.

As noted previously, the programmers and software developers' CFI score of 98 is one of the highest in the U.K. and has more positions in the U.K. (nearly 300,000) than any other top-ranking job of any field. In total, there are over 1.3 million workers currently employed in IT roles.³

In addition to IT directors and software programmers/developers, three other IT jobs have CFI scores above 90 in the U.K.: IT business analysts, IT project managers and IT managers.

IT Careers in the U.K.

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Median Annual Pay (Euros)	Number of Jobs (2022)
3	Information technology directors	100	£68,912	35,000
10	Programmers and software development professionals	98	£44,559	296,000
16	IT business analysts, architects and systems designers	97	£49,845	132,000
32	IT project managers	93	£47,732	25,000
37	IT managers	91	£49,026	200,000
52	Information technology professionals (not elsewhere classified)	88	£40,665	96,000
69	Web design professionals	84	£38,080	NA
70	Cybersecurity professionals	83	£45,141	15,000
98	IT quality and testing professionals	77	£39,764	15,000
104	IT network professionals	75	£39,064	53,000
112	Information technology trainers	73	£34,230	N/A
118	CAD, drawing and architectural technicians	72	£30,073	37,000
167	Graphic and multimedia designers	60	£26,886	NA
169	IT user support technicians	59	£29,395	155,000
201	Data analysts	51	£30,678	46,000
203	Database administrators and web content technicians	51	£29,831	24,000
207	IT operations technicians	50	£28,545	82,000

³ This is calculated by summing three-digit IT jobs in the 214 category (web design professionals and graphic and multimedia designers) using aggregated U.K. data with no suppressions and adding that number to the total for IT jobs with no data suppressions.



Gender Differences in Teens' Expected Careers

About four in 10 U.K. 15-year-olds interviewed in the PISA survey, including 38% of girls and 44% of boys, do not indicate a desired career. Girls' top careers are medical doctors, lawyers, psychologists and nursing professionals. Most of the top choices for girls in the U.K. are in the field of medicine or education.

Boys' top choices are engineering professionals, athletes and lawyers. Boys' favoured occupations span a larger number of fields and include professional trades such as carpenters and mechanics.

For the most part, U.K. youth with career preferences are interested in jobs that will set them up well for the future, as the expected occupations of U.K. youth generally have above-average CFI scores. The most notable exception is athletes and sport players, a top choice among boys but a profession with a low score of 4. Six of the other top desired professions for U.K. boys have CFI scores exceeding 80, with four above 90, including engineers, lawyers, software developers and airline pilots.

Three of the top professions for girls have CFI scores of at least 80, while three others have scores in the 70s. Girls' lowest scored profession in the top 10 is teaching professional, at 39. All of the top 10 careers for U.K. girls generally require a bachelor's degree equivalent or higher.





Most Popular Expected Careers of U.K. Girls and the CFI Scores of Those Careers

Top mentions of careers 15-year-old U.K. girls expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not name career	37.9%	--
Medical doctors	5.1%	88
Lawyers	5.0%	94
Psychologists	2.9%	74
Nursing professionals	2.5%	60
Teaching professionals	2.1%	39
Primary school teachers	1.7%	75
Veterinarians	1.6%	93
Social work and counselling professionals	1.5%	72
Biologists, botanists, zoologists and related professionals	1.5%	58

Most Popular Expected Careers of U.K. Boys and the CFI Scores of Those Careers

Top mentions of careers 15-year-old U.K. boys expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not name career	44.4%	--
Engineering professionals (excluding electrotechnology)	3.6%	92
Athletes and sport players	2.7%	4
Lawyers	2.1%	94
Medical doctors	1.9%	88
Mechanical engineers	1.6%	87
Carpenters and joiners	1.5%	44
Software developers	1.5%	98
Motor vehicle mechanics and repairers	1.1%	48
Aircraft pilots and related associate professionals	1.1%	99



Differences in Teens' Expected Careers Based on Language Spoken at Home

The top two chosen careers for U.K. teens who speak English at home, versus those who speak other languages at home are the same: lawyers and medical doctors. Psychologists, engineers, nurses and athletes also rank among the top career preferences for both groups.

Most U.K. teens who do not speak English at home do not express a preferred career (66%). That figure is twice as high as those who speak English at home (33%).

For home English speakers, four of the top careers have scores of 80 or higher, including two above 90.

Six of home non-English speakers' most preferred careers have CFI scores of 80 or better, and four exceed 90 (lawyers, engineers, architects and software developers).





Most Popular Expected Careers of 15-Year-Olds Who Speak English at Home and the CFI Scores of Those Careers

Top mentions of careers 15-year-olds who speak English at home expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not mention career	32.6%	--
Lawyers	4.1%	94
Medical doctors	3.5%	88
Engineering professionals (excluding electrotechnology)	2.4%	92
Psychologists	2.0%	74
Athletes and sport players	1.7%	4
Teaching professionals	1.7%	39
Nursing professionals	1.5%	60
Biologists, botanists, zoologists and related professionals	1.5%	58
Mechanical engineers	1.2%	87

Most Popular Expected Careers of 15-Year-Olds Who Do Not Speak English at Home and the CFI Scores of Those Careers

Top mentions of careers 15-year-olds who do not speak English at home expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not mention career	66.8%	--
Medical doctors	3.4%	88
Lawyers	1.8%	94
Engineering professionals (excluding electrotechnology)	1.7%	92
Psychologists	1.0%	74
Athletes and sport players	0.9%	4
Building architects	0.8%	90
Software developers	0.8%	98
Nursing professionals	0.7%	60
Accountants	0.6%	88



France

Best-Scoring Jobs Overall

Half of the top 20 careers in France involve engineering of some kind, and these high-scoring engineering jobs represent nearly 300,000 current workers. These jobs may require some level of coding skills.

The jobs in France with the highest CFI scores are air traffic controllers, technical-commercial engineers and executives in building and public works, financial market executives, and mechanics and metalworking engineers and executives.

Commercial executives of small and medium-sized enterprises and IT managers are the most plentiful jobs among France's 20 top-rated careers. Air traffic controllers and technical navigating officers and executives of the merchant navy have the fewest number of jobs.

Two of the top-ranked jobs in France are information technology careers. A third — technical directors of large companies — includes IT directors, but also other director-level positions that are not related to IT, so it is not considered an IT job for this analysis.⁴



⁴ See <https://www.insee.fr/fr/metadonnees/pcs2003/professionRegroupee/380a?champRecherche=true> for more detail.



Top Careers in France, Based on CFI Score

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Mean Annual Pay (Euros)	Number of Jobs (2021)
1	Air traffic control engineers	100	€69,620	3,816
2	Technical-commercial engineers and executives in building, public works	100	€62,105	25,764
3	Financial market executives	100	€122,760	15,612
4	Engineers and executives of study, research and development in mechanics and metalworking	100	€62,451	61,056
5	IT project managers, IT managers	99	€57,141	169,188
6	Banking operations executives	99	€64,680	25,296
7	Technical-commercial engineers and executives in professional electrical or electronic equipment	99	€60,720	15,276
8	Engineers and executives of study, research and development in electricity, electronics	99	€62,486	54,696
9	Commercial executives of small and medium-sized enterprises (excluding retail)	98	€66,000	184,608
10	Technical-commercial engineers and executives in IT and telecommunications	98	€64,680	32,424
11	Technical-commercial engineers and executives in professional mechanical equipment	98	€54,120	16,224
12	Engineers and technical executives of transport operations	98	€54,120	40,500
13	Technical directors of large companies	97	€105,600	19,236
14	Environmental engineers and technical executives	97	€47,520	20,484
15	Product managers, buyers in commerce and other marketing executives	97	€61,509	60,324
16	Dental surgeons	97	€92,400	8,196
17	Real estate executives	97	€58,080	39,708
18	Engineers and executives of study, research and development in energy distribution, water	96	€63,057	25,068
19	Technical navigating officers and executives of the merchant navy	96	€63,360	4,836
20	Administrative, financial, commercial executives of large companies	96	€70,595	36,228

*France has only mean annual pay data available, whereas the U.K. and Germany present median annual pay. IT careers are highlighted in bold.



Best-Scoring Jobs for Which Formal Higher Education Is Not Required

Looking specifically at the top 20 careers in France that do not necessarily require formal higher education,⁵ supervisory and technician roles in maintenance, manufacturing, electricity, agriculture, water, forest and the environment make up most of the list. Drivers, firefighters and artisans are also among the top 20.

The CFI scores for careers on this list range from 69 to 87. While all of the top 20 French jobs according to the CFI require the equivalent of a bachelor's degree, job seekers who do not have nor wish to obtain a higher degree can still find jobs that promise to be rewarding in the future.



⁵ The percentage of workers with an undergraduate degree or less was not available in the French data.



Best Careers in Which Most Workers Do Not Have an Academic Credential

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Mean Annual Pay (Euros)	Number of Jobs (2021)
59	Supervisory agents in maintenance, installation in mechanics	87	€41,262	27,972
60	Supervisors in manufacturing: agri-food, chemistry, plastics, pharmacy	87	€44,016	35,868
70	Supervisors in mechanical construction, metalworking	84	€48,339	15,708
82	Supervisors in manufacturing of other industries (printing, flexible materials, furniture and wood)	81	€40,604	9,948
83	Supervisors in manufacturing: metallurgy, heavy materials and other transformation industries	81	€43,111	18,312
87	Work drivers (non-executives)	80	€35,640	36,936
91	Supervisory agents in maintenance, installation in electricity and electronics	79	€43,980	13,272
95	Manufacturing technicians and quality control in electricity, electromechanics and electronics	78	€40,206	28,980
97	Firefighters (including military firefighters)	78	€34,320	43,116
99	Site managers (non-executives)	77	€35,640	65,628
100	Artisans employed by their company	77	€30,360	39,816
109	Environmental technicians and pollution treatment	75	€31,680	21,036
112	Research-development technicians and manufacturing methods in electricity, electromechanics and electronics	74	€38,407	25,584
114	Study technicians and consultants in agriculture, water and forest	74	€36,207	11,748
117	Technicians for the operation and control of production in agriculture, water and forest	73	€34,849	4,524
119	Supervisors and technicians in production and distribution of energy, water, heating	73	€45,208	37,608
120	Foremen and supervisory agents (non-executives) in agriculture, forestry	73	€37,969	2,628
126	Salaried technician level experts, various technicians	71	€34,990	85,308
134	Restaurant management: establishment management	69	€30,360	13,992
137	Qualified electricians, electronics technicians in maintenance, servicing: non-industrial equipment	69	€29,646	8,952

IT Jobs

In the past 12 months, 30% of job vacancies in France have mentioned the need for IT skills, such as coding, programming, software or design. These positions include IT careers such as web developers and software developers, but also a large variety of engineering careers and more.

The French dataset identifies 10 careers as being in the information technology field. These careers have CFI scores ranging from 38 for computer operators to 99 for IT managers. Three of the careers have CFI scores above 90, and two others have scores above 80.

Computer science engineers and executives of study, research and development are by far the most plentiful jobs, with IT managers a distant second. The total number of workers currently employed in IT careers in France is approximately 828,000.

IT Careers in France

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Mean Annual Pay (Euros)	Number of Jobs (2021)
5	IT project managers, IT managers	99	€57,141	169,188
10	Technical-commercial engineers and executives in IT and telecommunications	98	€64,680	32,424
21	Telecommunications specialist engineers and executives	96	€55,440	24,912
75	Engineers and executives of study, research and development in computer science	83	€52,139	315,192
79	Engineers and executives of administration, maintenance, support and user services in computer science	82	€60,085	62,340
162	Telecommunications and network computer technicians	63	€30,360	42,576
173	Computer production, operation technicians	60	€32,242	27,108
197	Installation technicians, maintenance, support and user services in computer science	55	€30,832	48,924
203	Computer study and development technicians	53	€31,680	61,260
267	Employees and computer operations operators	38	€26,400	44,304



Gender Differences in Teens' Expected Careers

Data from the 2022 OECD PISA exam reveal that many 15-year-olds in France are uncertain about their future careers. When asked what career they expect to have at the age of 30, 35.4% of girls and 42.2% of boys in France could not name one.

French girls are most likely to name potential careers in the medical field, including doctors, nursing professionals, psychologists and veterinarians, along with lawyers and architects. These occupations have CFI scores ranging from 59 to 86.

The job with the highest CFI score on the girls' list, 97, is real estate agents and property managers, while the lowest-scoring job is childcare workers (47).

Most Popular Expected Careers of French Girls and the CFI Scores of Those Careers

Top mentions of careers 15-year-old French girls expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not name career	35.4%	--
Medical doctors	5.6%	79
Lawyers	4.1%	86
Nursing associate professionals	3.2%	69
Psychologists	3.0%	83
Building architects	2.1%	59
Veterinarians	1.9%	67
Sales workers	1.6%	63
Real estate agents and property managers	1.5%	97
Childcare workers	1.4%	47



Teen boys in France are less focused on the medical field than their female counterparts, as only one medical career is among their top choices. Boys' top career choices are non-commissioned armed forces officers and athletes. These occupations have middling CFI scores of 56 and 42, respectively, and are significantly lower than teen girls' most popular career expectations.

Most Popular Expected Careers of French Boys and the CFI Scores of Those Careers

Top mentions of careers 15-year-old French boys expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not name career	42.2%	--
Non-commissioned armed forces officers	2.3%	56
Athletes and sport players	2.2%	42
Medical doctors	1.9%	79
Engineering professionals (excluding electrotechnology)	1.6%	93
Police officers	1.6%	63
Armed forces occupations	1.5%	56
Building architects	1.3%	59
Electronics engineers	1.3%	98
Systems analysts	1.3%	N/A

Note: Average CFI for careers associated with armed forces or military were calculated as the average of the CFI scores for all armed forces or military occupation in France. N/A for CFI score indicates there was not a sensible match between the PISA occupation and the country-specific occupation coding system.

Germany



Best Scoring Jobs Overall

There are six careers in Germany with a CFI score of 100, including medical doctors and managerial-level positions in a variety of fields, including medicine, computer science and law. These fields are also represented in careers with CFI scores of 97 to 99.

Occupations in medicine and business — medical and dental practitioners, managing directors/executive board members and business consultants — are by far the most abundant among Germany's top-rated careers.





Top Careers in Germany, Based on CFI Score

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Median Annual Pay (Euros)	Number of Jobs (2022)
1	Managers in human medicine and dentistry	100	€150,264	38,621
2	Managers in technical research and development	100	€108,996	12,229
3	Managers of legal services, contracts and compliance	100	€120,324	1,399
4	Managers in computer science	100	€106,800	2,942
5	Medical doctors specialised in surgery**	100	€107,844	14,699
6	Managers in pharmacy	100	€111,600	2,182
7	Aircraft pilots	99	€103,728	12,031
8	Managers in advertising and marketing	99	€82,752	14,519
9	Medical doctors specialised in anaesthesiology**	99	€103,164	12,210
11	Managers in human resources management	99	€88,560	18,067
12	Medical doctors specialised in dermatology, gynaecology etc.**	99	€96,672	15,770
13	Managing directors and executive board members**	99	€90,000	229,118
15	Lawyers**	98	€88,860	38,393
16	Medical doctors specialised in internal medicine**	98	€96,732	18,387
17	Managers of IT-system, applications, consulting and sales	98	€96,000	570
19	Business consulting**	98	€74,892	107,311
21	Managers of IT-network engineering, administration (not elsewhere classified)	98	€82,800	24,833
22	Occupations in human medicine and dentistry	97	€91,668	307,704
23	Supervisors in environmental protection engineering	97	€85,788	1,308
24	Medical doctors specialising in neurology, psychiatry**	97	€92,412	10,939

Notes: Limited to occupations with at least 500 jobs. **Indicates that the job is considered highly complex by the German Federal Statistical Office. See Germany's methods sections for details. IT careers are highlighted in bold.



Best-Scoring Jobs for Which Most Workers Do Not Have a Higher Education Qualification

Two of the 25 top-rated occupations in Germany — aircraft pilots and environmental protection engineering managers — are mostly held by workers without a higher education credential. Other top-rated jobs that do not require higher education — and have CFI scores of at least 75 — include managerial positions in manufacturing, production, mining and hospitality.

Careers in nursing and emergency services are by far the most abundant jobs for those without a higher degree in Germany. Purchasing and sales occupations have the next largest number of positions.

Best Careers in Which Most Workers Do Not Have an Academic Credential

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Median Annual Pay (Euros)	Number of Jobs (2022)
7	Aircraft pilots	99	€103,728	12,031
23	Supervisors in environmental protection engineering	97	€85,788	1,308
31	Managers in transportation equipment manufacturing	96	€105,743	37,491
148	Managers in production planning and scheduling	81	€65,431	154,542
152	Managers in machine building and operating	80	€67,074	25,298
170	Managers in mining or blasting industry	78	€74,628	2,956
174	Managers in hotels	77	€51,528	24,592
188	Legislators or senior officials of international organisations	75	€64,980	19,591
210	Managers in nursing, emergency, obstetrics	72	€55,704	39,697
230	Supervisors in mechatronics, automotive or control technology	70	€63,000	793
232	Occupations in purchasing and sales	69	€57,984	812,466
257	Occupations in electrical engineering	66	€45,252	500,180
260	Occupations in nursing, emergency medical services or obstetrics	66	€45,636	1,176,472
267	Supervisors in energy technology	65	€60,384	8,279
272	Supervisors in papermaking, processing, packaging	64	€71,904	1,264
288	Supervisors in civil engineering	62	€60,108	10,082
289	Managers in retail trade	62	€49,776	100,547
291	Occupations in real estate and facility management	62	€45,000	94,073
292	Technical occupations in production planning and scheduling	62	€55,608	607,407
296	Occupations in event technology, cinematography, sound	61	€42,804	43,206

Note: Limited to occupations with at least 500 jobs.



IT Jobs

Thirty-seven percent of job vacancies in Germany request IT skills that range from engineering to programming. We estimate that there were 5.8 million job vacancies in Germany that advertised one or more IT skills over one year covering 2022 to 2023.

The CFI scores of the top 10 IT careers in Germany range from 100 for computer science managers to 88 for complex database development and administration and highly complex IT application consultants.

There are a total of 2.5 million IT jobs in Germany, with six careers totalling more than 100,000 jobs each.





IT Careers in Germany

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

CFI Rank	Title	CFI Score	Median Annual Pay (Euros)	Number of Jobs (2022)
4	Managers in computer science	100	€106,800	2,942
17	Managers of IT systems, applications and consulting	98	€96,000	570
21	Managers IT network engineering and administration	98	€82,800	24,833
27	Managers in software development and programming	97	€84,996	4,347
65	IT network engineering**	92	€65,004	1,922
68	Occupations in software development and programming	91	€63,168	298,849
75	IT coordination*	90	€63,996	22,596
83	Bio and medical informatics**	89	€68,556	1,621
88	IT organisation*	89	€63,804	24,788
91	IT application consulting**	88	€66,600	108,154
93	Database development and administration*	88	€60,000	8,869
103	Occupations in IT network engineering, coordination, administration	87	€61,440	195,478
110	Occupations in IT system analysis, app construction, sales	86	€65,640	213,742
115	IT system analysis**	85	€71,448	27,996
118	Business informatics*	85	€61,944	14,179
131	Occupations in computer science, information and communications	83	€62,796	1,000,349
137	Computer science (not otherwise classified)*	82	€73,260	70,730
143	IT system administration*	81	€55,752	92,042
158	Occupations in computer science	79	€60,456	292,280
163	IT sales*	79	€64,200	20,087
167	Software development†	78	€53,292	30,402
173	Information, telecommunications technology*	77	€62,508	40,624
191	Programming*	75	€56,796	34,702
209	Computer engineering†	73	€52,800	5,000
215	Web administration*	72	€54,996	852
238	Geoinformatics**	69	€49,104	1,620
269	Media informatics**	65	€50,004	911

**Indicates that the job is considered highly complex by the German Federal Statistical Office.

*Indicates complex. See Germany's methods sections for details.

†Indicates skilled jobs.



Gender Differences in Teens' Expected Careers

PISA exam data in Germany show that roughly 49% of both 15-year-old girls and boys are uncertain what career they expect to have at the age of 30.

German girls are most likely to name potential careers in the medical field, including doctors, psychologists and nursing professionals, along with teachers and childcare workers. Six of German girls' most preferred careers have CFI scores exceeding 75, including two above 90 (medical doctors and lawyers). Childcare workers and nursing professionals are popular careers, with average CFI scores around 50. None of the top 10 jobs named by girls are in IT or engineering fields.

Most Popular Expected Careers of German Girls and the CFI Scores of Those Careers

Top mentions of careers 15-year-old German girls expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not name career	48.6%	--
Medical doctors	4.4%	95
Psychologists	3.5%	89
Teaching professionals	3.4%	88
Childcare workers	3.2%	56
Nursing associate professionals	2.6%	50
Police officers	2.5%	63
Building architects	2.3%	82
Lawyers	2.0%	98
Primary school teachers	1.1%	84



Teen boys' expected careers include police officers, mechanics of motor vehicles and machinery, IT professionals, non-commissioned armed forces officers, athletes, teachers and medical doctors. German boys are less likely than German girls to choose higher-rated careers, with four of boys' top careers having CFI scores of 75 or higher. Two of boys' most preferred careers — motor vehicle mechanics and agricultural/ industrial machine mechanics — have CFI scores in the 20s.

Most Popular Expected Careers of German Boys and the CFI Scores of Those Careers

Top mentions of careers 15-year-old German boys expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not name career	49.2%	--
Police officers	2.5%	63
Motor vehicle mechanics and repairers	2.1%	20
Agricultural and industrial machinery mechanics and repairers	1.9%	27
Information and communications technology professionals	1.9%	85
Non-commissioned armed forces officers	1.5%	44
Athletes and sport players	1.4%	55
Information and communications technology operations and user support technicians	1.4%	77
Teaching professionals	1.3%	88
Medical doctors	1.3%	95



Differences in Teens' Expected Careers, Based on Language Spoken at Home

The top two expected careers of German teens, whether or not they speak German at home, are medical doctors and police officers. There are other overlapping careers among both groups, including teachers, childcare workers, psychologists, building architects and lawyers. Students who speak German at home also named nursing and IT professionals in their top expected careers, while those not speaking German at home named athletes and shop sales assistants.

Teens that speak German at home are more likely to name a career aspiration (59.1%) versus non-home German speakers (30.9%).





Most Popular Expected Careers of 15-Year-Olds Who Speak German at Home and the CFI Scores of Those Careers

Top mentions of careers 15-year-olds who speak German at home expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not mention career	40.9%	--
Medical doctors	3.0%	95
Police officers	2.8%	63
Teaching professionals	2.8%	88
Childcare workers	2.2%	56
Psychologists	2.2%	89
Building architects	1.9%	82
Lawyers	1.8%	98
Nursing associate professionals	1.7%	50
Information and communications technology professionals	1.4%	85

Most Popular Expected Careers of 15-Year-Olds Who Do Not Speak German at Home and the CFI Scores of Those Careers

Top mentions of careers 15-year-olds who do not speak German at home expect to have by the age of 30

Gallup-Amazon CFI Score ■ 1-19 ■ 20-39 ■ 40-59 ■ 60-79 ■ 80+

Career	% Mentions	Gallup-Amazon CFI Score
Did not mention career	69.1%	--
Medical doctors	2.4%	95
Police officers	1.5%	63
Building architects	1.3%	82
Lawyers	1.3%	98
Teaching professionals	1.3%	88
Psychologists	1.2%	89
Athletes and sport players	1.0%	55
Shop sales assistants	1.0%	54
Childcare workers	0.9%	56

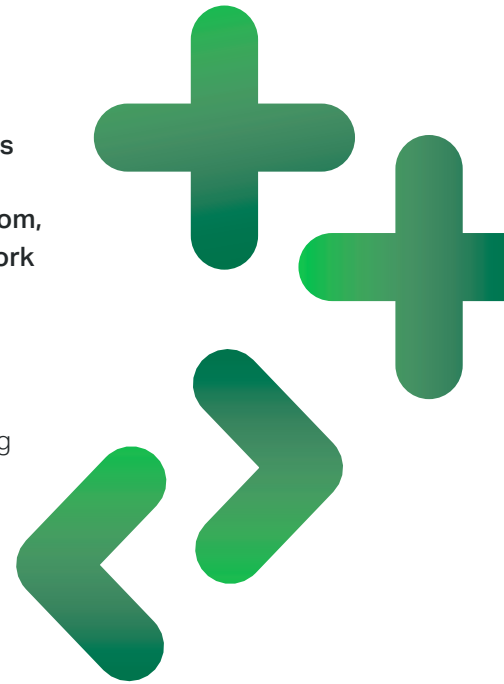
Conclusion

Some young people identify a preferred career early in life and take steps throughout their teens and adult years to set themselves up to acquire a job in that field. However, with nearly four in 10 teens in the United Kingdom, France and Germany without a particular career in mind, there is more work to do to get young people familiar with high-potential career options.

One key to helping young people find a rewarding career is to have them identify possible career options in their teen years, either through their studies, observing what people they know do for a living, or by their schools hosting information sessions with people in a variety of careers. Secondary information sources, like the Careers of the Future Index, can highlight overlooked areas of opportunity for teachers and students to explore the careers of the future. The CFI attempts to provide a user-friendly resource to compare a wide range of careers based on their economic viability and educational requirements.

The report also identifies a number of gender gaps. Specifically, girls generally favour professional careers requiring advanced education. However, there is a clear gender gap, as they do not generally identify jobs in technology fields as their preferred career path. Boys are more likely to aspire to technical professional jobs, and to a number of jobs (some with low CFI scores) that do not require extensive formal education.

While many existing career lists identify the best paying jobs or the best paying jobs with promising futures, none provide the same comprehensive coverage and depth of information, the same level of transparency about how jobs are scored, or the flexibility to analyse various jobs using different considerations, as the CFI does. Beyond the ranking of careers and the interactive tool to explore the CFI, this report provides useful insights about the many great jobs that exist and what career paths are most promising for those not interested in or able to pursue higher education. At the same time, the information ought to reinforce the broader message that higher education is an accelerator of success, thereby motivating students to act early on to set themselves up for academic and professional accomplishments.



Methodology

Occupation as the Unit of Analysis

A career refers to a job or series of jobs performed by an individual over time within a field of work. All jobs are classified by government statistical agencies into occupations based on the task requirements of that job. An occupation is therefore a group of closely related jobs and can be thought of as a career. For this reason, we report data for careers using occupations as the basic unit. For income and job growth, we used data from each country's national statistics office. For each country, there were changes in the occupational coding over the period of analysis. This required converting jobs in the old coding system to jobs in the latest coding system. This process relied on harmonisation matrices provided by the national statistical offices, so that career titles in the baseline year matched titles in the final years. This process inevitably introduces errors in estimated job growth for cases in which there were large changes to the job categorisations, but we have done our best to minimise these.





United Kingdom National Data

U.K. data on the number of workers, pay and educational requirements by occupation were obtained by the U.K. Office of National Statistics (ONS). The income and employment data were available for 2014 and 2022. We used median annual pay as our baseline measure. The underlying source for earning and jobs is the Annual Survey of Hours and Earnings. To get data on education by occupation, we used a 2019 summary table from ONS. The occupations are classified using the U.K.'s Standard Occupational Classification (SOC) system.

The employment and wage data are based on 1% samples of the workforce. ONS withholds disclosing the number of jobs at the four-digit level when the coefficient of variation reaches a certain threshold, as would be the case for careers with relatively small numbers of total workers in the U.K. For these cases, we do not report the number of jobs, but we calculate growth using three-digit employment levels, which are available.

ONS also publishes data on education by occupation, based on Census data. A career is considered professional — or requiring a college degree — if the percentage of workers with "level 4 qualifications or higher" is 50% or higher. This is similar to a U.S. bachelor's degree.



French National Data

French data on pay and the number of jobs were drawn from INSEE, the French statistical office. The original data were compiled from the Nominative Social Declaration (NSD) database, which requires all employers subject to social security taxation to report employment and compensation information to the French authorities. Data from workers in the public sector data are from the Information System on Public Services (Siasp), and data on self-employed workers come from other tax sources, compiled by INSEE. INSEE publishes microdata for one-twelfth of the French working population and includes detailed job categorisation using the nomenclature of occupations and socio-professional categories (PCS) system. These data are available for 2014 and 2021, but wages are reported only in categories, not precisely. To estimate precise measures of pay, we took the mean of the minimum and maximum pay for each category, multiplied by 12, and divided by the number of annual hours to estimate hourly compensation. This served as a preliminary estimate and was used to generate a more accurate estimate, as described below. We further eliminated employees who worked less than 1,000 hours in the previous year and less than 200 days to downward bias in compensation for occupations with many part-time or seasonal workers. The sum of workers fitting these criteria was calculated by occupation for 2014 and 2021, allowing us to calculate the rate of growth.

INSEE also publishes summary data on mean compensation data by PCS, adjusted for full-time equivalent employees. These data are more accurate measures of compensation than those available in the microdata, since they do not rely on categorical ranges. The published monthly compensation figures were adjusted to annual compensation by multiplying by 12. These data were available for 258 occupations. For 171 remaining occupations, annual pay was estimated by regressing mean annual pay — from the aggregated INSEE database — on estimated hourly pay at the 20th, 50th and 80th percentiles using the microdata. The adjusted R-squared in this model was 0.65, suggesting that the actual mean was well predicted by the estimated points on the distribution. For predicted values less than 10,000 Euros, the actual mean figure based on the categorical microdata was used (affecting only nine occupations). Finally, the reported 2021 Euros were converted into 2022 Euros by multiplying by 1.1, reflecting growth in the Eurozone consumer price index.

We could not identify any source of published data or microdata for the educational attainment of workers by occupation for France. As a result, we used the new PCS2020 structure to identify jobs as likely or unlikely to require a college degree. Using the first two digits of the PCS 2020, we identified jobs as likely to require a college degree if the first two digits were at or above 23 and at or below 46. Civil servants were also classified as professionals. This analysis was informed by class distinctions made by Amossé (2019).⁶

⁶ Amossé, Thomas, Olivier Chardon and Alexis Eidelman. La rénovation de la nomenclature socioprofessionnelle (2018-2019): rapport du groupe de travail du Cnis. Diss. Conseil national de l'information statistique (Cnis), 2019.



German National Data

Data on employment, skill requirements and compensation were obtained from Germany's Federal Employment Agency (Bundesagentur für Arbeit), and their quarterly data on Employees by Occupation, using the German KldB 2010 classification system. These data were available for 2014 and 2022 and included educational attainment information for each occupation. The salary data were reported monthly and converted to annual pay by multiplying by 12. This reports uses the median level of compensation.

A career is considered professional — or requiring a college degree — if the percentage of workers with an "academic professional qualification" is 30% or higher. We apply this low threshold because many professional careers in Germany (e.g., pharmacist, computer scientist) can be entered with a non-academic "recognised professional qualification", which may involve post-secondary training and education. In this way, the German data do not clearly distinguish between tertiary education statuses. A threshold of 50% would overstate the ease of entering many careers that require advanced education.

The German Federal Employment Agency classifies many jobs by the level of expertise required to perform the job, in addition to the types of activities and tasks performed.⁷ The levels of expertise include 1) unskilled or semi-skilled, which are activities that do not require specialised knowledge beyond general schooling 2) specialist jobs, which require on-the-job-training or vocational training 3) complex specialist activities, which require expertise that goes beyond short-term training or vocational schooling and may include master craftworkers or managers 4) highly complex, which require a very high level of knowledge that often requires a graduate degree. Several of the top-scoring jobs are deemed highly complex.

⁷ Wiebke, Paulus and Britta Matthes 2013. "The German Classification of Occupations 2010 – Structure, Coding and Conversion Table" Research Data Centre of the German Federal Employment Agency, FDZ-Methodenreport 08/2013.

Job Vacancies for Each Country

Some high-paying jobs may, nonetheless, have few vacancies, and some fast-growing fields may have even faster growth in labour supply, through immigration or new entry from training programmes, leading to difficulty for new entrants. To estimate the ratio of demand to supply, we purchased data from Lightcast, which aim to scrape the universe of online job postings for each country and classify them by occupation (see below). The data are classified to occupations using the international ISCO system. To convert ISCO job vacancies to the national systems, Gallup downloaded correspondence tables created by ONS and INSEE for the U.K. and France. For Germany, Gallup created its own correspondence table to convert vacancies from ISCO to KldB 2010. Vacancies per occupation were divided by the number of workers to calculate vacancies per worker, which was used to estimate demand relative to supply. A limitation of these data is that Lightcast only collects and analyses English-language posts. This is not a problem for the U.K. data, but in Germany and France, this understates job postings. As described below, we estimate total job postings for Germany and France — including native-language postings — based on the number of English-language posts.

The CFI is not itself a forecast itself, but relies on trends in current and past data to measure future job potential. Past job growth and job vacancy rates predict current growth and vacancy rates, so current growth and vacancy rates will likely be predictive of future demand. However, there are some job roles, such as those in disruptive technologies like artificial intelligence, that are so new they are not reflected in the data.

Our method for calculating a career's capacity to withstand automation gives higher values to jobs that require complex, creative tasks and less value to jobs that require routine or repetitive tasks. This will be positively correlated with future job growth based on current economic theory and studies of automation.

Calculating the CFI score

The CFI is calculated using the following formula:

CFI = (0.502 x income) + (0.166 x vacancies/worker) + (0.166 x growth) + (0.166 x automation resistance index)

Since each measure uses a different scale, the underlying concept is first standardised to have a mean of zero and a standard deviation of one within each country. This is called a z-score and is a continuous variable with no upper or lower bound. It was clear that this process, however, resulted in a few outliers (extreme growth, for example) that would give too much weight to one of the concepts. To limit the influence of outliers and preserve something closer to the intended weighting, we replaced the z-score described above with one based on the centile rank of the underlying concept if the maximum z-score exceeded 6 standard deviations. For example, one career might have extreme job growth, giving it a z-score of 10. Even if the career were otherwise at the mean on the other three indicators, its CFI score would be 1.7 standard deviations above the mean, using the formula above. Ranking job growth on a centile scale before taking the z-score limits the maximum value to approximately 1.7 (and the minimum to -1.7). In this example, the final CFI score would fall from 1.7 to 0.29, which is much closer to the mean of zero and better reflective of the four components.

In practice, we used this centile-based z-score for the following concepts:

- U.K. — vacancies per worker
- France — job growth, income and vacancies per worker
- Germany — job growth and vacancies per worker

Otherwise, we used the z-score of the underlying value.

Identifying IT Skills Listed in Vacancies

Lightcast data are limited to English-language job postings that were advertised between 1 October 2022 and 10 October 2023. The database includes a list of the skills referenced in each job vacancy. To identify vacancies that require an IT skill, we tagged any job that mentioned one of these words as IT: machine, artificial, intelligence, software, data, information, technology, engineering, programming, code, coding, computer, hardware, graphic, design, interface, web, internet. For France and Germany, we estimate that approximately 10% of job vacancies are listed in English. This is calculated by comparing the number of vacancies per worker in the U.K. data to vacancies per worker in France and Germany. The ratio in the U.K. is roughly 10 times larger, which we interpret as evidence that Lightcast data include only a subset of total vacancies in Germany and France, since most jobs would be advertised in the native languages of each country.

Our focus in the analysis is on the share of total jobs that require IT skills, so the language limitation is unlikely to be a problem for our analysis, unless English-language jobs tend to be biased in their skill requirements toward or away from IT skills. We cannot know for sure, but in so far as the percentage of vacancies that mentioned IT skills in the U.K. (where English is the language for all vacancies) is similar to the percentage of vacancies in Germany and France, this bias is unlikely. The data indicate a small bias in favour of IT skills, since 25% of English-language jobs in the U.K. advertise IT skills, compared to 30% of jobs in France and 37% of jobs in Germany. Thus, English-language jobs in France and Germany may over-represent IT skills relative to native-language job vacancies, but it may also be the case that there is truly a higher share of job vacancies in Germany and France that require IT skills.

Capacity to Withstand Automation

We measure capacity to withstand automation as an index that summarises the level and importance of non-automatable tasks required for each career. The details are available in a previous Gallup report for Amazon, which uses the same method.⁸ Economists have long been concerned about the potential for machines to displace humans and lower the demand for labour for specific tasks and careers. The automation of manufacturing plants is well known, but the effects extend much wider. To list some examples, bank ATMs, self-checkout kiosks at grocery stores, vending machines and automated customer service chatbots are among the tools that have specifically replaced tasks that were previously only performed by humans. With the recent release of open-source artificial intelligence tools like ChatGPT and DALL-E, the domain of jobs subject to competition from automation has been expanded still further. At the same time, economic theory holds that automation technologies expand demand for labour by enhancing the productivity of workers and production processes, thereby creating value that increases demand for complementary tasks, novel tasks or additional work. For example, if a law firm uses AI to streamline tedious research, law clerks and lawyers could become more productive, take on more cases and expand revenue, leading to higher salaries for and/or additional demand for work. Much of the extra value would go back to the economy in the form of increased consumption.

⁸ Gallup, "Data-Driven Career Advice: The Gallup-Amazon Careers of the Future Index" (2023), <https://www.gallup.com/analytics/506930/amazon-future-engineer-interactive-careers.aspx>

A career of the future should be able to withstand this trend and either perform tasks that cannot be automated or use these new technologies to make themselves more productive, as many workers did through the introduction of computers.

The approach to measuring the capacity to withstand automation is summarised here, but readers interested in details can see the appendix of the referenced report.⁹ The first step was to identify a set of 24 constructs related to the tasks, skills, abilities and work context of occupations. These constructs are associated with capacity to withstand automation in the economics literature, and the United States Department of Labor's O*NET database collects and reports these data for every occupation in the U.S. economy. These constructs were weighted based on how well they predict worker agreement or disagreement with the statement: "A machine, robot, computer, could do my job", using data from a 2019 Gallup survey. The tasks performed by workers were highly predictive of their response to this statement. Using these data, we calculated a mean-weighted score of capacity to withstand automation per occupation, using the U.S. Standard Occupational Classification system. We then used a SOC-ISCO crosswalk to estimate automation risk using the ISCO system and applied this to each country using the ISCO-national occupational coding described above.

While the task data are based on U.S. research, the set of tasks performed in these occupations are broadly similar across countries. A doctor, for example, performs similar tasks whether in the U.K., France, Germany or the United States, and so does a software developer. Indeed, multinational corporations employ workers around the world, and while pay scales vary between country, the occupation-specific tasks are similar across locations.

PISA Data

The career interests of 15-year-old students are calculated using data from the Programme for International Student Assessment (PISA), part of the Organisation for Economic Co-operation and Development (OECD). As part of its background data collection for the PISA exam, the OECD asks, "What kind of job do you expect to have when you are about 30 years old?" Data on career preferences are analysed separately by boys and girls in each country. We also analysed data by whether the student spoke the native language of the country or a different language at home. We limited the analysis to groups with at least 100 responses to avoid large margins of error in the estimates. The sample size is 6,116 for Germany, 6,770 for France and 12,972 for the United Kingdom.

Additionally, we classified careers references in PISA into several aggregate classes using the ISCO-08 code that is provided by PISA: Information technology careers were identified as careers 25, management as careers 11, 12, 13 and 14. STEM careers are codes 25 and 21. The following titles were classified as engineering: 2141-2161 and 3111-3115, 3119. A similar method of coding ISCO-88 was used by Caprile et al (2015) in a study for the European Parliament.¹⁰ Furthermore, jobs in healthcare were based on the two-digit code 22, which refers to "health professionals" and includes doctors, nurses, midwives, veterinarians, dentists, pharmacists and other specialists that diagnose and treat patients. Teaching professionals were identified with the two-digit code 23. Legal professionals, which includes judges and lawyers, were identified with the three-digit code 261. Sport occupations were identified using the three-digit code 342, which refers to sport and fitness workers, and includes athletes, coaches and fitness trainers.

9 Data-Driven Career Advice The Gallup-Amazon Careers of the Future Index, <https://www.gallup.com/analytics/506930/amazon-future-engineer-interactive-careers.aspx>

10 Maria Caprile, Rachel Palmén, Pablo Sanz, Giancarlo Dente. 2015. "Encouraging STEM studies: Labour Market Situation and Comparison of Practices Targeted at Young People in Different Member States" (European Parliament's Committee on Employment and Social Affairs).

Classifying aggregated job families using national data

To summarise the CFI score by larger career families (engineering, healthcare, IT, legal, management, sport and teaching) and compare the results of these careers to interest levels among youth (using PISA), we created aggregations of the national occupational coding systems for each country using the methods described below.



United Kingdom: The U.K. uses the Standard Occupational Classification (SOC 2020) system, which builds in hierarchical classifications with each additional digit. STEM jobs are defined as those in the major category "science, research and engineering professionals" (21) and associate professionals (31), plus additional IT and engineering roles outside of those categories. Management jobs are defined as corporate managers and directors (11) and other managers and proprietors (12). IT and engineering jobs are a subset of the STEM jobs. Engineering jobs are defined as the broad category 212. Information technology jobs are category 213 (IT professionals and IT managers), plus IT directors (1137), IT associate professionals/technicians (3120, 3131, 3132, 3133), data analysts (3544) and IT trainers (3573). Health professionals are grouped under the two-digit SOC code 22; teaching professionals fall under code 23; legal professionals are found within the three-digit group 241 and sport and fitness occupations fall under 343.



France: Management jobs are defined as two broad occupational categories "business leaders of 10 employees or more" (PCS 23) and "administrative and commercial executives of company" (PCS 37). IT jobs are listed above and classified as such if the job title mentioned "information technology", "computer(s)" or "telecommunications". Jobs were classified as engineering careers if the job listed "engineer" in the title. STEM jobs include engineering and IT jobs as well as the detailed titles, "directors and research managers in public research" (342F) and "public research fellows" (342H). Lawyers are classified as PCS 312A. Healthcare professional jobs include the following titles: hospital doctors without private practice (344A), non-hospital salaried doctors (344B), interns in medicine, dentistry and pharmacy (344C), salaried pharmacists (344D), dental surgeons (311C), psychologists, psychoanalysts, psychotherapists (non-doctors) (311D), veterinarians (311E) and all nursing occupations with code 431 in the first three digits. Careers in sport come from the title "sport instructors and educators, professional athletes" (424A). Teaching jobs are spread across school teachers (421A), school teachers (421B), general education teachers in colleges (422A), professional high school teachers (422B), auxiliary masters and contract teachers in secondary education (422C) and professors and lecturers (342B).



Germany: STEM jobs are defined at the two-digit KldB 2010 level, as 41, 42 and 43, which together are called "IT and scientific service professions". Management jobs are defined using two methods. One is to include all jobs that fall under "jobs in corporate management and organisation", which fall under the broad KldB code of 71, with the exception of clerical and secretarial jobs that fall under 714. The second method counted all jobs as managerial if the title included any of the words (in the English translation provided by the German statistical office): "manager", "director" or "managing". This took advantage of the fact that many industry-specific managerial jobs are classified outside of the 71 family. Jobs were classified as IT based on the broad IT family captured by KldB code 43. Additionally, one job in electronics was also classified as IT: "information, telecomm. Technology — complex" (KldB code 2631). Careers were classified as engineering if they used engineer in the title or "mechatronics", if also complex in skill level. "Medical health professions" is identified as KldB 81. Teaching careers were based on "teaching and training professions (Kldb 84). Legal careers are identified as "occupations in legal services" (KldB 731) and sport-related careers are identified as "actors, dancers, athletes and related occupations (KldB 942).

A Note About Novel Skills in Information Technology

The existing data sources used in this report, which cover the years 2014-2022, do not identify specific jobs in the fields of artificial intelligence (AI) or machine learning (ML). Jobs in those fields that do exist currently would largely fall under computer science or software engineering careers and related occupations. Statistical agencies have not developed specific classifications for occupations that rely on these skills/technologies, so the number of jobs requiring these specific skills cannot be estimated from national data sources. The report does break out the highest scoring current job titles in the field of information technology.

Further, we provide information on the share of job vacancies that mention IT skills, including those advertising the words "machine" and "artificial intelligence". Across the three countries, we find that 5% of jobs listing IT skills (defined above) mention the word "machine" and 2% mention the phrase "artificial intelligence". These skills are not yet nearly as common as skills involving data, software and programming.

About AFE, Amazon and Gallup

About Amazon Future Engineer

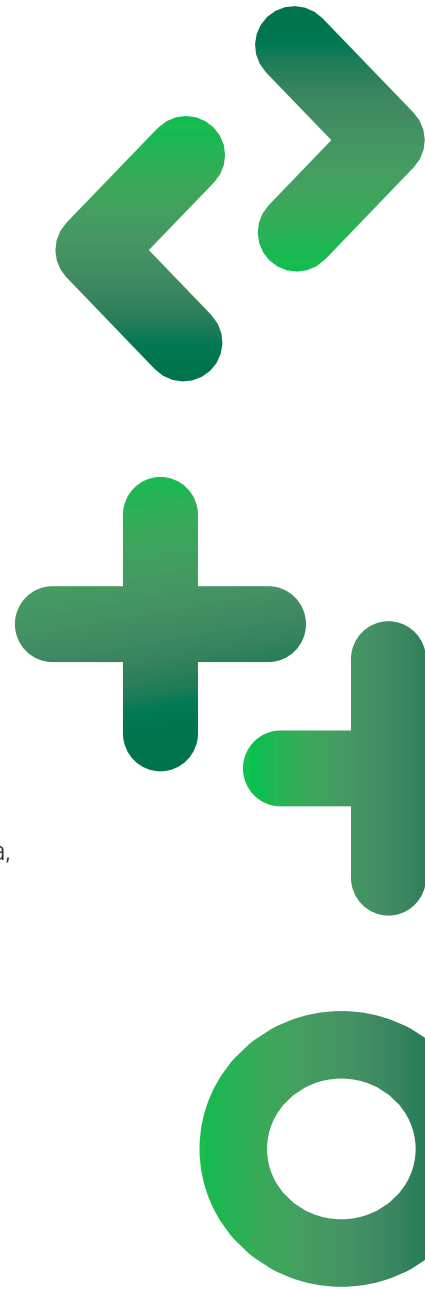
Amazon Future Engineer is a childhood-to-career programme to bring Careers of the Future and computer science literacy to young people, with a focus on students historically underrepresented in technology. Amazon Future Engineer operates in the United Kingdom, France, Germany, India, the United States and has a limited presence in several other countries. The programme, collaborating with local charities, provides resources for career exploration, classroom resources for teaching computer science, teacher training, live workshops and more. For more information, see the Amazon Future Engineer [website](#) in your country.

About Amazon

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