What's Trending in Jobs and Skills

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**What we learned from analyzing
95 million online job postings
over the past three years**

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Introduction

Understanding economic trends in the broadest terms—which industries are expanding, which are on the downswing—can be as straightforward as keeping up with the business headlines. But it's not quite as easy to get a similar grasp of the job market: not merely which jobs are growing and which are disappearing, but which skills are increasingly in demand—and which are becoming obsolete.

The ability to answer these questions and discern supply and demand trends has major implications. For companies, such insights can improve accuracy in strategic workforce planning by identifying future workforce needs sooner. Companies can adapt their recruitment practices and target their talent development investments more appropriately, even proactively. For governments, insights about the supply of and demand for jobs and skills can inform public policy. These insights are crucial, for example, in reforming education and training programs to better serve the public, businesses, and economies. For individuals, they can guide pivotal decisions about education and careers.

As the pace of technological change accelerates, so does the technology-driven evolution of jobs and skills. Fortunately, technology also offers ways to enhance our understanding of that evolution. With online postings now the primary means for advertising jobs, we have a rich trove of digital data that provides an unprecedented opportunity to understand how the world of work is changing.
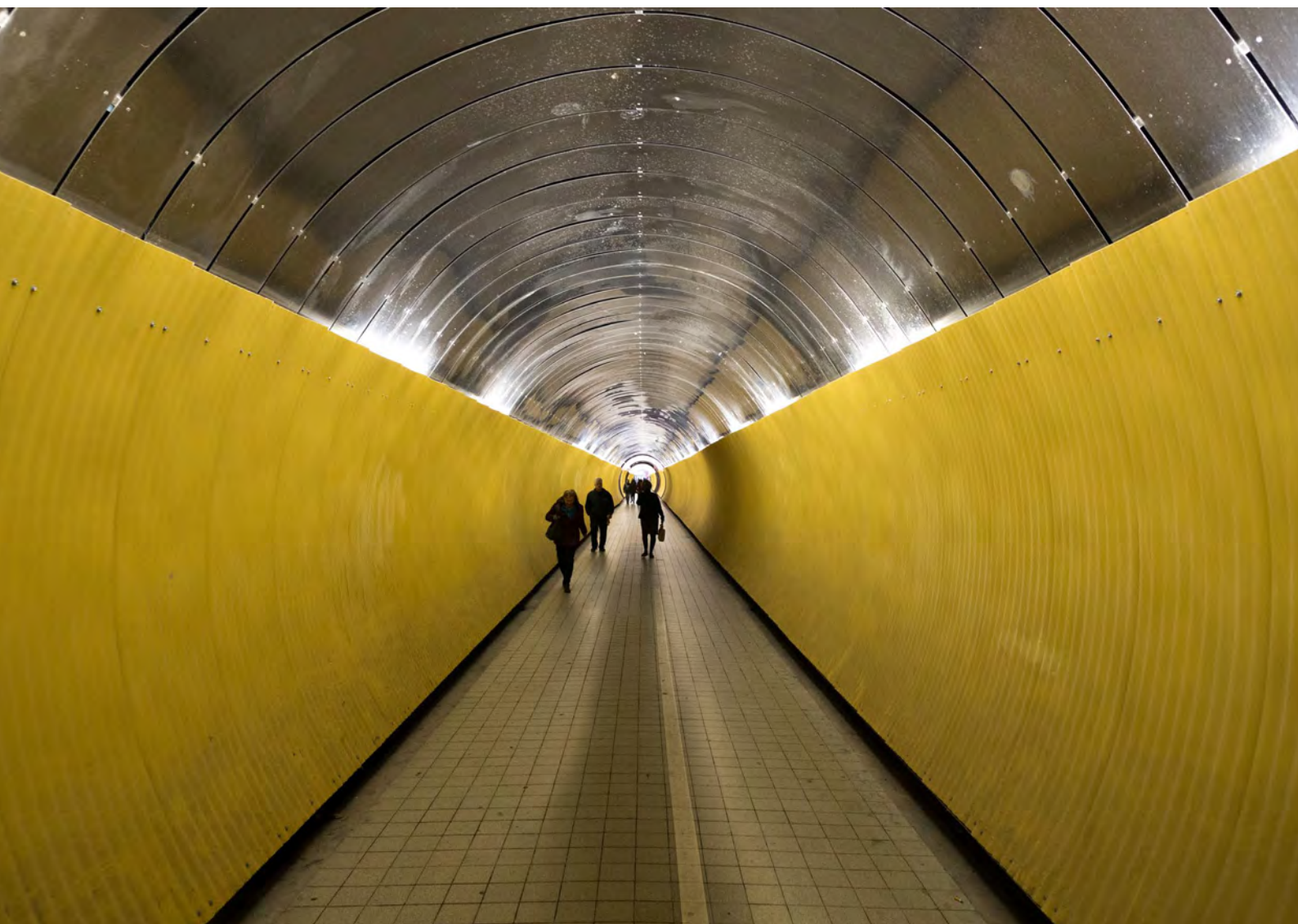
In this report, we examine job market trends as reflected in millions of online job postings in the US—collected by Burning Glass Technologies, a leading provider of real-time labor market information—over the three-year period from 2015 through 2018. Although the data covers the US market only, the size and diversity of the US population and economy are a reasonable proxy for global trends. By analyzing the number and growth rate of these listings year over year, we were able to get a picture of the trends in job postings across broad sectors and within specific job areas.

A look at the skills that these jobs require provides a more detailed view of changes in the nature of work. We therefore looked at the skills listed in job postings, classifying them in the same way that we classified jobs.

A vibrant economy and, by extension, a healthy society depend on having an adequate supply of qualified workers to meet current and future demand. Both the economy and society depend on ensuring that individuals are prepared for the future and remain employable. But people change more slowly than technology. As technology affects jobs and the skills required to perform those jobs, we must all adapt.

Many skills can be learned relatively quickly, so companies and individuals who are aware of the latest trends will be at an advantage. In the longer term, the insights now available through big data and analytics tools can help employers and governments more effectively preempt or mitigate demand and supply gaps—and help employees prepare for the future. In a fast-changing world, the sooner we can identify change, the more we can adapt successfully.

Jobs in Demand and Growth in That Demand

ifferences in the demand for and supply of particular jobs give us a window into workplace trends and, more broadly, the changing nature of work. To understand how these differences have evolved in recent years, we analyzed more than 95 million online job postings from January 2015 through December 2018 based on data from Burning Glass Technologies. (See the sidebar "Our Methodology.") Although the data we studied covers the US job market only, our analysis has global relevance, given the size of the US economy and the similarity of key trends affecting employers worldwide. While online job ads do not represent the totality of job openings, they capture a sizable enough percentage—85%—that the sheer number, breadth, and timeframe of our data set provide a reliable mirror of national job market trends.[1]

The Five Job Categories

We grouped the jobs in our study into five categories along two dimensions: the number of job postings in 2018 and the growth in the number of postings, as reflected in the average annual change over the period January 2015 through December 2018. (See Exhibit 1 and Exhibit 2.)

- **Flagship jobs** are those in high demand (10,000 to 1 million postings) and still growing (up to a 20% increase in postings yearly).

- **Fast-growing jobs** also experience high demand but are growing even faster (more than 20% yearly).

- **High-growth jobs** are those that have fewer than 10,000 annual postings but are growing at an extremely high rate (more than 40%).

- **Modest-growth jobs** show the lowest demand. Because their impact is limited, we do not analyze them in detail in this report.

- **Declining jobs** are those for which demand is shrinking.

These jobs span a wide range of sectors and functions, which we organized within seven broad groups based on the US Department of Labor's O*NET families:

- Business

- Construction and transportation

- Digital

- Health care

- Science, engineering, and manufacturing

- Social services, personal services, and education

- Other

Exhibit 1 - Five Job Categories According to Number and Growth of Postings
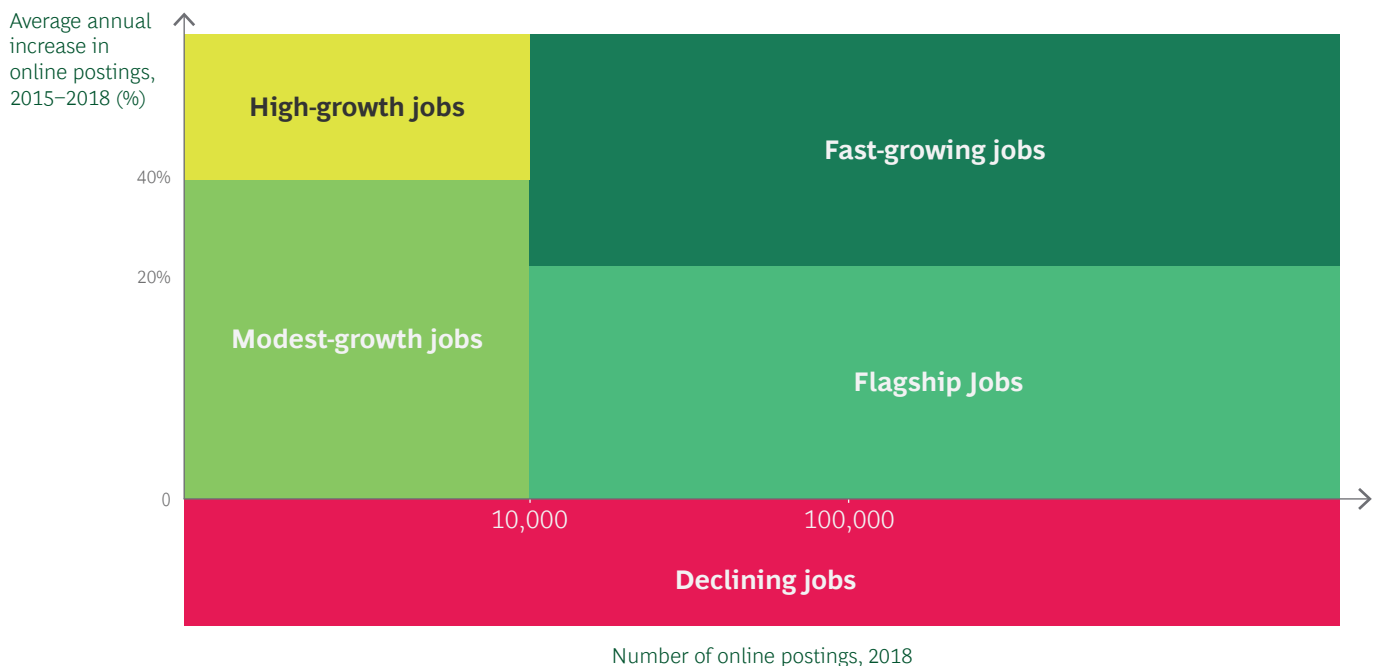
Sources: Burning Glass Technologies; BCG analysis.

1. Burning Glass Technologies, Frequently Asked Questions, https://www.burning-glass.com/about/faq/.

Business jobs, for example, include such traditional functions as general management, sales, customer service, human resources, and administration. Digital jobs include software application development, user support, systems analysis, and IT security.

In four out of our five job categories, growth in the number of postings is increasing. But the fifth category, in which the number of postings is shrinking, is also important to follow. On a macro level, the dwindling number of these jobs provides yet another indicator of an evolving economy; on a micro level, it serves as a warning signal for the businesses in which such jobs dominate and for the individuals who hold them.

Flagship Jobs: Moderate Growth in the Largest Jobs Category

Flagship jobs are those with postings from 10,000 to 1 million per year. Collectively, they represented the bulk of the US economy in 2018. Flagship jobs all experienced moderate growth of less than 20% yearly from 2015 to 2018. (See Exhibit 3 and Exhibit 4 on pages 8 and 9.)

In the business job grouping, listings for managers (general and operations), secretaries and administrative assistants, customer service reps, human resources specialists, and sales reps all experienced double-digit growth during this period. In the digital group, jobs in high demand encompassed such areas as computer user support, application software development, IT security, systems analysis, and database administration. Growth in the number of post-

ings in both of these broad categories—business and digital—correspond to the overall growth trend in the recovering economy.

In the science, engineering, and manufacturing group, the top five job areas all experienced posting growth of more than 10% in white-collar occupations (such as civil engineers) as well as in blue-collar jobs (such as technicians and production workers). Both reflect the boom in manufacturing. In construction and transportation, growth in the number of postings for building inspectors and electricians reflected heightened demand fueled by the growth in real estate development. And health care is among the fastest-growing sectors in the US economy thanks to an aging population, as reflected in the growing number of postings for medical assistants, pharmacy technicians, occupational therapists, and nurses.

Not all low-tech jobs are fated to fade away. Consider the social and personal services grouping, in which the dominant growth jobs are teachers, human services assistants, and hairdressers. By definition, such jobs are performed in person and are thus largely unaffected by digitalization. The same goes for the miscellaneous "other" grouping, which includes cooks and other jobs related to food preparation.

Exhibit 4 shows the top five fastest-growing flagship jobs across all of our broad industry groupings. Collectively, the trends within this category indicate the areas of demand growth that are outpacing supply.

Exhibit 2 - Five Job Categories According to Share of Online Postings

Share of online postings, 2018

- 70%
- 23%
- 3%
- 3%
- 1%

- ■ Flagship
- ■ Fast-growing
- ■ Modest-growth
- ■ Declining
- ■ High-growth
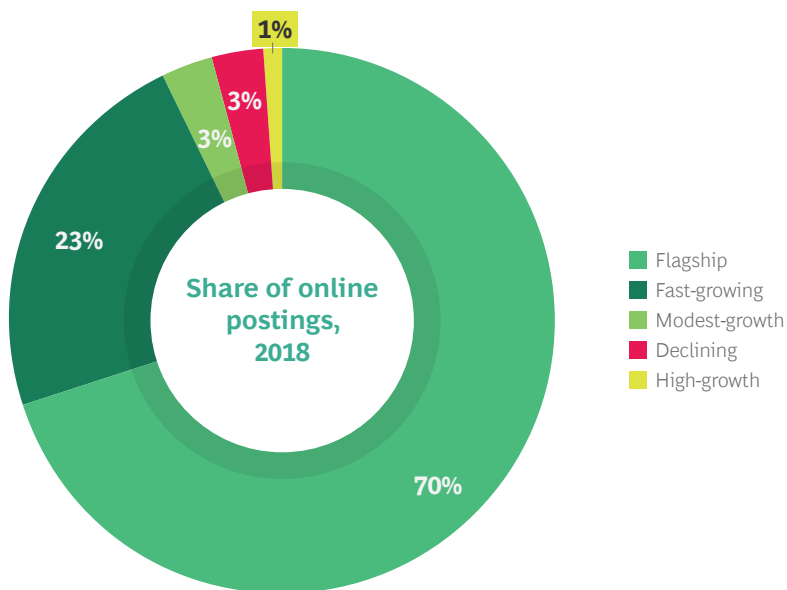
Sources: Burning Glass Technologies; BCG analysis.
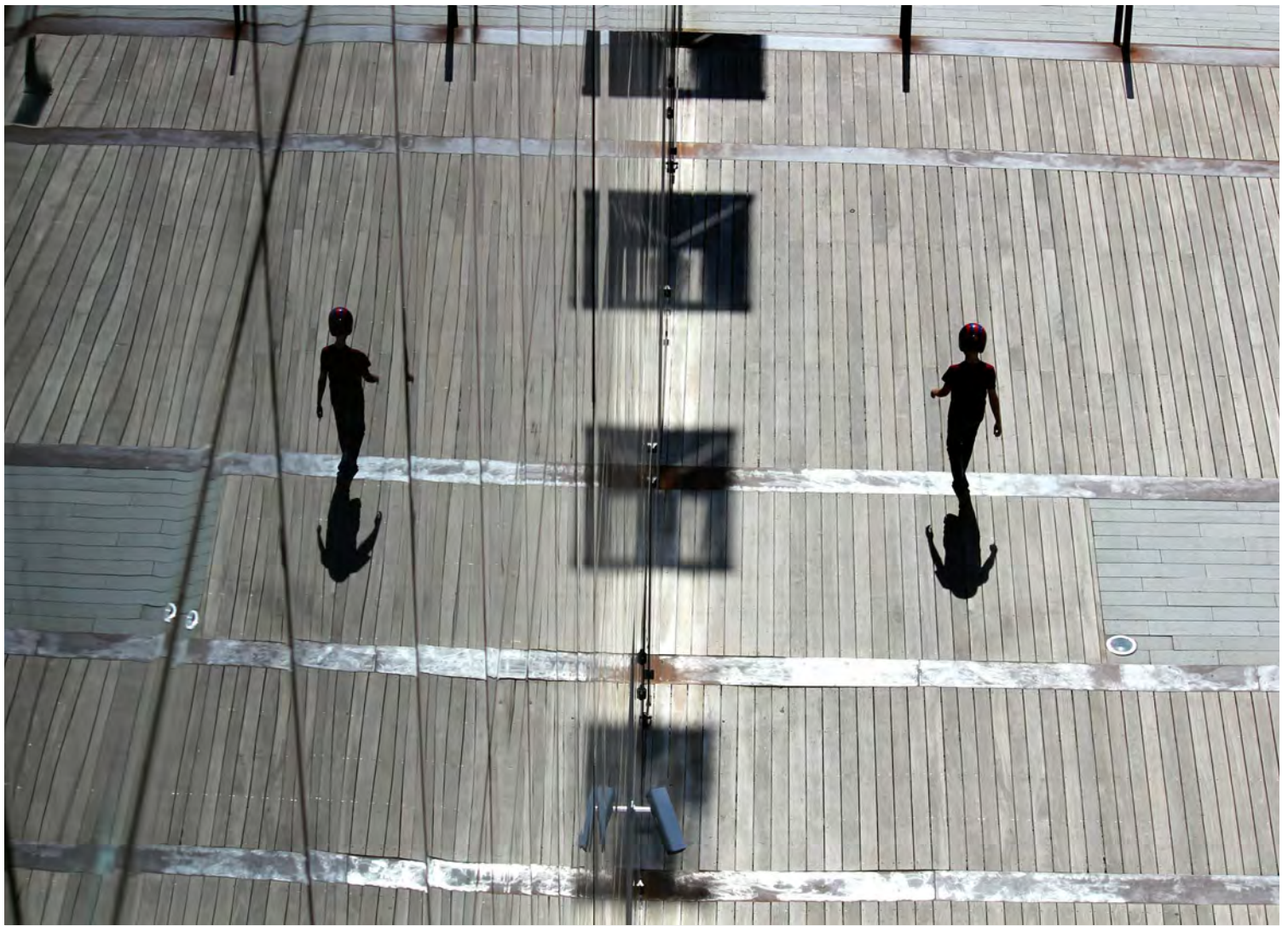
Our Methodology

Each year, Burning Glass Technologies scans millions of job postings in the US and analyzes them using artificial intelligence technologies. Drawing on data sourced from more than 95 million online job postings between 2015 and 2018, we examined current job demand (as represented by the number of online job postings in 2018) as well as the evolution of that demand (as represented by the average of annual percentage changes in the number of postings over the three-year period).

The number of postings for a job can increase because demand is growing or because the supply of qualified workers is shrinking (for example, because baby boomers are retiring). Moreover, want ads for certain traditional jobs, such as barbers, have only started to appear online in recent years. To be clear—and in order to avoid suggesting a one-to-one relationship—we refer to our trend data simply by the numbers: the number of job postings (as a proxy for current demand) and the growth in the number of postings (as a proxy for the evolution of demand). Altogether, we cover 750 occupations derived from the Occupa-

tional Information Network (O*NET) taxonomy. (O*NET, a database produced under the auspices of the US Department of Labor/Employment and Training Administration, contains hundreds of standardized and occupation-specific descriptions of some 1,000 occupations.)

The 15% of publicly listed job postings in the US that are not listed online are typically for jobs at local businesses that generally require a relatively low skill level, such as pipefitters and steamfitters or automotive specialty technicians. Nevertheless, we took precautions to ensure that our data reflected the true change in market demand and supply, without distortion from job ads that might have migrated from offline to online sources during the period. For each job, we calculated the ratio of online postings to overall employment (using data from the US Bureau of Labor Statistics) over the three-year period. Any ratios that showed very high growth (and thus a possible jump in the share of online postings) were flagged as potential false signals for real growth. We analyzed every such ratio on a case-by-case basis to exclude any suspicious data points.

Exhibit 3 – Top Flagship Jobs Ranked by Online Postings

Number of postings, 2018 (thousands)

Job	Postings
Registered nurses	1,219
Application software developers	897
Sales representatives, wholesale and manufacturing	882
Customer service representatives	623
Secretaries and administrative assistants	372
Human resource specialists	304
Combined food preparation and serving workers	281
General and operations managers	263
Computer user-support specialists	261
Computer systems analysts	197
Nursing assistants	195
Restaurant cooks	191
Information security analysts	139
Database administrators	124
Medical assistants	119
Occupational therapists	94
Pharmacy technicians	90
First-line supervisors of mechanics, installers, and repairers	89
Civil engineers	75
Industrial-engineering technicians	73
First-line supervisors of production and operating workers	72
Educational, guidance, school, and vocational counselors	58
Bus and truck mechanics and diesel engine specialists	55
Chefs and head cooks	48
Hairdressers, hair stylists, and cosmetologists	48
Electricians	47
Food preparation workers	40
Secondary-school teachers	39
Social and human service assistants	30
First-line supervisors of housekeeping and janitorial workers	30
Vocational-education teachers	30
Construction and building inspectors	14

Legend:
- ■ Business
- ■ Digital
- ■ Science, engineering, and manufacturing
- ■ Other
- ■ Construction and transportation
- ■ Health care
- ■ Social services, personal services, and education

Sources: Burning Glass Technologies; BCG analysis.

Note: Job titles follow O*NET taxonomy.

Exhibit 4 – Top Flagship Jobs Ranked by Growth in Online Postings

Average growth in number of postings, 2015–2018 (%)[1]

Job	Growth
Food preparation workers	20
Combined food preparation and serving workers	19
Vocational-education teachers	19
Construction and building inspectors	18
Restaurant cooks	18
General and operations managers	17
First-line supervisors of housekeeping and janitorial workers	16
Secondary-school teachers	16
Bus and truck mechanics and diesel engine specialists	14
Computer user-support specialists	14
First-line supervisors of mechanics, installers, and repairers	14
Industrial-engineering technicians	14
Pharmacy technicians	14
Secretaries and administrative assistants	14
Customer service representatives	13
Electricians	13
Medical assistants	13
Social and human services assistants	13
Civil engineers	12
Human resource specialists	12
Application software developers	11
Chefs and head cooks	11
First-line supervisors of production and operating workers	11
Registered nurses	11
Sales representatives, wholesale and manufacturing	11
Computer systems analysts	10
Information security analysts	10
Educational, guidance, school, and vocational counselors	9
Occupational therapists	9
Hairdressers, hair stylists, and cosmetologists	7
Nursing assistants	7
Database administrators	5

Legend:
- Business
- Digital
- Science, engineering, and manufacturing
- Other
- Construction and transportation
- Health care
- Social services, personal services, and education
- Flagship jobs that experienced the greatest acceleration in growth

Sources: Burning Glass Technologies; BCG analysis.

Note: Job titles follow O*NET taxonomy.

[1] Average growth is the average year-over-year percentage change in the number of online postings between 2015 and 2018.

Fast-Growing Jobs: Large in Number and Growing Fast

If flagship job patterns reflect current areas of economic growth, fast-growing jobs offer a window into the future economy. Like their flagship counterparts, these jobs are in high demand, but they are growing at an even faster pace: on average, the growth in postings exceeded 20% in each year of the period studied. (See Exhibit 5 and Exhibit 6.)

Among the business jobs in this category are real estate agents, hotel clerks, and interviewers—evidence that new technologies don't necessarily replace jobs but instead often spur industry growth and job creation. The fields within this grouping all show a strong trend toward automation and disintermediation: consider the use of online videos and websites such as Zillow in real estate, the lodging sites Airbnb and vrbo.com in travel and hospitality, and the use of robo-interviews and the digitalization of many processes in human resources. The aforementioned jobs are in demand despite these technological advances.

In the digital grouping, the only positions showing growth of 20% or more are computer and information research scientists. But this is almost certainly owing to a shortcoming of existing classification systems. Digital jobs have become much more specialized in recent years. Companies no longer seek generalized software developers but rather specify the desired application or language, such as Java/Python developer. O*NET (and other official databases) have not always kept up with such changes.

> **Concerns about data and IT systems security are mounting. Job postings for cybersecurity engineers grew on average more than 50% from 2015 through 2018.**

In the science, engineering, and manufacturing group, growth in such positions as computer-controlled machine tool operators reflects the impact of newer technologies. But there are many traditional manufacturing jobs whose growth is accelerating rapidly. For example, in aircraft manufacturing we are seeing growth of 20% or more in such jobs as structure, surface, rigging, and system assemblers as well as cutting, punching, and press machine operators.

In the construction and transportation group, painters and packagers, industrial truck and tractor operators, light-truck and delivery drivers, and taxi drivers and chauffeurs account for the leading jobs. Growth in the job of truck driver is interesting given predictions that truck driving could become extinct as autonomous vehicles go mainstream. (See the sidebar "Fast Lane or Off-Ramp? The Paradox of Truck Driver Jobs.")

In health care, fast-growing jobs span virtually every major area, from professional specialists (such as anesthesiologists) to caretakers (such as nurses and massage therapists) and from medical equipment preparers to dental hygienists. Similarly, in social services, personal services, and education, among the hottest jobs are child care workers, personal-care aides, and animal caretakers. Overall economic growth, an aging population, and longer workdays are contributing to the accelerating growth of these occupations. Finally, in the umbrella category labeled "other," service jobs such as waiters, janitors and cleaners, and dishwashers predominate.

Exhibit 6 shows fast-growing jobs ranked by growth and highlights those whose growth we see accelerating.

High-Growth Jobs: High-Tech and High-Touch

High-growth jobs are a beacon of longer-term economic trends, driven primarily (although not exclusively) by the impact of new technologies. They also reflect such developments as the significant increase in air travel and the rising demand for personal services. In 2018, there were typically a relatively small number of online postings (fewer than 10,000) for high-growth jobs, but the average annual growth in such postings from 2015 through 2018 was more than 40%.
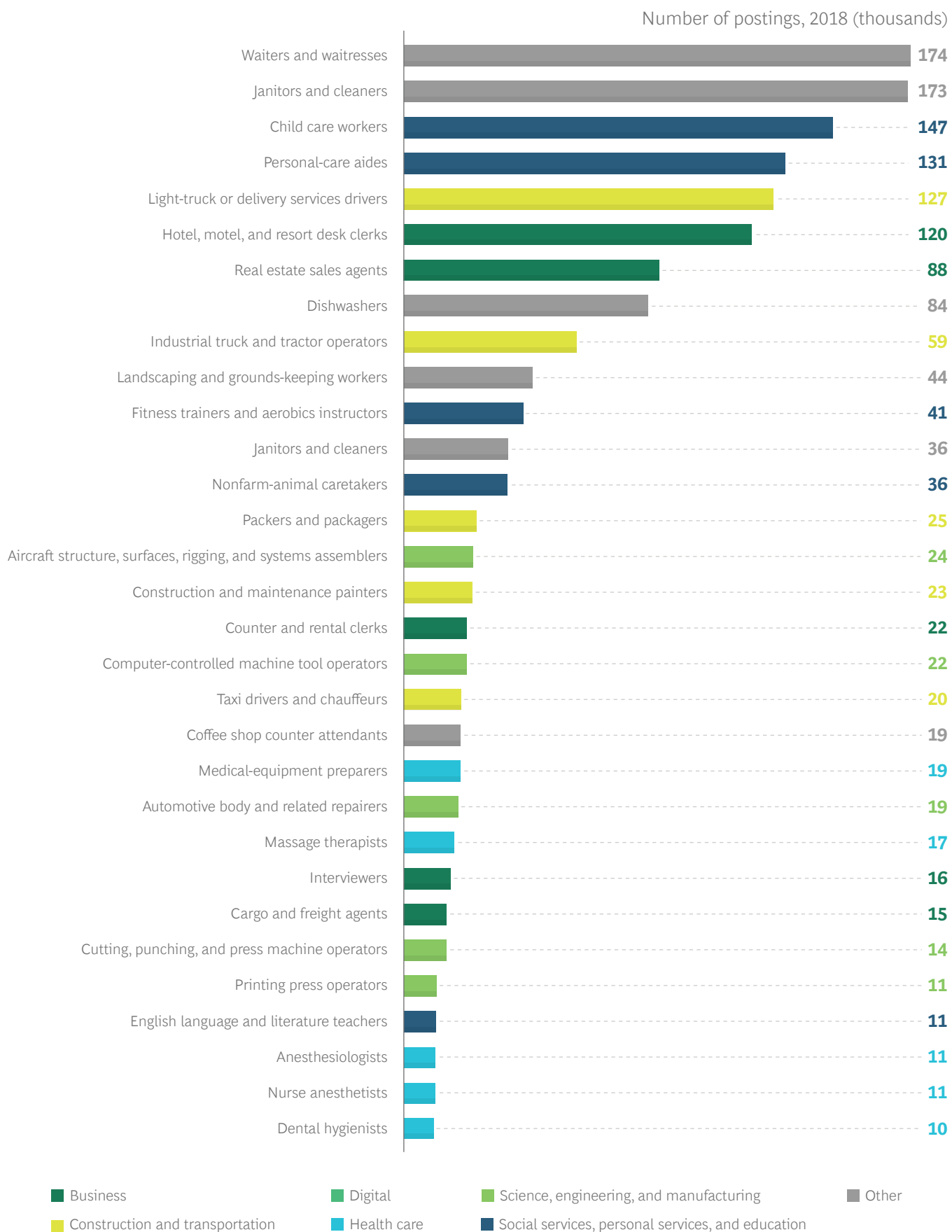
Of the high-growth jobs included in the O*NET database, some of those experiencing the greatest growth are airline pilots and flight engineers, automotive glass installers and repairers, and nanosystems engineers. Other jobs in this category are so new that they have not yet been codified in the O*NET taxonomy. So for a more accurate assessment, we looked beyond O*NET's classification to identify jobs that are growing rapidly but are not yet commonplace.[2]

For example, the number of postings for new digital jobs involving cloud-based services has been growing at a significant rate. The number of online job listings for senior cloud engineers and for Microsoft Azure developers grew, on average, more than 70% each year from 2015 through 2018.[3] Jobs related to enterprise automation solutions, such as administrators for NetSuite or Servicenow, are also on the rise. The 50% average annual growth in postings for Jira administrators (Jira is an agile project management and issue-tracking tool) reflects the increasing adoption of agile ways of working throughout many industries. As the use of digital technologies grows more pervasive, concerns about data and IT systems security are mounting. Job postings for cybersecurity engineers grew on average more than 50% from 2015 through 2018.

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2. As noted in the "Methodology" sidebar, some of the fastest-growing jobs according to O*NET include artifacts: traditional jobs whose postings have only recently migrated to online advertising.

3. Microsoft Azure is a cloud services platform that can be used for developing, deploying, and managing applications and services.

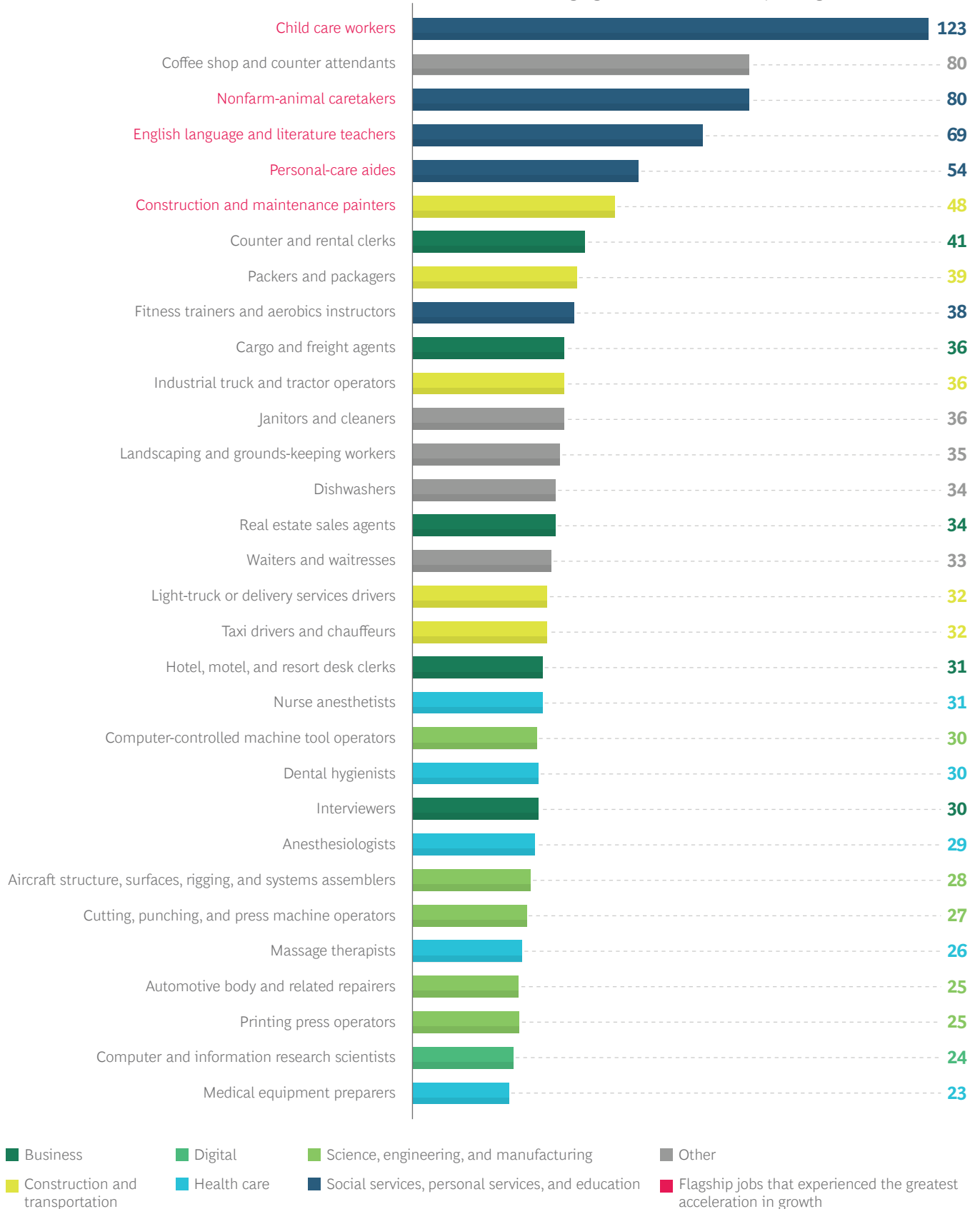# Exhibit 5 – Top Fast-Growing Jobs Ranked by Online Postings

Number of postings, 2018 (thousands)

Job	Postings
Waiters and waitresses	174
Janitors and cleaners	173
Child care workers	147
Personal-care aides	131
Light-truck or delivery services drivers	127
Hotel, motel, and resort desk clerks	120
Real estate sales agents	88
Dishwashers	84
Industrial truck and tractor operators	59
Landscaping and grounds-keeping workers	44
Fitness trainers and aerobics instructors	41
Janitors and cleaners	36
Nonfarm-animal caretakers	36
Packers and packagers	25
Aircraft structure, surfaces, rigging, and systems assemblers	24
Construction and maintenance painters	23
Counter and rental clerks	22
Computer-controlled machine tool operators	22
Taxi drivers and chauffeurs	20
Coffee shop counter attendants	19
Medical-equipment preparers	19
Automotive body and related repairers	19
Massage therapists	17
Interviewers	16
Cargo and freight agents	15
Cutting, punching, and press machine operators	14
Printing press operators	11
English language and literature teachers	11
Anesthesiologists	11
Nurse anesthetists	11
Dental hygienists	10

Legend:
- Business
- Digital
- Science, engineering, and manufacturing
- Other
- Construction and transportation
- Health care
- Social services, personal services, and education

Sources: Burning Glass Technologies; BCG analysis.

Note: Job titles follow O*NET taxonomy.

Exhibit 6 - Top Fast-Growing Jobs Ranked by Growth in Online Postings

Average growth in number of postings, 2015–2018 (%)[1]

Job	Growth
Child care workers	123
Coffee shop and counter attendants	80
Nonfarm-animal caretakers	80
English language and literature teachers	69
Personal-care aides	54
Construction and maintenance painters	48
Counter and rental clerks	41
Packers and packagers	39
Fitness trainers and aerobics instructors	38
Cargo and freight agents	36
Industrial truck and tractor operators	36
Janitors and cleaners	36
Landscaping and grounds-keeping workers	35
Dishwashers	34
Real estate sales agents	34
Waiters and waitresses	33
Light-truck or delivery services drivers	32
Taxi drivers and chauffeurs	32
Hotel, motel, and resort desk clerks	31
Nurse anesthetists	31
Computer-controlled machine tool operators	30
Dental hygienists	30
Interviewers	30
Anesthesiologists	29
Aircraft structure, surfaces, rigging, and systems assemblers	28
Cutting, punching, and press machine operators	27
Massage therapists	26
Automotive body and related repairers	25
Printing press operators	25
Computer and information research scientists	24
Medical equipment preparers	23

Legend:
- Business
- Digital
- Science, engineering, and manufacturing
- Other
- Construction and transportation
- Health care
- Social services, personal services, and education
- Flagship jobs that experienced the greatest acceleration in growth

Sources: Burning Glass Technologies; BCG analysis.

Note: Job titles follow O*NET taxonomy.

[1] Average growth is the average year-over-year percentage change in the number of online postings between 2015 and 2018.

Beyond the expected growth in jobs involving digital expertise and skills, we have also observed a dramatic increase in postings for occupations related to human capital, in particular, talent sourcing and development. The number of postings for onboarding specialists and talent coordinators rose more than 50% on average during the sample period.

Declining Jobs: Whether Fast or Slow, Disappearance Is Certain

Finally, there are the jobs for which demand is steadily decreasing, primarily because they are being replaced by automation or otherwise becoming obsolete through technology. Declining jobs include telemarketers, office machine operators, loan interviewers, computer operators (being replaced by a number of more specific digital and IT jobs), tellers, office workers, and administrative-support workers. These jobs averaged declines in demand of between 2% and 12% during the period 2015 through 2018. Their fate is clear; the only question is how long it will take for them to disappear altogether.

>70%

Average annual growth in listings for senior cloud engineers and Microsoft Azure developers, 2015–2018

50%
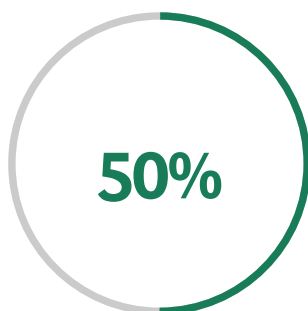
Average annual growth in listings for Jira administrators, 2015–2018

>50%

Average annual growth in listings for cybersecurity engineers, 2015–2018

Fast Lane or Off-Ramp? The Paradox of Truck Driver Jobs

Intensifying demand for truck drivers and increasing growth in the number of job postings for truckers are among the most noteworthy job trends of the past few years. According to our data, job postings for light-truck and tractor operators have grown 32%; postings for drivers of heavy trucks and tractor-trailers grew almost as rapidly, at 29%. In 2018, the shortage of truck drivers hit a record high: an estimated 300,000 positions.*

While the growth rate of postings is accelerating, some experts are proclaiming the end of the era of human-driven trucks. Autonomous vehicles, predicted by many to eventually take over the highways, are considered especially suitable for long-distance trips, which represent a major proportion of freight traffic. So how do we explain this seeming paradox of breathless job growth alongside predictions of job extinction?

Consider some of the factors at work that are squeezing the supply of truck drivers:

- As most freight in the US is transported by road, the strong economic growth of the past few years has increased the demand for long-distance drivers. Short-haul drivers are sought after for the same reason.

- The average age of truck drivers today is 55, so looming retirement further threatens their supply. Moreover, the pipeline is constrained by age restrictions. Drivers must be at least 21 years old in order to cross state borders, so new high-school graduates are not eligible.

- The gender gap doesn't help: 90% of drivers are male. Unless more women enter the field, the potential pool of drivers will remain limited.

- Millennials have changing attitudes and values regarding on-the-job travel. Industry HR professionals point out that many younger people are reluctant to take jobs that require a good deal of travel and time away from home.

- All the hoopla surrounding autonomous vehicles may have dissuaded many from pursuing an occupation that is purportedly about to disappear.

Essentially, we're witnessing two opposing trends: in the near to intermediate term, there will be a shortage of qualified truck drivers. But in the long run, self-driving trucks could render drivers obsolete. Companies therefore need to act on several levels to attract workers. In addition to raising wages, they can seek workers from more diverse groups, offer more flexible work arrangements to make the job more attractive, and perhaps even develop next-generation job options should autonomous vehicles become a reality. As we outlined in our joint study with the World Economic Forum, there are many ways that truck drivers can successfully transition into other jobs, all of which require a certain investment of time and money.[†] But both the company and the individual must approach this in a strategic and forward-looking manner.

[*] Why the Trucking Shorting Is Costing You," Bloomberg News, updated October 5, 2018, https://www.bloomberg.com/news/articles/2018-08-01/how-a-trucking-shortage-is-fueling-u-s-inflation-quicktake.

[†] BCG and World Economic Forum, *Towards a Reskilling Revolution: Industry-Led Action for the Future of Work, 2019*, http://www3.weforum.org/docs/WEF_Towards_a_Reskilling_Revolution.pdf.

Skills in Demand and Growth in That Demand
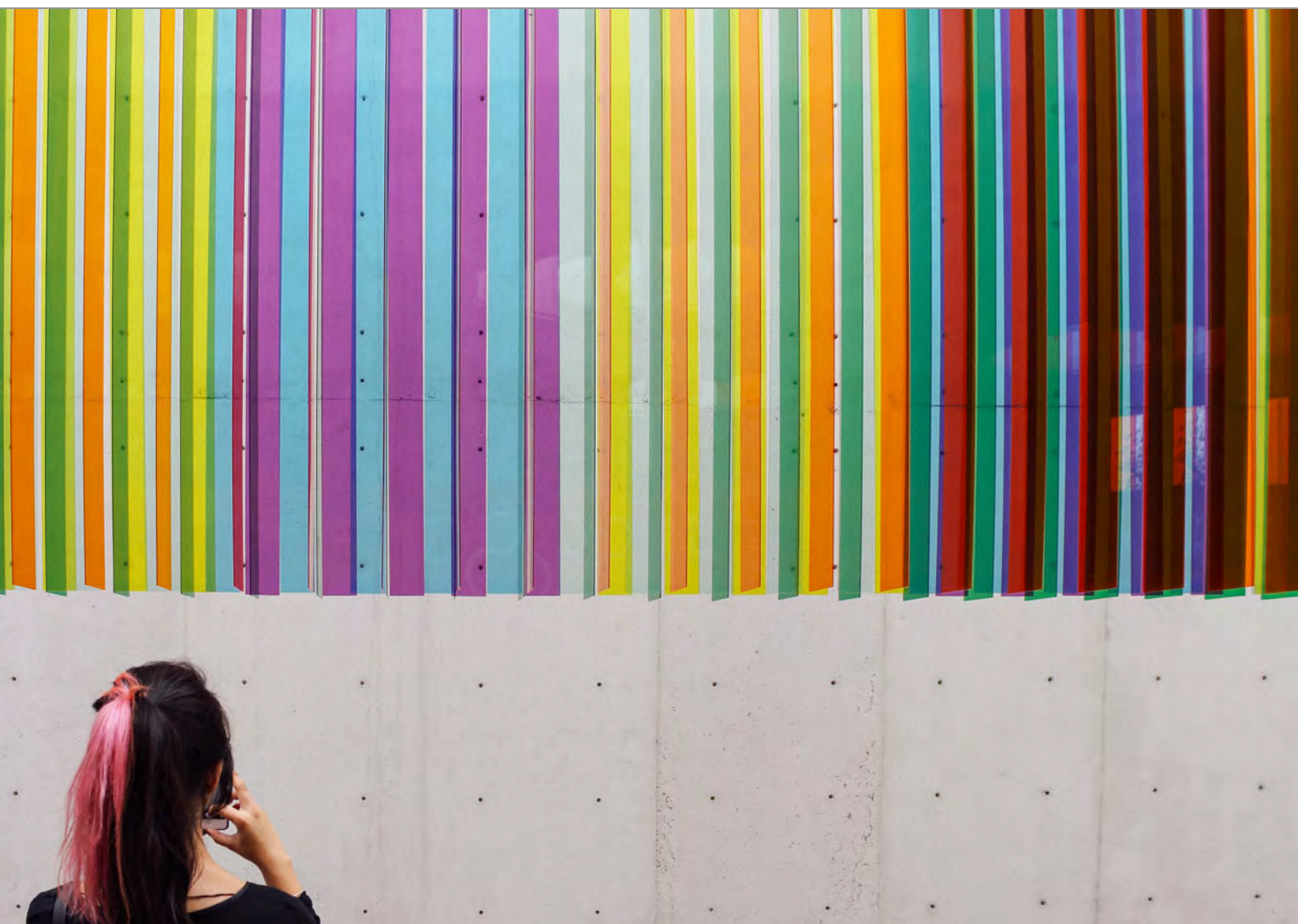
The same technological, business, and demographic trends that shape the supply of and demand for jobs likewise affect the market for skills. In fact, analyzing trends in the demand for skills gives us a preview of future job trends, as new skills often arise even before a new technology or trend has produced a corresponding new job title. To be consistent, and because we relied on the identical set of job-posting data, we classified skills according to the same categories used in our analysis of occupations: flagship, fast-growing, high-growth, modest-growth, and declining. (See the sidebar "Our Methodology for Skills Analysis.") These designations are based on the number of times a skill was mentioned in the total job listings and the annual rate of growth in that number. (See Exhibit 7 and Exhibit 8.)

Flagship Skills: In Wide Demand

As one would expect, demand for most of the skills in the flagship category is driven by the demand for jobs in the broad sector and function groupings (based on the O*NET taxonomy) throughout the economy. Like flagship jobs, flagship skills show significant demand (more than 10,000 appearances each in 2018 online job postings). These skills are also experiencing growing demand, with up to 20% average annual growth from 2015 through 2018 in their number of mentions in online job postings. (See Exhibit 9 and Exhibit 10.)

Almost 50% of the most sought after flagship skills fall under the general business rubric. They include basic skills, such as handling general administrative and clerical tasks, scheduling, and billing and invoicing, along with those requiring more experience or training, such as general sales. More specialized skills in the category include business strategy, budget management, people management, quality assurance, and project management.

In the digital field, flagship skills are tied more to traditional computer skills, such as fluency in Microsoft Office, or to an understanding of software development principles.

In health care, skills related to general medicine and basic patient care are in great demand, as are more specialized skills such as emergency and intensive care and occupational health. These trends conform to the overall trend in health care, where both general and specialized jobs are growing robustly.

The remaining groupings show a large number of postings for skills associated with jobs that are largely unaffected by digitalization, such as teaching and food service.

As shown in Exhibit 10, the flagship skills across all of our broad industry groupings whose listings showed the largest increase in growth last year were teaching, project management, software development principles, scheduling, and business strategy.

Exhibit 7 - Five Skills Categories According to Number and Growth of Postings

Number of mentions in online postings, 2018
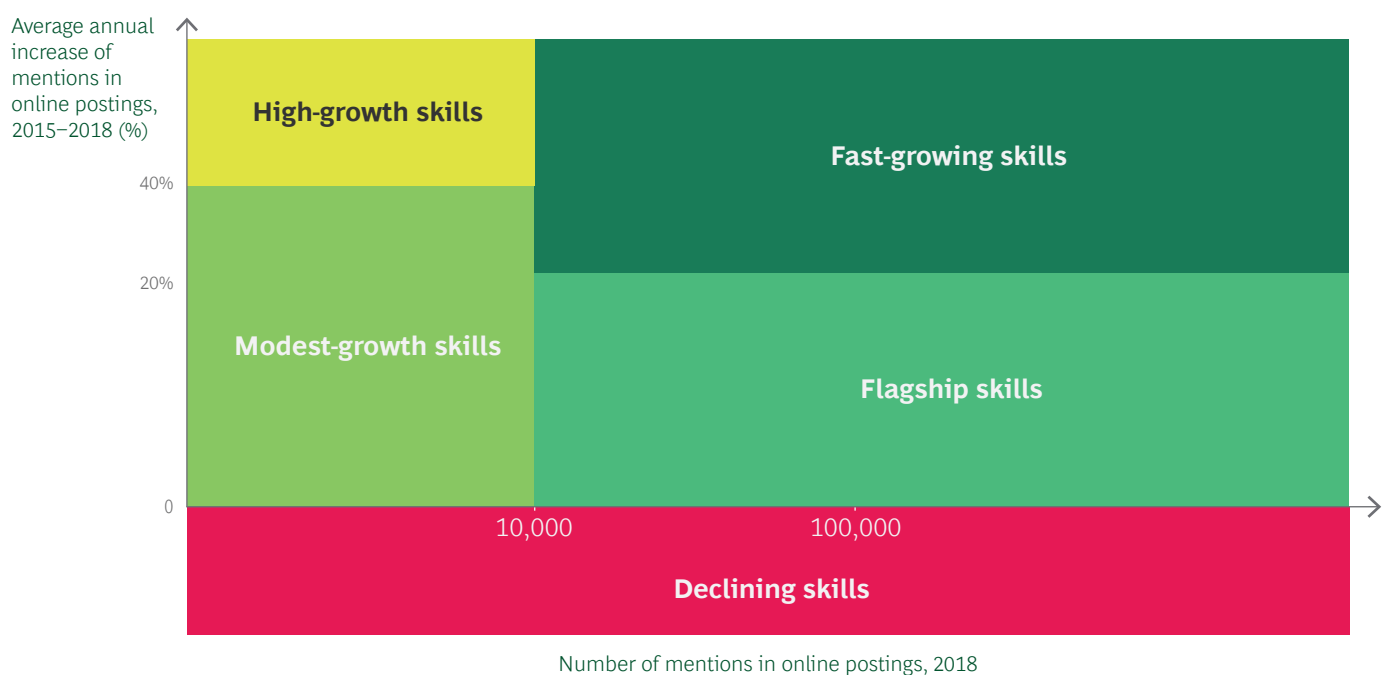
Sources: Burning Glass Technologies; BCG analysis.

Fast-Growing Skills: Digital and Personal Services Dominate

Digital skills make up around 70% of all fast-growing skills: those that saw more than 10,000 mentions each in 2018 online job postings and experienced, on average, more than 20% year-over-year growth in the number of mentions. (See Exhibit 11 and Exhibit 12.) The demand for expertise in fields like artificial intelligence, the Internet of Things, cloud solutions, machine learning, and fintech shows the extent to which new technologies are being adopted across industries. At the same time, demand for more "traditional" digital skills is high and continues to grow rapidly; these include handling document management systems, IT automation, and application programming interface. In the business grouping, the only fast-growing skill is online sales—again, a skill set driven by digitalization.

The top five fast-growing skills with the fastest-growing demand from 2017 through 2018 were a motley mix: document management systems, animal care, behavior analysis, child care, and exercise training. Interestingly, the grouping with the largest number of fast-growing skills after digital was social services, personal services, and education. Child care, animal care, exercise training, and
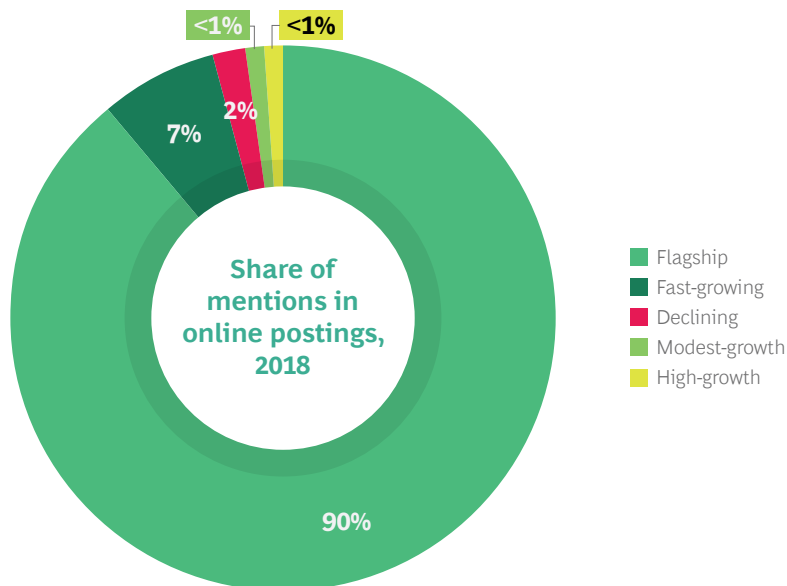
behavior analysis skills are all related to the growing pursuit of general well-being and leisure. As with the jobs in this group, high growth and burgeoning demand for these skills are unimpeded by digitalization.

Construction and transportation is another group that is well represented in the fast-growing category, with skills like roofing, drywall building, and construction painting reflecting the enormous demand for housing in the US.
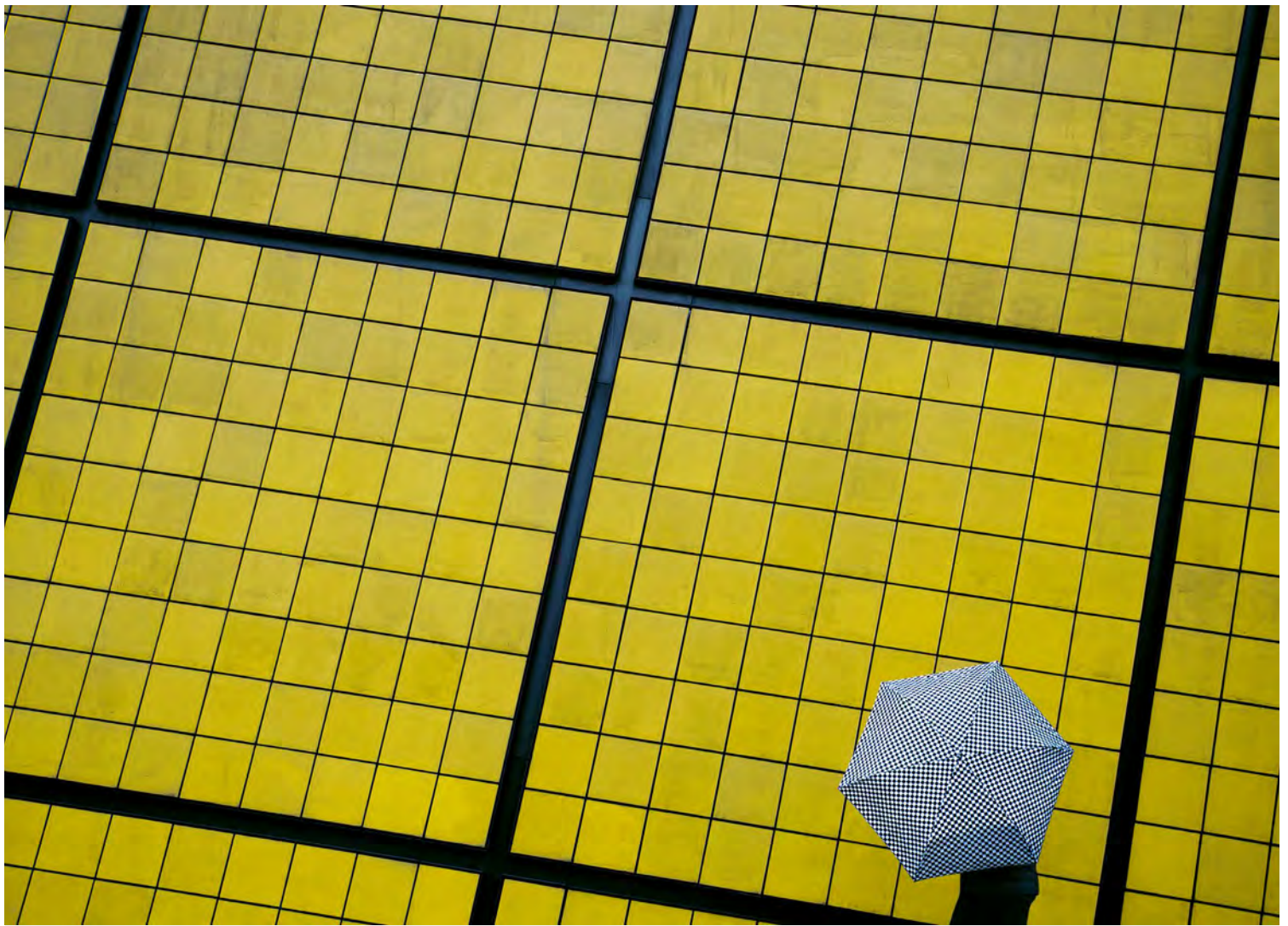
> **Analyzing trends in the demand for skills gives us a preview of future job trends, as new skills often arise even before a new technology or trend has produced a corresponding new job title.**

Health care registered only one skill in the fast-growing skills category (genetics), as did science, engineering, and manufacturing (with tailoring and sewing).

Exhibit 8 - Five Skills Categories According to Share of Mentions in Online Postings

Share of mentions in online postings, 2018

- <1%
- <1%
- 7%
- 2%
- 90%

Legend:
- Flagship
- Fast-growing
- Declining
- Modest-growth
- High-growth

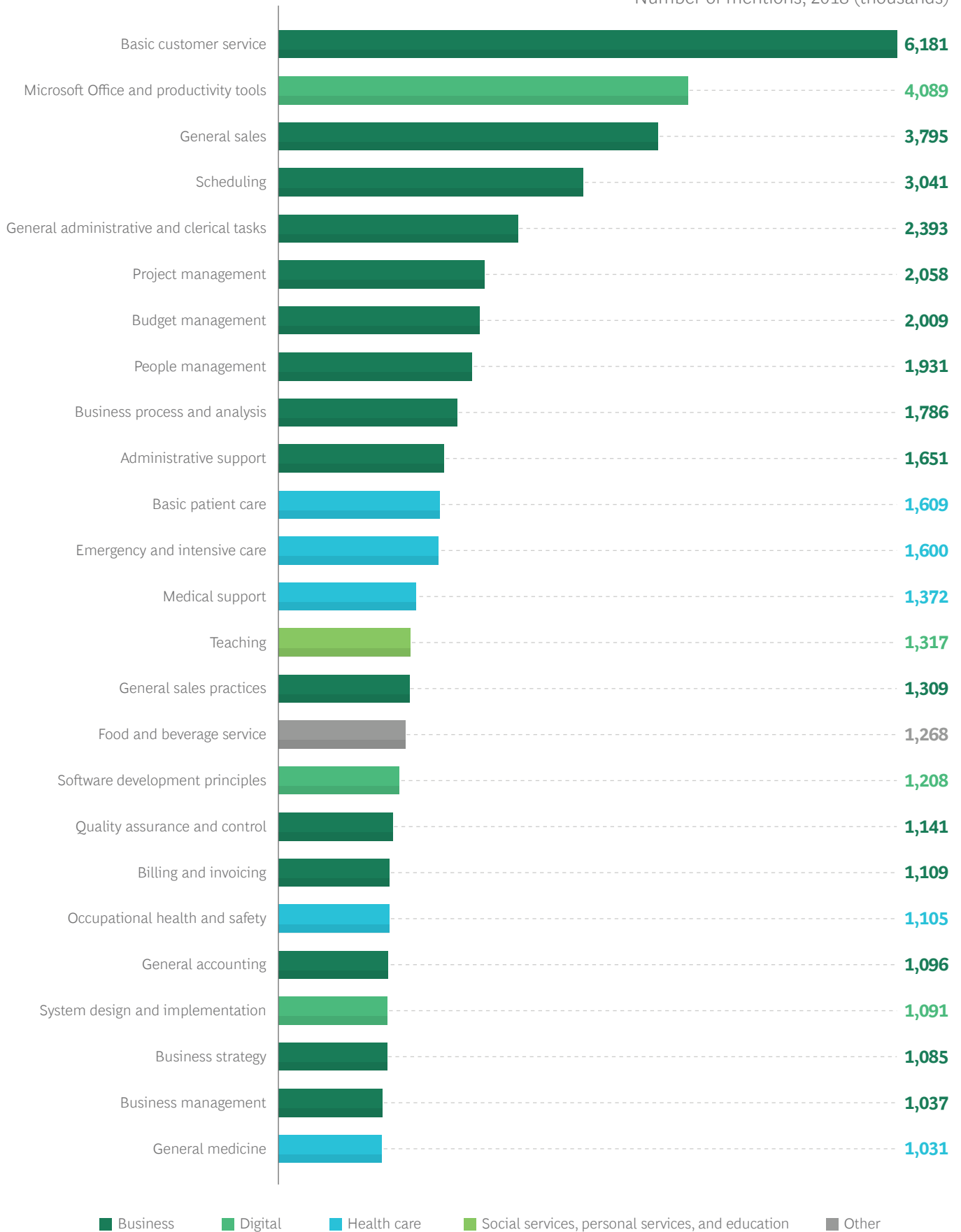**Sources:** Burning Glass Technologies; BCG analysis.

Our Methodology for Skills Analysis

To understand skill trends, we analyzed the same data that we used for our occupational trend analysis: more than 95 million online job postings from 2015 through 2018, provided by Burning Glass. We studied the current level of demand, represented by the number of 2018 online job postings in which the given skills were mentioned. We also examined the evolving demand for skills, as represented by the average annual change in the number of job postings in which the skills were mentioned over the three-year period.

Burning Glass's database tracks more than 17,000 individual skills, grouped into some 650 skill clusters. Skill clusters can be groups of individual skills that are variations of the same basic skill (for example, programming languages); skills that are similar in function (such as meeting planning and making travel arrangements); or skills for which employees can be trained together (for example, proficiency in kaizen and Lean Six Sigma). For the purposes of this report, it made more sense to analyze skill clusters rather than individual skills.
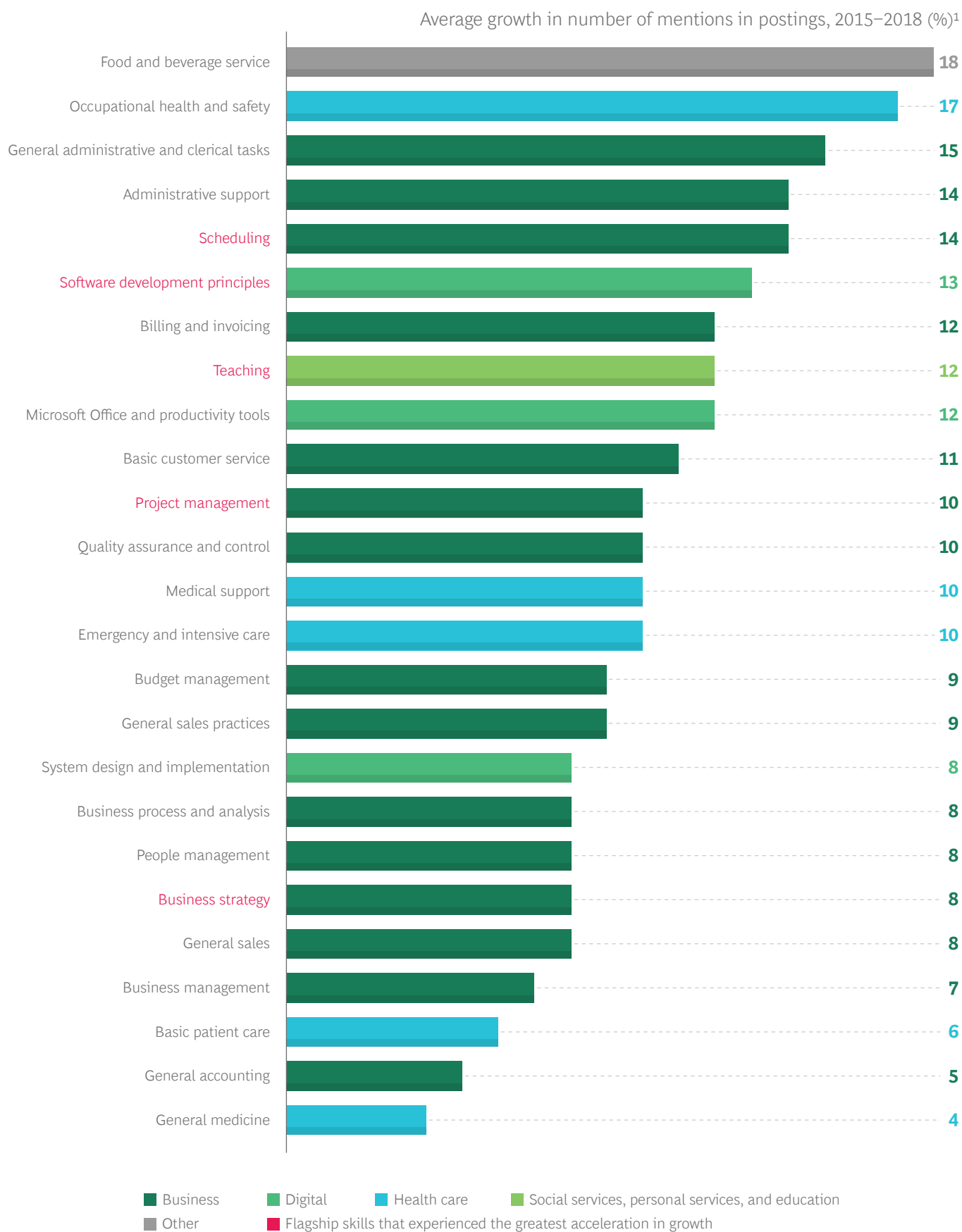
Exhibit 9 - Top Flagship Skills Ranked by Mentions in Online Postings
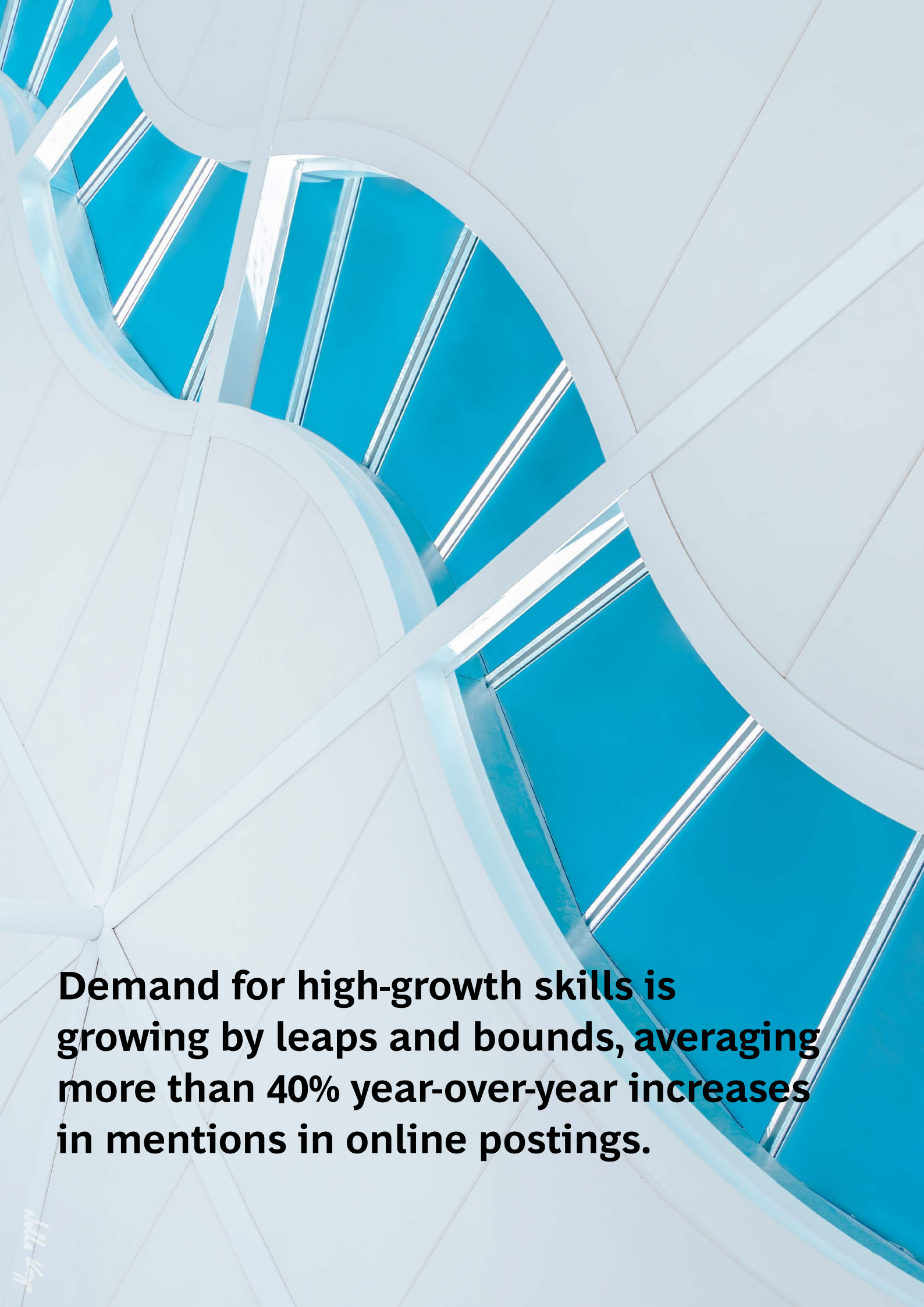
Number of mentions, 2018 (thousands)

Skill	Mentions
Basic customer service	6,181
Microsoft Office and productivity tools	4,089
General sales	3,795
Scheduling	3,041
General administrative and clerical tasks	2,393
Project management	2,058
Budget management	2,009
People management	1,931
Business process and analysis	1,786
Administrative support	1,651
Basic patient care	1,609
Emergency and intensive care	1,600
Medical support	1,372
Teaching	1,317
General sales practices	1,309
Food and beverage service	1,268
Software development principles	1,208
Quality assurance and control	1,141
Billing and invoicing	1,109
Occupational health and safety	1,105
General accounting	1,096
System design and implementation	1,091
Business strategy	1,085
Business management	1,037
General medicine	1,031

Legend: ■ Business ■ Digital ■ Health care ■ Social services, personal services, and education ■ Other

Sources: Burning Glass Technologies; BCG analysis.

Exhibit 10 - Top Flagship Skills Ranked by Growth in Online Postings

Average growth in number of mentions in postings, 2015–2018 (%)[1]

Skill	Growth (%)
Food and beverage service	18
Occupational health and safety	17
General administrative and clerical tasks	15
Administrative support	14
Scheduling	14
Software development principles	13
Billing and invoicing	12
Teaching	12
Microsoft Office and productivity tools	12
Basic customer service	11
Project management	10
Quality assurance and control	10
Medical support	10
Emergency and intensive care	10
Budget management	9
General sales practices	9
System design and implementation	8
Business process and analysis	8
People management	8
Business strategy	8
General sales	8
Business management	7
Basic patient care	6
General accounting	5
General medicine	4

Legend:
- Business
- Digital
- Health care
- Social services, personal services, and education
- Other
- Flagship skills that experienced the greatest acceleration in growth

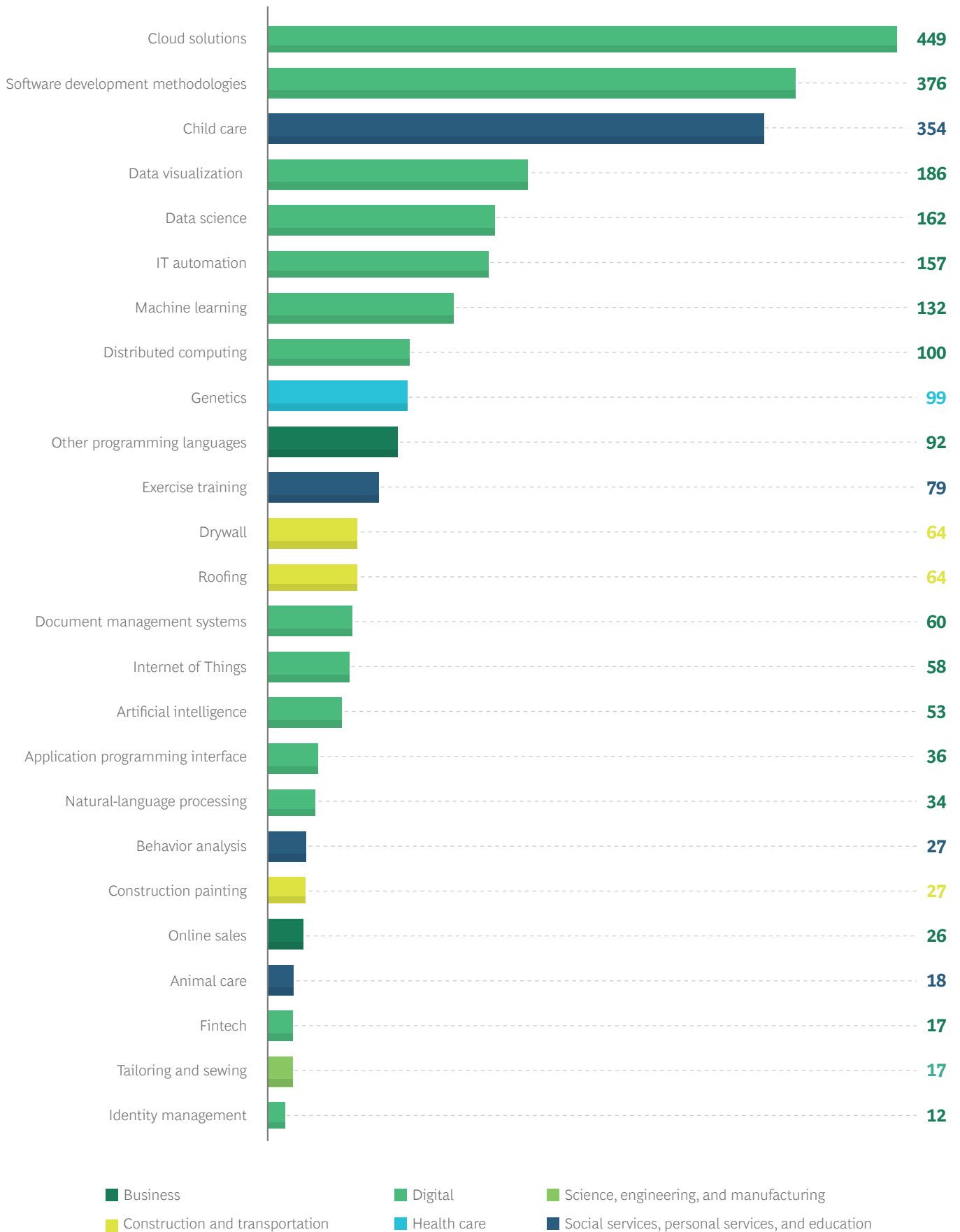**Sources:** Burning Glass Technologies; BCG analysis.

[1] Average growth is the average year-over-year percentage change in the number of appearances in online postings between 2015 and 2018.

Demand for high-growth skills is growing by leaps and bounds, averaging more than 40% year-over-year increases in mentions in online postings.

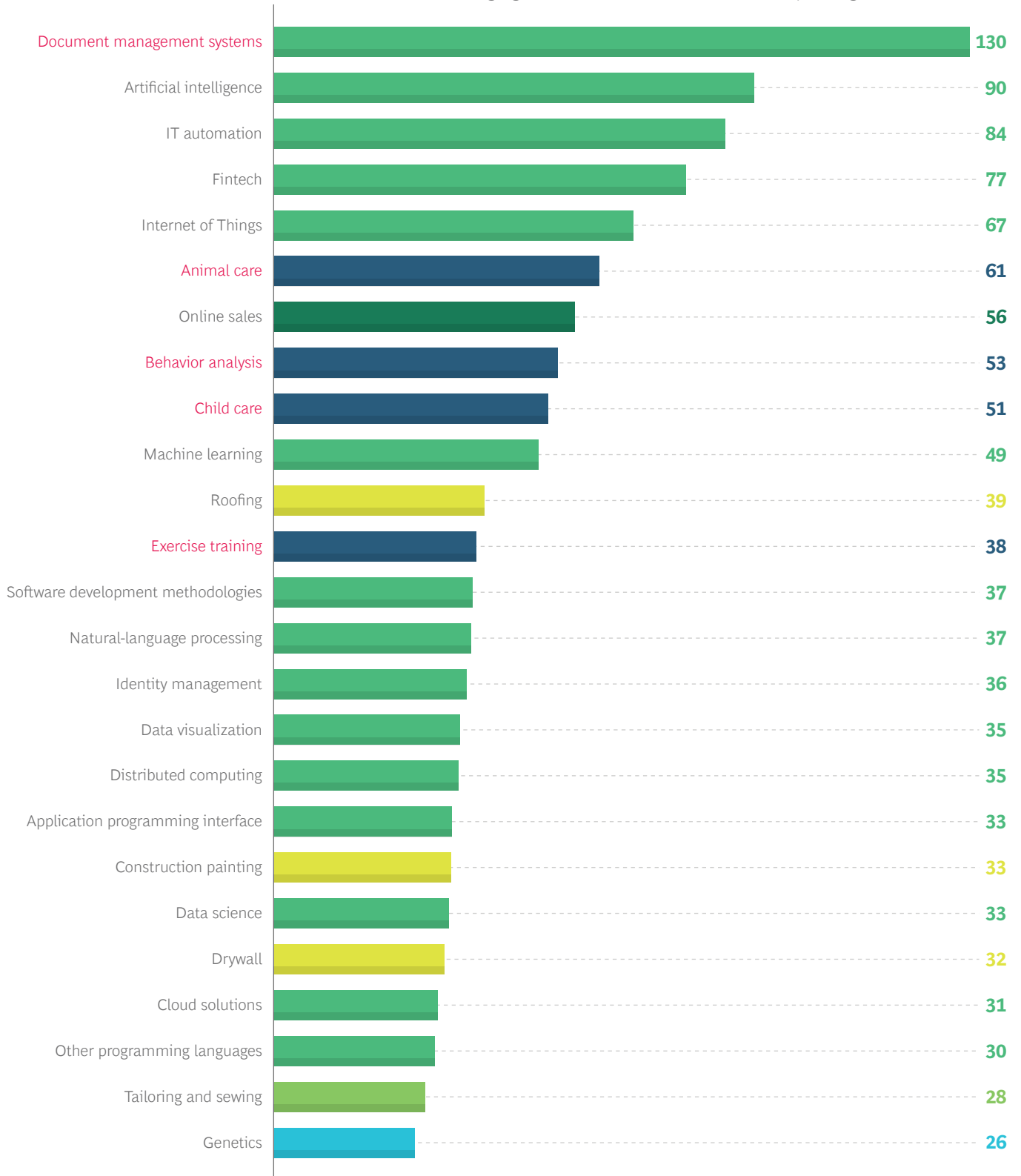# Exhibit 11 - Top Fast-Growing Skills Ranked by Mentions in Online Postings

Number of mentions, 2018 (thousands)

Skill	Mentions
Cloud solutions	449
Software development methodologies	376
Child care	354
Data visualization	186
Data science	162
IT automation	157
Machine learning	132
Distributed computing	100
Genetics	99
Other programming languages	92
Exercise training	79
Drywall	64
Roofing	64
Document management systems	60
Internet of Things	58
Artificial intelligence	53
Application programming interface	36
Natural-language processing	34
Behavior analysis	27
Construction painting	27
Online sales	26
Animal care	18
Fintech	17
Tailoring and sewing	17
Identity management	12

■ Business   ■ Digital   ■ Science, engineering, and manufacturing
■ Construction and transportation   ■ Health care   ■ Social services, personal services, and education

Sources: Burning Glass Technologies; BCG analysis.

Exhibit 12 - Top Fast-Growing Skills Ranked by Growth in Online Postings

Average growth in number of mentions in postings, 2015–2018 (%)[1]

Skill	Growth
Document management systems	130
Artificial intelligence	90
IT automation	84
Fintech	77
Internet of Things	67
Animal care	61
Online sales	56
Behavior analysis	53
Child care	51
Machine learning	49
Roofing	39
Exercise training	38
Software development methodologies	37
Natural-language processing	37
Identity management	36
Data visualization	35
Distributed computing	35
Application programming interface	33
Construction painting	33
Data science	33
Drywall	32
Cloud solutions	31
Other programming languages	30
Tailoring and sewing	28
Genetics	26

Legend:
- ■ Business
- ■ Digital
- ■ Science, engineering, and manufacturing
- ■ Fast-growing skills that experienced the greatest acceleration in growth
- ■ Construction and transportation
- ■ Health care
- ■ Social services, personal services, and education

Sources: Burning Glass Technologies, BCG analysis.

[1] Average growth is the average year-over-year percentage change in the number of appearances in online postings between 2015 and 2018.

High-Growth Skills: Centered in Technology-Specific Niches

The high-growth skills category offers a view of our evolving digital future. As Exhibit 13 shows, many of these skills are linked to the latest technologies, which are at the beginning of their life cycle. They are in relatively low demand, with fewer than 10,000 individual mentions in 2018 job postings. But demand is growing by leaps and bounds, averaging more than 40% year-over-year increases in mentions in online postings during the period 2015 through 2018.

High-growth skills include those in chatbot technology, Amazon Alexa (the voice-control digital assistant), data lakes, and cloud security. The fastest-growing high-growth skills for 2017 to 2018 included quantum computing, digital currency, natural-language toolkit, and cloud security

strategy and planning. While some of the underlying technologies that these skills support may remain niche technologies, others could quickly become mainstream. And as they are more widely adopted, the skills associated with them will be the fast-growing skills of the future. (See the sidebar "High-Growth Skills Are in Demand in an Ever-Widening Range of Jobs.")

Declining Skills

As new technologies replace old ones, the demand for older technology skills is, as one would expect, declining. Demand is sagging for skills like PHP web, backup software, servers, enterprise management software, and assembly languages. Reskilling becomes a pressing need for workers whose main skill set consists of such competencies.

Exhibit 13 – High-Growth Skills Are Associated with the Latest Technologies
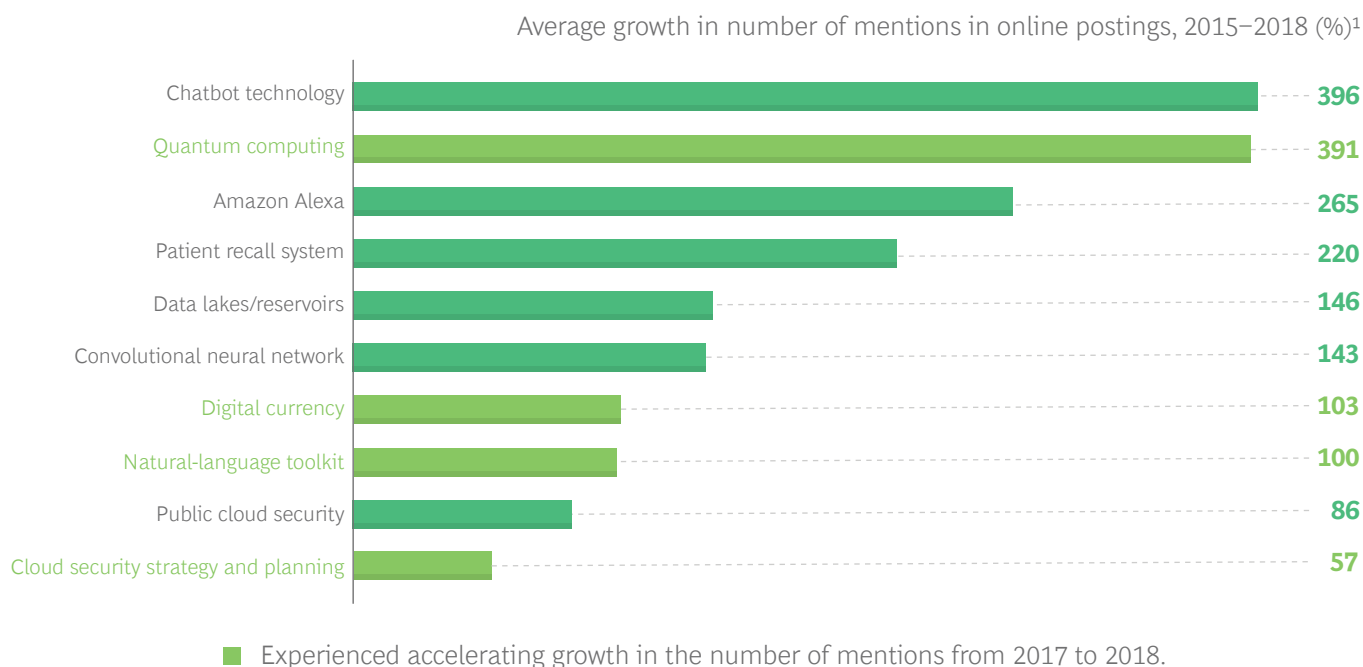
Average growth in number of mentions in online postings, 2015–2018 (%)[1]

Skill	Value
Chatbot technology	396
Quantum computing	391
Amazon Alexa	265
Patient recall system	220
Data lakes/reservoirs	146
Convolutional neural network	143
Digital currency	103
Natural-language toolkit	100
Public cloud security	86
Cloud security strategy and planning	57

■ Experienced accelerating growth in the number of mentions from 2017 to 2018.

Sources: Burning Glass Technologies; BCG analysis.

[1] Average growth is the average year-over-year percentage change in the number of appearances in online postings between 2015 and 2018.
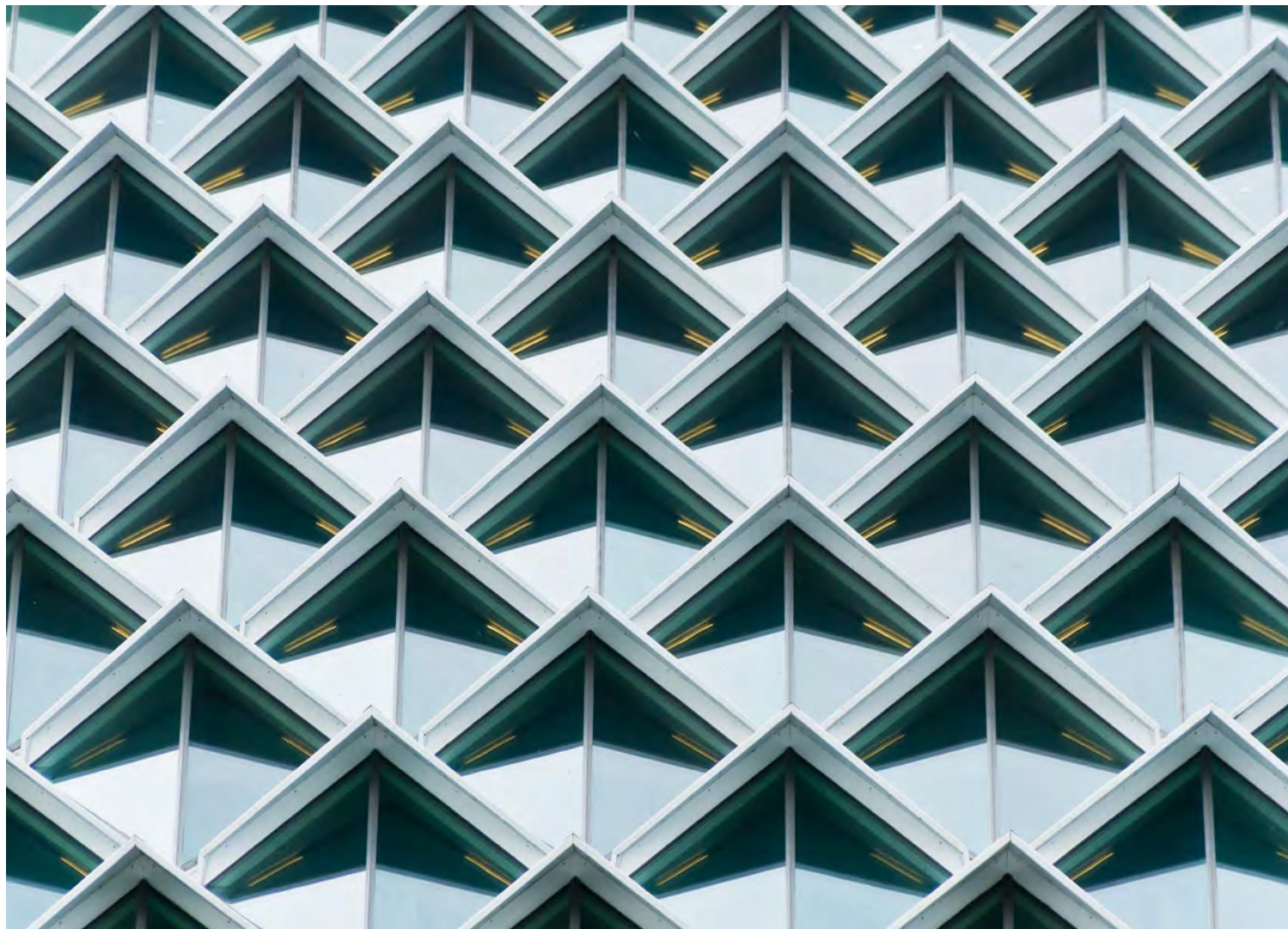
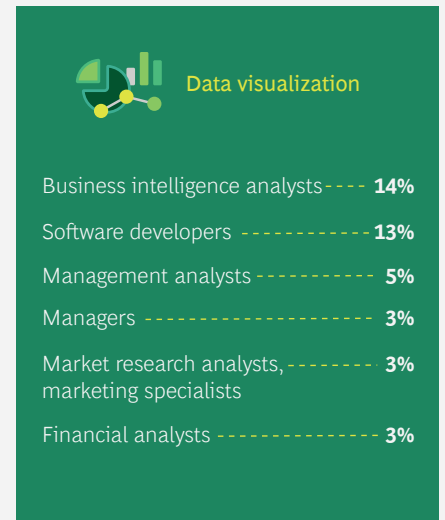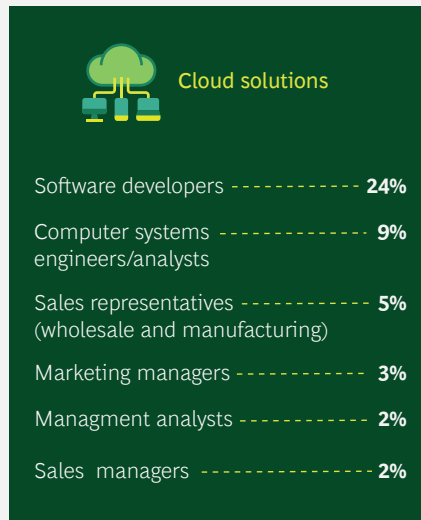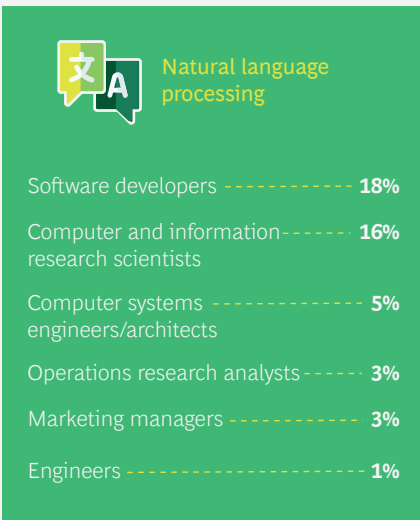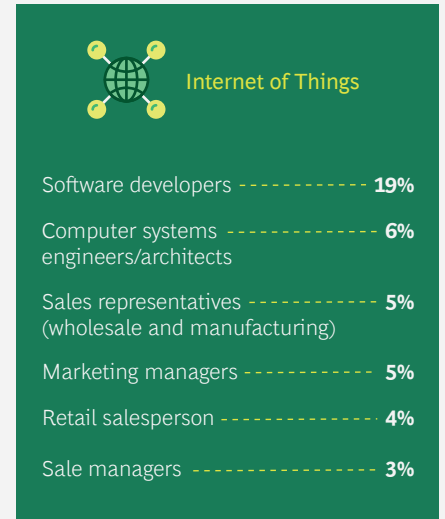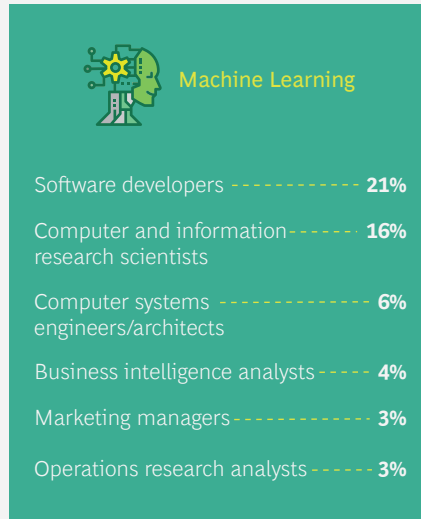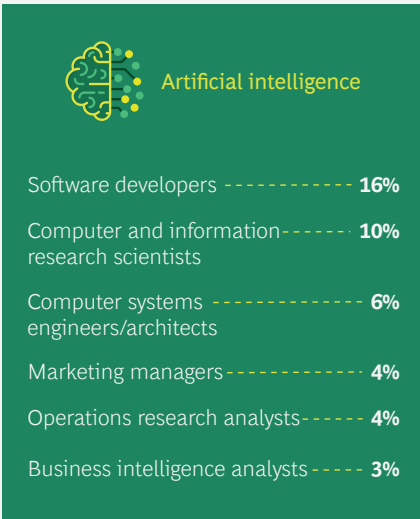# High-Growth Skills Are in Demand in an Ever-Widening Range of Jobs

As digital technologies pervade core business functions and processes, demand for the more specialized or advanced high-growth skills is beginning to crop up in a wider range of positions. (See the exhibit, page 27.) These skills are increasingly being required in many conventional technology positions, such as software developers and computer systems engineers. Even more interesting, they are emerging in nontechnical job listings as well.

For example, artificial intelligence and machine learning skills are appearing in job ads for marketing managers and business intelligence analysts, and knowledge of or experience with the Internet of Things is showing up as a requirement for various sales and marketing positions. Similarly, proficiency in natural language processing is a requirement for certain engineering positions. And skills in cloud solutions are being called for in various marketing, analyst, and sales positions, as are data visualization skills. We believe this is only the beginning of an important trend that will reshape the skill requirements for many traditional job profiles in the future.

Occupations Demanding High-Growth Skills

Share of mentions in total online job postings

Artificial intelligence

Software developers	**16%**
Computer and information research scientists	**10%**
Computer systems engineers/architects	**6%**
Marketing managers	**4%**
Operations research analysts	**4%**
Business intelligence analysts	**3%**

Machine Learning

Software developers	**21%**
Computer and information research scientists	**16%**
Computer systems engineers/architects	**6%**
Business intelligence analysts	**4%**
Marketing managers	**3%**
Operations research analysts	**3%**

Internet of Things

Software developers	**19%**
Computer systems engineers/architects	**6%**
Sales representatives (wholesale and manufacturing)	**5%**
Marketing managers	**5%**
Retail salesperson	**4%**
Sale managers	**3%**

Natural language processing

Software developers	**18%**
Computer and information research scientists	**16%**
Computer systems engineers/architects	**5%**
Operations research analysts	**3%**
Marketing managers	**3%**
Engineers	**1%**

Cloud solutions

Software developers	**24%**
Computer systems engineers/analysts	**9%**
Sales representatives (wholesale and manufacturing)	**5%**
Marketing managers	**3%**
Managment analysts	**2%**
Sales managers	**2%**

Data visualization

Business intelligence analysts	**14%**
Software developers	**13%**
Management analysts	**5%**
Managers	**3%**
Market research analysts, marketing specialists	**3%**
Financial analysts	**3%**

Sources: Burning Glass Technologies, BCG analysis.

How Should We Respond?

W hat do the trends in the demand for jobs and skills tell us? What do they mean for companies, governments, and individuals, in the near and longer term?

The Implications for Companies

There are a number of ways in which companies can address the significant shifts in the types of talent and skills needed for the future, but the process starts with strategic workforce planning. In the context of workforce planning, "strategic" means looking beyond the traditional yearly horizon for staffing plans and developing a longer-term model. At its best, strategic workforce planning comprises not only the roles but also the skills critical for achieving an organization's business objectives.

We use the word strategic for another reason. Identifying the supply of and demand for the roles and skills most important to a company—and understanding what any gaps in them can mean—should be embedded in the broader strategic business planning process. In other words, no company can have a bona fide strategic business plan without also having a corresponding workforce plan. The workforce plan serves, in effect, as the business case for human capital needs; it is the trigger for buying, building, and borrowing the requisite capabilities. In order for it to be effective, there must be tight cooperation between operations, human resources and finance (and sometimes procurement), because the decision rights and responsibilities for planning and execution typically span these areas.

Recruitment (Buying the Capabilities). Recruitment may be the most established of HR disciplines, but it is also one of the fastest changing. Companies are already modifying their employer value proposition to conform to the changing needs of the contemporary workforce and, in some cases, to compete more effectively for digital talent. Increasingly, companies are also tailoring their value proposition by specific employee segment or market to appeal to the differing priorities of each. Beyond the traditional avenues, companies have at their disposal other new means of talent acquisition, including acqui-hiring, or acquiring companies expressly for their people rather than for their products or services. Finally, new selection methodologies and tools (such as psychometrics and gamification), along with new self-service tools that simplify and streamline dealings between HR and the rest of the business, offer ways for companies to be more proactive in their recruitment practices than ever before.

Development (Building the Capabilities). No company can count on recruitment alone to meet its future workforce needs. The bulk of any company's workforce remains unchanged from year to year, so companies need to develop their employees on an ongoing basis. Regardless of a company's ability to attract top talent, it needs to invest substantially in training and upskilling. For example, the trends we found in fast-growing skills indicate that companies need to ramp up their investment in digital-skills building to meet future workforce needs.

Responding nimbly to changing skill requirements is a must in order for companies to remain vibrant. The adage "He gives twice who gives quickly" should guide their approach. New learning methods and tools, such as personalized learning journeys, gamification, and massive open online courses, are fueling an upskilling revolution. The longstanding learning model (70% experience-based, 20% relationship-based, 10% formal training) remains relevant. However, all too often companies focus on the 10% formal training and leave the remaining 90% to employees or their managers. True experience-based learning entails supporting the day-to-day work with learning rhythms and routines (such as projects, stretch roles, and daily huddles). It is only possible if companies are open to flexible career pathways, including welcoming horizontal moves more than they traditionally have. And true relationship-based learning uses expert and community learning group networks (such as peer groups, expert coaches, and online learning forums) to stimulate reflection and reinforcement.

Contingent Labor (Borrowing the Capabilities). Contingent labor can become an integral part of an organization's workforce. For example, the use of freelancers has become easier, more reliable, and more widespread (thanks largely to digital technologies) and will likely extend to new fields and new positions throughout many industries. Yet in most organizations today, contingent-labor planning isn't managed centrally; often it is handled by the procurement team, rather than by HR. As a result, it can be difficult to manage as part of a holistic strategy.

The use of contingent labor should be carefully based on strategic workforce planning models and on a deep understanding of the role that various skills play in the organization. It is crucial that organizations adapt their contingent-labor models accordingly—where appropriate, making the process a daily practice. Equally important, organizations need to identify the short list of critical strategic skills that must be kept internal. Outsourcing critical skills creates unnecessary risks, a situation we've seen in the IT functions of many companies.

An Alternative for Building the Capabilities. When traditional approaches won't deliver results quickly enough, there are other options for filling a talent gap, especially for skills needed in bulk. One such approach is build-operate-

transfer (BOT). Traditionally used for infrastructure projects developed through public-private partnerships, we have adapted it to help organizations rapidly amass new capabilities. Essentially, the company sets up a new entity tailored to the targeted talent. At first, the entity is operated by an external party; once it is fully functional and able to provide the needed capabilities efficiently, it is transferred back to the company. BOT is particularly useful when the talent in question is culturally different—for example, digital talent—and has needs and expectations that are generally not served by the traditional organization.

The Implications for Governments and Individuals

Reskilling is not merely a necessity for companies; it is also an obligation of governments and public institutions. Many developed economies will face worker shortages. Retraining those whose jobs are becoming obsolete is not only a humanitarian duty; it is a requirement for maintaining economic growth. Governments should both encourage and support employers and employees to engage in large-scale skills-building programs.

In a BCG report produced with the World Economic Forum, we show that reskilling is a realistic option for the majority of workers affected by the shifts in demand described here.[4] Companies should revisit and refocus their development activities; but ultimately, it is up to individuals to take control of their career, learn new skills, and seize new opportunities.

> **Retraining those whose jobs are becoming obsolete is not only a humanitarian duty; it is a requirement for maintaining economic growth.**

Reskilling, however, is only part of the solution, because it focuses on closing skill gaps in the near and medium term. To ensure that people are equipped not only with the skills required for work in the future but also with the ability to adapt to new ways of learning, policymakers throughout the world should apply their understanding of these gaps to shape elementary, secondary, and higher-level education.[5] Healthy organizations, healthy economies, and healthy societies depend on it.

4. See BCG and World Economic Forum, *Towards a Reskilling Revolution: Industry-Led Action for the Future of Work,* 2019, http://www3.weforum.org/docs/WEF_Towards_a_Reskilling_Revolution.pdf.
5. See BCG and World Economic Forum, *New Vision for Education: Fostering Social and Emotional Learning through Technology,* March 2016, http://www3.weforum.org/docs/WEF_New_Vision_for_Education.pdf.

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For Further Reading

Towards a Reskilling Revolution—Industry-Led Action for the Future of Work
A report by Boston Consulting Group and the World Economic Forum
January 2019.

How Learning Contracts Can Drive an Industrious Revolution
A report by Boston Consulting Group
November 2018

Decoding Global Talent
A report by Boston Consulting Group
June 2018

Towards a Reskilling Revolution—A Future of Jobs for All
A report by Boston Consulting Group and the World Economic Forum
January 2018

Acknowledgments

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