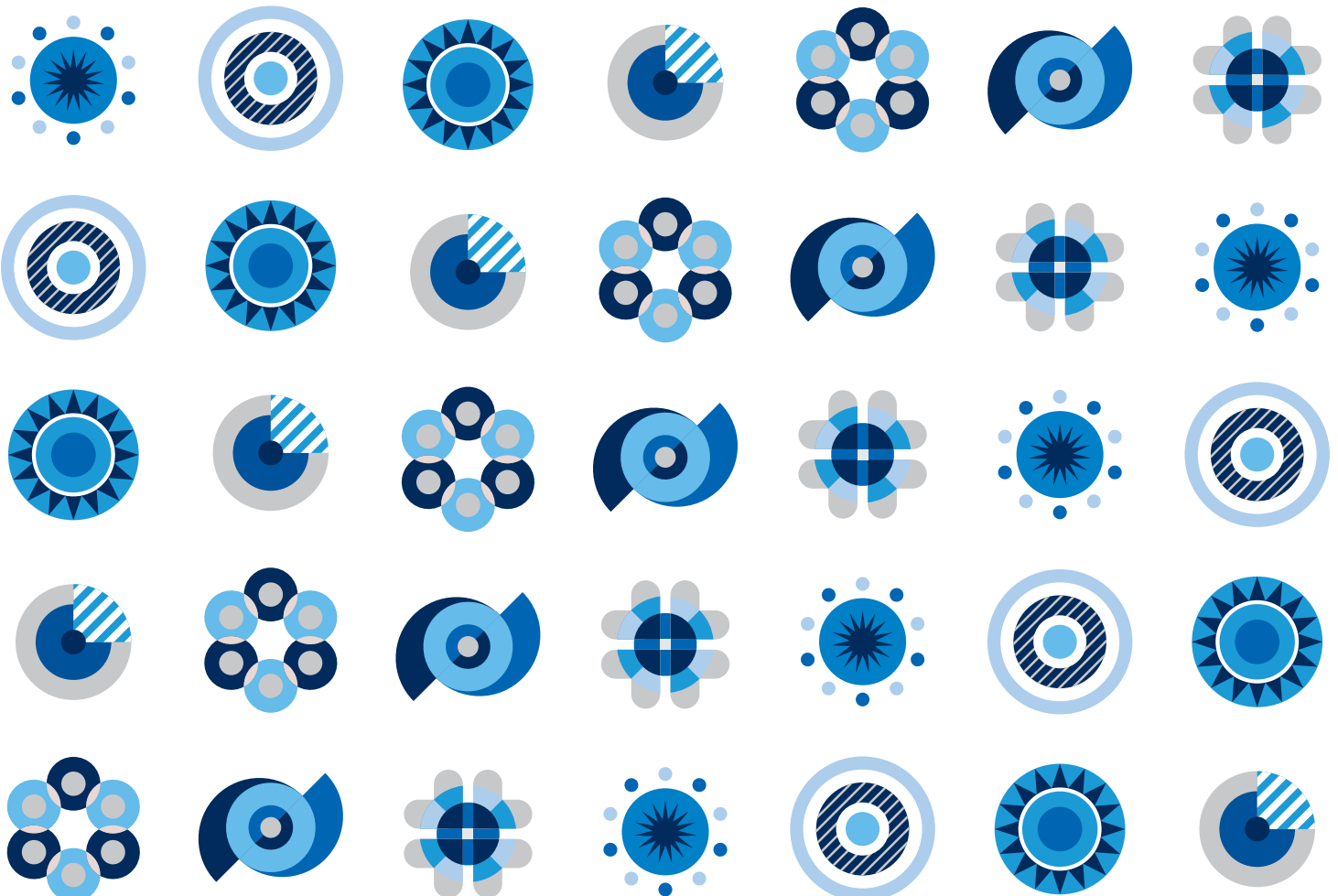Platform for Shaping the Future of the New Economy and Society

Jobs of Tomorrow
Mapping Opportunity in the New Economy

January 2020

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Key Findings

The Fourth Industrial Revolution is creating demand for millions of new jobs, with vast new opportunities for fulfilling people's potential and aspirations. However, in order to turn these opportunities into reality, new sources of data and innovative approaches to understand emerging jobs and skills, as well as to empower effective and coordinated large-scale action are urgently needed across the globe. This report, *Jobs of Tomorrow: Mapping Opportunity in the New Economy*, takes an in-depth look into the 'black box' of new job creation, reviewing the shifting focus of employment to emerging professions of the future, the reasons behind it and what skills will be required by these professions.

The analysis presented in this report is based on innovative metrics authored in partnership between the World Economic Forum's New Metrics CoLab in its Platform for the New Economy and Society, and data scientists at three partner companies: Burning Glass Technologies, Coursera and LinkedIn. Through these collaborations, the report provides insights into emerging opportunities for employment across the global economy as well as unique detail regarding the skill sets needed to leverage those opportunities.

Key findings include:

→ **Demand for both "digital" and "human" factors is driving growth in the professions of the future**. Seven key professional clusters are emerging in tandem. On the one hand, these reflect the adoption of new technologies—giving rise to greater demand for green economy jobs, roles at the forefront of the data and AI economy as well as new roles in engineering, cloud computing and product development. On the other hand, emerging professions also reflect the continuing importance of human interaction in the new economy, giving rise to greater demand for care economy jobs; roles in marketing, sales and content production; as well as roles at the forefront of people and culture. Indeed, the future of work shows demand for a broad variety of skills that match these professional opportunities, inclusive of both disruptive technical skills but also specialized industry skills and core business skills.

→ **There are seven emerging professional clusters and 96 jobs of tomorrow within them that vary in their individual rate of growth and in the scale of job opportunities they offer in the aggregate**. As an innovative feature of this report, the 'scale of job opportunities' is measured as the number of job opportunities offered by the professional cluster for every 10,000 job opportunities offered across the global labour market. In other words, we are able to measure the growing prominence of our seven emerging professional clusters relative to the overall labour market. We estimate that, in 2020, the featured professional clusters will represent 506 out of every 10,000 job opportunities—by 2022, this share will have risen to 611 out of every 10,000 job opportunities.

→ **Growth in these clusters and jobs is largest among care roles and smallest among green professions**. Building upon previous analysis from the World Economic Forum's 2018 *Future of Jobs Report*, which forecasts a figure of 133 million new jobs over the 2018–2022 period as the baseline, the emerging professions of the future analysed in this report will account for 6.1 million opportunities globally in 2020–2022. According to these assumptions, if current growth trends hold, these emerging professions will provide 1.7 million new jobs in 2020— and that figure will see a significant increase of 51% to 2.4 million opportunities by 2022. In the aggregate, over the coming three years 37% of projected job opportunities in emerging professions will be in the Care Economy; 17% in Sales, Marketing and Content; 16% in Data and AI; 12% in Engineering and Cloud Computing; and 8% in People and Culture. Current projections for Green professions remain low, with 117,200 openings (1.9%) projected for the period spanning 2020–2022.

→ **The highest-growth jobs of tomorrow span all seven profession clusters**. The roles with the highest rate of growth within high-volume jobs include Artificial Intelligence Specialists, Medical Transcriptionists, Data Scientists, Customer Success Specialists and Full Stack Engineers. Within lower-volume jobs, the highest growth is in Landfill Biogas Generation System Technicians, Social Media Assistants, Wind Turbine Service Technicians, Green Marketers and Growth Hackers.

→ **The highest-demand skills required in these emerging professional clusters span both technical and cross-functional skills**. Increasing demand for high-growth professions has further driven the value of a range of distinctive skill sets that underwrite these seven professional clusters and their promise of growth and prosperity in the new economy. These in-demand skills can be divided into five distinct skills clusters: Business Skills, Specialized Industry Skills, General and Soft Skills, Tech Baseline Skills and Tech Disruptive Skills. While some professional clusters—such as Data and AI and Engineering and Cloud Computing— require strong expertise in digital technologies, other high-growth professions place greater emphasis on Business Skills or Specialized Industry Skills.

Part 1
Opportunity in the Emerging Labour Market
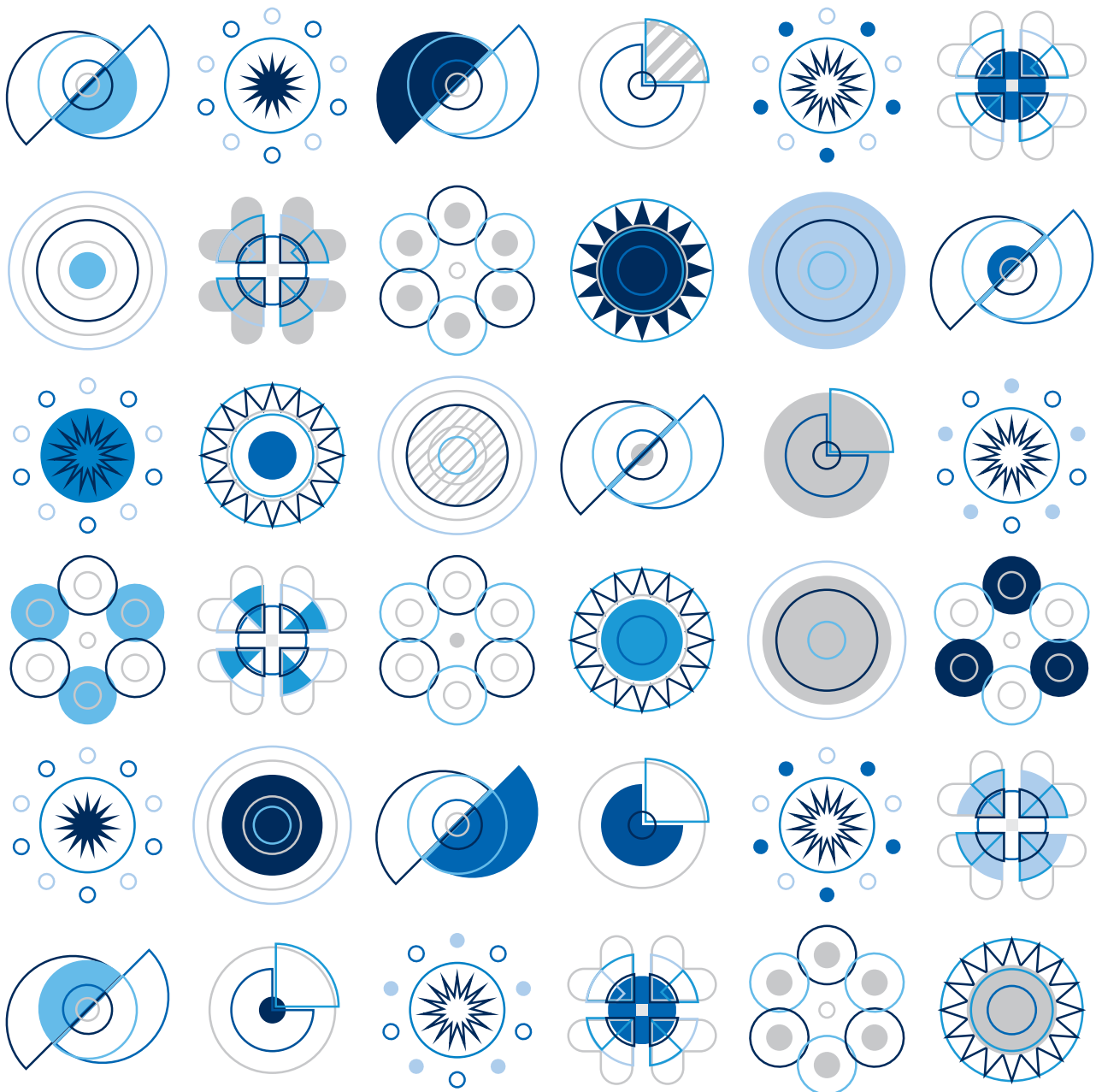
The Fourth Industrial Revolution, demographic change, industrial transitions and changing consumer needs are creating demand for millions of new jobs, with vast new opportunities for fulfilling people's potential and aspirations. Yet the threat of unequal opportunity, job displacement and widening income inequality seem ever more present. With societal unrest on the rise across much of the industrialized and emerging world, collaboration between the public and private sectors can advance an entirely different agenda—one in which people's futures as well as global economic prospects are enhanced by mobilizing worldwide mass action on better education, jobs and skills. Within this overarching vision, it is critical that new sources of data and innovative insight development help empower effective, efficient and coordinated action.

While the new labour market, spurred by advances in technologies such as data science and artificial intelligence, is changing at a rapid pace, new data and metrics can simultaneously reveal its composition and evolution with unprecedented detail, depth and dynamism. The approach to these issues outlined in this report is intended to contribute to the World Economic Forum's platform to create a "Reskilling Revolution" and new opportunities for as many as one billion people in the global labour market over the next 10 years.

Emerging Professions and Job Churn

Aggregate headline figures that track labour market dynamism typically reveal relatively modest annual changes in job growth. However, such figures mask a more dynamic reality. Those modest gains are commonly made not by the steady growth of existing firms, but result from the changes and churns of economic output and job shifts—from less to more successful firms, from shrinking to growing economic sectors, and from declining to emerging occupations.[1] In the United States, for example, over the three decades of 1977–2005, the annual share of newly created jobs—in existing and new firms, sectors and occupations—averaged 18% of total jobs. Over the same period, 16% of all jobs, on average, were lost annually due to firm closures and sectoral and occupational contractions, resulting in an annual net job growth rate of 2%, but an annual 34% 'job churn' rate.[2] Similar rates of annual 'job churn' are prevalent across major global economies (averaging 22% in developed economies during 1997–2004).[3]

In terms of absolute numbers of job openings in one year, in 2018, the US labour market saw 39 million job openings in a labour market of 156 million employed individuals.[4] Job openings might arise due to job transitions by those already in the labour market, because some individuals retire or exit the labour market, or due to economic demand to employ fewer or more individuals than have been employed in the past.

Importantly, irrespective of the aggregate gross or net number of newly created jobs or job openings, *the type of job opportunities* which open up will change with the needs of the evolving technological, demographic and economic context.[5] Over the next decade, a non-negligible share of newly created jobs will be in job openings for wholly new occupations, or for existing occupations undergoing significant transformations in terms of their job content and skills requirements. The importance of these emerging professions for fuelling future economic growth and domino effects in adjacent roles and sectors is considerable. According to one estimate, across the G20, fully meeting the labour market demand for emerging professions and skills to meet the needs of the new technological era could add US$11.5 trillion in GDP growth over the next decade.[6] For workers, these emerging professions may promise new, attainable pathways to social mobility and prosperity. The rate of emergence of new professions is only set to accelerate as a result of the advancing Fourth Industrial Revolution.

According to an estimate of the World Economic Forum's 2018 *Future of Jobs Report*, globally, the labour market transformation brought about by the Fourth Industrial Revolution may lead to the creation of 133 million new jobs and the simultaneous displacement of 75 million jobs over the 2018–2022 period.[7] Out of this total 'job churn', the report estimates that in 2018, wholly new roles accounted for 16% of all jobs—a share that will rise to 27% by 2022.[8] Further, this net positive job outlook will be concentrated in a set of newly emerging *professional clusters*.

In this report, the World Economic Forum for the first time takes an in-depth look into the 'black box' of new job creation, reviewing the shifting focus of employment to emerging professional clusters and the jobs of tomorrow, and to what fuels this growth and what skills will be required by these professions. These professions of the future reflect increasing demand for new services and products across global economies. Seven key professional clusters appear to be emerging in tandem. On the one hand, these reflect the adoption of new technologies—giving rise to greater demand for green economy jobs, roles at the forefront of the data and AI economy, as well as new roles in engineering, cloud computing and product development. On the other hand, emerging professions also reflect the continuing importance of human interaction in the new economy, giving rise to greater demand for care economy jobs; roles in marketing, sales and content production; as well as roles at the forefront of people and culture.

The analysis presented in this report is based on innovative metrics authored in partnership between the World Economic Forum's New Metrics CoLab initiative and data scientists at three partner companies: Burning Glass Technologies, Coursera, and LinkedIn. Through these collaborations, the report is able to provide innovative insights into emerging opportunities for employment across the global economy as well as unprecedented detail regarding the skill sets needed to leverage those opportunities. The report builds on an earlier piloted New Metrics collaboration and publication on *Data Science in the New Economy*.[9]

Mapping Emerging Occupations

In 2013, researchers Carl Benedikt Frey and Michael Osborne animated a new conversation about the nature of structural changes to labour markets set to displace the work performed by humans.[10] Over the following half-decade a significant amount of research has examined the ways in which the Fourth Industrial Revolution is creating demand for new skill sets, displacing existing jobs as well as giving rise to wholly new ones, with wide-ranging consequences for the return on skills in the form of wages and the prosperity of those in employment today.[11] This transformation affects all segments of the workforce, holding as much power to affect the livelihoods of those in low-skilled employment as it does professions underpinned by high-skilled expertise.[12]

Over the past five years, the World Economic Forum has tracked this unfolding transformation, identifying the potential scale of worker displacement[13] alongside strategies for empowering job transitions from declining to emerging roles.[14] In addition to forecasts led by company leaders at the forefront of decision-making, through the *Future of Jobs Report* in 2018, the Forum's *Towards a Reskilling Revolution: Industry-Led Action for the Future of Work* report modelled the opportunities for job transitions to new professions on the basis of skills similarity between a worker's current and potential future roles, as well as the needed reskilling investment. In addition, the report documented expert views on the wholesale change that will be needed to create prosperity in the new labour market, such as a shift to a skill-based hiring system focused on lifelong learning and flexible accreditation for navigating transitions in the labour market.[15]

To complement these earlier efforts, this report showcases an innovative approach to understanding the emergence of new, in-demand professions, as well as their accompanying skills requirements. Similar to a number of other recent research efforts to document the changing jobs landscape,[16] the approach taken in this report is one of, first, 'real-casting' recent trends in employment. These efforts were undertaken in partnership with two firms that hold unique data that speaks to job opportunities in the new economy: LinkedIn and Burning Glass Technologies. The companies identified sets of professions with increasing job prospects across key economies globally. This specific approach does not model the potential effects of changes in consumer demand, population size, trade flows or a range of other macro-economic and demographic factors that are typically included in long-term models such as those developed by the International Labour Organization[17] or the United States Bureau of Labor Statistics.[18] Instead, it is built on recent historic trend data from online job postings, hiring rates and LinkedIn's Economic Graph research,[19] tracking in near-real time the transformations underway in the global labour market.

In this report, emerging professions are defined as those that have experienced the most growth over the previous five years. To arrive at these figures, the New Metrics collaborators approximate the number of job opportunities across different professional clusters by refining two sources of data.

LinkedIn tracks the number of professionals who are hired into new opportunities. The data scientists at LinkedIn identified the 20 job roles that have seen the most growth over the past five years in 20 major economies, representing 45% of global economic output.[20] Roles that demonstrated growth in only one specific economy were excluded from the analysis, resulting in a shortlist of 99 emerging roles, which were then aggregated into professional clusters. Innovatively, these professional clusters are defined from the "bottom up", according to the distinctive skill sets required for the performance of those roles. To identify these clusters, LinkedIn uses its Skills Genome metric, which calculates the 30 'most representative' skills across the 99 emerging roles, using the TF-IDF method[21] to identify the most popular but also most unique skills within each role. Opportunities were then clustered according to this distinctive Skills Genome metric.[22] The application of these methods resulted in seven empirically distinctive occupational clusters: Data and AI; Engineering; Cloud Computing; People and Culture; Product Development; Marketing; Sales and Content.[23] For concise presentation in this report, a number of these clusters were then further re-aggregated into professional families: Engineering *and* Cloud Computing as well as Marketing *and* Sales and Content. This results in five unique professional clusters representing 66 of the original 99 opportunities derived from the LinkedIn data.

In addition to the five professional clusters identified above, recent analyses of global and local labour market trends have identified strong job growth in two professional clusters: Green Economy jobs and Care Economy jobs.[24] Comparative international data sets do not currently exist for these two growing professions. Burning Glass Technologies tracks the number of job openings posted in digital job boards globally and for this report has focused on roles located in the United States.[25] Therefore, Burning Glass Technologies used the United States Department of Labor's detailed professional categorization (O*NET) and the subset of its job postings data that capture US-based positions to identify 15 emerging roles in these two categories. The Care Economy professional cluster was defined directly in reference to a set of pre-established health and care support professions.[26] By contrast, the Green Economy cluster still lacks some definition in the existing US labour market taxonomy. In response, Burning Glass Technologies data scientists identified Green professions through a combination of two measures: 1), the existing O*NET categorization of Green tasks in combination with, 2), a bespoke 'Green score' defined within the Burning Glass Technologies skills taxonomy. Through this approach, the data scientists at Burning Glass Technologies mapped 56 Green occupations in the US economy that contain 'Green tasks' or require 'Green skills'. Both professional clusters were then further pared down to the 15 job roles that exhibit the highest growth.

In sum, the resulting 96 roles represent a unique data set of jobs of tomorrow within seven professional clusters

that have demonstrated the highest growth over the past five years. Notably, these seven clusters vary in their individual rate of growth and in the scale of job opportunities they offer in the aggregate. As an innovative feature of this report, the 'scale of job opportunities' is measured as the number of available positions within a given professional cluster for every 10,000 job opportunities offered across the global labour market. In other words, the report measures the growing prominence of the seven emerging professional clusters relative to the overall labour market. For example, by the end of 2020, the Data and AI professional cluster will represent 78 out of every 10,000 job opportunities—by 2022, this share is expected to rise to 100 out of every 10,000 job opportunities (Figure 1).

Figure 1: Emergence of clusters of professions of the future, 2020-2022

	Number of opportunities (per 10,000)	
Professional Cluster	**2020**	**2022**
figures extrapolated from data for 20 economies (LinkedIn)		
Data and AI	78	123
Engineering and Cloud Computing	60	91
People and Culture	47	58
Product Development	32	44
Sales, Marketing and Content	87	125
figures extrapolated from data for the United States (Burning Glass)		
Care Economy	193	260
Green Economy	9	14
ALL CLUSTERS	**506**	**715**

Note
Number of opportunities refers to the number of new opportunities for every 10,000 opportunities in the labour market and is calculated as a compound average annual growth rate.

Sources
LinkedIn and Burning Glass Technologies.

Quantifying the Jobs of Tomorrow

Taking the World Economic Forum's 2018 *Future of Jobs Report* figure of 133 million new jobs over the 2018–2022 period as the baseline, and using the aggregate figure for number of opportunities per 10,000 new opportunities, the emerging professions of the future analysed in this report will account for 6.1 million opportunities globally over the course of 2020–2022. According to these assumptions, if current growth trends hold, these emerging professions will provide 1.7 million new jobs in 2020—and that figure will see a significant increase of 51% to 2.4 million opportunities by 2022.

Figure 2 plots the scale of opportunity against the annual growth rate of each professional cluster. It shows that the Care Economy professional cluster is by far the most in-demand, followed by Sales, Marketing and Content as well as by Data and AI. The professional clusters that exhibit the highest growth rates are the Data and AI, Green Economy, and Engineering and Cloud Computing professional clusters, with annual growth rates of 41%, 35% and 34%, respectively.

In the aggregate, this report estimates that over the coming three years, 37% of job openings in emerging professions will be in the Care Economy; 17% in Sales, Marketing and Content; 16% in Data and AI; 12% in Engineering and Cloud Computing; and 8% in People and Culture. Current projections for Green Economy professions remain more subdued, with a projected 117,200 openings, which amounts to just 1.6% of emerging job openings in the period spanning 2020–2022.
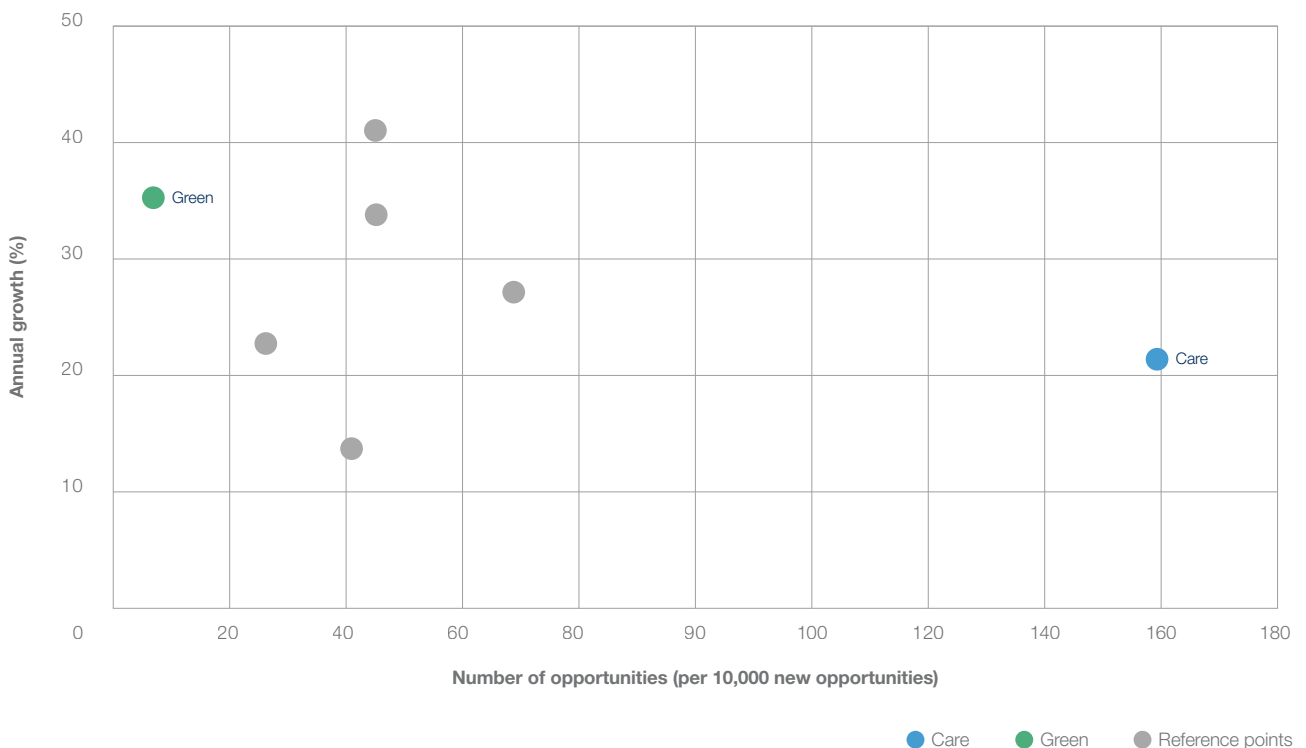
Figure 2: Opportunities by selected professional cluster, 2014-2019

2a. Figures extrapolated from data for 20 economies
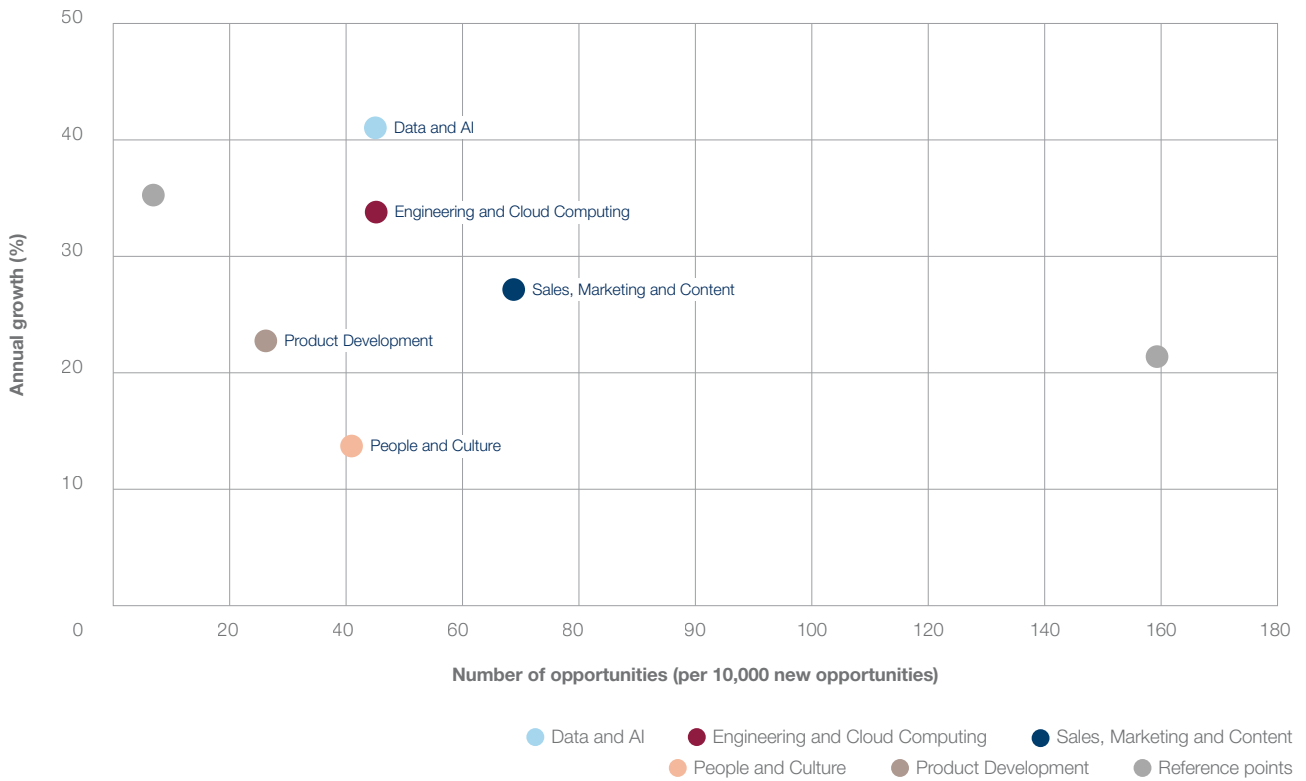
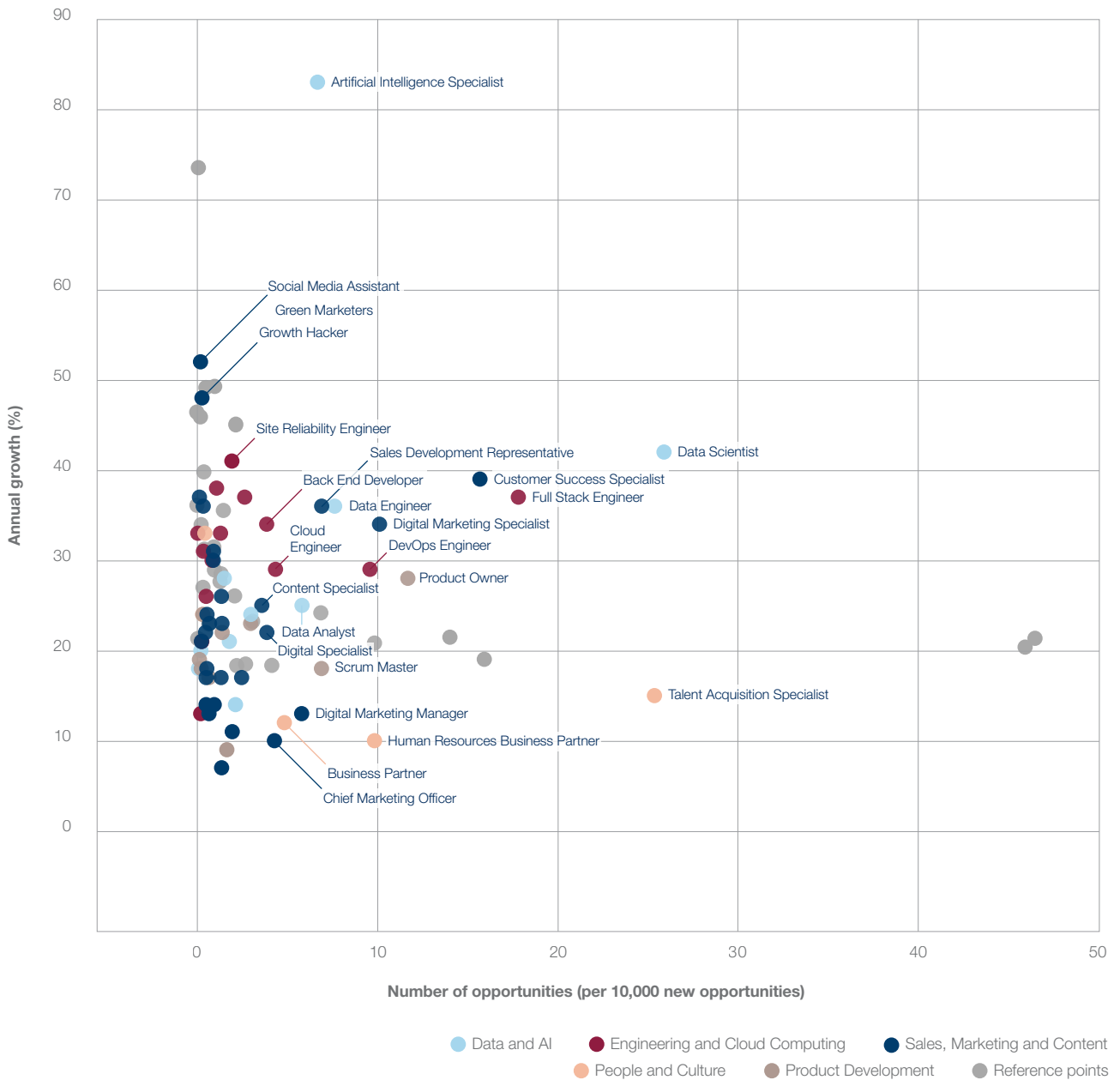### 2b. Figures extrapolated from data for the United States

Figure 3: Opportunities by selected professional cluster and occupation, 2014-2019

3a. Figures extrapolated from data for 20 economies

Annual growth (%)

- Artificial Intelligence Specialist
- Social Media Assistant
- Green Marketers
- Growth Hacker
- Site Reliability Engineer
- Sales Development Representative
- Data Scientist
- Back End Developer
- Customer Success Specialist
- Data Engineer
- Full Stack Engineer
- Cloud Engineer
- Digital Marketing Specialist
- DevOps Engineer
- Product Owner
- Content Specialist
- Data Analyst
- Digital Specialist
- Scrum Master
- Talent Acquisition Specialist
- Digital Marketing Manager
- Human Resources Business Partner
- Business Partner
- Chief Marketing Officer

Number of opportunities (per 10,000 new opportunities)

- Data and AI
- Engineering and Cloud Computing
- Sales, Marketing and Content
- People and Culture
- Product Development
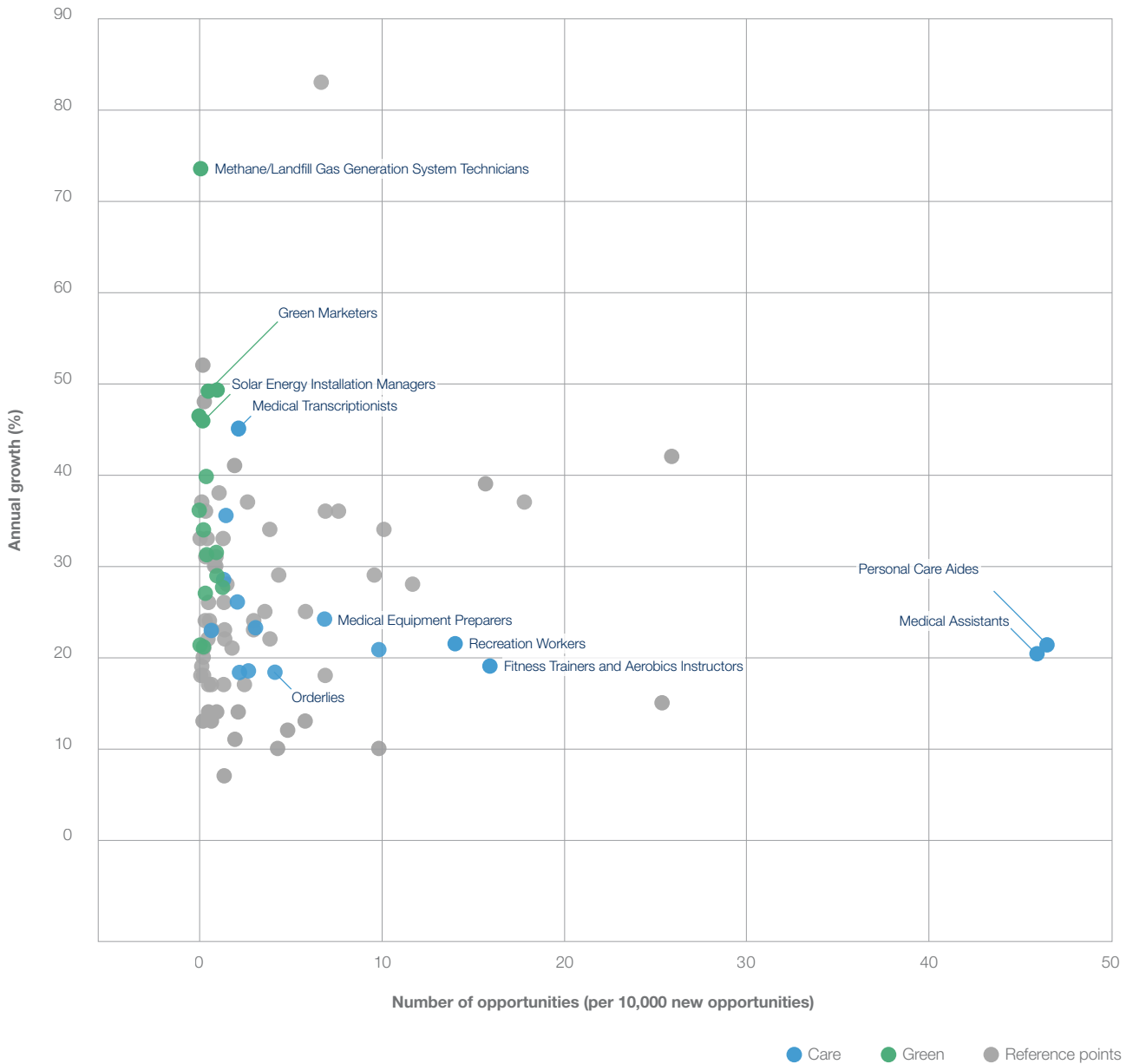- Reference points

Source
LinkedIn.

Of these figures, the absolute number of opportunities in Green Economy jobs and Care Economy jobs are most likely to change in tandem with new and unpredictable shifts in government legislation and business practices. New government regulations or investment programmes in the Green Economy, such as a wholesale update of the utilities infrastructure for renewable energy, may have a dramatic impact on the absolute number of Green Economy roles. In addition, various social and demographic trends may have an impact on the overall outlook for Care Economy roles: The ongoing transition of women into the labour market is certainly a driver of demand for the Care Econ-

omy, changing demographic structures might expand the demand for eldercare, while changing socio-cultural norms might expand demand for leisure activity workers. Figure 3 reveals more granular insights into these fast-growing roles, plotting the scale of opportunities against their rate of change over the previous five years.

The Care Economy professional cluster includes some of the most in-demand roles in the United States, including Medical Assistants, Personal Aides and Fitness Instructors. In tandem, the Green Economy professional cluster includes some of the fastest-growing professions, in particular, Solar Energy Installers, Methane Gas Gener-

3b. Figures extrapolated from data for the United States

Annual growth (%) (y-axis)

Number of opportunities (per 10,000 new opportunities) (x-axis)

Labeled points:
- Methane/Landfill Gas Generation System Technicians
- Green Marketers
- Solar Energy Installation Managers
- Medical Transcriptionists
- Medical Equipment Preparers
- Recreation Workers
- Fitness Trainers and Aerobics Instructors
- Orderlies
- Personal Care Aides
- Medical Assistants

Legend: ● Care ● Green ● Reference points

ation Technicians and Green Marketers, although overall numbers remain low.

In the Data Science and AI cluster, the role of Artificial Intelligence Specialist is the fastest-growing new economy role; however, the absolute number of opportunities for this profession is relatively low. On the other hand, Data Scientist positions have slower annual growth rates but form the third-largest opportunity among the set of growing professions. In Sales, Marketing and Content, the critical new opportunities include Digital Marketing Specialists, Content Specialists and Customer Success Specialists. In Engineering and Cloud Computing, they include DevOps Engineers and Full Stack Engineers.

Additional details about the prospects of specific emerging roles are provided in the tables featured in Part 2: Professions in Focus.

Identifying Rising Demand for Skill Sets

Increasing demand for high-growth professions has further driven the value of a range of distinctive skill sets that underwrite these seven professional clusters and their promise of growth and prosperity in the new economy. New data gathered by LinkedIn and Burning Glass Technologies reveals that these in-demand skills span a diverse set of competencies. Based on a taxonomy first developed by LinkedIn with the World Bank[27], this report groups these skills into skills clusters: Business Skills, Specialized Industry Skills, General and Soft Skills, Tech Baseline Skills and Tech Disruptive Skills.

Business Skills are the set of skills required to operate or start an enterprise. The cluster includes skills such as Marketing, Project Management, Budgeting and Business Development. Specialized Industry Skills are specific to the field of the professions in question, such as Documentation in Cloud Computing, Video and Editing in Marketing, Sales and Content or Radiation Oncology (in the Care Economy professional

cluster). The cluster *excludes* skills related to the operation and design of digital technologies. General skills (otherwise known as cross-functional skills) are typically non-cognitive capabilities which are needed across all professions. These include Leadership, Communication, Negotiation, Creativity and Problem-Solving. LinkedIn has mapped most General Skills into a Soft Skills cluster, which includes attitudinal and behavioural skills such as Leadership. The General Skills and Soft Skills clusters remain unharmonized between the two data sets. Tech Baseline Skills span Basic Computer Literacy, such as the ability to use the Microsoft Productivity Suites, alongside industry-specific applications of technology such as Web Design, Online Marketing, Social Media, Telecommunications, Drafting and Engineering Design Software, as well as Medical and Clinical Software. Finally, Tech Disruptive Skills are those that allow individuals to use and design technologies that are set to impact business models and the labour market in significant ways over the coming years. These include Data Science, Natural Language Processing, Automation, Robotics, Cloud Computing and Cybersecurity.

For concise presentation in this report, the taxonomies

Figure 4: Share of skills clusters by selected professional cluster

4a. Figures extrapolated from data for 20 economies

Source
LinkedIn.

4b. Figures extrapolated from data for the United States
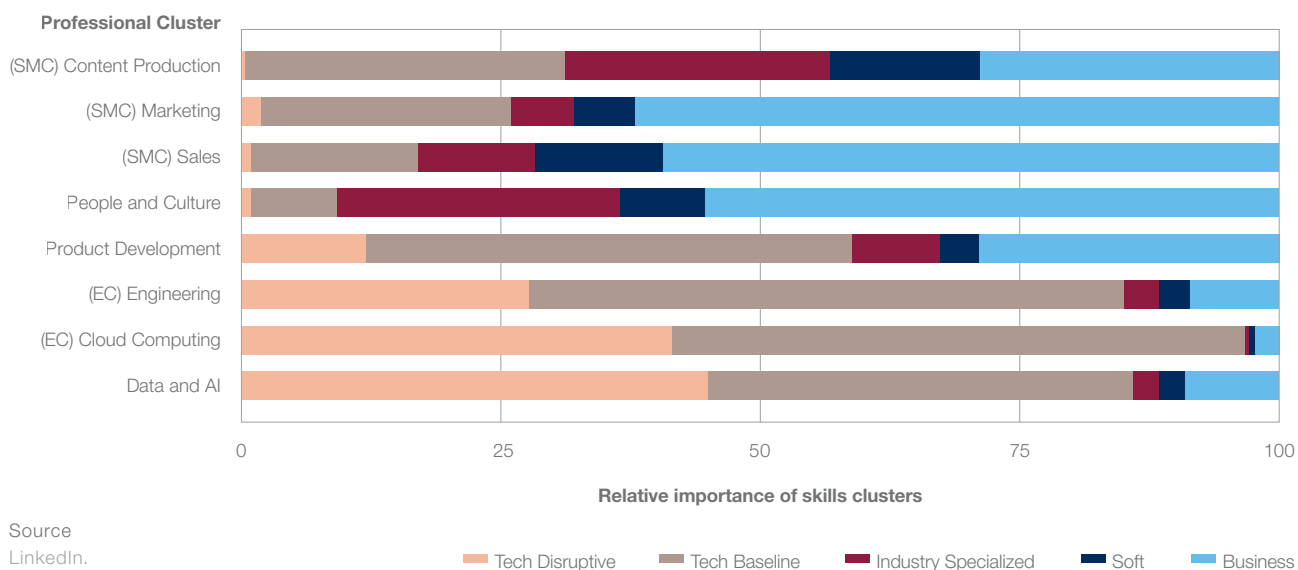
Source
Burning Glass Technologies.
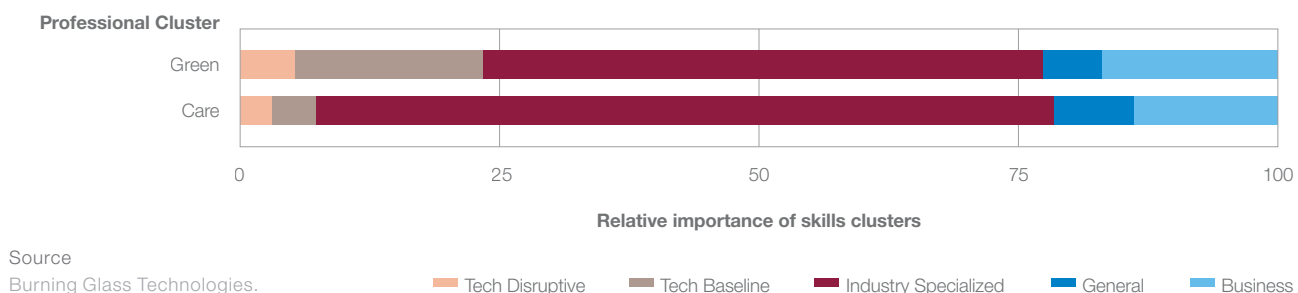
Figure 5: Variety of skills within the baseline technical skills cluster, Care and Green professions

Care

Skills Cluster | Share of postings

Medical Billing and Coding — ~19
Telecommunications — ~17
Clinical Informatics — ~13
Operating Systems — ~12
Social Media — ~11
Auditing — ~4
Graphic and Visual Design — ~4
Health Care Procedure and Regulation — ~3
Enterprise Resource Planning (ERP) — ~2
Customer Relationship Management (CRM) — ~1.5

(x-axis: 0, 5, 10, 15, 20, 25 — Share of postings)

Green

Skills Cluster | Share of postings

Drafting and Engineering Design — ~22
Graphic and Visual Design — ~17
Social Media — ~16
Engineering — ~8
Geographic Information System (GIS) — ~7
Web Analytics — ~5
Online Marketing — ~3
SQL Databases and Programming — ~2.5
Data Analysis — ~2
Project Management — ~2

(x-axis: 0, 5, 10, 15, 20, 25 — Share of postings)

used by each of the Forum's New Metrics partners have been harmonized to a shared standard. The current harmonization remains preliminary and, globally, more efforts are needed to create a shared language of the labour market in the form of a commonly agreed upon skills taxonomy and broadly shared standards for tracking labour market trends across economies. The basis of the skills grouping presented above was formulated in a three-year technical collaboration between the World Bank and LinkedIn.[28] To compute a detailed skills profile for each featured profession of the future, the data scientists at LinkedIn identified the most distinctive skills for each profession by prioritizing skills that are most critically important within an industry through a computational weight based on the frequency with which a skill appears across all professions. This method produced the 30 most representative skills for each profession and professional cluster. The resulting metric represents the share of each of the skills clusters as a proportion of the most distinctive skills for each profession and professional cluster. For the purposes of this report, the data shared by Burning Glass Technologies has been harmonized to correspond to these approaches for comparative purposes. As such, the entries for the Care Economy and Green Economy job clusters should be considered as indicative and preliminary.

While some professional clusters—such as Data and AI and Engineering and Cloud Computing—primarily require strong expertise in digital technologies, other high-growth professions place greater emphasis on Business Skills or Specialized Industry Skills. Figure 4 presents these skill sets as a share of the thirty most important and unique skills for each cluster of emerging professions of the future. Marketing, Sales and Content roles place greater emphasis on Business Skills. Professional opportunities within the Care Econ-

omy cluster require a more significant share of Specialized Industry Skills such as Medical Transcription, Sterilization and Vital Signs Measurement. Similarly, in the Green Economy professional cluster, Specialized Industry Skills—which focus on Health and Safety Standards, Wind Turbines, Solar Installation and Electrical Schema—are prominent.

Tech Disruptive Skills are most commonly required in the Data and AI professional cluster, where they make up 45% of the top 30 skills required, and in Cloud Computing roles, where the corresponding share is 41%. Tech Baseline Skills are important across all emerging professions. They are most critical for in-demand roles in Engineering and Cloud Computing as well as Product Development, where they make up 56% and 47% of the top in-demand skills, respectively. The demand for Tech Baseline Skills is least significant in People and Culture, Care Economy and Green Economy professions, at 8%, 3% and 18%, respectively.

The broad label 'Tech Baseline Skills' contains a significant variety of in-demand digital skills. Figure 5 displays the variety of these skills for the Care Economy and Green Economy professional clusters. This analysis is built on a taxonomy of Digital Skills developed by Burning Glass Technologies. It showcases the demand for employees with skills in the technical tools which are distinctive to their chosen profession.[29] The data shows that the Care Economy professional cluster requires distinctive technical skills for use in Medical Billing and Clinical Informatics software. For Green Economy professionals, technical skills demand is oriented towards Drafting and Engineering Design and Geographic Engineering Systems. Additional details about the key skills requirements of specific emerging roles are provided in Part 2.

Mapping Distinctive Learning Trajectories and Skills Capabilities

Shifts in pathways towards economic growth are commonly reflected in changing demand for distinctive skill sets and professions. These requirements give rise to varied priorities for additional learning among the individuals employed in the seven professional clusters presented in this report.

Through a data and research collaboration with online learning provider Coursera, this report provides innovative insights into the reskilling and upskilling efforts undertaken by individuals in emerging professions. Data scientists at Coursera have created a taxonomy of the skills content of online courses and assessments, drawing on insights from learners and instructors on the Coursera platform. Tracking the learning activities of individuals employed in emerging professions

in the aggregate reveals the distinctive priorities for upskilling in those fields. For example, online learners employed in Care Economy roles are focused on courses such as Patient Safety and skills within that area of focus, such as problem-solving and design thinking. For the Data and AI professional family, a course on Deep Learning is ranked first as it teaches in-focus skills such as Tensorflow and Artificial Neural Networks. This prioritization is shared in the Engineering and Cloud Computing professional cluster. Marketing, Sales and Content professionals are focused on updating their skills in areas such as Digital Marketing and Strategies for Content Management. People and Culture professionals have a distinctive focus on updating their skills in People Analytics. Finally, professionals in Green Economy roles look to expand their learning into Geographic Information Systems (GIS), and those in Product Development roles have a particular focus on agile methodologies. Additional details about the learning priorities of specific emerging professional clusters are provided in Figure 6.

Figure 6: Priorities for additional learning among online learners

Care Professions

1. **The Science of Well-Being**

   SKILLS TAUGHT   Kindness, Meditation, Savoring, Happiness, Gratitude

2. **Essentials in Clinical Simulations Across the Health Professions**

   SKILLS TAUGHT   Debriefing, Learning, Simulation

3. **Nursing Informatics Leadership**

   SKILLS TAUGHT   Nursing, Exercise, Mentorship, Leadership

4. **Patient Safety**

   SKILLS TAUGHT   Problem-Solving, Design Thinking, Leadership, Patient, Safety

5. **Vital Signs: Understanding What the Body Is Telling Us**

   SKILLS TAUGHT   Pain Management, Human Error Assessment And Reduction Technique, Pain, Vital Signs, Digital Signature

Data and AI

1. **Deep Learning**

   SKILLS TAUGHT   Hyperparameter, Deep Learning, Artificial Neural Network, Convolutional Neural Network, Tensorflow

2. **TensorFlow in Practice**

   SKILLS TAUGHT   Natural Language, Omega Language, Environment Variable, Time Series, Natural Language Processing

3. **IBM Data Science**

   SKILLS TAUGHT   Computer Programming, Data Analysis, Machine Learning, Python Programming, Sql

4. **Advanced Machine Learning**

   SKILLS TAUGHT   Natural Language Processing, Bayesian Inference, Reinforcement Learning, Bayesian, Computer Vision

5. **Applied Data Science with Python**

   SKILLS TAUGHT   Matplotlib, Code Segment, Pandas, Machine Learning, Network Analysis

Engineering and Cloud Computing

1. **Deep Learning**
   SKILLS TAUGHT   Hyperparameter, Deep Learning, Artificial Neural Network, Convolutional Neural Network, Tensorflow

2. **Machine Learning**
   SKILLS TAUGHT   Linearity, Machine Learning Algorithms, Artificial Neural Network, Algorithms, Machine Learning

3. **Algorithms, Part I**
   SKILLS TAUGHT   Computer Programming, Data Uri Scheme, Java (Software Platform), Data Structure, Algorithms

4. **TensorFlow in Practice**
   SKILLS TAUGHT   Natural Language, Omega Language, Environment Variable, Time Series, Natural Language Processing

5. **Functional Programming in Scala**
   SKILLS TAUGHT   Parallel Computing, Functional Programming, Scala Programming, Apache Spark, Computer Programming

Green Professions

1. **Natural Attenuation of Groundwater Contaminants: New Paradigms, Technologies, and Applications**
   SKILLS TAUGHT   Hydraulics, Geology, Chemistry

2. **Geographic Information Systems (GIS)**
   SKILLS TAUGHT   Data Analysis, Arcgis, Imagery Analysis, Model Building, Geographic Information Systems

3. **Global Environmental Management**
   SKILLS TAUGHT   Natural Resources, Urban Planning, Green Technology, Environmental Protection, Water Resource Development

4. **Water Resources Management and Policy**
   SKILLS TAUGHT   Environmental Protection, Policy Analysis, International Law, International Relations, Law

5. **Fundamentals of GIS**
   SKILLS TAUGHT   Workflow, Troubleshooting, Software, Spatial Data Analysis, Data Analysis

Marketing, Sales and Content

1. **Digital Marketing**
   SKILLS TAUGHT   Data Analysis, Marketing Analytics, Analytics, Digital Marketing, Marketing

2. **Search Engine Optimization (SEO)**
   SKILLS TAUGHT   Mathematical Optimization, Social Media, Content Marketing, Marketing, Search Engine Optimization

3. **The Strategy of Content Marketing**
   SKILLS TAUGHT   Writing, Marketing Content Development, Copywriting, Content Marketing, Marketing

4. **Viral Marketing and How to Craft Contagious Content**
   SKILLS TAUGHT   Social Media, Marketing Strategy, Social Network, Viral Marketing, Marketing

5. **The Science of Well-Being**
   SKILLS TAUGHT   Kindness, Meditation, Savoring, Happiness, Gratitude

People and Culture

1. **Human Resource Management: HR for People Managers**

   SKILLS TAUGHT   Onboarding, Performance Management, Human Resources, Management, Performance

2. **Introduction to People Analytics**

   SKILLS TAUGHT   Human Resources, Measurement, Employment, Employee Engagement, Analytics

3. **Recruiting, Hiring, and Onboarding Employees**

   SKILLS TAUGHT   Management, Employment, Recruitment, Onboarding

4. **Managing Employee Compensation**

   SKILLS TAUGHT   Human Resource Management, Human Resources, Compensation Strategies, Management, Compensation And Benefits

5. **Preparing to Manage Human Resources**

   SKILLS TAUGHT   Resource Management, Human Resources, Management

Product Development

1. **Digital Product Management: Modern Fundamentals**

   SKILLS TAUGHT   Product/Market Fit, Product (Business), Product Management, Management, Product

2. **Software Product Management**

   SKILLS TAUGHT   Software Metrics, Finger Protocol, Agile Software Development, User Story, Software Development

3. **Agile Development**

   SKILLS TAUGHT   Persona (User Experience), Agile Management, Design Sprint, Management, Software Testing

4. **AI for Everyone**

   SKILLS TAUGHT   Project Plan, Management, Planning, Ethics, Project

5. **Introduction to Software Product Management**

   SKILLS TAUGHT   Finger Protocol, Software Product Management, Agile Software Development, Software Development, Agile Manifesto
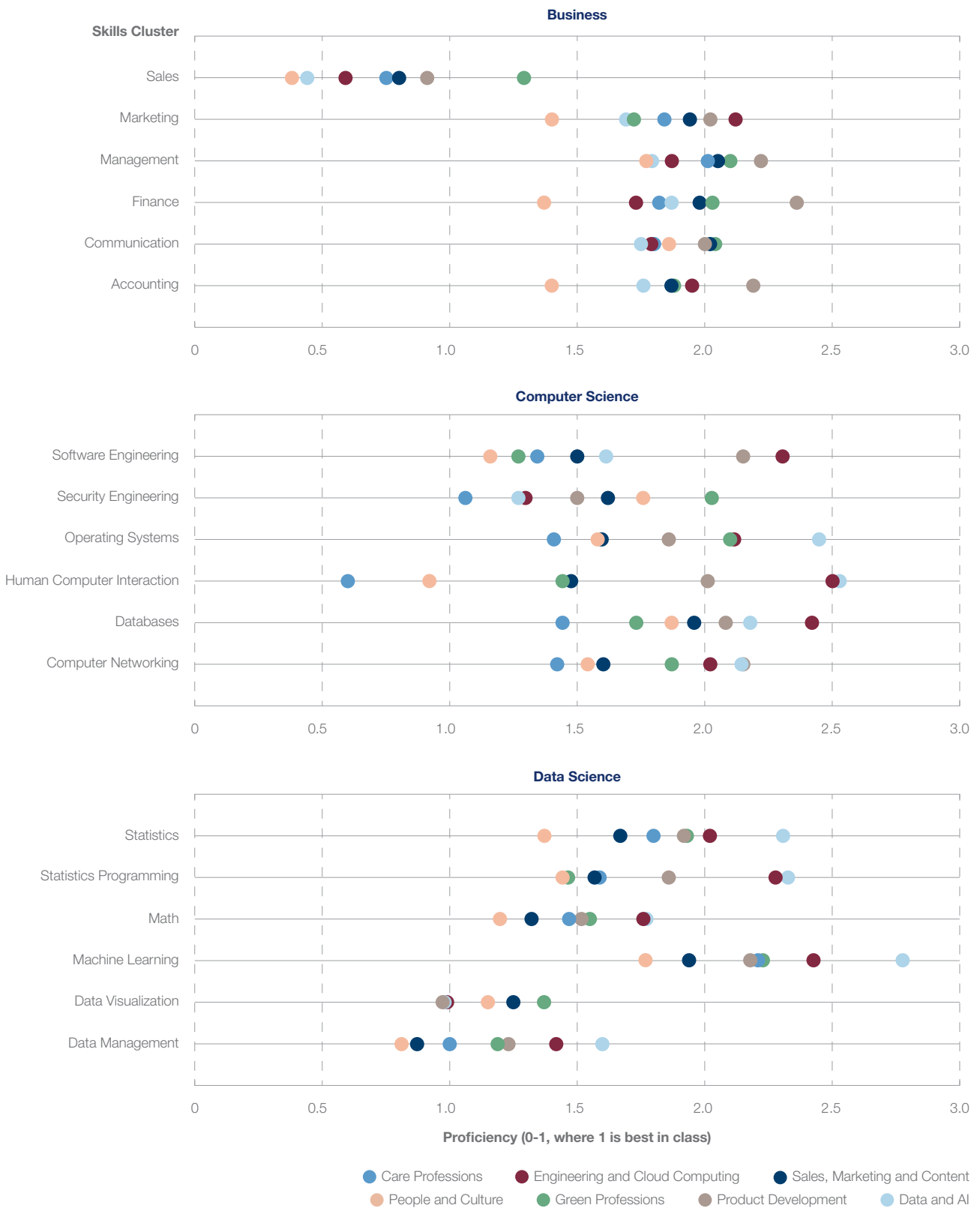
Source
Coursera.

New metrics about the courses and associated assessments that learners take on Coursera's online learning platform may also offer fresh insights into the assessed abilities of online learners against common measurement criteria. To this end, Coursera data scientists have developed a skills profile for each learner. That distinctive skills profile is based on each learner's performance across all attempted assessments on the learning platform. Figure 7 illustrates the comparative strengths and weaknesses of learners employed in each of the professional clusters identified in this report against a set of future-oriented skills proficiencies.

Specifically, Coursera's data scientists have developed a Global Skills Index that evaluates learners across a common set of critical future-oriented skills organized into three skills clusters: Business, Computer Science and Data Science. Learners employed in each of the seven emerging professional clusters may therefore be evaluated on these skills. Across the measured capabilities, the People and Culture professional cluster shows consistently low skills outcomes, as do individuals employed in the Care Economy professional cluster. Individuals employed in emerging professions in Data and AI as well as in Engineering and Cloud Computing are at the forefront of skills capacity in Computer and Data Science but underperform on Communication and Sales skills. The Product Development professional cluster demonstrates strong capabilities in Business skills and, to a lesser degree, strong outcomes in Software Engineering, Databases and Machine Learning. Green Economy professionals demonstrate relative strengths in Business Skills, Security Engineering and Computer Networking, Machine Learning, Data Management and Statistics. They underperform in newly emerging skills such as Statistical Programming, Data Visualization and Human-Computer Interaction.

Figure 7: Current key skills proficiency by professional cluster

Business

Skills Cluster

- Sales
- Marketing
- Management
- Finance
- Communication
- Accounting

Computer Science

- Software Engineering
- Security Engineering
- Operating Systems
- Human Computer Interaction
- Databases
- Computer Networking

Data Science

- Statistics
- Statistics Programming
- Math
- Machine Learning
- Data Visualization
- Data Management

Proficiency (0-1, where 1 is best in class)

- ● Care Professions
- ● Engineering and Cloud Computing
- ● Sales, Marketing and Content
- ● People and Culture
- ● Green Professions
- ● Product Development
- ● Data and AI

Conclusion

For the past decade of technological, social and economic disruption the possibility of extensive job losses and untenable skills inflation have raised significant public concern. Wage employment forms the bedrock of prosperity for citizens across the global economy with fair and stable work guaranteeing the livelihoods of individuals and families. To date, the conclusions drawn from a significant body of analysis appear to offer both hope and caution. Few analysts propose that technological disruption will lead to shrinking opportunities in the aggregate, and many of the insights gathered point to the emergence of new job opportunities across labour markets. However, the type of opportunities that are set to materialize are also changing fast, in tandem with the evolving needs of the technological and economic context—demanding pragmatic and effective mechanisms to support workers' transitions to the new opportunities that lie ahead.

Jobs of Tomorrow: Mapping Opportunity in the New Economy identifies the seven key professional clusters with emerging prospects across in the future of work: Data and AI; Care Economy; Green Economy; Engineering and Cloud Computing; People and Culture; Product Development; as well as Sales, Marketing and Content. Collectively, these professions are set to yield 6.1 million new job opportunities in the coming three years.

The report has taken a data-driven, quantitative approach to identifying those critical professional clusters. New computing and data capabilities are offering unprecedent insights into the labour market. By live-casting the actual labour market and developing new skills taxonomies that reflect the skills language in use across that market, the metrics shared by private sector companies provide a critical new tool which can help orient employers, governments and workers who wish to plan an adequate, timely reskilling and upskilling agenda.

The approach taken to mapping these professions has the capacity to be both methodologically expanded and more broadly piloted with a view to creating sustainable systems for providing labour market information in near real-time. Existing skills taxonomies of global labour markets lack the granularity and agility to track changes in the demand for industry specialized skills and for baseline and disruptive technical skills. Additional focus is needed to develop skills taxonomies that can monitor new disruptive skills, unique industry skills and critical core skills simultaneously.

The seven professions of the future outlined in this report, and their corresponding skills needs, reflect the significant diversity of opportunity in the labour market, and offer opportunities for both high- and low-skilled employment. Despite overwhelming public focus on disruptive technological skills, this report shows the diverse skill sets in demand in the future. While disruptive technology skills such as data science and AI skills will certainly be critical to the future of work, so will caregiving, leadership, and the ability to provide learning and development. In other words, the transition to the new world of work will be both human- *and* tech-centric.

Finally, the growth and absolute scale of a number of those professions will be distinctively determined by the choices and investment made by governments today. New investments in the Green Economy, such as a focus on renewable energy, have the potential to lead to expanding employment prospects in this sector. In addition, renewed focus on closing gender gaps in labour force participation can drive further demand for Care Economy jobs, as can better quality standards in the care sector. Similarly, new data regulation has already increased demand for workers who can untangle the ethical and regulatory requirements of big data storage, collection and use.

This report demonstrates that we have at our fingertips tools that offer unprecedented, granular insight into the nature of opportunity in the labour market. The emerging imperative is to use such tools wisely and in the service of workers in their quest for productive, fulfilling employment.

Part 2
Professions of the Future in Focus
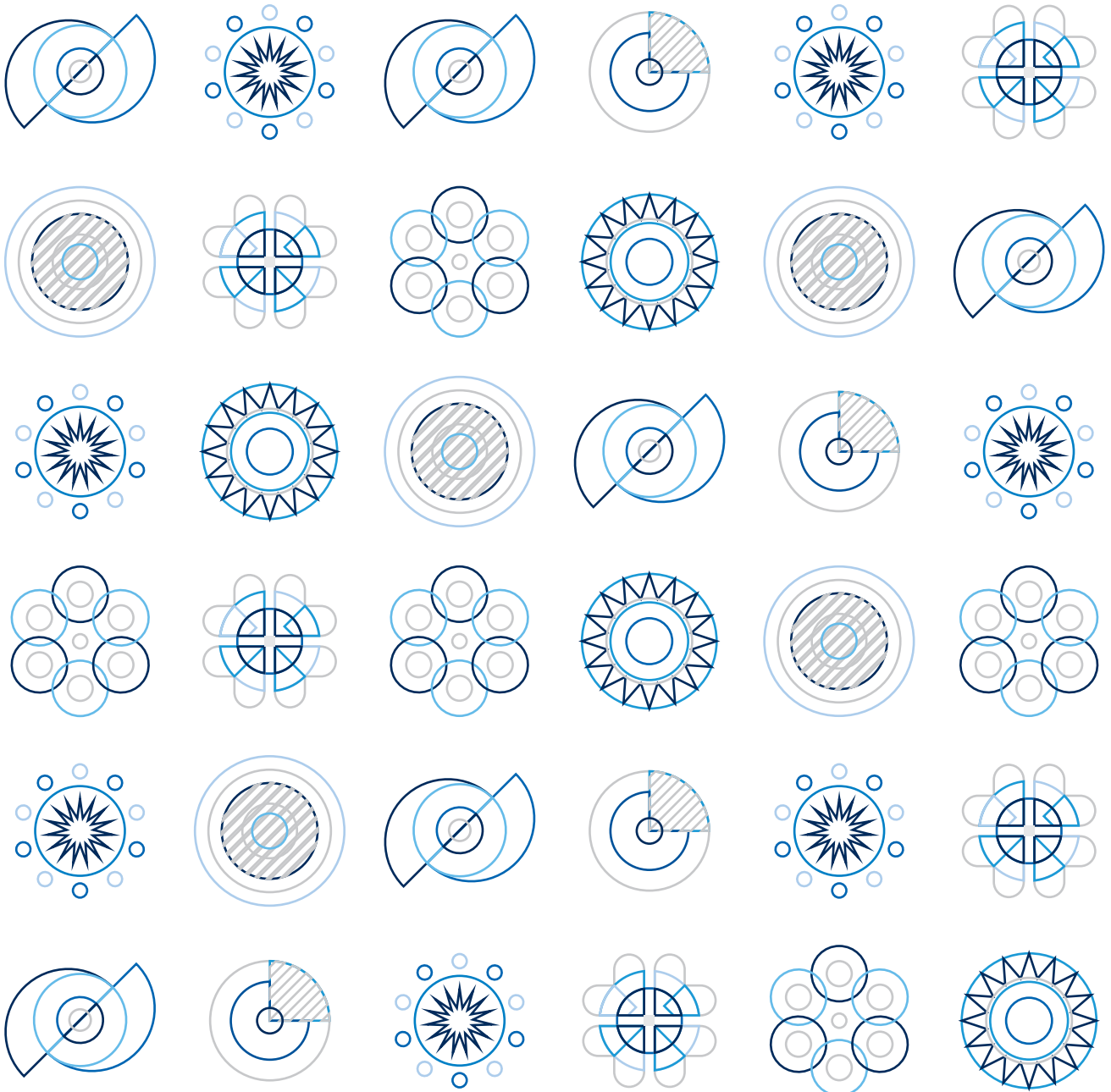
The insights provided by new sources of data provide truly granular understanding into opportunity in the new economy at scale. Part 2 of the report outlines both the top roles against each of the seven professional clusters and the key skills needed to be proficient in those roles. These snapshots differentiate between large-scale and small-scale opportunities where large-scale opportunities present more than 5,000 job postings or new hires in any one year. Skills are qualified according to their type. For example, Digital Marketing and Product Marketing are among the top 10 Business Skills required in the Care Economy, which includes professions such as Personal Care Aides and Athletic trainers.

Data and AI professions require skills in Artificial Intelligence and Data Storage Technologies, and include small-scale roles such as Big Data Developers alongside large-scale roles such as Data Scientists. Engineering and Cloud Computing requires Technology baseline skills such as Computer Networking skills and Technology disruptive skills such as Human Computer Interaction across roles such as Full Stack Engineers and DevOps Engineers. The Green Economy cluster requires Industry Specialized skills such as Wind Turbines and Solar Installation as well as Business Skills such as Email Marketing across roles such as Solar Photovoltaic Installers and Green Marketeers. The Product Development cluster requires Tech Baseline Skills such as Software Testing and Web Development as well as Business skills such as Manufacturing Operations. The roles which are included in this cluster include large-scale opportunity roles such as Agile Coaches, Product Owners and Product Analysts. Sales, Marketing and Content professions require Tech Baseline skills such as Social Media and Soft skills such as Leadership. The roles that require such skills span large-scale opportunities such as Digital Marketing Specialists.

Care Economy

Emerging Jobs

1. Medical Transcriptionists
2. Physical Therapist Aides
3. Radiation Therapists
4. Athletic Trainers
5. Medical Equipment Preparers
6. Veterinary Assistants and Laboratory Animal Caretakers
6. Exercise Physiologists
8. Recreation Workers
8. Personal Care Aides
8. Respiratory Therapists
11. Medical Assistants
12. Fitness Trainers and Aerobics Instructors
13. Occupational Health and Safety Technacians
13. Orderlies
13. Healthcare Support Workers, All Other

Top 10 Skills

1. Respiratory Therapy
2. Caregiving
3. Sterile Procedures / Techniques
4. Transciption
5. Radiation Treatment
6. Medical Dosimetry
7. Vital Signs Measurement
8. Simulation
9. Advanced Cardiac Life Support (ACLS)
10. Radiologic Technology

(N) Rank   **Scale of Opportunity:** ● Small-scale ● Large-scale

Skill Type: ● Industry Specialized

Data and AI

Emerging Jobs

1. Artificial Intelligence Specialist
2. Data Scientist
3. Data Engineer
4. Big Data Developer
5. Data Analyst
6. Analytics Specialist
7. Data Consultant
8. Insights Analyst
9. Business Intelligence Developer
10. Analytics Consultant

Top 10 Skills

1. Data Science
2. Data Storage Technologies
3. Development Tools
4. Artificial Intelligence
5. Software Development Life Cycle (SDLC)
6. Management Consulting
7. Web Development
8. Digital Literacy
9. Scientific Computing
10. Computer Networking

(N) Rank   **Scale of Opportunity:** ● Small-scale ● Large-scale

Skill Type: ● Tech Disruptive ● Tech Baseline ● Business

Engineering and Cloud Computing

Emerging Jobs

1. Site Reliability Engineer / Cloud Computing /
2. Python Developer / Engineering /
3. Full Stack Engineer / Engineering /
3. Javascript Developer / Engineering /
5. Back End Developer / Engineering /
6. Frontend Engineer / Engineering /
6. Software Developer Dotnet / Engineering /
8. Platform Engineer / Cloud Computing /
9. Development Specialist / Engineering /
10. Cloud Engineer / Cloud Computing /
10. DevOps Engineer / Cloud Computing /
12. Cloud Consultant / Cloud Computing /
13. DevOps Manager / Cloud Computing /
14. Technology Analyst / Engineering /

Top 10 Skills

1. Development Tools
2. Web Development
3. Data Storage Technologies
4. Software Development Life Cycle (SDLC)
5. Computer Networking
6. Human Computer Interaction
7. Technical Support
8. Digital Literacy
9. Business Management
10. Employee Learning & Development

Ⓝ Rank **Scale of Opportunity:** ● Small-scale ● Large-scale
Skill Type: ● Tech Disruptive ● Tech Baseline ● Business

Green Economy

Emerging Jobs

1. Methane/Landfill Gas Generation System Technicians
2. Wind Turbine Service Technicians
2. Green Marketers
4. Biofuels Processing Technicians
4. Solar Energy Installation Managers
6. Water Resource Specialists
7. Wind Energy Project Managers
8. Chief Sustainability Officers
9. Refuse and Recyclable Material Collectors
9. Sustainability Specialists
11. Solar Photovoltaic Installers
12. Water/Wastewater Engineers
13. Forest Fire Inspectors and Prevention Specialists
14. Fuel Cell Engineers
14. Nuclear Power Reactor Operators

Top 10 Skills

1. Digital Marketing
2. Wind Turbines
3. Landfill Gas Collection
4. Social Media
5. Equipment Inventory
6. Solar Installation
7. Health and Safety Standards
8. Microsoft Power BI
9. Electrical Diagrams / Schematics
10. Email Marketing

Ⓝ Rank **Scale of Opportunity:** ● Small-scale ● Large-scale
Skill Type: ● Industry Specialized ● Tech Baseline ● Business

People and Culture

Emerging Jobs

1. Information Technology Recruiter
2. Human Resources Partner
3. Talent Acquisition Specialist
4. Business Partner
5. Human Resources Business Partner

Top 10 Skills

1. Recruiting
2. Human Resources
3. Business Management
4. Employee Learning & Development
5. Leadership
6. Digital Literacy
7. Project Management
8. People Management
9. Compensation & Benefits
10. Foreign Languages

(N) Rank   **Scale of Opportunity:** ● Small-scale ● Large-scale

Skill Type: ● Industry Specialized ● Tech Baseline ● Business ● Soft

Source

LinkedIn.

Product Development

Emerging Jobs

1. Product Owner
2. Quality Assurance Tester
3. Agile Coach
4. Software Quality Assurance Engineer
5. Product Analyst
6. Quality Assurance Engineer
6. Scrum Master
8. Digital Product Manager
9. Delivery Lead

1. Software Testing
2. Software Development Life Cycle (SDLC)
3. Development Tools
4. Project Management
5. Business Management
6. Data Storage Technologies
7. Web Development
8. Manufacturing Operations
9. Digital Literacy
10. Leadership

(N) Rank   **Scale of Opportunity:** ● Small-scale ● Large-scale

Skill Type: ● Tech Disruptive ● Tech Baseline ● Business ● Soft

Source

LinkedIn.

Sales, Marketing and Content

Emerging Jobs

1. Social Media Assistant / Content Production /
2. Growth Hacker / Marketing /
3. Customer Success Specialist / Sales /
4. Social Media Coordinator / Content Production /
5. Growth Manager / Marketing /
5. Sales Development Representative / Sales /
7. Digital Marketing Specialist / Marketing /
8. Commercial Sales Representative / Sales /
9. Business Development Representative / Sales /
10. Customer Specialist / Sales /
11. Content Specialist / Content Production /
12. Content Producer / Content Production /
13. Content Writer / Content Production /
13. Partnerships Specialist / Sales /
15. Digital Specialist / Marketing /
15. Chief Commercial Officer / Sales /
17. Ecommerce Specialist / Marketing /
18. Head Of Partnerships / Sales /
19. Commerce Manager / Marketing /
19. Head Of Digital / Marketing /
19. Enterprise Account Executive / Sales /
22. Digital Marketing Consultant / Marketing /
22. Business Development Specialist / Sales /
24. Digital Marketing Manager / Marketing /
24. Chief Strategy Officer / Sales /
26. Creative Copywriter / Content Production /
27. Chief Marketing Officer / Marketing /
28. Head Of Business Development / Sales /

Top 10 Skills

1. Digital Marketing
2. Social Media
3. Business Management
4. Digital Literacy
5. Advertising
6. Product Marketing
7. Video
8. Graphic Design
9. Leadership
10. Writing

(N) Rank   **Scale of Opportunity:** ● Small-scale ● Large-scale

Skill Type: ● Industry Specialized ● Tech Baseline ● Business ● Soft

Notes

1. Henrekson, 2020.

2. Ibid.

3. Ibid.

4. Based on Burning Glass Technologies data for 2018.

5. Autor and Dorn, 2009.

6. Accenture, 2018.

7. World Economic Forum, 2018a.

8. Ibid.

9. World Economic Forum, 2019b.

10. Frey and Osborne, 2013.

11. Bessen, 2016, Acemoglu and Autor, 2011, and Goldin and Katz, 2007.

12. Muro, et al., 2019, and Susskind and Susskind, 2015.

13. World Economic Forum, 2016 and 2018a.

14. World Economic Forum, 2018b.

15. World Economic Forum, 2019a.

16. See, for example, Wallace-Stevens, 2020, and Cognizant, 2020.

17. *ILOSTAT*, Employment Statistics, https://ilostat.ilo.org/topics/employment/.

18. United States Bureau of Labor Statistics, Employment Projections, https://www.bls.gov/emp/.

19. LinkedIn Economic Graph, https://economicgraph.linkedin.com.

20. The 20 economies are: Argentina, Australia, Brazil, Canada, France, Germany, India, Ireland, Italy, Mexico, Netherlands, New Zealand, Saudi Arabia, Singapore, South Africa, Spain, Sweden, United Arab Emirates, United Kingdom and the United States.

21. TF-IDF is an information retrieval technique that weighs a term's frequency (TF) and its inverse document frequency (IDF). Each word or term has its respective TF and IDF score. The product of the TF and IDF scores of a term is called the TF*IDF weight of that term.

22. The occupations were then clustered using a cosine similarity matrix indicating how similar (1) or dissimilar (0) were any one pair of occupations, and a clustering algorithm using a combination of K-means and hierarchical algorithms.

23. A number of the identified high-growth roles require distinctive skills specialization: UX Designers, Cyber Security Specialists and Data Protection Officers require distinctive skills profiles and have not been included in any one cluster.

24. ILO, 2019, and De Henau, et al., 2017.

25. With more time this data set can be expanded to cover the United Kingdom, Canada, Australia, New Zealand, Singapore, Indonesia, Malaysia and 28 EU countries.

26. The included categories are: 39-9000 Other Personal Care and Service Workers, 31-0000 Healthcare Support Occupations, 29-9000 Other Healthcare Practitioners and Technical Occupations, 29-1120 Therapists, and 29-9000 Other Healthcare Practitioners and Technical Occupations.

27. Zhu, et al., 2018.

28. Ibid.

29. For both professional clusters, the skills cluster for Microsoft Office and Productivity Tools has been removed as it would otherwise comprise 35% of postings for the Green Economy cluster and 58% of those in the Care Economy cluster.

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- → Sanofi
- → SAP
- → Saudi Aramco
- → Stanley Black & Decker Inc.
- → Teck Resources Limited
- → Turkcell
- → UBS
- → Unilever
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