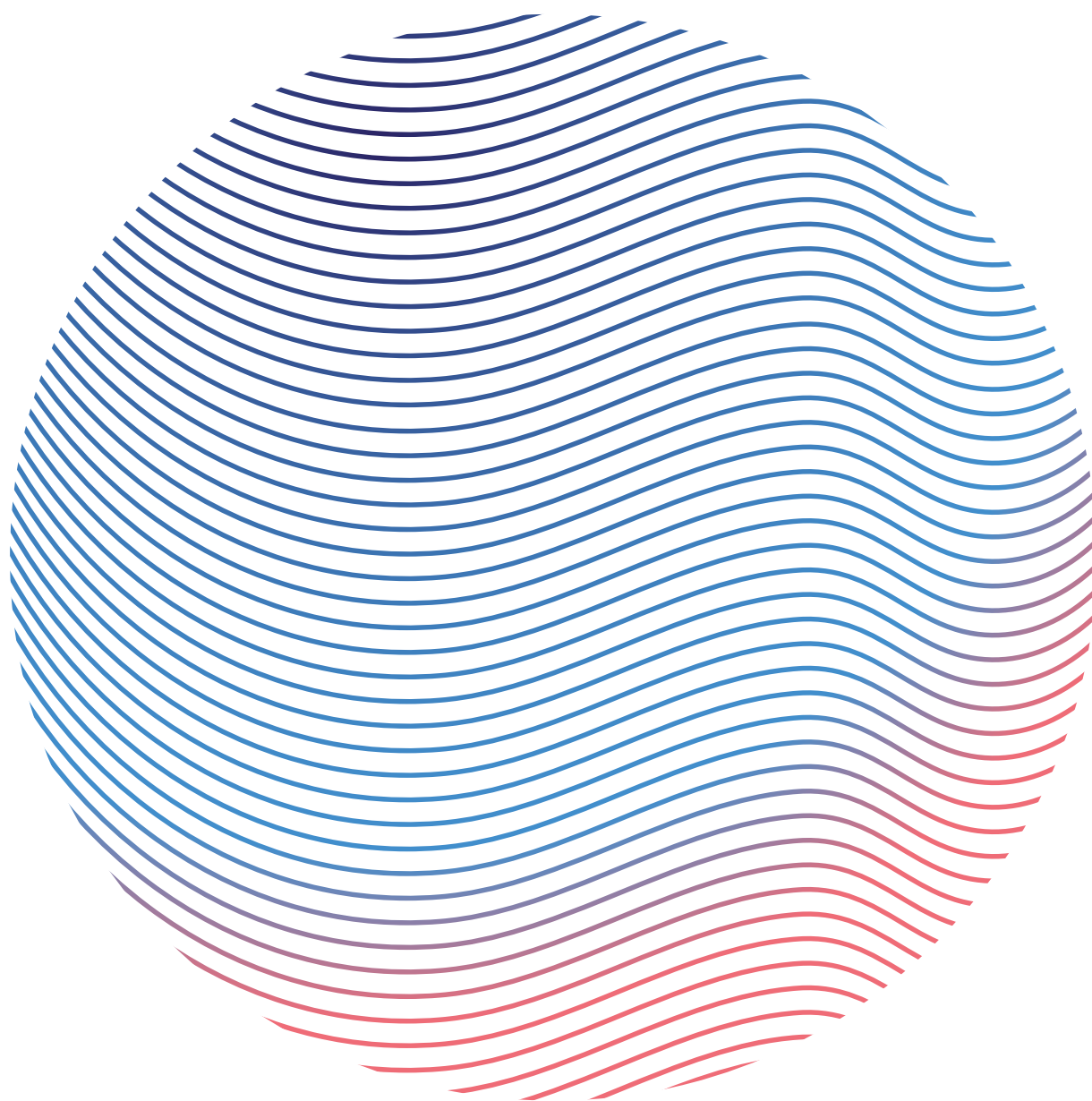


coursera

Global Skills Index

2020



About Coursera

Coursera was founded by Daphne Koller and Andrew Ng with a vision of providing life-transforming learning experiences to anyone, anywhere. Coursera is now a leading online learning platform for higher education, where 65 million learners from around the world come to learn skills of the future.

Coursera serves governments, higher education institutions, and businesses worldwide.

Coursera for Government equips government employees and citizens with in-demand skills to build a competitive workforce. Coursera for Campus empowers any college or university to offer high-quality, job-relevant online education to students, alumni, faculty, and staff. Finally, Coursera for Business is trusted by 2,500 companies globally to transform their talent.

coursera.org



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INTRODUCTION:

A Letter from Our CEO

COVID-19 has profoundly reshaped our world. The disruption to lives and livelihoods has been staggering. The economic devastation has thrown many industries into survival mode. As we begin to revive jobs and economies, it will be important to understand the impact of the crisis on the skills landscape. The second edition of Coursera's Global Skills Index provides an in-depth analysis of the state of skills across countries, industries, and fields of study.

It has been painful to watch COVID-19 disrupt education worldwide. At the peak of the pandemic, UNESCO¹ reported that 1.6 billion learners were affected by school closures, including more than 200 million in higher education. To mitigate the impact, educational institutions transitioned to emergency remote teaching overnight, moving online to deliver lectures, administer tests, and even hold graduation ceremonies. Four months down the line, they have, in some form, adapted to virtual learning despite being largely unprepared for such an abrupt shift.

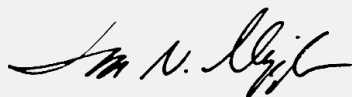
Universities aren't the only ones adapting to the crisis. Companies facing accelerated digital transformation are reimagining work with a distributed workforce and virtual collaboration. Governments are shifting their civic interactions online, embracing virtual modes of communication and making plans for remote voting. Although the pandemic has caused widespread disruption, institutions have come together to coordinate an effective response.

We must use this momentum to drive lasting change for the causes that matter. Equal access to education and skills is one of them. COVID-19 has further exposed many inequalities with respect to education and employability. The unemployment crisis caused by COVID-19 has disproportionately hit low-skilled workers, with the International Labour Organization² estimating a loss of 435 million jobs in the first half of 2020.

Progress in a post-COVID world relies on equipping individuals with job-relevant skills. The onus is on institutions to prioritize skills development, enabling more diverse pathways into the workforce and energizing their economies. Online learning has proven effective in delivering on that promise, now more than ever. From March to June of this year, more than 15 million new learners registered on Coursera. Governments and universities using Coursera's Campus Response Initiative³ have already equipped more than one million people with free access to job-relevant online learning.

Although the call to action is clear, leaders struggle to identify which skills are important. The pandemic has further heightened the need to understand which skills command the jobs of the future. Looking across the 65 million learners on the platform, and drawing on rich performance data of learners in the past 12 months, the Global Skills Index draws on rich data from Coursera's 65 million learners to benchmark skills proficiency for 60 countries, 10 industries, and 11 fields of study across the fundamental skill domains of the future: business, technology, and data science.

It's clear that institutions must work together to address the underlying inequities in our society, further exposed by this crisis. We hope this report inspires action to provide equal access to job-relevant skills that will be essential to our future.



JEFF MAGGIONCALDA
CEO, Coursera

Executive Summary

HOW COVID-19 IS SHAPING THE SKILLS LANDSCAPE

The following insights are based on Coursera platform data from the past 12 months. The findings are meant to help governments, businesses, higher education institutions, and individuals better understand how the pandemic has impacted the skills landscape and how best to move forward.

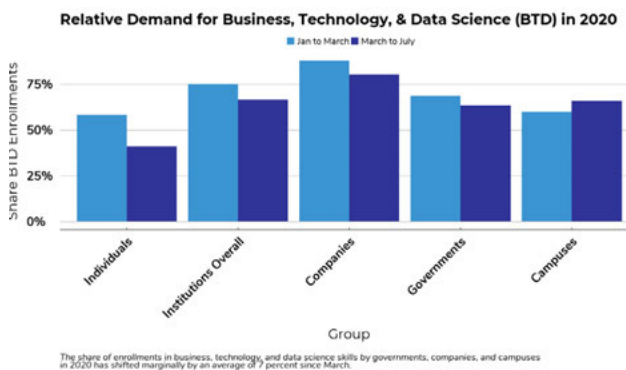
Of the 200 million higher education students whose studies have been disrupted by COVID-19, 80% are located in countries with emerging or lagging skills.

School closures have disrupted higher education for millions of students in countries already in need of more accessible learning. Eighty percent of students enrolled in tertiary education are located in countries that have both closed schools due to COVID-19 and are in the bottom half of the world rankings for proficiency in business, technology, and data science skills.⁴

To help overcome deepening skill inequities, institutions must work together to democratize access to quality online learning resources and ensure we are all prepared for the rapidly changing economy.

Institutions navigating COVID-19 continue to prioritize business, technology, and data science skills.

The Fourth Industrial Revolution has called for a new set of critical skills across the business, technology, and data science domains to compete in an increasingly digital world—and governments, companies, and campuses have continued to prioritize these essential skills amid the coronavirus pandemic. Over two-thirds of the enrollments by governments, companies, and campuses on the Coursera platform are in courses teaching business, technology, and data science skills.

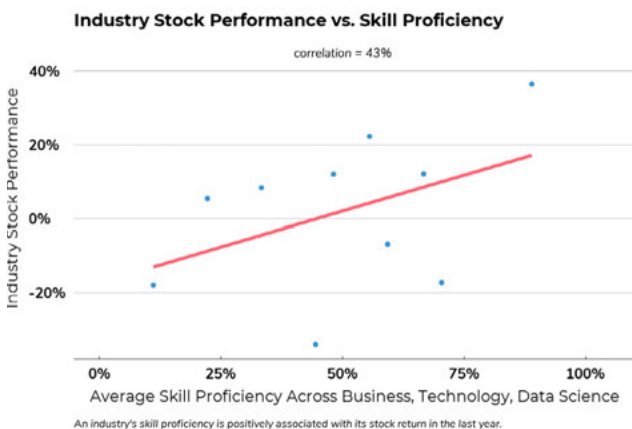


Executive Summary (cont.)

Industries with more highly skilled talent, especially in technology skills, see higher stock returns and less disruption from COVID-19.

Skills shortages come at a cost for organizations across all industries. Our data reveals the correlation between an industry's skill proficiency and its U.S. stock return in the past year is 43% across all skill domains. The correlations for technology, business, and data science skill proficiencies are 39%, 30%, and 21%, respectively. In the past three months, the correlation between an industry's skill proficiency and its U.S. stock return is 40%: in other words, companies with higher skill proficiency have seen their valuation disrupted less by COVID-19.⁵

Digital skills have also been essential to helping companies respond to the crisis in the short-term and drive long-term transformation. With the sudden push to remote work, we've seen that digital skills are critical to short-term business operations—from managing change and driving online services to automating processes that can no longer be done in person.



The top five trending skills related to COVID-19 are public health, recognizing symptoms, understanding risk factors, social distancing, and contact tracing. Since March, there have been more than 800,000 enrollments in Coursera courses teaching these skills.

As the effects of the pandemic are felt around the globe, learners are eager to gain job-relevant skills directly related to COVID-19 recovery efforts and to understand the science behind the virus. Since March, there have been more than 800,000 enrollments in Coursera courses teaching public health, how to recognize symptoms, understanding risk factors, social distancing, and contact tracing. Johns Hopkins University's COVID-19 Contact Tracing course has become the most popular course of the year by enrollments on the Coursera platform.

Demand for personal development skills like confidence, stress management, and mindfulness has grown by 1,200% among individual learners.

Uncertain diagnoses, looming resource shortages, growing financial losses, and the infringement of personal freedoms have undoubtedly contributed to widespread mental and emotional distress. Since the outbreak, demand from individuals for personal development courses, including stress management and mindfulness, has increased by 1,200%.

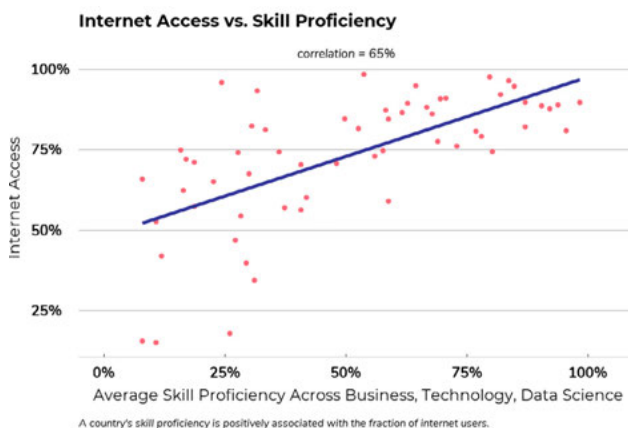
Governments and campuses are also engaging with courses related to personal development, with a focus on anxiety and mental health. Research has long indicated that better mental health leads to higher productivity, and we expect increased investment in citizens' and students' mental and emotional well-being.⁶

HIGHER SKILLS PROFICIENCY IS LINKED TO ECONOMIC PROGRESS

COVID-19 has exposed many inequalities with respect to access to the internet, tertiary education, and employment opportunities. Our data indicates that countries with more equality, across multiple dimensions (e.g., digital, economic, education, and labor force participation), are also those with higher skill proficiencies. Countries with higher skill proficiencies see greater GDP returns in the long-term.

Countries with more equal access to the internet are also those with higher skill proficiencies.

As more learning happens online as a result of COVID-19, access to digital education resources will become increasingly important to keeping pace with the skills of the future. Our data indicates that there is a significant, positive correlation (65%) between a country's skill proficiency across domains and the percentage of its population using the internet.⁷ The Netherlands, for example, has an average skill proficiency of 85%, and 94% of its population has access to the internet. In comparison, Indonesia has an average skill proficiency of 29%, and only 40% of its population has access to the internet.⁸

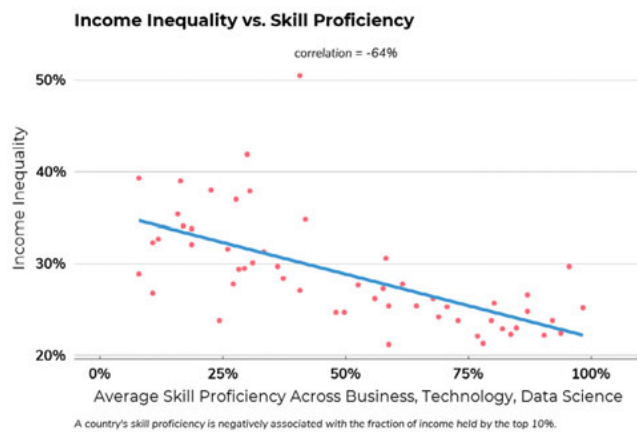


Executive Summary (cont.)

Countries, both developed and developing, excelling in critical skills see lower income inequality.

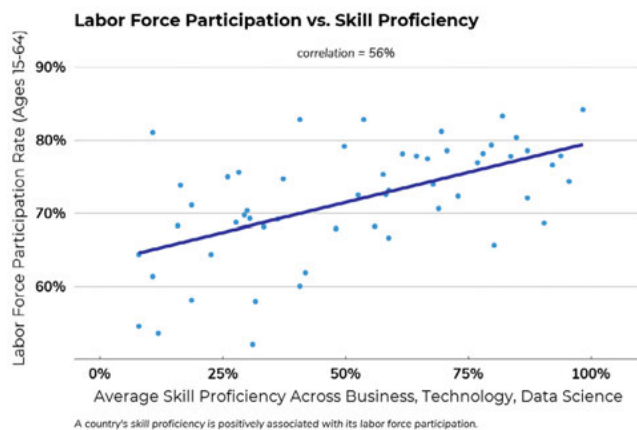
With labor markets thrown into turmoil amid COVID-19 and technology putting large populations at risk of losing their jobs, countries should consider the impact of their skills landscape on income inequality. Our data reveals a negative correlation between a country's average skill proficiency across domains and the share of income held by the top 10% in a country.

In the U.S., the share of income held by the top 10% of the population is 31%, and its average skill proficiency is 58%. In contrast, the share of income held by the top 10% of the population in Canada is 25%, and its average skill proficiency is 71%.⁹



Countries with higher labor force participation rates are also those with higher skill proficiencies.

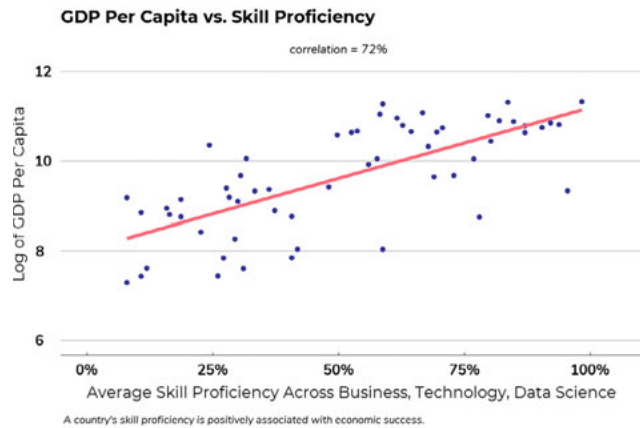
Skills are essential to quality and sustainable employment; correspondingly, our data shows that a country's skill proficiency across domains is positively correlated with the fraction of its working-age population active in its labor force. The trend is especially clear in Switzerland and Greece. Switzerland has an average skill proficiency of 98% and a labor force participation rate of 84%, while Greece has an average skill proficiency of 56% and a labor force participation rate of 68%.¹⁰



Every skill proficiency percent gained for a country is associated with a \$600 increase in GDP per capita.

Our data indicates that every skill proficiency percent gained in a country's average proficiency (across domains) is associated with a \$600 increase in per capita GDP. For example, Kenya has an average skill proficiency of 26% while Egypt has an average skill proficiency of 27%. The difference in their per capita GDPs is approximately \$700.¹¹

COVID-19 will undoubtedly adversely affect global GDP as it disrupts domestic consumption and services, global trade, and tourism.¹² Countries can counteract this decline and make their economies more resilient by investing in skill development.¹³



How to Read the Report

About the GSI Skills Taxonomy

The second GSI report covers the domains of business, technology, and data science, much like the inaugural version. We focus on these areas because they are the three most popular domains on Coursera in terms of enrollments, and they encapsulate the skills most crucial to the future of work.

The competencies and skills in the GSI are the building blocks of the business, technology, and data science domains. The six competencies within each domain capture the broad capabilities required to achieve expertise in these areas, and individual skills capture specific requirements to achieve mastery within each competency.

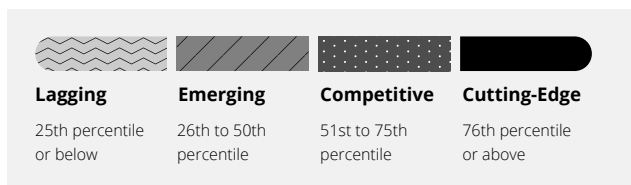
Functionally, our competencies and skills come from Coursera's Skills Graph, which is a set of skills assembled through both open-source taxonomies like Wikipedia, as well as crowdsourcing from Coursera educators and learners on what they teach/learn on the Coursera platform.

Reading the Country and Industry Rankings

For each graph in the global and industry sections, we show the rankings of countries and industries on each domain and competency. The 60 countries and 10 industries within the report are ranked against each other, and we show the percentile rankings for each entity within its group.

A country or industry that is at 100% ranks at the top of the 60 countries or 10 industries and a country or industry at 0% is at the bottom.

For each groups' percentile rankings, we also break them apart into four categories based on quartiles:



These groups help identify where a particular country or industry ranks within the relevant population.

READING THE GLOBAL HEATMAPS

The global and regional heatmaps are constructed to easily display a country's overall ranking in each domain. For each of business, technology, and data science there is a unique textured color scale that identifies a country's placement in the four ranking categories (Lagging, Emerging, Competitive, and Cutting-Edge). Lighter colors indicate lower performance while darker colors indicate stronger performance.

READING THE INDUSTRY SLIDER CHARTS

We show each industry's performance across the competencies in the business, technology, and data science domains. We display this using three slider charts (one per domain) with an individual bar for each competency. The slider bar is broken up into four segments that map to the four ranking categories (Lagging, Emerging, Competitive, and Cutting-Edge). If an industry has one segment filled in for a particular competency, it is in the Lagging category for that competency, and so on until where four categories filled in means it is in the Cutting-Edge category.

READING THE FIELDS OF STUDY RANKINGS

We rank 11 fields of study based on their performance on Coursera in the business, technology, and data science domains. These fields of study can map to multiple programs at universities such as those below and represent a rollup of all the relevant programs:

- Arts & Humanities: English, Art History, History
- Biological Sciences: Biology, Genetics, Neuroscience
- Business: Finance, Marketing, Accounting
- Computer Science: Information Systems, Computer Science, Information Security
- Education: Student Counseling, Teaching English, Instructional Design
- Engineering: Electrical Engineering, Civil Engineering, Chemical Engineering
- Health Professions: Nursing, Clinical Science, Pharmacy Studies
- Legal Professions: Pre-Law, Law, Paralegal Studies
- Mathematics & Statistics: Mathematics, Applied Mathematics, Statistics
- Physical Sciences: Physics, Chemistry
- Social Sciences: Economics, Sociology, Political Science

Our rankings reflect the skills of an average student in these fields of study.

READING THE TOP FIELDS OF STUDY AND ROLES PER SELECTED SKILL

For each skill we show the top three fields of study and top five roles that are engaging with the skill on the Coursera platform. Engagement here is defined as the field of study or role whose enrollment rate into relevant content teaching that skill is the greatest number of standard deviations from the platform-wide enrollment rate. This essentially shows the fields of study/roles that are disproportionately learning this skill on the Coursera platform.

GLOSSARY OF COMPETENCY DEFINITIONS

Within each of the three domains in the report, we cover six competencies that span key skills in business, technology, and data science. Below we define each competency we use in the GSI as well as provide sample skills within it as part of our Skills Taxonomy.

BUSINESS

Skills in this domain focus on the practice and day-to-day running of a business.

- 1) Accounting** is about proper record keeping and communication of financial information for corporations in accordance with government regulations.

Sample skills: Auditing, Financial Accounting

- 2) Communications** is the practice of discussion between two or more individuals in written or oral forms.

Sample skills: People Skills, Writing

- 3) Finance** is focused on the efficient allocation of capital towards investment opportunities under conditions of risk or uncertainty.

Sample skills: Financial Ratios, Blockchain

- 4) Management** is about how to set a company's strategy and coordinate the effort of employees.

Sample skills: People Management, Business Analytics

- 5) Marketing** is the process of creating relationships with potential and actual customers, allowing businesses to identify how they should present themselves and who they should cater to.

Sample skills: Digital Marketing, Product Placement

- 6) Sales** is focused on taking a company's products and services to market and transacting with actual customers.

Sample skills: Cross-Selling, Lead Generation

TECHNOLOGY

Skills in this domain focus on the creation, maintenance, and scaling of computer systems and software.

- 1) Computer Networking** is the process of creating a digital telecommunications network where connected devices exchange data with each other.

Sample skills: Cloud Computing, Internet of Things

- 2) Databases** are an organized collection of data, generally stored and accessed electronically from a computer system.

Sample skills: Relational Database, Key Value Database

- 3) Human-Computer Interaction** researches the design and use of computer technology, focused on the interfaces between people and computers.

Sample skills: Graphic Design, User Experience Design

- 4) Operating Systems** consists of building system software that provides common services for other types of computer programs.

Sample skills: Mobile App Development, C Programming Language

- 5) Security Engineering** is a specialized field that focuses on the security aspects in the design of systems that need to be able to deal robustly with possible sources of disruption.

Sample skills: Cybersecurity, Cryptography

- 6) Software Engineering** involves applying rigorous principles to the design, development, maintenance, testing, and evaluation of computer software.

Sample skills: Web Development, Software Development

DATA SCIENCE

Skills in this domain focus on capturing and utilizing the data generated within a business for decision-making and/or powering underlying products and services.

- 1) Data Management** comprises everything related to managing and accessing data for reporting, analysis, and model building.

Sample skills: Cloud APIs, Hadoop

- 2) Data Visualization** involves the creation and study of visual representations of data to communicate information clearly and efficiently.

Sample skills: Tableau, Plotting Data

- 3) Machine Learning** creates algorithms and statistical models that computer systems can use to perform a specific task without explicit instructions.

Sample skills: Multi-Task Learning, Deep Learning

- 4) Math** is the study of numbers and their relationships, applying these principles to models of real phenomena.

Sample skills: Calculus, Linear Algebra

- 5) Statistical Programming** is the set of programming languages and tools used to create statistical models and algorithms.

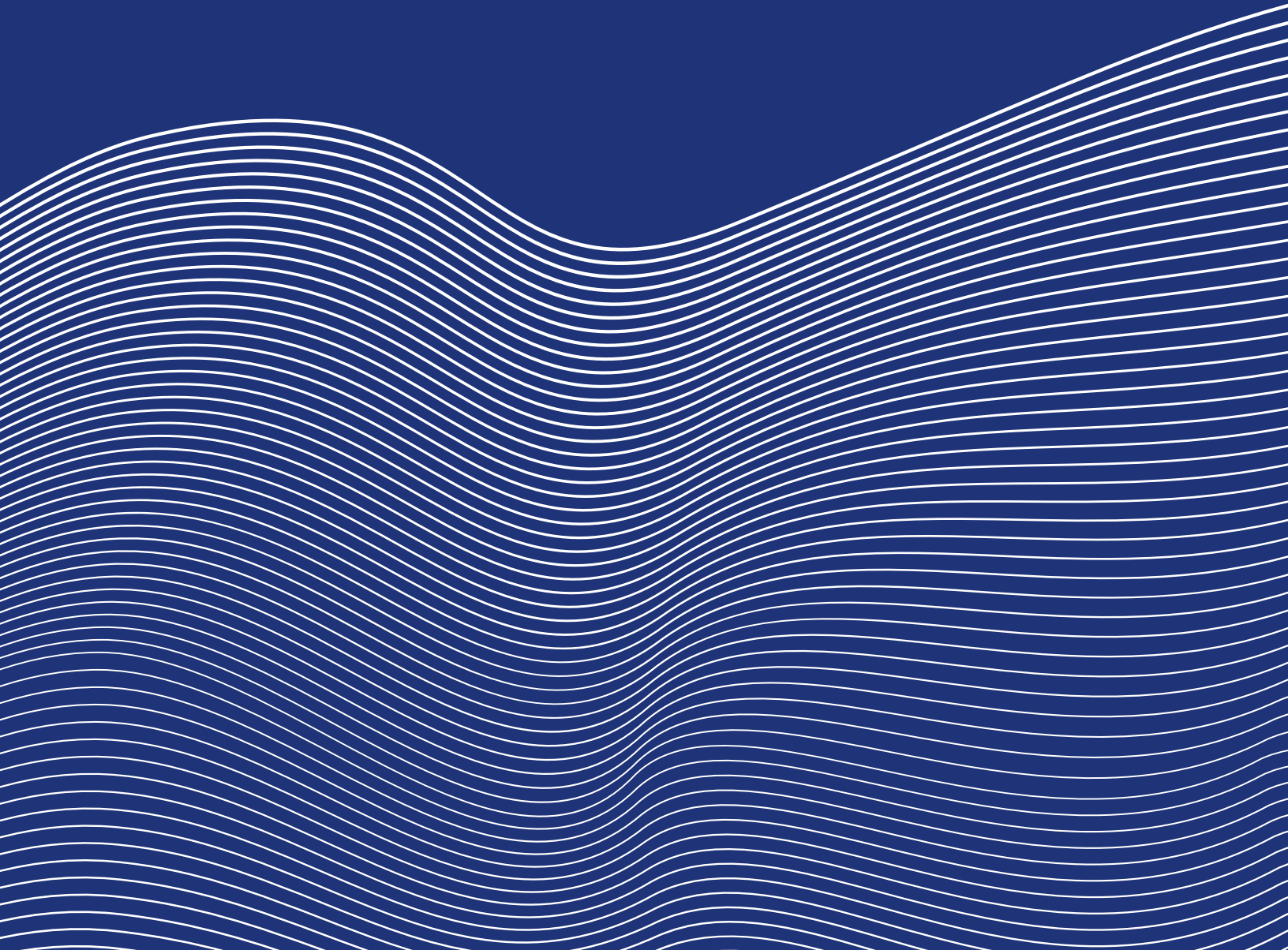
Sample skills: R, Python

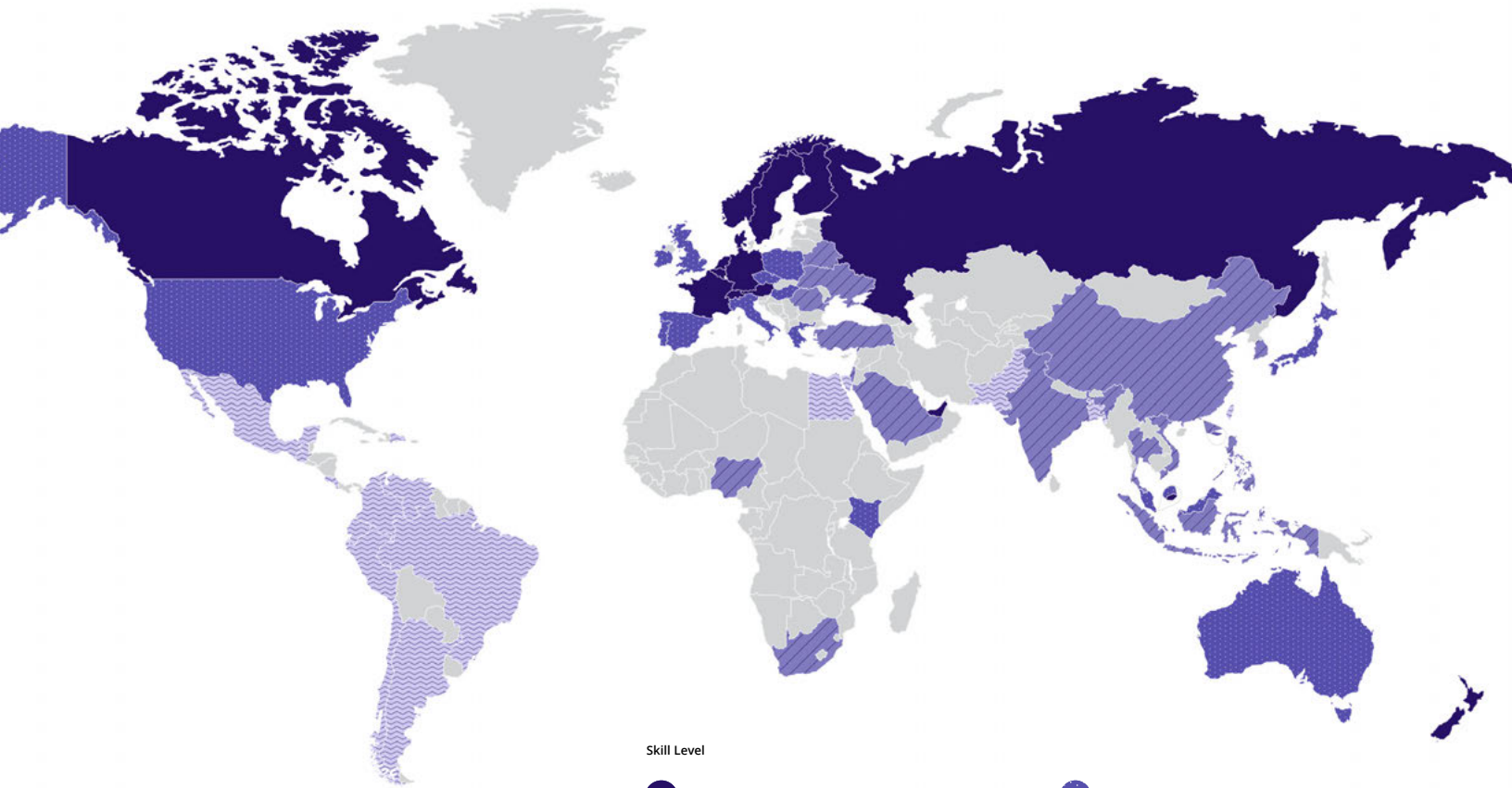
- 6) Statistics** deals with all aspects of data collection, organization, analysis, interpretation, and presentation.

Sample skills: Regression, AB Testing

PART ONE:

Global & Regional Results





GLOBAL VIEW

Business

TRENDING SKILLS:

Microsoft Excel
 Project Management
 Digital Marketing
 Blockchain
 Business Analytics
 People Management
 Writing
 Human Resources
 Product Placement
 Supply Chain

Skill Level

CUTTING-EDGE

		PERCENTILE
01	Switzerland	100%
02	Austria	98%
03	Denmark	97%
04	Finland	95%
05	United Arab Emirates	93%
06	Norway	92%
07	Germany	90%
08	Belgium	88%
09	Russia	86%
10	Singapore	85%
11	Sweden	83%
12	France	81%
13	New Zealand	80%
14	Canada	78%
15	Netherlands	76%

EMERGING

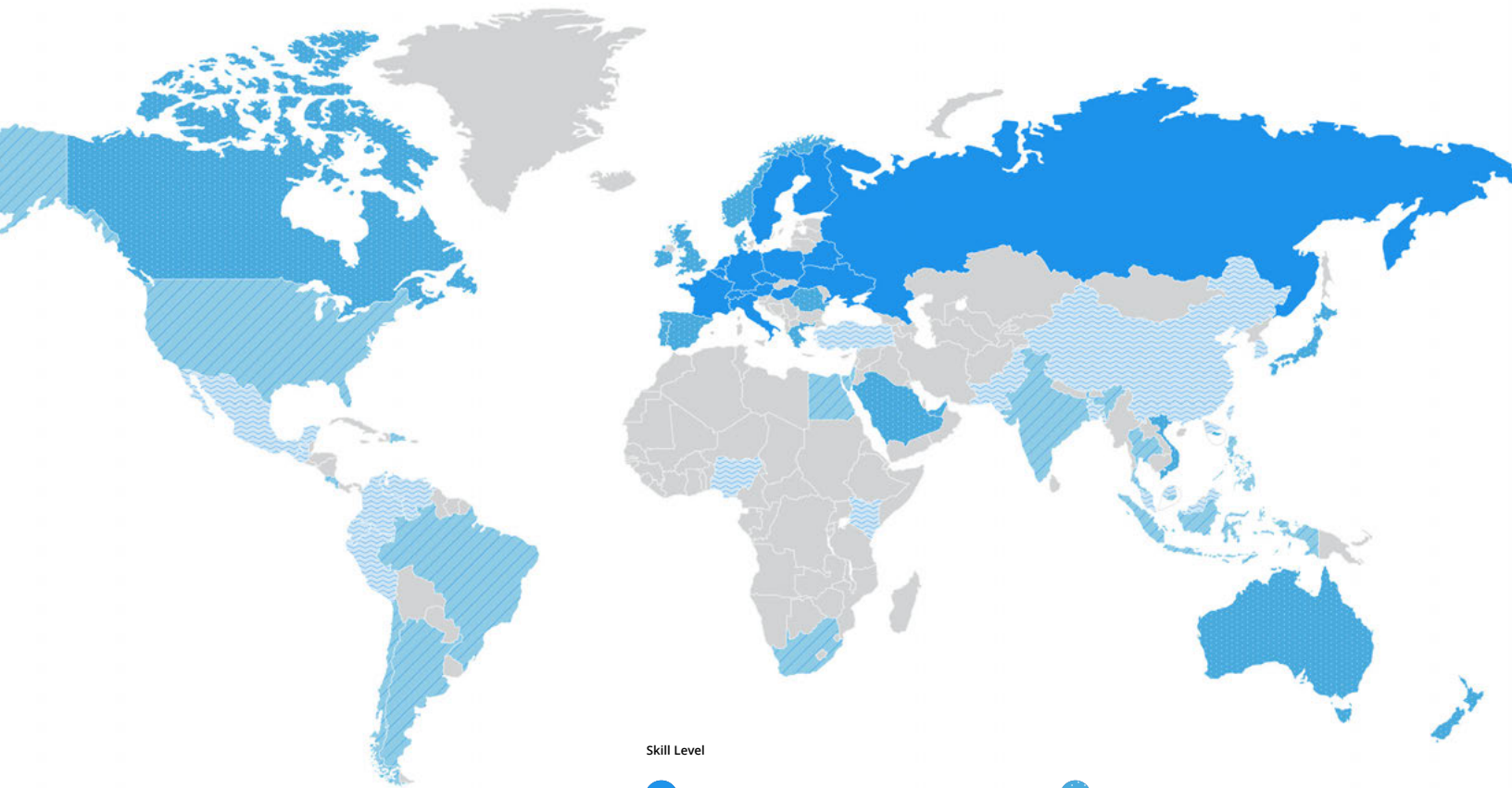
		PERCENTILE
31	South Africa	49%
32	Belarus	47%
33	Vietnam	46%
34	India	44%
35	Israel	42%
36	Romania	41%
37	Philippines	39%
38	Turkey	37%
39	Nigeria	36%
40	Thailand	34%
41	Indonesia	32%
42	Saudi Arabia	31%
43	Ukraine	29%
44	Republic of Korea	27%
45	China	25%

COMPETITIVE

		PERCENTILE
16	Italy	75%
17	United States	73%
18	Australia	71%
19	United Kingdom	69%
20	Czech Republic	68%
21	Hong Kong	66%
22	Ireland	64%
23	Hungary	63%
24	Poland	61%
25	Greece	59%
26	Portugal	58%
27	Kenya	56%
28	Japan	54%
29	Malaysia	53%
30	Spain	51%

LAGGING

		PERCENTILE
46	Brazil	24%
47	Bangladesh	22%
48	Egypt	20%
49	Pakistan	19%
50	Taiwan	17%
51	Costa Rica	15%
52	Chile	14%
53	Argentina	12%
54	Guatemala	10%
55	Ecuador	8%
56	Peru	7%
57	Venezuela	5%
58	Dominican Republic	3%
59	Colombia	2%
60	Mexico	0%



GLOBAL VIEW

Technology

TRENDING SKILLS:

C
 Artificial Intelligence
 JavaScript
 Web Development
 User Experience Design
 Cybersecurity
 Convolutional Neural Network
 Cloud Computing
 Internet of Things
 Application Programming Interface

Skill Level

CUTTING-EDGE

	PERCENTILE
01 Russia	100%
02 Belarus	98%
03 Switzerland	97%
04 Ukraine	95%
05 Finland	93%
06 Netherlands	92%
07 Italy	90%
08 France	88%
09 Belgium	86%
10 Czech Republic	85%
11 Austria	83%
12 Germany	81%
13 Sweden	80%
14 Poland	78%
15 Hungary	76%

COMPETITIVE

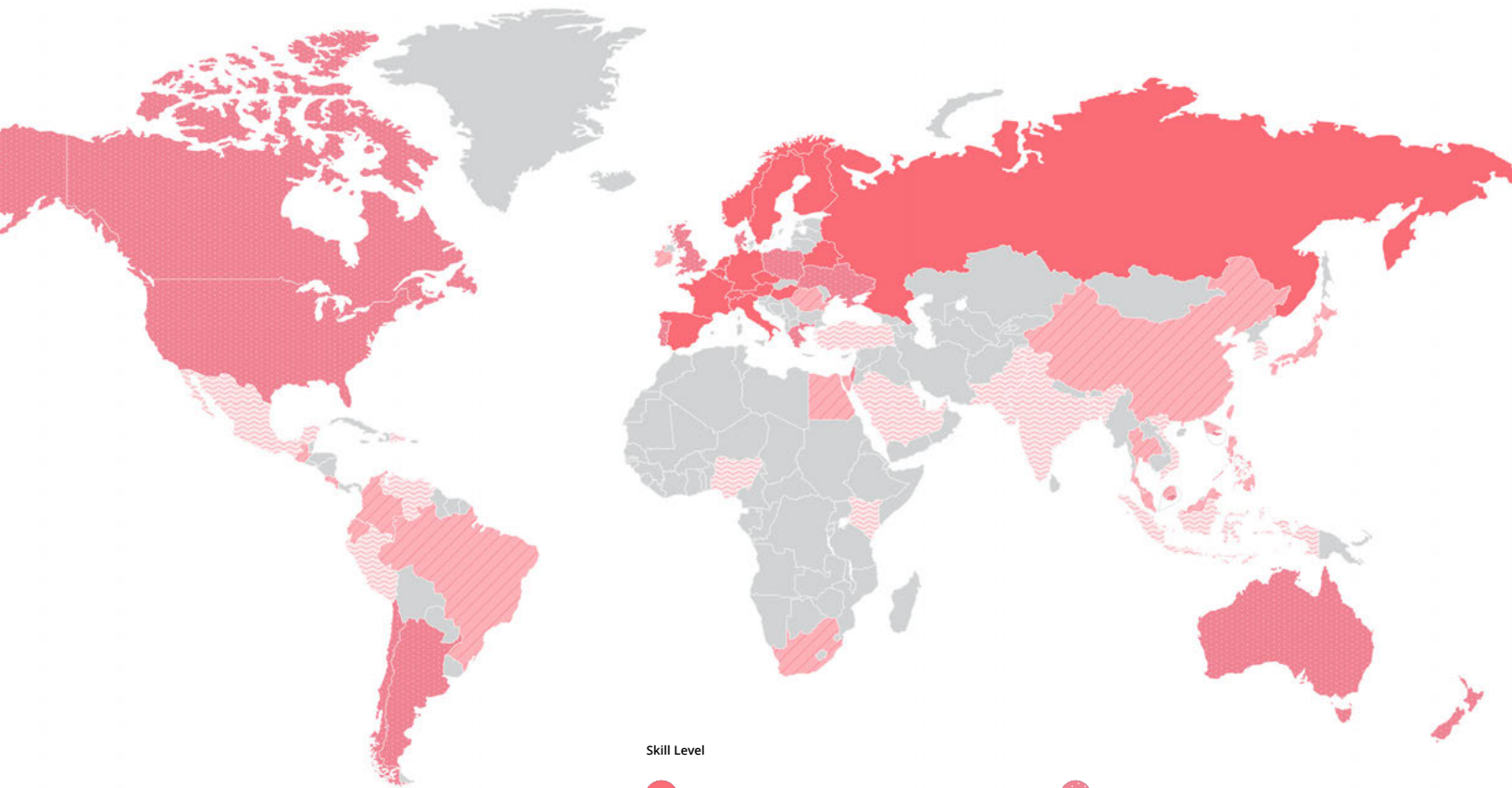
	PERCENTILE
16 Norway	75%
17 Denmark	73%
18 Spain	71%
19 New Zealand	69%
20 Canada	68%
21 Ireland	66%
22 Vietnam	64%
23 United Kingdom	63%
24 Japan	61%
25 Australia	59%
26 Portugal	58%
27 Romania	56%
28 Saudi Arabia	54%
29 Greece	53%
30 United Arab Emirates	51%

EMERGING

	PERCENTILE
31 Indonesia	49%
32 Hong Kong	47%
33 South Africa	46%
34 Israel	44%
35 Singapore	42%
36 Thailand	41%
37 United States	39%
38 Philippines	37%
39 Egypt	36%
40 India	34%
41 Argentina	32%
42 Brazil	31%
43 Costa Rica	29%
44 Chile	27%
45 Dominican Republic	25%

LAGGING

	PERCENTILE
46 Venezuela	24%
47 Republic of Korea	22%
48 Kenya	20%
49 Malaysia	19%
50 China	17%
51 Colombia	15%
52 Guatemala	14%
53 Peru	12%
54 Turkey	10%
55 Taiwan	8%
56 Ecuador	7%
57 Bangladesh	5%
58 Mexico	3%
59 Pakistan	2%
60 Nigeria	0%



GLOBAL VIEW

Data Science

TRENDING SKILLS:

Python
 Data Storytelling
 SQL
 R
 Deep Learning
 TensorFlow
 Cloud APIs
 Multi-Task Learning
 Linear Algebra
 NLP

Skill Level

CUTTING-EDGE

		PERCENTILE
01	Russia	100%
02	Switzerland	98%
03	Belgium	97%
04	Austria	95%
05	Finland	93%
06	France	92%
07	Germany	90%
08	Belarus	88%
09	Netherlands	86%
10	Norway	85%
11	Sweden	83%
12	Spain	81%
13	Hungary	80%
14	Czech Republic	78%
15	Italy	76%

COMPETITIVE

		PERCENTILE
16	Hong Kong	75%
17	Singapore	73%
18	Israel	71%
19	Denmark	69%
20	Poland	68%
21	Canada	66%
22	Argentina	64%
23	United States	63%
24	United Kingdom	61%
25	New Zealand	59%
26	Portugal	58%
27	Greece	56%
28	Australia	54%
29	Ukraine	53%
30	Chile	51%

EMERGING

		PERCENTILE
31	Philippines	49%
32	Romania	47%
33	Ireland	46%
34	Guatemala	44%
35	China	42%
36	Ecuador	41%
37	Costa Rica	39%
38	Thailand	37%
39	Brazil	36%
40	Japan	34%
41	Colombia	32%
42	Taiwan	31%
43	Malaysia	29%
44	South Africa	27%
45	Egypt	25%

LAGGING

		PERCENTILE
46	Republic of Korea	24%
47	Venezuela	22%
48	Mexico	20%
49	Dominican Republic	19%
50	United Arab Emirates	17%
51	India	15%
52	Peru	14%
53	Vietnam	12%
54	Saudi Arabia	10%
55	Turkey	8%
56	Indonesia	7%
57	Bangladesh	5%
58	Pakistan	3%
59	Kenya	2%
60	Nigeria	0%

North America

This year, North America is a global skills leader. The region is ranked #1 in business and #2 in tech and data science skills, second only to Europe. These skills, due, in part, to world-class education systems¹⁴, are propelling the region's economies forward. The United States is home to more Global Fortune 500 companies than any other country (121 total), and Canada also makes the top 10 list, home to 13 Global Fortune 500 companies of its own.¹⁵

That's not to say that the region is immune to skill decay. Roughly 45% of both the U.S. and Canada's work activities could be automated by adapting current technology¹⁶, and that reality is not lost on the region's business leaders. Sixty-four percent of U.S. executives believe they will need to retrain or replace more than a quarter of their workforce between now and 2023 due to advancing automation and digitization.¹⁷

As the need for upskilling increases, the region's workforce is more likely to want training provided by employers.¹⁸ With talent increasingly relying on their workplace to offer learning opportunities, it's not just enough for companies to stay abreast of skill trends. The question, then, is how will organizations respond to the learning needs of a workforce acutely aware of the possibility of its redundancy?

CANADA'S BRAIN GAIN PROPELS ITS TECH SKILLS FORWARD

While the U.S. and Canada perform comparably in the business and data science domains, Canada is the frontrunner when it comes to tech skills. Canada ranks #20 globally in tech skills, while the U.S. trails at #37. Canadian workers outperform American workers in all six core tech skill sets.

The United States is lagging in human-computer interaction (12%), operating systems (20%), and software engineering (15%)—all essential skills for digital transformation. The data also reveals that the U.S. is only emerging in security engineering, a skill that is top of mind for the nation's business leaders. Fifty percent of North American CEOs are "extremely concerned" about cyber threats.¹⁹

The countries' respective immigration policies may deepen the skills advantage that Canada holds. While recent U.S. legislation has made it harder for high-skilled workers to receive visas, a new streamlined visa process in Canada has brought in more than 40,000 tech workers from around the world in the past two years alone.²⁰ Toronto saw the most significant growth in technology jobs of any North American city over the past five years, outpacing San Francisco, New York, and Seattle; Vancouver also made the top five.²¹

The Canadian tech industry is booming. Canada is a wealthy country that trains its STEM students through one of the world's highest-ranked education systems.²² The government also incentivizes Canadian organizations to give post-secondary students work experience related to their field of study through its Student Work Placement Program.²³ On top of its world-class education programs, Canada also has venture capital and startup-friendly legal systems and cultural ties to the U.S., Europe, and Asia.²⁴ For the U.S. to maintain its status as a major global innovation hub, it will need to invest in upskilling existing employees and creating a tech culture of continuous learning.

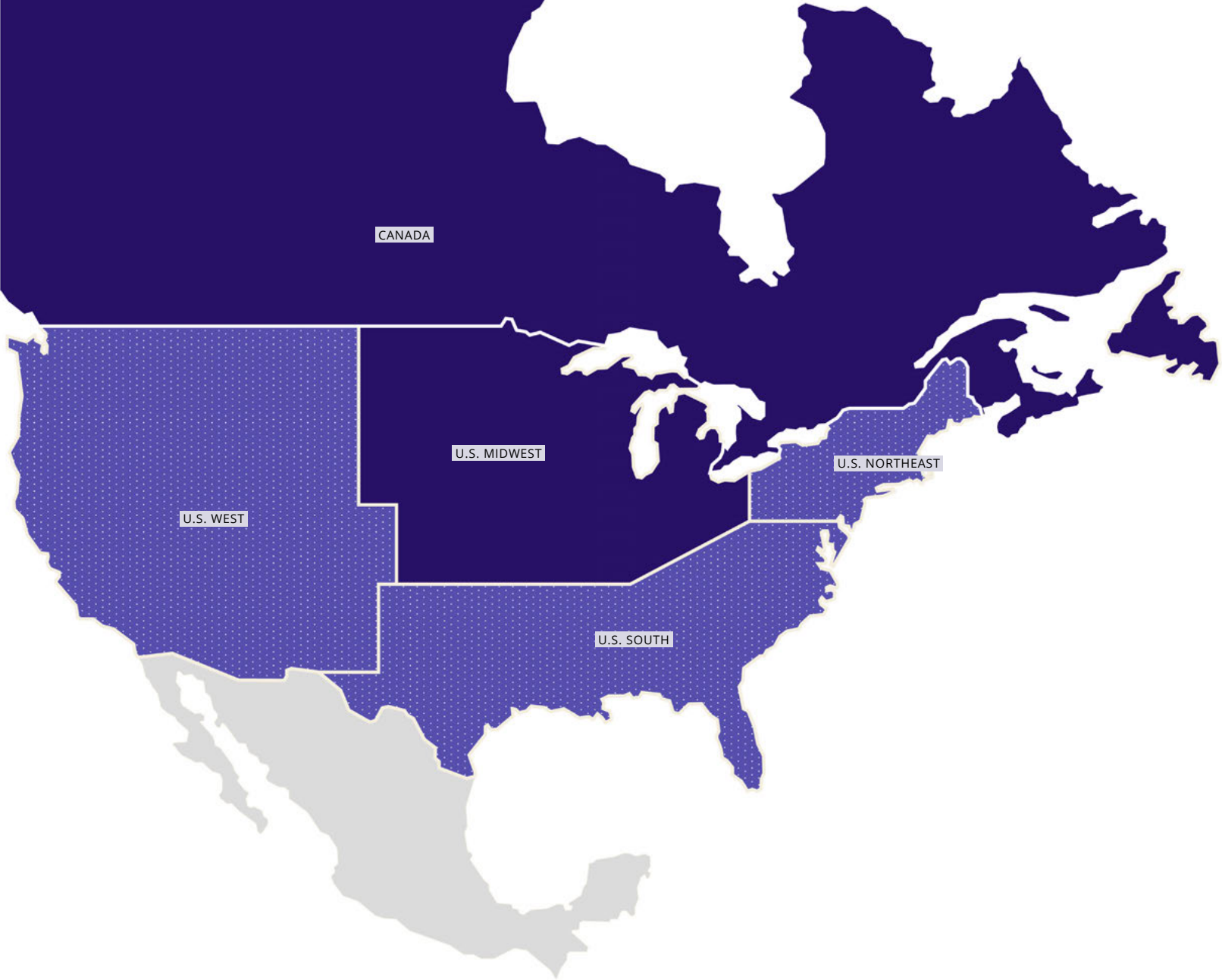
THE AMERICAN SOUTH IS STRUGGLING TO KEEP UP

Wealth is not equally distributed in the U.S., and COVID-19 threatens to deepen the already widening gap between the rich and poor.^{25, 26} While historically wealthier regions in America like the Northeast are preparing for digital transformation, the South—which holds a higher-than-average concentration of struggling economies²⁷—is lagging in essential business, computer science, and data science skills across the board. In fact, the South lags behind every other U.S. region in all three skill domains.

Today, high-paying information and business service jobs make up less than 8% of the region's workforce.²⁸ The South can no longer rely on blue-collar workers and traditional manufacturing to generate economic growth and must invest more resources in skill development.

In the wake of COVID-19, Coursera has partnered with governments in the U.S., including Oklahoma, Arizona, Illinois, and Minnesota to provide unemployed workers with free access to 3,800 online courses as part of our Workforce Recovery Initiative.²⁹ Similarly, Georgia's High Demand Career Initiative connects those responsible for the state's economic development efforts and those responsible for training Georgia's future workforce with employers to learn about current and projected challenges and needs (e.g., majors, certificates, and training courses).³⁰ Southern policymakers interested in attracting high-growth companies should invest in industry-driven skills development for their workforce through private and public partnerships.

These types of initiatives are critical as the region's population is growing rapidly, leading the nation in 2019 with a population growth of 81%.³¹ Unless the South—and local companies—prioritize upskilling the workforce and digital transformation, COVID-19 will only exacerbate regional inequality in the U.S.



NORTH AMERICA Business

Skill Level
● CUTTING-EDGE
● COMPETITIVE
● EMERGING
● LAGGING

Global Rank

- 14 **Canada**
- 17 **United States**
 - Midwest
 - Northeast
 - South
 - West

Accounting

- 58%
- 80%
- 98%
- 49%
- 67%
- 83%

Communications

- 63%
- 58%
- 75%
- 56%
- 44%
- 60%

Finance

- 64%
- 81%
- 98%
- 76%
- 60%
- 79%

Management

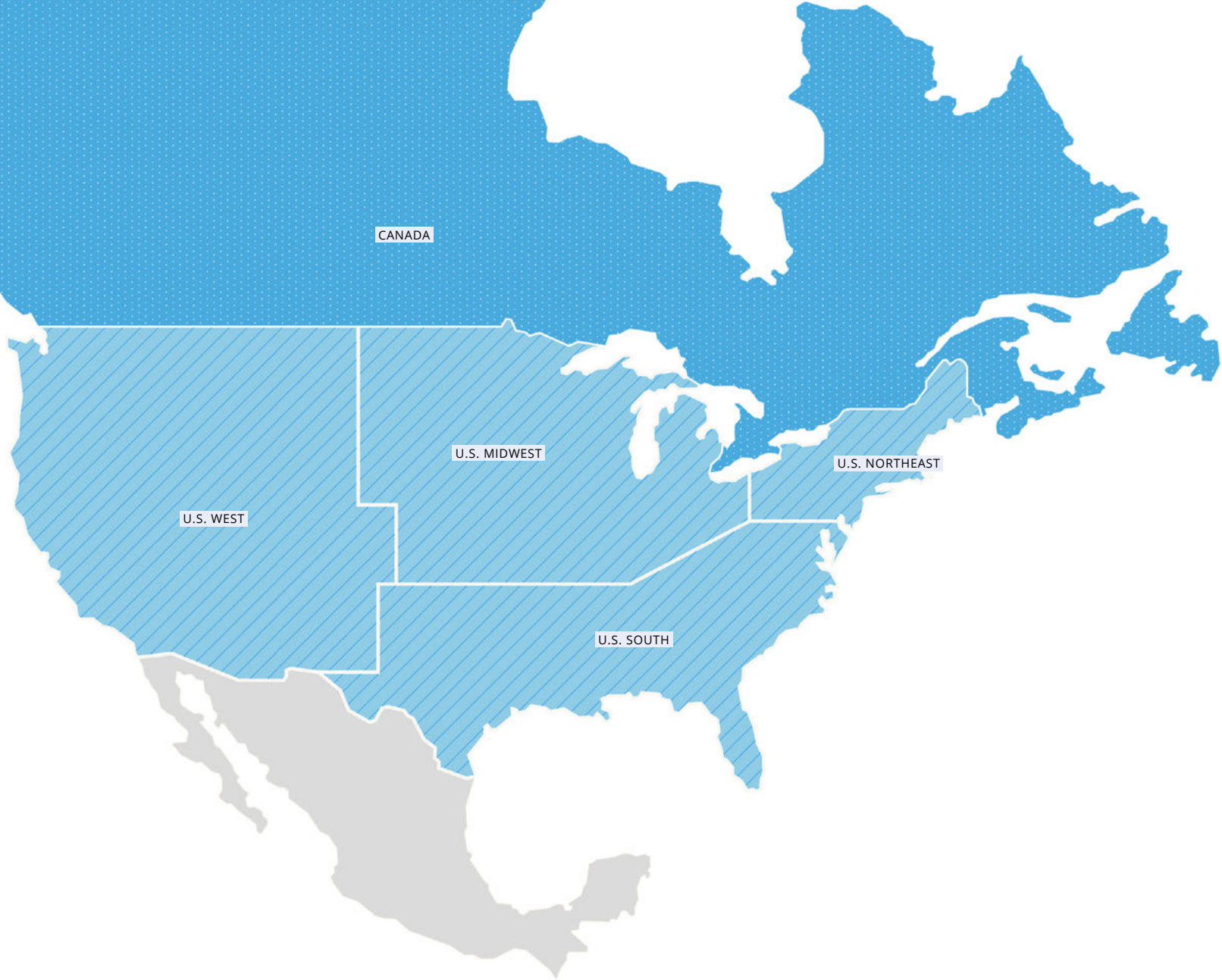
- 81%
- 76%
- 92%
- 71%
- 65%
- 54%

Marketing

- 71%
- 86%
- 100%
- 78%
- 75%
- 86%

Sales

- 47%
- 37%
- 33%
- 25%
- 30%
- 46%



NORTH AMERICA Technology

Skill Level
● CUTTING-EDGE ● COMPETITIVE ● EMERGING ● LAGGING

Global Rank

- 20 **Canada**
- / 37 **United States**
 - / Midwest
 - / Northeast
 - / South
 - West

Computer Networking

- 61%
- / 25%
- / 27%
- / 29%
- / 8%
- / 40%

Databases

- 80%
- 59%
- / 48%
- 62%
- 54%
- 68%

Human-Computer Interaction

- 54%
- / 12%
- / 5%
- / 13%
- / 3%
- / 30%

Operating Systems

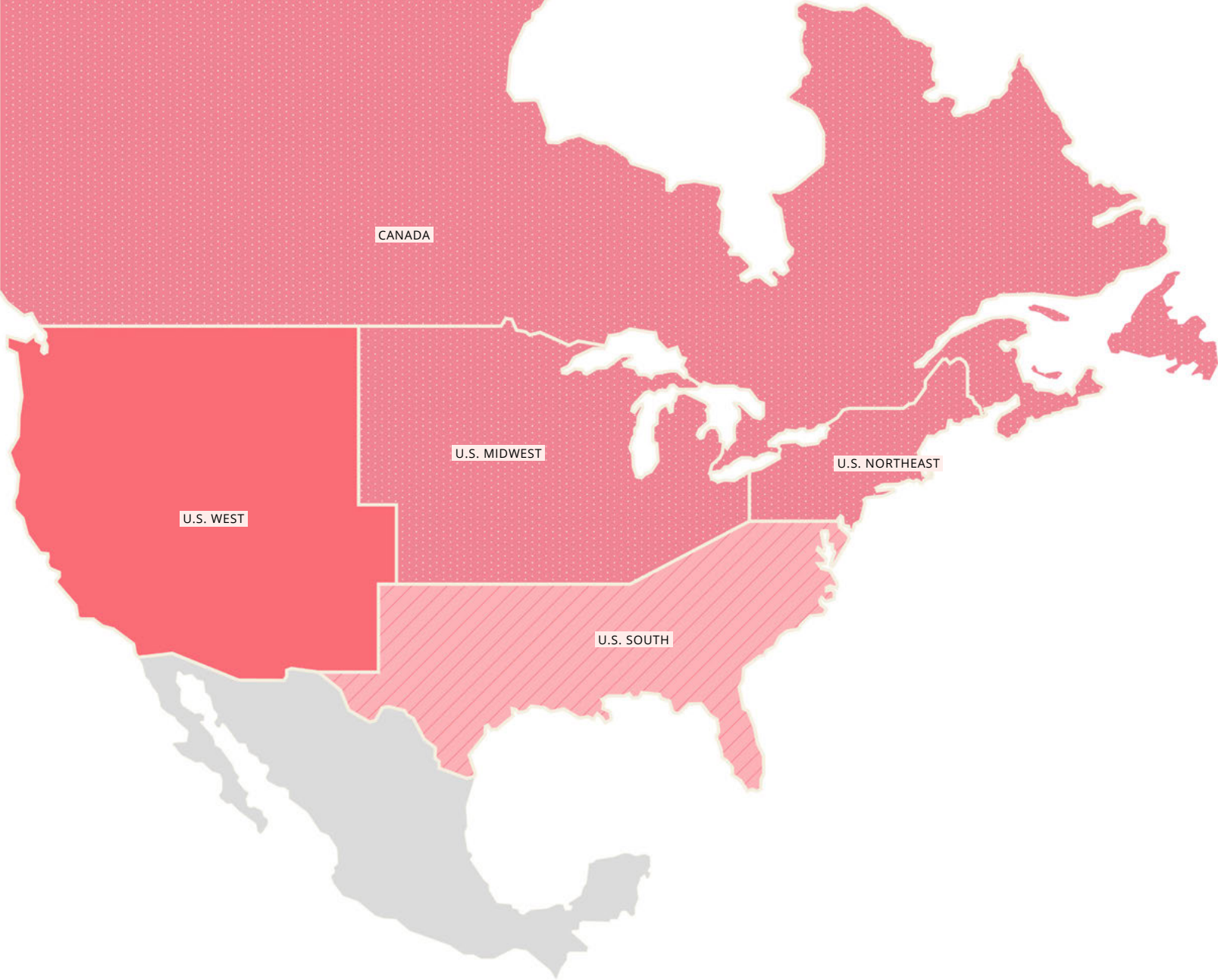
- 63%
- / 20%
- / 24%
- / 35%
- / 6%
- / 37%

Software Engineering

- / 46%
- / 15%
- / 16%
- / 21%
- / 11%
- / 37%

Security Engineering

- 64%
- / 36%
- / 41%
- 52%
- / 11%
- / 43%



NORTH AMERICA

Data Science

Skill Level

- CUTTING-EDGE
- COMPETITIVE
- EMERGING
- LAGGING

Global Rank

- 21 **Canada**
- 23 **United States**
 - Midwest
 - Northeast
 - South
 - West

Math

- 58%
- 61%
- 52%
- 65%
- 37%
- 75%

Statistics

- 63%
- 64%
- 56%
- 63%
- 49%
- 76%

Machine Learning

- 64%
- 68%
- 57%
- 68%
- 48%
- 86%

Data Visualization

- 80%
- 27%
- 60%
- 48%
- 43%
- 41%

Statistical Programming

- 73%
- 36%
- 27%
- 40%
- 30%
- 37%

Data Management

- 66%
- 41%
- 37%
- 35%
- 21%
- 48%

Latin America

Except for Brazil, Latin American countries rank lowest in overall business skills globally. Latin American countries lag the most in finance and marketing skills across the board. Latin America is also ranked lowest of all five regions when it comes to tech skills, with no country in the region ranking higher than emerging in the tech domain.

Regional business leaders are aware and concerned about the skills deficiency in the region, but it hasn't always translated into an investment in training. More than 60% of C-level executives in Brazil report that a lack of skills is a top workplace concern. Yet, only 1% are planning remarkable increases in their training and skill-building investments in the next three years.³²

Relative to other nations, Latin American governments spend a high percentage of GDP on education.³³ While the quality of their programs doesn't currently reflect this spending, there is an immense opportunity to invest more of these resources into tertiary education and improve the region's global standing.

ARGENTINA, BRAZIL, AND COSTA RICA DRIVE REGIONAL SKILLS GROWTH

Argentina leads the region in tech and data science skills, with notable strengths in data visualization, data management, statistical programming, and software engineering. The country is home to a vibrant tech ecosystem; it is one of three Latin American countries in the G20, and the country is investing in venture funds and creating new startup-friendly legislation.³⁴

Argentina's free higher education system may help explain the country's strong tech and data science skills; Argentina's population consistently ranks among the highest educated in Latin America.³⁵ The country also holds the highest level of English proficiency in Latin America, which has contributed to its desirability as a global outsourcing hub for software development.³⁶

Brazil ranks first in overall business skills and second in overall tech skills in Latin America. Within those domains, Brazil stands out from its neighbors—and the majority of the world—with its remarkable performance in software engineering and accounting. Brazil is ranked #6 of all 60 countries in software engineering and is the only country outside of Europe to make the top 10 list for accounting skills (at #3). This helps explain why private tech companies in Brazil receive the highest percentage of large company investments in the region, which is almost half of Latin America's total private funding.³⁷

Costa Rica ranks #2 in business and #3 in tech in the region, with a particular strength in sales. With the ambitious goal of becoming an entirely bilingual nation in the next decade, Costa Rica is encouraging students to pursue careers in the technology sector—and the results so far are impressive.^{38,39} In June 2020, the Costa Rican government partnered with Coursera to provide 50,000 online training scholarships for citizens who lost their jobs as a result of COVID-19⁴⁰; 15,000 learners enrolled in the program on its first day.

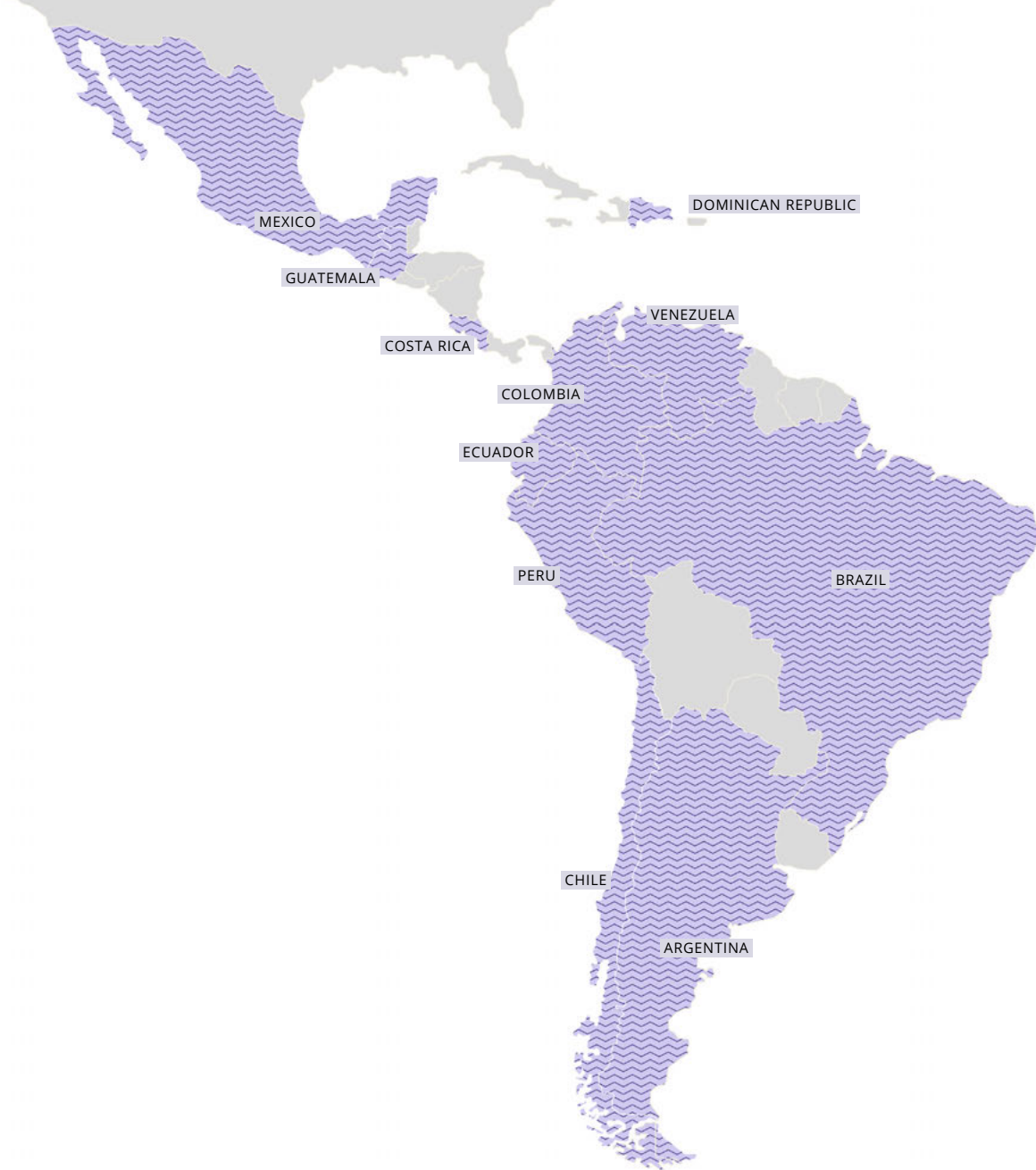
While many Fortune 100 companies already have operations in Costa Rica, including Amazon, Intel, Hewlett Packard Enterprise, and IBM, we expect the country to rise even further in the global skill rankings as it receives more foreign investment.

COLOMBIA AND MEXICO HAVE UNTAPPED POTENTIAL

Colombia and Mexico have the potential to become innovation drivers for Latin America, but have economic challenges to overcome. Both countries face steep unemployment rates, which contribute to a skills proficiency deficit.⁴¹ Both are lagging in business and tech skills; in fact, both nations lag behind every other country globally in overall business skills.

To combat their respective skills shortages, Colombia and Mexico are pursuing new ways to equip citizens with the skills needed to advance their careers, boost employability, and stimulate economic growth. The Colombia Ministry of Information and Technology Communication, with support from President Ivan Duque, has partnered with Coursera to offer 3,800 free online courses to 50,000 Colombian citizens in response to COVID-19, as well as pledged to train more than 2,800 Colombians in key artificial intelligence skills.⁴²

Researchers in Colombia are also conducting a randomized evaluation to test the impact of an interactive multimedia preschool program on children's math and science skills.⁴³ These initiatives capitalize on an immense opportunity for Latin American governments and businesses to drive economic change from within by equipping their workforce with the skills needed to innovate and compete.



LATIN AMERICA Business

Skill Level
● CUTTING-EDGE ● COMPETITIVE ● EMERGING ● LAGGING

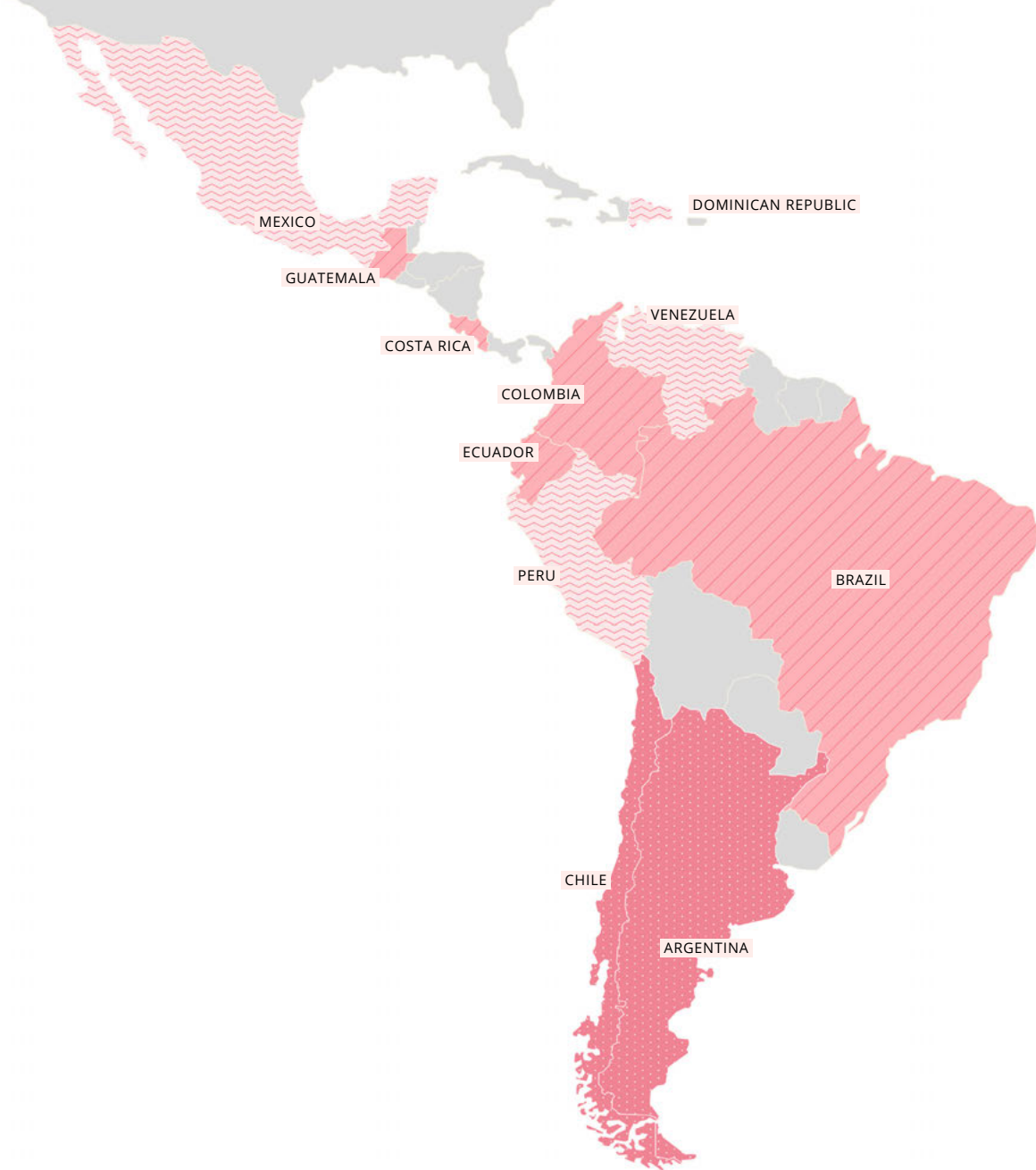
Global Rank		Accounting	Communications	Finance	Management	Marketing	Sales
46	Brazil	97%	25%	53%	39%	34%	12%
51	Costa Rica	31%	29%	12%	27%	31%	68%
52	Chile	14%	15%	10%	7%	0%	66%
53	Argentina	37%	27%	15%	32%	25%	20%
54	Guatemala	12%	17%	5%	15%	29%	56%
55	Ecuador	83%	20%	2%	0%	3%	25%
56	Peru	39%	2%	8%	3%	10%	10%
57	Venezuela	22%	34%	14%	12%	15%	8%
58	Dominican Republic	7%	8%	3%	5%	8%	22%
59	Colombia	32%	24%	7%	17%	37%	17%
60	Mexico	8%	12%	0%	2%	14%	19%



LATIN AMERICA Technology

Skill Level
● CUTTING-EDGE
● COMPETITIVE
● EMERGING
● LAGGING

Global Rank	Country	Computer Networking	Databases	Human-Computer Interaction	Operating Systems	Software Engineering	Security Engineering
41	Argentina	39%	68%	59%	31%	68%	22%
42	Brazil	31%	22%	53%	42%	92%	5%
43	Costa Rica	29%	39%	36%	14%	37%	19%
44	Chile	19%	5%	64%	5%	90%	2%
45	Dominican Republic	37%	31%	10%	10%	20%	73%
46	Venezuela	14%	3%	7%	27%	42%	63%
51	Colombia	7%	20%	29%	7%	31%	34%
52	Guatemala	8%	0%	17%	3%	19%	32%
53	Peru	3%	17%	22%	12%	47%	31%
56	Ecuador	17%	19%	8%	19%	22%	71%
58	Mexico	0%	8%	20%	0%	25%	3%



LATIN AMERICA Data Science

Skill Level
● CUTTING-EDGE ● COMPETITIVE ● EMERGING ● LAGGING

Global Rank	Country	Math	Statistics	Machine Learning	Data Visualization	Statistical Programming	Data Management
22	Argentina	47%	47%	49%	78%	75%	83%
30	Chile	44%	39%	34%	76%	56%	39%
34	Guatemala	34%	19%	7%	14%	7%	12%
36	Ecuador	93%	24%	2%	98%	59%	97%
37	Costa Rica	22%	31%	22%	81%	27%	24%
39	Brazil	31%	41%	39%	37%	90%	34%
41	Colombia	20%	12%	24%	58%	34%	34%
47	Venezuela	53%	25%	12%	42%	5%	56%
48	Mexico	73%	7%	8%	36%	22%	7%
49	Dominican Republic	27%	10%	14%	97%	29%	61%
52	Peru	42%	17%	10%	54%	46%	68%

Europe

European countries dominate the leaderboards in all three skill domains. The 15 most-skilled countries globally are in Europe, with Switzerland, Russia, and Finland topping the list. Their robust education systems combined with an emphasis on adult learning may be responsible for European countries' skill dominance.

Finland's efforts to skill and upskill its population are the strongest in the world due to its notoriously high-quality primary schools and overall education system. Similarly, Switzerland has a renowned education system, including staff training and a strong rate of vocational training.⁴⁴ Both countries boast per capita GDPs in the top 15 globally.⁴⁵

On a broader scale, the EU recently announced that its flagship program for education exchange across countries, Erasmus+, is prioritizing digital competencies and has educated over 10 million people in the last three decades.⁴⁶ While the region's strong emphasis on education has created a highly-skilled workforce to date, keeping pace with digital transformation will require vigilance. European governments and businesses will need to reassess the skills critical to success continuously.

THE UK TRAILS BEHIND IN TECH AND DATA SCIENCE SKILLS

While Europe is a skills powerhouse overall, the UK lags behind the rest of the region—ranked 23rd in overall computer science skills and 24th in overall data science skills. The lack of strong data science skills is having a notable impact; the UK is increasingly short on talent, and demand for data scientists and data engineers has tripled over the past five years (rising 231%).⁴⁷ As much as 47% of the region's organizations are currently struggling to fill their data science roles, with 37% also struggling to fill data engineering positions. That's compared to just 25% for security-based roles.⁴⁸

This may only be the start of the region's talent shortage as Brexit creates uncertainty, including confusion over visas and work permits that tech startups claim is already chasing skilled workers away. Although top universities in the UK are providing a pipeline of top talent, net inflows of European workers into the country have declined over the past few years, adding further pressure on employers to find skilled workers.⁴⁹

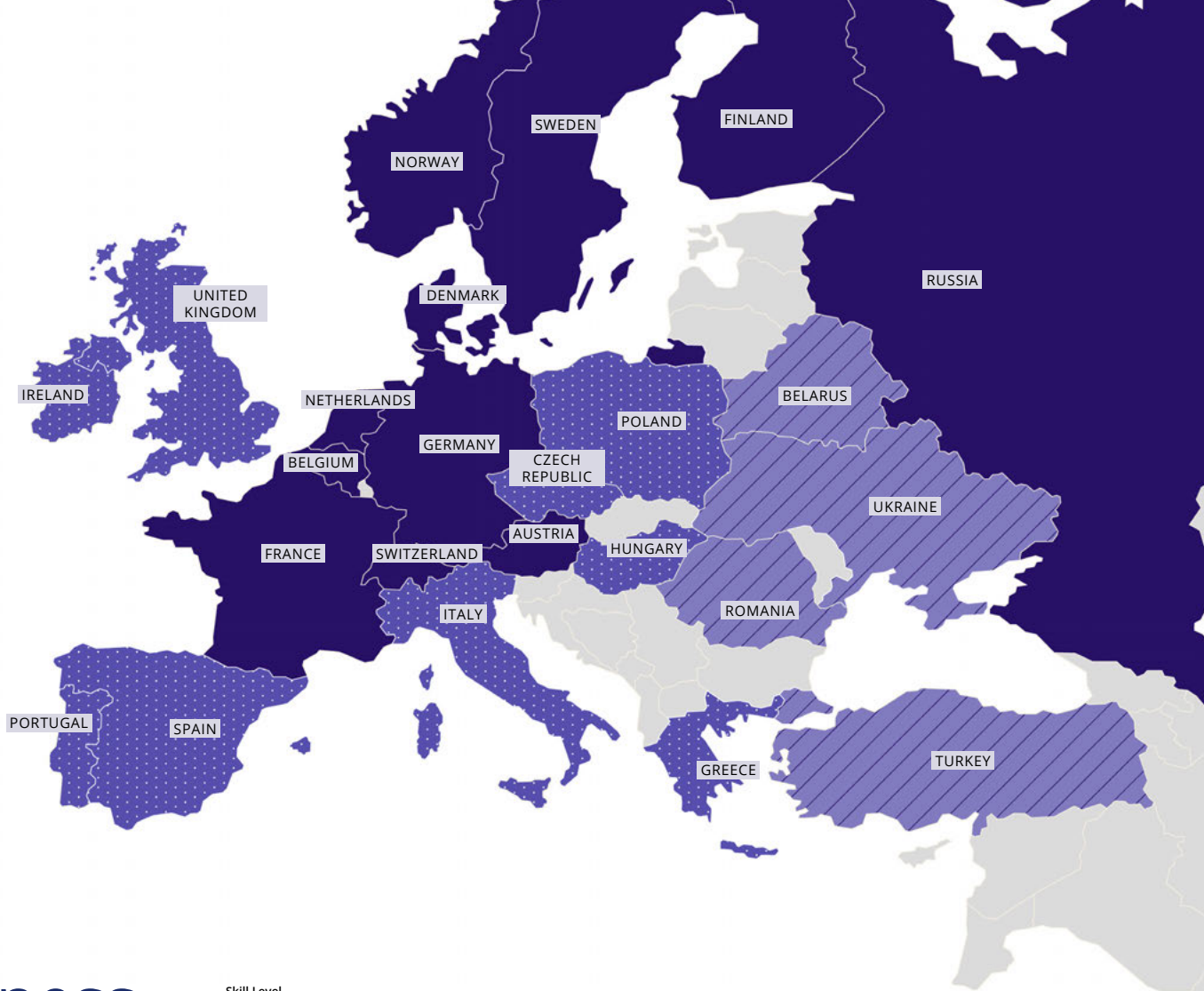
While Brexit is slowing the influx of foreign tech talent, it may provide an impetus to radically reform skills training in the UK.⁵⁰ To avoid a technical recession, the British government will need to invest heavily in upskilling its existing workforce and developing future-focused curricula in partnership with private organizations.

RUSSIA IS AHEAD OF THE GAME IN TECH EDUCATION

Russia is the most skilled country in technology and data science. The country is unparalleled in its software engineering, statistical programming, data management, database, and operating systems skills. All of Russia's tech and data science competencies are categorized as cutting-edge or competitive.

Russia produces some of the most talented Software Engineers in the world. The country consistently dominates international programming contests, outperforming both China and the U.S.⁵¹ Its STEM education also has scale; Russia produces the most engineering graduates of any country—more than 450,000 per year.⁵² Russian students get a head start in computer science compared to students in countries like the U.S.; Russia's Federal Educational Standards (FES) mandate that informatics be compulsory in middle school.⁵³ Students' technical skills are then fostered through a career-focused curriculum in higher education; Russia's Higher School of Economics, for example, recently announced the first top tier online master's program in data science that offers three career-related tracks for Data Scientists, Machine Learning Engineers, and Researchers in Data Science.⁵⁴

While the country is highly competitive in tech and data science skills, it currently lacks the startup pipeline to help its talented IT experts secure high-paying jobs. This may be, in part, why the country struggles in business skills. Russia ranks #9 globally and #8 regionally in overall business skills. As Moscow's and St. Petersburg's startup scenes continue to grow, it's expected that Russia will soon rise in the business domain rankings.⁵⁵



EUROPE Business

Skill Level
● CUTTING-EDGE ● COMPETITIVE ● EMERGING ▨ LAGGING

Global Rank	Accounting	Communications	Finance	Management	Marketing	Sales
1	Switzerland	98%	97%	100%	100%	97%
2	Austria	81%	86%	95%	98%	93%
3	Denmark	93%	100%	69%	90%	54%
4	Finland	73%	92%	97%	92%	49%
6	Norway	85%	93%	83%	93%	95%
7	Germany	90%	85%	90%	86%	86%
8	Belgium	92%	83%	98%	95%	85%
9	Russia	95%	98%	93%	80%	100%
11	Sweden	59%	68%	73%	85%	58%
12	France	100%	81%	85%	97%	98%
15	Netherlands	88%	76%	86%	69%	71%
16	Italy	86%	71%	88%	71%	81%
19	United Kingdom	54%	51%	80%	73%	64%
20	Czech Republic	66%	59%	78%	66%	51%
22	Ireland	36%	39%	54%	64%	41%
23	Hungary	41%	75%	31%	58%	53%
24	Poland	63%	44%	56%	56%	59%
25	Greece	75%	31%	76%	63%	36%
26	Portugal	56%	32%	51%	61%	61%
30	Spain	78%	47%	44%	59%	32%
32	Belarus	29%	54%	49%	37%	29%
36	Romania	49%	19%	37%	42%	80%
38	Turkey	0%	5%	20%	19%	15%
43	Ukraine	34%	53%	27%	24%	14%



EUROPE Technology

Skill Level
● CUTTING-EDGE
● COMPETITIVE
● EMERGING
● LAGGING

Global Rank	Country	Computer Networking	Databases	Human-Computer Interaction	Operating Systems	Software Engineering	Security Engineering
● 1	Russia	● 88%	● 100%	● 68%	● 100%	● 100%	● 98%
● 2	Belarus	● 81%	● 97%	● 81%	● 75%	● 98%	⚡ 0%
● 3	Switzerland	● 83%	● 98%	● 90%	● 98%	● 85%	● 93%
● 4	Ukraine	● 53%	⚡ 29%	⚡ 39%	⚡ 46%	● 88%	⚡ 17%
● 5	Finland	● 98%	● 85%	● 98%	● 88%	● 93%	⚡ 29%
● 6	Netherlands	● 93%	● 93%	● 75%	● 93%	● 66%	● 81%
● 7	Italy	● 76%	● 64%	● 85%	● 85%	● 80%	● 61%
● 8	France	● 71%	● 51%	● 92%	● 73%	● 64%	● 69%
● 9	Belgium	● 86%	● 92%	● 86%	● 83%	● 76%	● 90%
● 10	Czech Republic	● 85%	● 54%	● 56%	● 92%	● 61%	● 78%
● 11	Austria	● 90%	● 83%	● 88%	● 95%	● 75%	● 86%
● 12	Germany	● 75%	● 86%	● 78%	● 81%	● 71%	● 51%
● 13	Sweden	● 80%	● 69%	● 83%	● 68%	● 78%	● 75%
● 14	Poland	● 92%	● 75%	● 73%	⚡ 47%	● 83%	⚡ 41%
● 15	Hungary	● 97%	● 66%	● 63%	● 86%	● 81%	● 68%
● 16	Norway	● 95%	● 88%	● 80%	● 90%	● 63%	● 92%
● 17	Denmark	● 64%	⚡ 36%	● 93%	● 97%	● 86%	● 56%
● 18	Spain	⚡ 49%	● 63%	● 69%	● 56%	● 73%	⚡ 42%
● 21	Ireland	● 56%	● 90%	● 58%	● 69%	● 58%	● 58%
● 23	United Kingdom	● 66%	● 61%	● 61%	● 58%	● 51%	● 66%
● 26	Portugal	● 63%	⚡ 41%	⚡ 47%	● 64%	● 59%	⚡ 37%
● 28	Romania	● 69%	⚡ 25%	⚡ 42%	● 61%	● 54%	⚡ 10%
● 29	Greece	● 54%	⚡ 37%	⚡ 25%	● 80%	⚡ 39%	⚡ 46%
⚡ 54	Turkey	⚡ 5%	⚡ 2%	⚡ 14%	⚡ 32%	⚡ 8%	⚡ 15%



EUROPE Data Science

Skill Level
● CUTTING-EDGE ● COMPETITIVE ● EMERGING 〰 LAGGING

Global Rank		Math	Statistics	Machine Learning	Data Visualization	Statistical Programming	Data Management
● 1	Russia	● 100%	● 98%	● 98%	● 92%	● 100%	● 100%
● 2	Switzerland	● 97%	● 100%	● 100%	● 75%	● 95%	● 88%
● 3	Belgium	● 92%	● 97%	● 97%	〰 29%	● 80%	● 81%
● 4	Austria	● 90%	● 95%	● 95%	〰 44%	● 71%	● 95%
● 5	Finland	● 71%	● 81%	● 85%	● 93%	● 93%	● 75%
● 6	France	● 88%	● 93%	● 93%	〰 7%	● 85%	● 59%
● 7	Germany	● 81%	● 88%	● 92%	〰 59%	● 92%	● 78%
● 8	Belarus	● 98%	● 83%	● 83%	〰 19%	● 98%	● 86%
● 9	Netherlands	● 86%	● 85%	● 75%	〰 39%	● 86%	● 76%
● 10	Norway	● 66%	● 78%	● 78%	● 83%	● 78%	● 80%
● 11	Sweden	● 76%	● 86%	● 86%	〰 15%	● 81%	〰 44%
● 12	Spain	● 68%	● 59%	● 63%	〰 25%	● 63%	● 73%
● 13	Hungary	● 83%	● 76%	● 90%	● 68%	〰 39%	● 90%
● 14	Czech Republic	● 95%	● 90%	● 81%	〰 12%	● 88%	● 92%
● 15	Italy	● 69%	● 75%	● 76%	● 53%	● 83%	● 63%
● 19	Denmark	● 63%	● 71%	● 73%	〰 31%	● 69%	● 69%
● 20	Poland	● 78%	● 69%	● 71%	〰 34%	● 68%	〰 42%
● 24	United Kingdom	● 64%	● 68%	● 66%	● 51%	● 66%	〰 37%
● 26	Portugal	● 51%	● 61%	● 61%	● 73%	● 61%	● 54%
● 27	Greece	● 56%	● 58%	● 59%	● 88%	〰 24%	● 53%
● 29	Ukraine	● 85%	〰 49%	● 56%	〰 3%	● 97%	〰 15%
〰 32	Romania	〰 49%	● 53%	● 58%	● 71%	〰 31%	〰 49%
〰 33	Ireland	〰 39%	〰 46%	〰 47%	〰 32%	● 58%	〰 47%
〰 55	Turkey	〰 8%	〰 20%	〰 20%	● 69%	〰 19%	〰 20%

Middle East & Africa

The Middle East and Africa (MEA) lag behind developed regions like North America and Western Europe. Nowhere is this truer than in the data science domain; the region's overall data skills rank lowest in the world. There's one exception to the region's below-average data skills: Israel. Israel is ranked 18th of all 60 countries in the index when it comes to data science.

ISRAEL DEFIES REGIONAL LAG IN DATA SCIENCE

Israel's world-class data science skills are a product of both its education system and flourishing tech industry, dubbed "Silicon Wadi." Israel has one of the most educated populations globally, with 48% of 25-to-34-year-olds holding a tertiary degree,⁵⁶ of which engineering is the most common undergraduate degree.⁵⁷ The country's entrepreneurial spirit may play a pivotal role in its leading global ranking in education. Israelis started more than 10,000 companies between 1999 and 2014,⁵⁸ and the government routinely spends northward of 4% of its GDP on research and development (the U.S. spends about 2.8% for comparison).⁵⁹

With 45% of work in the Middle East projected to be automated by 2030,⁶⁰ the rest of the region can't afford to ignore their lagging data science skills. The stakes are high, and Israel is a prime example of how governments can prepare for a future of work in which humans and machines interact to drive productivity.

THE UAE IS RAISING THE BAR IN BUSINESS

The United Arab Emirates (UAE) stands out from its neighbors in both business and tech. The country's position as the regional business leader translates on the global stage as well; the country is ranked #5 of all 60 countries in the business domain. Of note, the UAE's management, marketing, and sales skills are all cutting-edge. Its economy is second in the region only to Saudi Arabia. While it still relies heavily on petroleum and natural gas, the UAE's government has made diversification a priority.

The Abu Dhabi School of Government (ADSG), for example, was established in 2018 and is the government entity responsible for overseeing and planning the learning and development of all Abu Dhabi government employees. ADSG's mission is to develop the most effective government workforce for the emirate through high-quality training and development activities, based on international best practices while considering the priorities and requirements of Abu Dhabi.

The organization has partnered with Coursera to upskill more than 60,000 government officials in cutting-edge skills like data science, artificial intelligence, and digital transformation.⁶¹ The unprecedented scope and scale of the public-private initiative signal that upskilling citizens is not just a business requirement, but an imperative that will define long-term economic competitiveness.

SAUDI ARABIA LEADS THE REGION IN TECH

While Saudi Arabia's business and data science skills are below average, the country leads the region in tech skills with 54% proficiency. The country's overall tech skills rank globally at #28 out of the 60 countries studied, surpassing the UAE at #30.

Saudi Arabia is already one of the region's leaders in the local availability of high-skilled jobs⁶² and working-age adults holding tertiary qualifications.⁶³ As the country diversifies its wealth away from diminishing oil reserves and invests billions into the tech industry (i.e., industrial manufacturing, virtual reality, and machine learning),⁶⁴ developing tech skills within the country will undoubtedly remain a priority.

SOUTH AFRICA'S LAGGING DATA SCIENCE SKILLS ARE AN OBSTACLE TO GLOBAL COMPETITION

South Africa is the region's third most skilled country, ranked #36 globally. The country's overall business and tech skills are on the cusp of being globally competitive, with 48% and 46% proficiency, respectively. Conversely, South Africa's overall data science proficiency lags at 27%, ranked #44 globally. Without the proper data science skills, South African businesses will struggle to expand and compete with organizations in more developed countries.

The country's economic divide is already resulting in a digital divide where many citizens don't have access to the internet or tech devices. Already, unemployment rates hold at an 11-year high, and the pandemic has now impacted 1.75 million workers.^{65 66} In an effort to stop the country's poorest citizens from falling even further behind, the government has developed the Presidential Commission on the Fourth Industrial Revolution, which introduces subjects such as coding and data analytics at a primary school level.⁶⁷ Government initiatives, private training programs, and alternative education approaches are all needed to ensure South African workers are prepared for the future of work.



MIDDLE EAST & AFRICA Business

Skill Level
● CUTTING-EDGE
● COMPETITIVE
● EMERGING
● LAGGING

Global Rank

- 5 United Arab Emirates
- 27 Kenya
- 31 South Africa
- 35 Israel
- 39 Nigeria
- 42 Saudi Arabia
- 48 Egypt

Accounting

- 71%
- 51%
- 42%
- 69%
- 19%
- 44%
- 5%

Communications

- 69%
- 22%
- 42%
- 36%
- 41%
- 3%
- 10%

Finance

- 59%
- 34%
- 47%
- 61%
- 25%
- 24%
- 17%

Management

- 88%
- 49%
- 53%
- 47%
- 41%
- 29%
- 10%

Marketing

- 83%
- 41%
- 58%
- 63%
- 36%
- 5%
- 7%

Sales

- 92%
- 90%
- 78%
- 75%
- 88%
- 7%
- 24%



MIDDLE EAST & AFRICA Technology

Skill Level

● CUTTING-EDGE ● COMPETITIVE ● EMERGING ● LAGGING

Global Rank

● 28	Saudi Arabia
● 30	United Arab Emirates
● 33	South Africa
● 34	Israel
● 39	Egypt
⊖ 48	Kenya
⊖ 60	Nigeria

Computer Networking

⊖ 24%
● 46%
● 47%
● 59%
● 20%
⊖ 15%
⊖ 2%

Databases

● 27%
● 71%
● 44%
● 56%
● 53%
● 95%
⊖ 7%

Human-Computer Interaction

● 32%
● 27%
● 44%
● 41%
⊖ 5%
⊖ 24%
⊖ 0%

Operating Systems

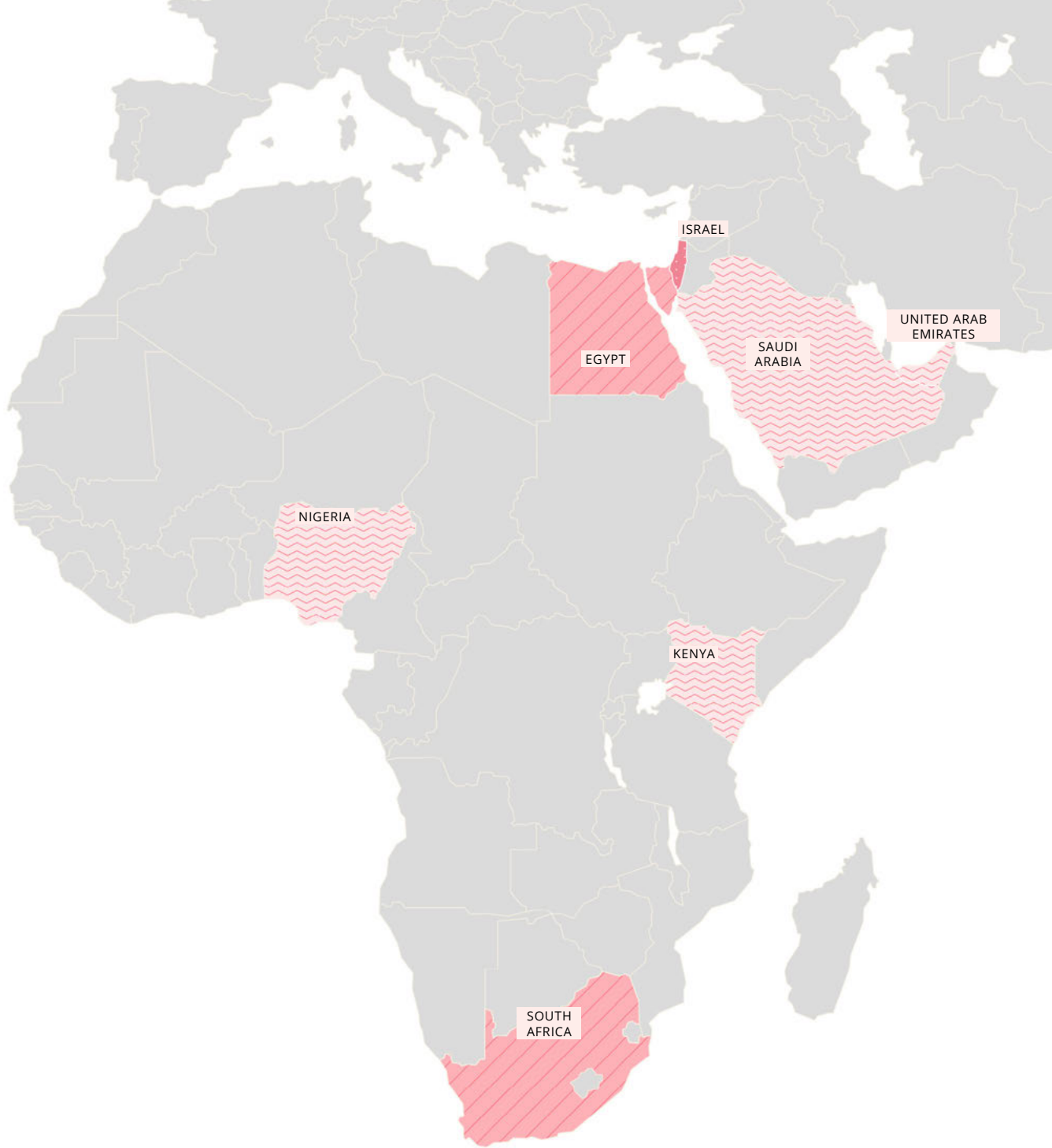
● 22%
● 53%
● 54%
● 76%
● 39%
⊖ 8%
⊖ 2%

Software Engineering

● 41%
● 56%
● 32%
● 29%
⊖ 24%
⊖ 12%
⊖ 3%

Security Engineering

● 59%
● 97%
● 76%
● 39%
● 95%
● 88%
● 49%



MIDDLE EAST & AFRICA

Data Science

Skill Level

- CUTTING-EDGE
- COMPETITIVE
- EMERGING
- LAGGING

Global Rank	Country	Math	Statistics	Machine Learning	Data Visualization	Statistical Programming	Data Management
18	Israel	80%	92%	80%	63%	51%	85%
44	South Africa	19%	32%	36%	61%	25%	19%
45	Egypt	32%	22%	42%	56%	2%	29%
50	United Arab Emirates	14%	14%	29%	100%	32%	46%
54	Saudi Arabia	5%	3%	19%	24%	20%	8%
59	Kenya	2%	5%	3%	86%	15%	5%
60	Nigeria	0%	0%	0%	66%	0%	0%

Asia Pacific

In Asia Pacific, there is a stark contrast between developing and developed economies' skills performance. While New Zealand, Australia, and Singapore have more resources per capita to invest in education and upskilling, developing economies—including Bangladesh, Pakistan, and the Philippines—are among the lowest skilled in our ranking. These countries spend less on education as a percent of GDP and have higher proportions of low-skilled workers.⁶⁸

As the nature of work undergoes massive transformations and the region's pool of digital consumers grows, the countries that are best poised to succeed are investing heavily in education and retraining.

EMPLOYABILITY DEPENDS ON STRONGER TECH AND DATA SKILLS

Throughout 2020, Asian economies will become larger than the rest of the world combined.⁶⁹ Yet, Asian countries are largely missing from the top 20 most skilled nations. The region's overall tech and data science skills are lagging, with major skills deficits in math, statistical programming, and software engineering. The lack of tech and data science skills across the region can be attributed partly to poor-quality STEM education systems in many countries, which struggle to equip students with essential skills needed for employment. The need for stronger STEM programs is heightened by the region's brain drain, reducing the supply of skilled workers locally available.⁷⁰

Without a considerable investment in upskilling the workforce, many Asian workers will be devastated by the Fourth Industrial Revolution and pervasive impact of the pandemic. Thailand, for example, consistently ranks in the bottom half of Asian countries across all three skill domains; the country also has one of the world's highest percentages of work that could be automated by adapting current technology (55%). Similarly, the majority of work activity in Japan, India, and China is at risk of obsolescence.⁷¹

Governments in the region must encourage public-private partnerships to identify the labor market's unmet needs, develop curricula and national standards, and implement cost-sharing mechanisms. As the region's economy continues to boom, the skill level of Asia's workforce will affect the region's trajectory and the global economy as a whole.

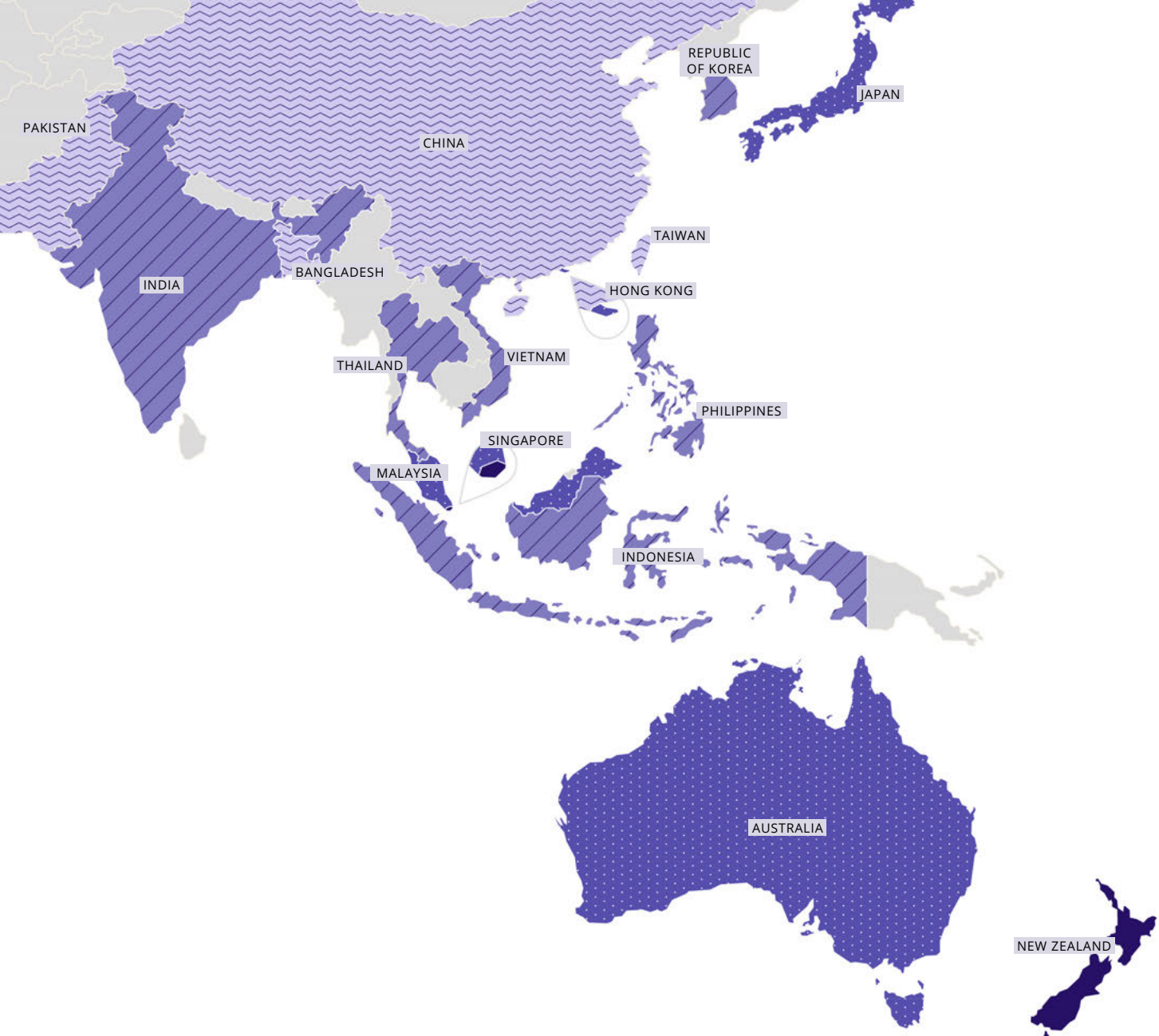
INDIA SURGES CHINA IN BUSINESS AND TECH SKILLS

Two of the largest economies in Asia—India and China—post similar figures in terms of skills mastery. India, however, scores higher in business (44%) and tech (34%), while China outperforms India in data science (42%).

India's tech and business skills are essential to its behemoth IT industry. The industry generated more than \$137 billion in exports in 2019, and business leaders across the globe have established their own IT or R&D centers to take advantage of India's software ecosystem.⁷² Unfortunately, automation poses a major threat to many of the tech jobs, such as data collection and processing, that first attracted global companies to India.

Realizing the importance of upskilling and training, the Indian government has already introduced various programs under its Skill India initiative to nurture highly skilled and employable Indian youth. With the Indian workforce expected to increase 27% to 600 million by 2022,⁷³ the opportunity for India to become the global talent hub for emerging technologies cannot be understated.

China's competitive edge over India in data science is not a shock given its ambitions to become the global leader in artificial intelligence.⁷⁴ The government is investing heavily in the development of facial recognition software, including facial recognition eyewear for police officers and smart classrooms that monitor student's facial expressions to track engagement.⁷⁵ To cement its place as the global AI leader, China will need business and tech skills to support its advancements in data science.



ASIA PACIFIC Business

Skill Level
 CUTTING-EDGE
 COMPETITIVE
 EMERGING
 LAGGING

Global Rank

- 10 Singapore
- 13 New Zealand
- 18 Australia
- 21 Hong Kong
- 28 Japan
- 29 Malaysia
- 33 Vietnam
- 34 India
- 37 Philippines
- 40 Thailand
- 41 Indonesia
- 44 Korea, Republic of
- 45 China
- 47 Bangladesh
- 49 Pakistan
- 50 Taiwan

Accounting

- 76%
- 61%
- 53%
- 64%
- 68%
- 20%
- 25%
- 47%
- 17%
- 24%
- 27%
- 3%
- 46%
- 15%
- 10%
- 2%

Communications

- 73%
- 78%
- 64%
- 88%
- 90%
- 46%
- 66%
- 14%
- 95%
- 49%
- 37%
- 61%
- 56%
- 7%
- 0%
- 80%

Finance

- 92%
- 68%
- 66%
- 75%
- 58%
- 41%
- 63%
- 42%
- 36%
- 39%
- 32%
- 29%
- 46%
- 22%
- 19%
- 71%

Management

- 83%
- 78%
- 75%
- 68%
- 46%
- 51%
- 54%
- 44%
- 31%
- 34%
- 22%
- 20%
- 36%
- 8%
- 14%
- 25%

Marketing

- 85%
- 73%
- 66%
- 80%
- 61%
- 27%
- 47%
- 64%
- 19%
- 22%
- 17%
- 39%
- 53%
- 12%
- 2%
- 44%

Sales

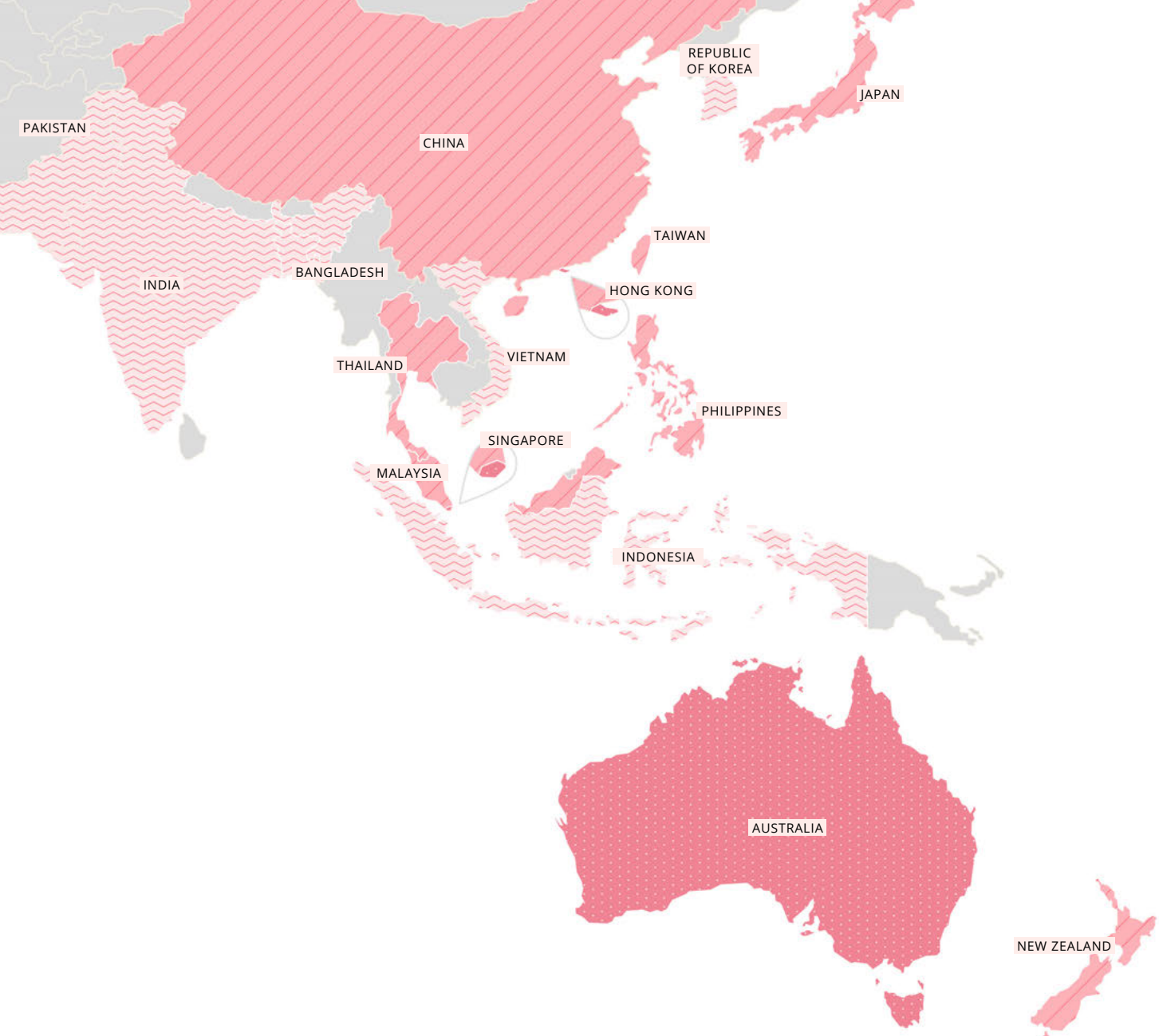
- 44%
- 39%
- 46%
- 42%
- 73%
- 3%
- 83%
- 27%
- 34%
- 76%
- 31%
- 63%
- 5%
- 2%
- 69%
- 0%



ASIA PACIFIC Technology

Skill Level
● CUTTING-EDGE
● COMPETITIVE
● EMERGING
▨ LAGGING

Global Rank	Country	Computer Networking	Databases	Human-Computer Interaction	Operating Systems	Software Engineering	Security Engineering
19	New Zealand	78%	49%	76%	78%	69%	14%
22	Vietnam	44%	32%	46%	66%	44%	47%
24	Japan	100%	24%	100%	25%	97%	12%
25	Australia	58%	73%	71%	49%	53%	27%
31	Indonesia	73%	46%	95%	37%	95%	100%
32	Hong Kong	51%	42%	66%	71%	34%	20%
35	Singapore	68%	47%	49%	59%	27%	85%
36	Thailand	27%	76%	51%	51%	36%	80%
38	Philippines	41%	14%	31%	24%	17%	24%
40	India	32%	78%	15%	36%	14%	53%
47	Korea, Republic of	12%	15%	97%	15%	49%	83%
49	Malaysia	36%	58%	37%	34%	10%	44%
50	China	10%	10%	19%	44%	0%	7%
55	Taiwan	42%	12%	34%	17%	5%	8%
57	Bangladesh	22%	81%	2%	41%	7%	54%
59	Pakistan	34%	34%	3%	29%	2%	25%



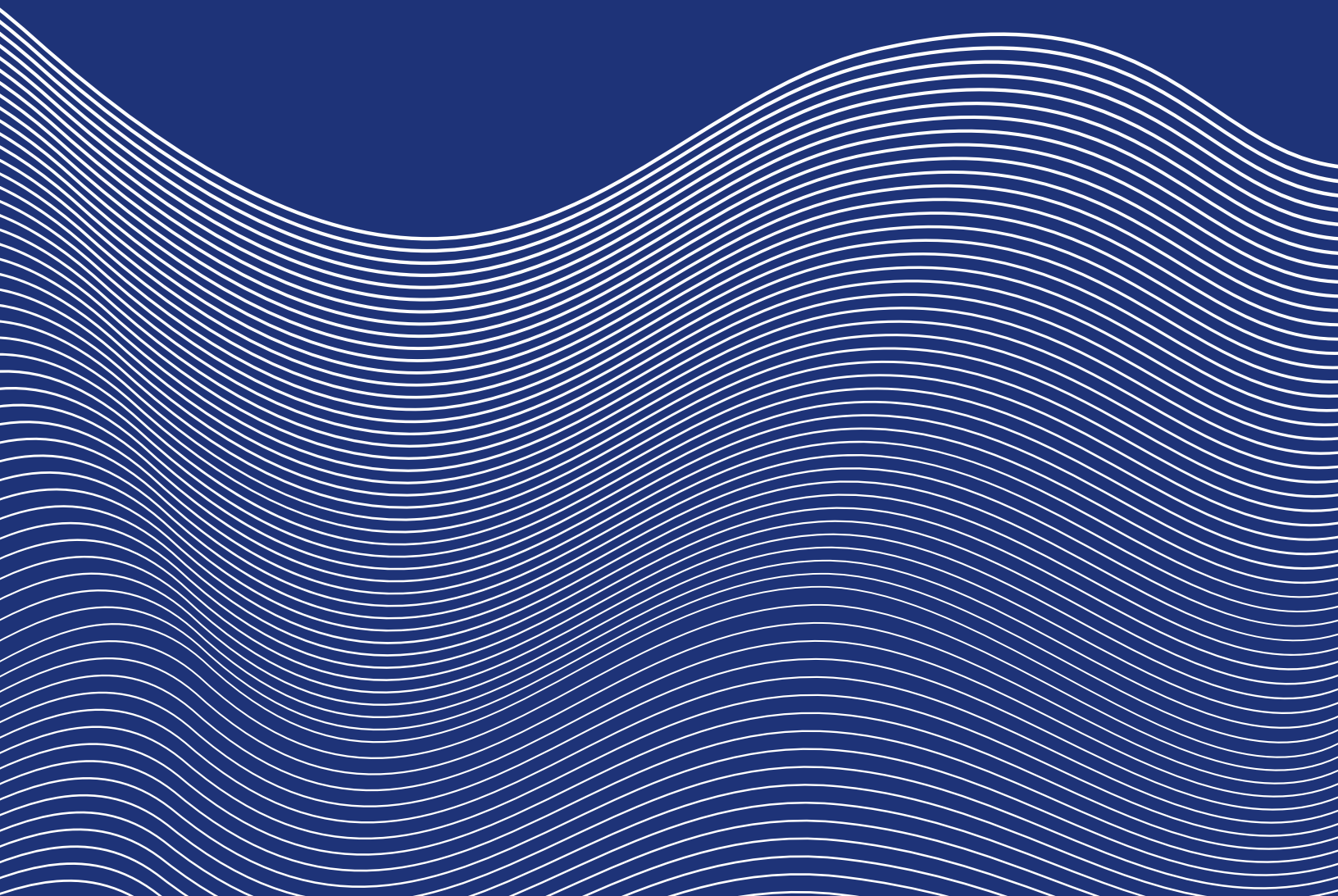
ASIA PACIFIC Data Science

Skill Level
● CUTTING-EDGE
● COMPETITIVE
● EMERGING
 LAGGING

Global Rank	Country	Math	Statistics	Machine Learning	Data Visualization	Statistical Programming	Data Management
16	Hong Kong	75%	73%	88%	46%	44%	27%
17	Singapore	59%	80%	69%	64%	49%	32%
25	New Zealand	41%	66%	53%	90%	64%	71%
28	Australia	46%	54%	51%	85%	54%	58%
31	Philippines	29%	56%	27%	8%	42%	2%
35	China	54%	51%	54%	5%	3%	14%
38	Thailand	24%	36%	44%	41%	76%	17%
40	Japan	37%	44%	41%	47%	41%	98%
42	Taiwan	36%	42%	46%	20%	17%	51%
43	Malaysia	12%	37%	32%	2%	47%	10%
46	Korea, Republic of	15%	34%	37%	0%	14%	64%
51	India	25%	27%	31%	49%	12%	3%
53	Vietnam	17%	29%	25%	10%	53%	31%
56	Indonesia	10%	15%	17%	17%	37%	93%
57	Bangladesh	7%	8%	15%	95%	10%	22%
58	Pakistan	3%	2%	5%	22%	8%	36%

PART TWO:

Industry Results



Introduction

HOW INDUSTRIES PERFORM ACROSS SKILL DOMAINS

COVID-19 has impacted every industry. Faced with declining consumer confidence, factory shutdowns, and product shortages, companies have had to navigate unprecedented uncertainty. But as economies around the world begin to reopen, business leaders will need to move beyond immediate response and recovery and mitigate disruption on the horizon.⁷⁶

The future calls for a new set of critical skills and the cost of a skills shortage has come into sharp focus amid COVID-19. Technology skills have been essential to helping companies respond to the crisis in the short-term and will continue to support the future of remote work—from managing change and driving online services to automating processes that will no longer be done in person. Our data also reveals that companies with stronger technology skills have seen their valuation disrupted less by COVID-19 than those with weaker technology skills.⁷⁷

Unfortunately for many workers, their skills are decaying more rapidly than ever; 70% of employees report that they do not have mastery of the skills needed for their jobs.⁷⁸ Businesses that invest in their employees' skill development will have the resilience to seamlessly pivot through future crises. The following analysis will help organizations identify the critical skills their workforce needs to keep up—and get ahead—in an increasingly uncertain world.

RANKING 10 INFLUENTIAL INDUSTRIES

To understand which industries are most prepared to navigate technological disruption, we rank 10 industries—many of which encompass the largest companies globally—poised for innovation in their skill landscapes:

Automotive	Insurance
Professional Services	Manufacturing
Consumer Goods	Media & Entertainment
Finance	Technology
Healthcare	Telecommunications

The technology, finance, and professional services industries top the list of the most-prepared industries to take advantage of this emerging environment.

OVERALL RANKINGS ARE AS FOLLOWS:

BUSINESS	TECHNOLOGY	DATA SCIENCE
Manufacturing	Technology	Technology
Professional Services	Media & Entertainment	Finance
Telecommunications	Finance	Automotive
Technology	Professional Services	Telecommunications
Healthcare	Manufacturing	Media & Entertainment
Finance	Consumer Goods	Professional Services
Insurance	Automotive	Healthcare
Automotive	Telecommunications	Manufacturing
Consumer Goods	Healthcare	Consumer Goods
Media & Entertainment	Insurance	Insurance

THE LEADERS

TECHNOLOGY

Business: Ranked #4
Technology: Ranked #1
Data Science: Ranked #1

FINANCE

Business: Ranked #6
Technology: Ranked #3
Data Science: Ranked #2

PROFESSIONAL SERVICES

Business: Ranked #2
Technology: Ranked #4
Data Science: Ranked #6

MIDDLE OF THE PACK

MANUFACTURING

Business: Ranked #1
Technology: Ranked #5
Data Science: Ranked #8

TELECOMMUNICATIONS

Business: Ranked #3
Technology: Ranked #8
Data Science: Ranked #4

MEDIA & ENTERTAINMENT

Business: Ranked #10
Technology: Ranked #2
Data Science: Ranked #5

BOTTOM TIER

AUTOMOTIVE

Business: Ranked #8
Technology: Ranked #7
Data Science: Ranked #3

HEALTHCARE

Business: Ranked #5
Technology: Ranked #9
Data Science: Ranked #7

CONSUMER GOODS

Business: Ranked #9
Technology: Ranked #6
Data Science: Ranked #9

INSURANCE

Business: Ranked #7
Technology: Ranked #10
Data Science: Ranked #10

Automotive

Consumer expectations have put enormous pressure on the automotive industry to provide more than transportation from point A to point B. Drivers and passengers increasingly expect cutting-edge software and seamless mobility experience. From infotainment to self-driving technology, the industry is on the precipice of revolutionary transformation. The pressure to innovate has only been heightened by complications due to COVID-19, including the disruption of supply chain part exports from China, large-scale manufacturing interruptions across Europe, and the closure of assembly plants in the United States.⁷⁹

Despite flashy headlines about emerging tech, the industry currently lags in key business competencies, including sales, communications, and finance. Our data reveals that sales skills in the automotive industry trail behind all other industries. While customer trust in the buying process has traditionally been low, transforming the customer experience has the potential to build brand loyalty, retention, and consequently, higher profit margins in sales and after-sales.⁸⁰ Just as dealerships have evolved beyond brick-and-mortar to omnichannel strategies, sales teams need the skills to shift from a product-driven mindset to a customer-centric approach focused on platforms and services.⁸¹ Managing customer experience across multiple touch points is critical to building trusted relationships.

WHAT'S AT STAKE

While the industry struggles in business and technology, it ranks third in the data science domain. This skills imbalance suggests that as automotive companies invest in data science skills to capitalize on self-driving vehicles, they are neglecting critical business and technology skills.

The World Economic Forum predicts that there is \$670 billion of value at stake for automotive players and a further \$3.1 trillion of societal benefits as a result of digital transformation of the industry until 2025.⁸² To prepare for the next wave of innovation, companies should focus on developing a more balanced set of skills beyond the data science domain, including: artificial intelligence (AI), blockchain, agile project management, and digital marketing.

TRENDING SKILLS:

BUSINESS

Microsoft Excel
Project Management
Crisis Management
Digital Marketing
Design Thinking

TECHNOLOGY

Artificial Intelligence
Convolutional Neural Network
Computer Vision
Autonomous Cars
Algorithms

DATA SCIENCE

Python
Deep Learning
Data Storytelling
SQL
NLP

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Professional Services

As COVID-19 forces executives to make difficult choices and accelerate their digital transformation, consultants with the cutting-edge skills to help companies weather the storm will continue to be in high demand. Professional services firms are pushing to deliver new technology solutions beyond their traditional scope (e.g., designing and developing apps, prototypes, and intelligent systems) and business, tech, and data science skills are key to success.

Charged with helping companies scale and navigate disruption, it's not so surprising that the professional services industry excels in both the business and technology domains. Professional services is ranked second (only to manufacturing) in overall business skills and fourth in overall technology skills. Of note, the industry demonstrated the strongest sales, management, and accounting skills of all 10 industries studied. And as the industry embeds tech and automation into their processes to better scale, manage, and connect their internal teams, the skills needed to maintain those systems will be a necessity.

THE NEED FOR A BALANCED SKILL SET

The professional services industry's data science skills rank in the bottom half overall, with data visualization, data management, and statistics skills lagging behind every other industry. Paired with strategic business acumen and strong communication skills, improved data science skills will unlock an opportunity for consultants to provide even deeper, predictive insights for their clients. As firms invest in internal analytics teams to support their strategy teams,⁸³ their ranking in the domain will undoubtedly improve.

In a data-centric world, professional services organizations will need to develop the following skills to compete: data visualization, data management, statistical analysis, business analytics, machine learning, and blockchain.

TRENDING SKILLS:

BUSINESS

Microsoft Excel
Project Management
Financial Modeling
Presentation Design
Digital Marketing

TECHNOLOGY

Artificial Intelligence
Cloud Computing
Internet of Things
C
User Experience

DATA SCIENCE

Python
SQL
Data Storytelling
R
Data-Informed Decision-Making

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



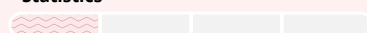
Math



Statistical Programming



Statistics



Consumer Goods

The consumer goods (CG) sector is evolving rapidly, shaped by today's more demanding customers. The rise of digital technology and "anytime, anywhere" consumption has created a perfect storm for disruption where only the most agile players can survive. With middle-class spending expected to triple by 2030 globally,⁸⁴ CG companies have a massive opportunity if they are willing to invest in the business, technology, and data science skills of the future.

There's a lot of work to be done: the CG industry ranks in the bottom half of industries in all three domains. This may explain why many CG companies are struggling to fully capitalize on digitization; on average, large consumer goods companies have online market shares that are at least five to 10 percentage points below the shares they have in the brick-and-mortar world. Those lower market shares translate into hundreds of millions of dollars in lost sales opportunities⁸⁵—a cost that will likely only increase as more consumers turn to online shopping in response to in-person store closures, COVID-19 health concerns, and longer-term trends.

STRONG DATA SCIENCE SKILLS ARE MISSION-CRITICAL

Overall, the industry's business and data science skills rank in the bottom 20%; notably, finance, marketing, and management competencies score lowest of all 10 industries studied. The CG sector fares better in technology than business and data science skills; specifically, security and software engineering competencies are above average. This is most likely a reflection of the industry's recent investments in e-commerce teams.⁸⁶

As the amount of consumer data skyrockets, a workforce with strong data science skills will be essential. AI and advanced analytics skills will produce more accurate forecasting for internal teams and hyper-personalization for consumers.⁸⁷ Paired with the industry's existing strengths in security and software engineering, advanced data science skills will permit better fraud detection to ensure customer information is always secure.

In addition to AI and statistical analysis skills, consumer goods companies will need to invest in the development of the following skills to avoid disruption: predictive analytics, brand management, consumer economics, competitive positioning, and strategic leadership.

TRENDING SKILLS:

BUSINESS

Product Placement
Digital Marketing
Project Management
Supply Chain
Writing

TECHNOLOGY

Cloud Computing
User Experience
Graphic Design
Algorithms
JavaScript

DATA SCIENCE

Python
Deep Learning
SQL
Data Storytelling
NLP

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Finance

From AI and blockchain to peer-to-peer lending, finance leaders are reimagining how we manage and invest our money. Today, many banks have fully embraced digitization. They exist entirely online, and soon, AI apps could be dispensing financial advice.⁸⁸ making investments across asset classes, geographies, and currencies in real-time.

The pressure to deliver cutting-edge solutions for customers will only intensify as social distancing disrupts traditional distribution channels and compliance. Near-zero interest rates and growing demands on consumers make managing revenue while meeting consumer expectations more difficult.⁸⁹

For continued success, the finance industry will need the business, tech, and data science skills to keep pace with rapid disruption; 81% of banking CEOs⁹⁰ are concerned about the speed of technological change—more than any other industry sector.

MODERN BANKING CALLS FOR A NEW SET OF SKILLS

Finance professionals have cutting-edge data science and tech skills, ranked second and third across all industries; however, the finance industry is in the middle of the pack in the business domain (#6 of 10 industries).

The industry's marketing skills rank the lowest of any industry. While the marketing of banking services could once rely on local branches, migration to online banking has changed consumer behavior and the way they interact with the brand—this calls for a different strategy. Marketing skills are expected to go beyond traditional brand building to data-powered decision-making, predictive analytics, digital marketing, and A/B testing.

TRENDING SKILLS:

BUSINESS

Microsoft Excel
Digital Marketing
Financial Modeling
Blockchain
Project Management

TECHNOLOGY

Cloud Computing
Artificial Intelligence
Algorithms
C
Algorithmic Trading

DATA SCIENCE

Python
Deep Learning
SQL
Data Storytelling
R

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



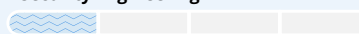
Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Healthcare

COVID-19 has exposed the importance of cutting-edge healthcare around the world, straining existing resources. As a result, the outbreak has already pushed the adoption of many inevitable tech innovations in healthcare, such as telemedicine and rapid diagnostics, forward by decades. However, it has also exposed the industry's vulnerabilities (e.g., data tracking and sharing). Healthcare is another traditional industry that lags in overall technology skills. As the healthcare industry emerges from a state of flux amid COVID-19, future-proofing the workforce's skill set should become a priority.

Data, artificial intelligence, and open, secure platforms will enable the future of healthcare. Automation has the power to transform how work gets done, reducing the number of times professionals spend on routine tasks and creating more personalized treatment plans and quality care for patients. An estimated 25% of existing tasks in today's healthcare workplace will be automated by 2030.⁹¹ This ambitious future requires a digitally skilled workforce to match the pace of innovation.

The healthcare industry's overall business skills are competitive, ranked #5 of 10 industries. The industry's communications, management, and marketing competencies are its strongest skill areas; in fact, the healthcare industry displayed the strongest marketing skills of any industry analyzed. Given that healthcare providers in any given area may provide the same or relatively similar services, marketing is essential to differentiation.

CUTTING-EDGE SKILLS SUPPORT NEW NORMS

While the industry holds its own in the business domain, healthcare is another traditional industry that lags in overall technology skills, ranked #9 out of the 10 sectors analyzed. Of note, the industry's subpar software engineering and human-computer interaction skills have room for improvement. These skills will only become more critical as electronic health records, patient portals, and cloud systems become the norm.

There is one bright spot within the technology domain for healthcare: security engineering (ranked #3). This strength is most likely a reflection of the sensitive nature of patient data and electronic health records increasingly stored in the cloud.

The tech and data science skills required for healthcare players to stay agile and relevant include Python programming, automation, data architecture, data visualization, and TensorFlow.

TRENDING SKILLS:

BUSINESS

Microsoft Excel
Project Management
Supervision
Digital Marketing
Added Value

TECHNOLOGY

Artificial Intelligence
JavaScript
Algorithms
C
Cloud Computing

DATA SCIENCE

Python
Data Storytelling
R
SQL
Biostatistics

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Insurance

Insurance companies are playing a pivotal role in helping companies and households manage risks and cushions against losses amid COVID-19. The crisis is already shifting the way insurers think about the valuation of their investments and liabilities.⁹²

The financial fallout of COVID-19 for insurers comes at a time when growing consumer expectations were already putting intense pressure on the industry to evolve. Modern consumers are pushing insurance companies to deliver more seamless, personalized, and secure experiences—including apps that track and reward patients' health based on ongoing physical and mental assessments.⁹³ These new demands have widened the chasm between fully-digitized insurance agencies and traditional ones. They are also a necessary catalyst within the industry to spur the development of business, data science, and technology skills—all of which rank in the bottom half of sectors.

The insurance industry ranks the lowest of all 10 industries in both technology and data science domains. While insurance professionals tasked with modeling risk have historically excelled in traditional data skills (e.g., statistics and data visualization), they now need to update those techniques to more accurately quantify risk.

THE WAVE OF THE FUTURE

To fully capitalize on AI, blockchain, and other relevant technological breakthroughs, the insurance industry will need to invest heavily in its workforce's technology and data science skills, including Python programming, data segmentation, software development, data URI scheme, and TensorFlow.

TRENDING SKILLS:

BUSINESS

Microsoft Excel
Risk Management
Project Management
Neuromarketing
Supervision

TECHNOLOGY

User Experience
Cloud Computing
Agile Software Development
Artificial Intelligence
Cybersecurity

DATA SCIENCE

Python
SQL
Deep Learning
R
NLP

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Manufacturing

The Fourth Industrial Revolution has unlocked countless opportunities for the manufacturing industry to maximize efficiency. From more timely production and delivery to managing inventory through predictive models, the industry has adopted leading technologies in stride.

This may explain why manufacturing is ranked #1 in the business domain and #5 in the technology domain across all industries. Within the technology domain, the only lagging competencies are human-computer interaction and software engineering.

While manufacturing has historically excelled in business and technology skills, COVID-19 has had a crippling effect on the industry. Many manufacturing jobs are on-site and cannot be carried out remotely, and slowed economic activity has reduced demand for many products around the globe. To fully recover and become more resilient, manufacturers should evaluate automation solutions to reduce the number of workers on the factory floor, leverage technology throughout the supply chain, and prioritize cybersecurity.³⁴

AN OPPORTUNITY FOR SKILLS GROWTH

While the industry is competitive in business and technology, it falls short in the data science domain, ranked #8 of 10 industries. As manufacturing processes (and the products they produce) get smarter, predictive analytics, data visualization, and forecasting rank high on the list of data skills needed for future innovation. Pairing powerful predictive analytics with customer experience apps will enable companies to deliver content more accurately based on their customers' wants and needs (e.g., restocking or upgrading a product).

TRENDING SKILLS:

BUSINESS

- Microsoft Excel
- Project Management
- Digital Marketing
- Supply Chain
- Technology Strategy

TECHNOLOGY

- Artificial Intelligence
- Internet of Things
- Algorithms
- Agile Software Development
- JavaScript

DATA SCIENCE

- Python
- Data Storytelling
- Deep Learning
- SQL
- MATLAB

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



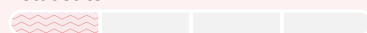
Math



Statistical Programming



Statistics



Media & Entertainment

Today, the borders between print and digital, video games and sports, and social and traditional media have all blurred. While social distancing in the wake of COVID-19 has created barriers for the development of new content and in-person events, the industry has seen a massive surge in demand for streamed, live, and multi-player content.⁹⁵ As the war for consumer attention intensifies, the winners will be those companies that embrace the right technology to deliver premium content in a personalized, cost-effective way.

The media and entertainment industry's strongest domain is technology, ranked second only to the technology industry itself. It outperforms most industries in both the human-computer interaction and software engineering competencies—two competencies essential to delivering the high-quality customer experiences that map users to the content that they want.

A PATH TO INNOVATION AND GROWTH

Media and entertainment lag behind every other industry in the business domain. Aside from sales and communications, the majority of business competencies are severely lacking. Industry leaders will always search for new business models that support profitability, thus making management, marketing, and finance skills forever top-of-mind.

As consumers' appetites for custom, cutting-edge experiences grow and competition heats up, skills including financial modeling, digital marketing and strategy, change management, and design thinking will remain particularly important.

TRENDING SKILLS:

BUSINESS

Digital Marketing
Project Management
Product Placement
Supervision
Microsoft Excel

TECHNOLOGY

User Experience
Algorithms
Artificial Intelligence
JavaScript
Cloud Computing

DATA SCIENCE

Python
SQL
Deep Learning
NLP
Linear Algebra

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



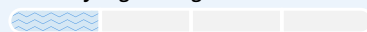
Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Technology

The technology industry is the most skilled in 2020. Agility is in the industry's DNA, and while traditional sectors are bogged down by legacy processes, tech organizations are inherently quick to embrace the rate of change. As the industry builds technology that will transform almost every other industry, tech professionals are acutely aware of which skills will be valuable.

The technology industry leads all other sectors in the technology and data science domains—and our data reveals that excelling in tech skills is mission critical. Industries with talent highly skilled in technology see higher stock returns and less disruption from COVID-19.

The tech industry also fares well in business, ranked 4th overall with room for improvement in management, marketing, and accounting competencies. With the industry's emphasis on growth declining, and a refocus on profitability,⁹⁶ the skills to achieve durable unit economics and grow sustainably will become even more essential.

THE RISK OF COMPLACENCY

Although tech is currently an industry at the forefront of many essential competencies, complacency is dangerous in an era and industry of constant change. Skill decay happens rapidly within the tech industry.⁹⁷ As tech companies compete to provide the most cutting-edge and sophisticated solutions, they will need to remain deeply committed to addressing the continuously shrinking half-life of skills within their talent pool.

Technology companies must address fundamental issues such as how they create platforms, how to serve customers better, and how to build digital infrastructure within their companies. The challenge for today's organizations is to keep an eye on trends, then prepare to transform and reskill their workforce. Continuous development of analytics, PaaS, IaaS, and cloud computing skills, in particular, should be a priority for tech companies moving forward.

TRENDING SKILLS:

BUSINESS

Project Management
Blockchain
Microsoft Excel
Digital Marketing
Product Management

TECHNOLOGY

Cloud Computing
Algorithms
Artificial Intelligence
Apache Beam
C

DATA SCIENCE

Python
Deep Learning
SQL
NLP
TensorFlow

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



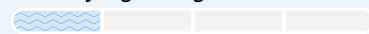
Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming



Statistics



Telecommunications

COVID-19 has put the importance of the telecommunications industry into sharp focus: families and communities rely on it to stay connected while businesses, governments, and educational institutions require its services to remain up and running online. While technical innovations, including 5G, promise more convenient, reliable, and high-speed connectivity, they will also demand new capabilities and data skills. As telecommunications companies consolidate and expand, many are left with highly sophisticated, rigid structures that are resistant to change. This resistance may explain why telecom companies are lagging in overall technology skills, ranked #8 of 10 industries.

CRITICAL SKILLS NEEDED TO CLOSE THE GAP

Conversely, telecom performs competitively in both business and data science domains. Telecoms displayed the highest machine learning skills in any industry. Machine learning technology is used by nearly all telecoms to improve customer service (via virtual assistants and chatbots) and prevent outages through predictive maintenance.⁹⁸

While machine learning is a strong suit, marketing presents an opportunity for telecoms to upskill and better target customers in an intensely competitive environment. Also, critical skills for the telecom industry include data-centric skills, ranging from big data to machine learning to data manipulation and internet privacy and security skills, which align with consumer safety concerns.

TRENDING SKILLS:

BUSINESS

Project Management
Microsoft Excel
Capital Budgeting
Discounting
Digital Marketing

TECHNOLOGY

Artificial Intelligence
Internet of Things
Cloud Computing
Algorithms
Cybersecurity

DATA SCIENCE

Python
SQL
Deep Learning
NLP
R

LEGEND

Lagging Emerging Competitive Cutting-Edge



Business

Accounting



Communications



Finance



Management



Marketing



Sales



Technology

Computer Networking



Databases



Human-Computer Interaction



Operating Systems



Security Engineering



Software Engineering



Data Science

Data Management



Data Visualization



Machine Learning



Math



Statistical Programming

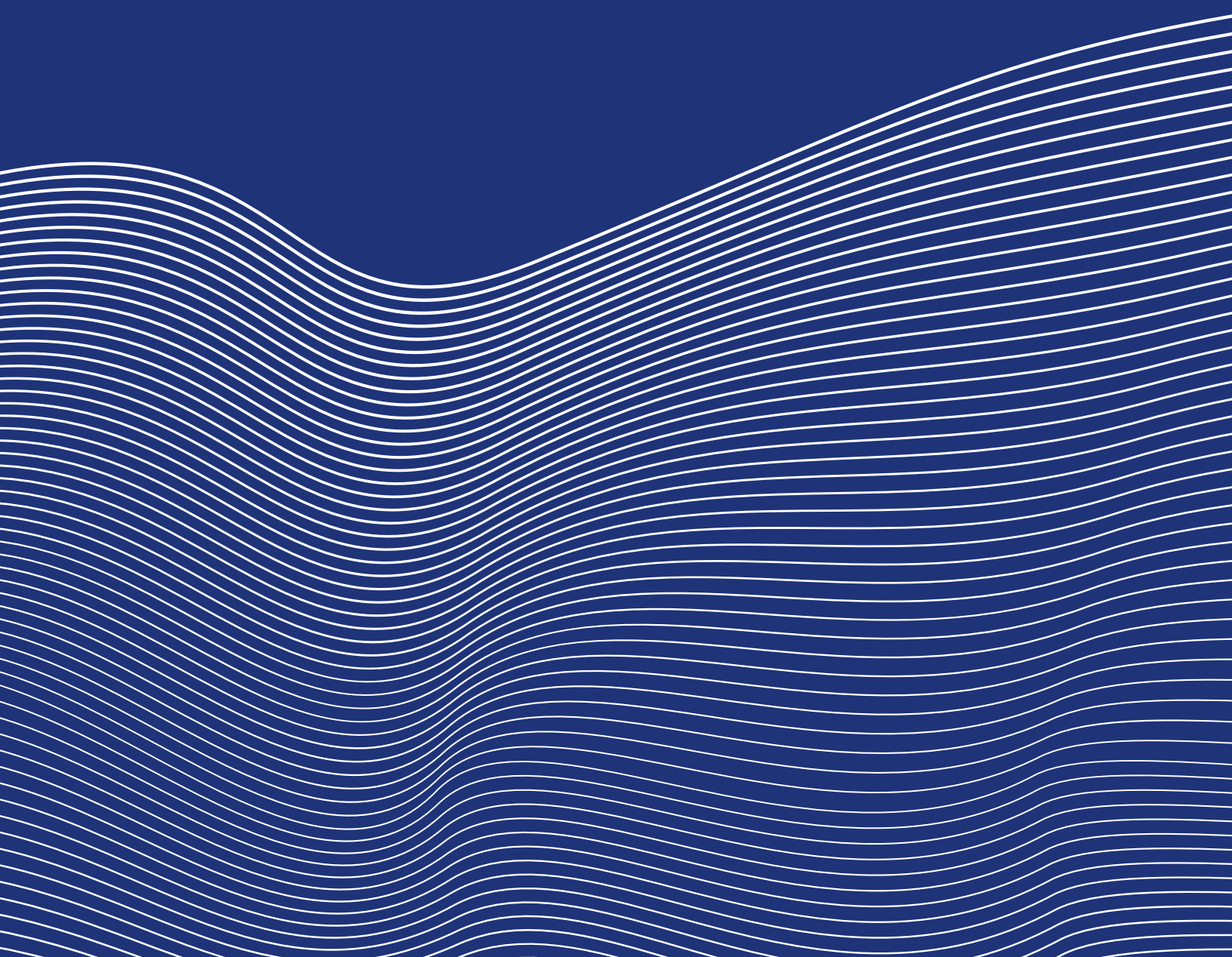


Statistics



PART THREE:

Role & Education Trends



Introduction

Individuals and businesses are eager to keep pace with the change occurring in the Fourth Industrial Revolution, but the new technological frontier requires new skills. After the economic disruption caused by COVID-19 subsides, students, governments, and businesses will continue to look at universities as a critical engine for skill acquisition.

To ensure that students gain the skills needed to successfully enter the workforce upon graduation, university education must become more closely connected to the fast-changing labor market. Universities will need to ensure their curricula provide students with the requisite skills for sustainable, future-proof careers.

The World Economic Forum has identified seven key professional clusters essential for the future of work: data and AI; care economy; green economy; engineering and cloud computing; people and culture; product development; and sales, marketing, and content. Collectively, these professions are projected to yield 6.1 million new job opportunities in the coming three years.⁹⁹

Essential to these clusters are the business, technology, and data science skills to lead and work with others, apply technology to solve customer and business challenges, and develop new technological innovations to increase profits and productivity.

In this new addition to the Global Skills Index, we have unified Coursera's skills, fields of study, and role data to help universities understand the skills their students will need to pursue sustainable careers across industries.

HOW FIELDS OF STUDY PERFORM ACROSS SKILL DOMAINS

BUSINESS	TECHNOLOGY	DATA SCIENCE
Physical Sciences	Physical Sciences	Physical Sciences
Engineering	Computer Science	Mathematics & Statistics
Business	Mathematics & Statistics	Engineering
Mathematics & Statistics	Arts & Humanities	Computer Science
Biological Sciences	Engineering	Biological Sciences
Computer Science	Legal Professions	Social Sciences
Social Sciences	Business	Business
Legal Professions	Social Sciences	Health Professions
Arts & Humanities	Education	Arts & Humanities
Health Professions	Biological Sciences	Legal Professions
Education	Health Professions	Education

Business, technology, and data science skills give students a competitive edge in the workforce. Skills across all three domains should be incorporated into higher education in interdisciplinary ways to better connect curricula to the labor market.

Our data reveals that students who major in Physical Sciences (e.g., physics, chemistry, meteorology) and Mathematics & Statistics currently have the strongest skill set across all three domains. These programs of study tend to emphasize things like mathematical thinking, using data to inform decision-making, and measuring uncertainty, all with the use of the latest software tools that ensure students have the ability to navigate the changing technological landscape. Students in these fields can more easily acquire new skills because they have already mastered the foundations that future innovations will be built upon.

Conversely, students majoring in Health Professions (e.g., nursing, clinical science, pharmacy studies) perform poorly across all three domains. As the healthcare industry grapples with COVID-19 and stands on the precipice of major disruption, business, technology, and data science skills will be essential for recovery and future growth. As data, artificial intelligence, and open, secure platforms become the new normal in healthcare, technology skills, in particular, will set Health Professions graduates apart in a competitive field.

BRIDGING CURRICULA WITH CAREER PATHS

As advancing technology continues to shape the workforce, acquiring important business, technology, and data science skills can mean the difference between entering a growing career or stagnancy after graduation in an already uncertain labor market. To better understand which skills can help students get ahead and which career paths they make possible, we've mapped the top trending skills on the Coursera platform and the roles that disproportionately enroll in related content.



DOMAIN: TECHNOLOGY

Blockchain

FIELDS OF STUDY BY ENROLLMENT:
COMPUTER SCIENCE, BUSINESS, ENGINEERING

ROLES ENROLLED IN BLOCKCHAIN COURSES

1. Chief Financial Officer
2. Entrepreneur
3. Product Manager
4. Financial Analyst
5. Economist

Blockchain is a data structure that provides a digital, decentralized transaction ledger, developed explicitly so that the data is unalterable and transparent. While Bitcoin may have put this technology on the map, its applications go beyond crypto. Blockchain's versatility enables safe capabilities ranging from supply chains to payment networks to healthcare data sharing.

EARLY ADOPTERS DRIVE UNDERSTANDING AND APPLICATIONS

The promise of a secure, digital-ledger system has captured the attention of forward-thinking leaders across all industries. Our data shows that a broad mix of industry leaders, including Chief Financial Officers, entrepreneurs, and Product Managers, are currently the most engaged with blockchain skills.

From designing and programming smart contracts to finding novel application models, the development of blockchain skills is essential to the technology's ability to have a significant impact on business models, reduce risk, and save cost and capital across.



DOMAIN: TECHNOLOGY

Cloud Computing

FIELDS OF STUDY BY ENROLLMENT:

COMPUTER SCIENCE, ENGINEERING, MATHEMATICS & STATISTICS

ROLES ENROLLED IN CLOUD COMPUTING COURSES

1. Cloud Architect
2. Infrastructure Engineer
3. Application Architect
4. Site Reliability Engineer
5. Business Intelligence Analyst

Cloud platforms and ecosystems have played a significant role in driving digital transformation. Attracted by reduced time-to-market and the ability to scale, many organizations have adopted the public cloud as a cost-effective resource for hosting enterprise applications and developing and deploying customer-facing solutions.

ANALYSTS AND ARCHITECTS TAKE THE LIMELIGHT

With public cloud services spending projected to reach \$370 billion in 2022, demand for cloud computing skills will only continue to accelerate.¹⁰⁰ Cloud Architects, Infrastructure Engineers, and Application Architects currently engage the most with cloud computing skills, according to our insights.

Business Intelligence Analysts also make the list of roles highly engaged with cloud computing proficiencies. Given that the skill serves as a repository for both structured and unstructured data, the cloud is an ideal platform to provide Business Intelligence professionals with the data they need to make informed decisions.

A COSTLY SKILLS SHORTAGE COMPELS SPECIALIZED ROLES

Unfortunately, there is a growing cloud computing skills shortage that has costly ramifications. Nearly three-quarters of IT decision-makers (71%) believe their organizations have lost revenue due to a lack of cloud expertise, and the lack of cloud professionals costs businesses up to \$250 million per year.¹⁰¹ To keep pace with the demand for cloud technology, companies will need to invest in reskilling and upskilling their workforce in the most cutting-edge cloud computing skills.



DOMAIN: TECHNOLOGY

Cybersecurity

FIELDS OF STUDY BY ENROLLMENT:

COMPUTER SCIENCE, ENGINEERING, PHYSICAL SCIENCES

ROLES ENROLLED IN CYBERSECURITY COURSES

1. Software Engineer
2. IT Manager
3. Security Engineer
4. Chief Technology Officer
5. Site Reliability Engineer

There is a global surge in hiring demand for cybersecurity skills—and for good reason. Cyberattacks are the fastest growing crime and predicted to cost the world \$6 trillion annually by 2021.¹⁰² As companies scramble to fill a growing cybersecurity skills shortage,¹⁰³ our data illustrates that Software Engineers, IT Managers, and Security Engineers are highly engaged with cybersecurity skills.

ENGINEERING TEAMS REQUIRE SKILL MASTERY

The rise of cloud services, smartphones, and the Internet of Things (IoT) has created a new breed of cyber security threats. In light of massive, high-profile data breaches, data privacy has become a top concern for consumers; 87% of consumers say they will take their business elsewhere if they don't trust a company is handling their data responsibly.¹⁰⁴ As the nature of these threats evolve, cybersecurity skill decay will inevitably leave company and consumer data vulnerable for attack.

AI, machine learning (ML), and automation are playing increasingly important roles in cybersecurity strategies as companies battle a growing array of external and internal threats. Still, professionals with cybersecurity skills will continue to be mission-critical to avoid unnecessary reputational, economic, and regulatory costs.



DOMAIN: DATA SCIENCE

Data Storytelling

FIELDS OF STUDY BY ENROLLMENT:
MATHEMATICS & STATISTICS, COMPUTER SCIENCE, ENGINEERING

ROLES ENROLLED IN DATA STORYTELLING COURSES

1. Data Analyst
2. Business Analyst
3. Operations Analyst
4. Data Scientist
5. Financial Analyst

Data storytelling is a methodology for communicating large, complex data into compelling narratives that drive impact. While Data Scientists are notably skilled in collecting and delivering data to a technical audience, workers skilled in data storytelling can convey meaning and concepts clearly and simply to any audience.

ANALYSTS UNEARTH DATA'S HIDDEN NARRATIVE

However, data is only as valuable as we make it. As the amount of data in the world increases, the ability to extrapolate meaning and influence through storytelling is a necessity. Our insights reveal that Data Analysts, Business Analysts, and Operations Analysts currently possess the most robust data storytelling skills.

DATA VISUALIZATION: A MUST-HAVE SUBSKILL

Data visualization enables effective storytelling through simplified visual elements like graphics, charts, dashboards, and maps. Visual representations of information provide an accessible way to identify trends, patterns, and outliers—all of which help to tell the story within the data.

Empowered by self-service tools like Tableau, QlikView, and Zoho, professionals across functions can interact with company data in new ways, unearthing fresh insights in the process. As powerful as these tools may be, without the skills to leverage them, these insights lose their value.



DOMAIN: DATA SCIENCE

Deep Learning

FIELDS OF STUDY BY ENROLLMENT:
COMPUTER SCIENCE, MATHEMATICS & STATISTICS, ENGINEERING

ROLES ENROLLED IN DEEP LEARNING COURSES

1. Data Scientist
2. ML Engineer
3. Actuary
4. Biostatistician
5. Data Engineer

Deep learning is a branch of machine learning that harnesses massive data and algorithms modeled loosely on how the brain processes information to make predictions. From enabling driverless cars to differentiate between pedestrians and lamp posts to facilitating voice commands on an iPhone, deep learning is reimagining the way machines interact with the world around them.

SCIENTISTS AND ACTUARIES COME OUT ON TOP

Data Scientists, ML Engineers, and Actuaries are currently most engaged with this cutting-edge technology. The application of deep learning techniques to actuarial problems is a rapidly emerging field; it can enhance the predictive power of models built by Actuaries and provide the means to extend actuarial modeling to new types of data potentially.¹⁰⁵

JUST SCRATCHING THE SURFACE—FOR NOW

Despite the excitement around deep learning technology, there is currently a pervasive deep learning skills shortage. In the UK and Nordic regions, 83% of AI decision-makers believe the scarcity of deep learning skills is affecting their business's ability to compete in the market, with almost half saying the shortage is delaying projects.¹⁰⁶ As more practical applications of deep learning are discovered across industries, the skills to develop and implement the technology will become increasingly valuable.



DOMAIN: BUSINESS

Digital Marketing

FIELDS OF STUDY BY ENROLLMENT:
BUSINESS, ARTS & HUMANITIES, SOCIAL SCIENCES

ROLES ENROLLED IN DIGITAL MARKETING COURSES

1. Social Media Strategist
2. Marketing Analyst
3. Graphic Designer
4. Copywriter
5. Public Relations/Communications Specialist

Arguably, no business function has been disrupted by digitization as profoundly as marketing. Technology has unlocked unprecedented ways to reach, engage, monitor, and respond to consumers.

STRATEGISTS, ANALYSTS, AND DESIGNERS TAKE THE LEAD

Our analysis shows that Social Media Strategists and Marketing Analysts are currently engaging the most with digital marketing skills. Graphic Designers come in at #3; as marketing campaigns across devices and channels bombard consumers, the visualizations and informative visual elements they create are essential to capturing consumers' attention.

GOING BEYOND TRADITIONAL BRAND BUILDING

Modern consumers want seamless experiences; 87% of them believe brands should put more effort into creating such experiences, and 90% expect consistent interactions across all channels.¹⁰⁷ Not only does digital marketing allow companies to reach users virtually anywhere, anytime, but customer behavior tracking enables more effective targeting and personalized experiences.

Today's digital marketing skills will go beyond traditional brand building to data-powered decision-making, predictive analytics, and A/B testing. As consumer demands continue to evolve, companies' ability to meet their expectations with delightful customer journeys is what will determine their ability to compete.



DOMAIN: DATA SCIENCE

Natural Language Processing

FIELDS OF STUDY BY ENROLLMENT:

COMPUTER SCIENCE, MATHEMATICS & STATISTICS, ENGINEERING

ROLES ENROLLED IN NLP COURSES

1. Data Scientist
2. ML Engineer
3. Data Engineer
4. Data Analyst
5. Software Engineer

Natural language processing (NLP) skills sit at the intersection of computer science, artificial intelligence, and computational linguistics. From chatbots to voice-activated assistants like Siri and Alexa, businesses and consumers are becoming increasingly reliant on NLP technology. In fact, over a quarter of U.S. adults now own a smart speaker.¹⁰⁸

SCIENTISTS AND ENGINEERS ARE AT THE FOREFRONT OF NLP

Given this skill's technical nature, our data shows that Data Scientists, ML Engineers, and Data Engineers are most engaged with NLP. These professionals will be at the forefront of addressing important human-centric challenges, including employee and customer satisfaction, workplace diversity, and unconscious bias.¹⁰⁹

SOLVING HUMAN-CENTRIC PROBLEMS

As technology inevitably evolves, NLP will only become more powerful and omnipresent as it taps into the magnitude and complexity of human feelings. Eventually, NLP will be programmed to understand more complex elements of the human language, from humor and sarcasm to satire and irony.



DOMAIN: BUSINESS

Project Management

FIELDS OF STUDY BY ENROLLMENT:
ENGINEERING, BUSINESS, SOCIAL SCIENCES

ROLES ENROLLED IN PROJECT MANAGEMENT COURSES

1. Product Manager
2. Operations Analyst
3. Business Intelligence Analyst
4. Program Manager
5. Consultant

Project management goes beyond spinning plates and herding cats. Managing a complex project—on time and on budget—requires technical competency, leadership, diligence, communication, and above all: adaptability.

MANAGERS AND ANALYSTS: THE DYNAMIC DUO

While that may sound like table stakes for Product Managers, Program Managers, and Consultants, our data demonstrates that Business Intelligence and Operations Analysts also excel in project management.

PROJECT MANAGEMENT: A FOUNDATIONAL SKILL

Both Business Intelligence and Operations Analysts are adept at identifying, communicating, and solving complex business problems—all of which give them a competitive edge when managing fast-moving projects. Meanwhile, proficiency in technical skills, including statistical modeling and data analysis, provide additional support for the project's duration.

With this expertise, Business Intelligence Analysts and Operations Analysts are often responsible for creating foundational company assets. They leverage data to coordinate that work and ensure it is actionable for cross-functional partners, which leans heavily on project management skills.

Armed with a host of new technological tools for scheduling, collaborating, documenting, and evaluating, individuals and teams are now able to manage even longer and more complex initiatives seamlessly and remotely.



DOMAIN: DATA SCIENCE

Python

FIELDS OF STUDY BY ENROLLMENT:
COMPUTER SCIENCE, MATHEMATICS & STATISTICS, ENGINEERING

ROLES ENROLLED IN PYTHON COURSES

1. Quantitative Analyst
2. Physicist
3. Actuary
4. Data Scientist
5. Data Analyst

Open-source, easy to learn, and versatile, Python is one of the most in-demand programming languages today, and adoption shows no signs of slowing down.¹¹⁰ From web development to data analysis and visualization to building machine learning models and prototyping AI algorithms, the use cases for Python will continue to permeate industries everywhere.

TODAY'S SNAKE CHARMERS ARE DATA-DRIVEN

While Web Developers often prefer Python for its simplicity, our data uncovers that they're not the only ones deploying the language: Quantitative Analysts, Physicists, and Actuaries are most engaged with Python, followed by Data Scientists, and Data Analysts.

Its ease of use makes Python ideal for professionals who may not have a robust computer science background. Physicists and Analysts, for example, may learn Python to process data programmatically rather than using graphical-based software such as Excel.

THE POWER OF PYTHON

Now more than ever, it's critical for organizations to choose the right tools to build their digital presence, and Python is a top contender. Google, Instagram, Reddit, and Facebook, for instance, all leverage Python for a variety of applications and claim a global community of millions and vast support resources. Needless to say, a team skilled in Python can bring the same capabilities and innovations as the world's tech giants.



DOMAIN: DATA SCIENCE

SQL

FIELDS OF STUDY BY ENROLLMENT:
MATHEMATICS & STATISTICS, COMPUTER SCIENCE, ENGINEERING

ROLES ENROLLED IN SQL COURSES

1. Data Analyst
2. Data Scientist
3. Data Engineer
4. Business Analyst
5. Risk Manager

SQL, pronounced “sequel,” is the world’s most popular programming language used to query and manage databases. Professionals skilled in SQL can retrieve, manipulate, and analyze data from a relational database for faster, more reliable data management and decision-making.

MAKING SMARTER DECISIONS WITH DATA MANAGEMENT

Our insights show that data-driven workers, specifically, Data Analysts, Data Scientists, and Data Engineers, are most engaged with SQL, followed by Business Analysts and Risk Managers.

As we move into a more data-driven economy, those workers are among the most qualified to improve business information, provide new insights, and steer digital transformation across any given organization.



DOMAIN: DATA SCIENCE

TensorFlow

FIELDS OF STUDY BY ENROLLMENT:
COMPUTER SCIENCE, MATHEMATICS & STATISTICS, ENGINEERING

ROLES ENROLLED IN TENSORFLOW COURSES

1. Data Scientist
2. ML Engineer
3. Data Engineer
4. Biostatistician
5. Data Analyst

As tech and traditional industries alike explore the value of machine learning, TensorFlow has become a popular open-source tool for building, training, and deploying machine learning models, such as neural networks and for desktop, mobile, web, and cloud applications.

UNLOCKING MACHINE LEARNING CAPABILITIES

Perhaps unsurprisingly, professionals with a basic understanding of ML principles and core concepts top the list of workers highly engaged with TensorFlow: Data Scientists, ML Engineers, and Data Engineers.

TensorFlow's popularity is due, in part, to its readable syntax, flexibility, and network control. It provides a collection of workflows to develop and train models using Python, JavaScript, or Swift, and to quickly deploy in the cloud, on-prem, in the browser, or on-device. It has been used to classify images at scale for Airbnb, detect fraud for PayPal, and even identify brain anatomy from MRIs for GE.¹¹

LEARNINGS FROM MACHINE LEARNING

Ultimately, machine learning has the power to solve some of the most challenging problems facing companies across all industries. As more companies pursue machine learning to gain insights from the oceans of data they generate, we foresee professionals with TensorFlow skills will become increasingly in-demand.



DOMAIN: TECHNOLOGY

User Experience Design

FIELDS OF STUDY BY ENROLLMENT:
ARTS & HUMANITIES, COMPUTER SCIENCE, SOCIAL SCIENCES

ROLES ENROLLED IN UX DESIGN COURSES

1. Designer
2. Graphic Designer
3. UI/UX Designer
4. Product Manager
5. Marketer

User experience (UX) design informs every aspect of a user's interaction with a product or service: layout, visual design, text, brand, and even sound effects. A well-designed user interface rakes in ROI that speaks for itself. It can raise a website's conversion rate by up to 200%, and a better UX design can yield conversion rate increases up to 400%.¹¹² Other metrics include user ratings, reviews, and average session time.

FOR EVERYONE WHO CREATES A CUSTOMER EXPERIENCE

While Designers engage most with UX design skills, Product Managers (PMs) and Marketers are also engaged. Responsible for ensuring the success of a product's design, development, and launch, PMs unquestionably need a sound understanding of UX design to lead a cross-functional team with confidence. For Marketers, excellent user experience plays a pivotal role in ensuring customer satisfaction and boosting business conversion.

FOCUS GROUPS AND ANALYTICS TOOLS: THE KEY TO UX

One of the only ways to gain a deep understanding of user behavior, needs, and motivation is through data, analytics, and research. Analytics tools, including Data Studio and Google Optimize, help uncover valuable quantitative data to inform the design and can be coupled with qualitative research, such as focus groups or usability testing. Additionally, those skilled in UX design are often competent at sketching, scenario development, storyboarding, and wireframing.



DOMAIN: TECHNOLOGY

Web Development

FIELDS OF STUDY BY ENROLLMENT:
COMPUTER SCIENCE, ENGINEERING, MATHEMATICS & STATISTICS

ROLES ENROLLED IN WEB DEVELOPMENT COURSES

1. Software Engineer
2. Designer
3. Entrepreneur
4. Product Manager
5. Project Manager

Virtually every successful company today has a digital presence, and it's a good thing they do: many consumers spend the majority of their time online. As competition for consumers' attention intensifies between both digitally-native startups and traditional companies, the quality of the online experience will determine if a company succeeds or falls behind.

SOFTWARE ENGINEERS AND DESIGNERS ARE THE NEW WEBMASTERS

Historically, Website Developers were among the most skilled in web development (web dev), but in the wake of digital transformation, companies are seeking an even deeper understanding of the skill. As it turns out, organizations may already have the talent in-house: Software Engineers, Designers, and Product Managers are among the most engaged with web development.

A CRITICAL SKILL FOR EXPERIENCE AND VISIBILITY

User experience and online visibility, or search engine optimization (SEO), are two components that make or break a company's digital presence. SEO determines if a website lands a sweet spot on Google's page one, or if it falls victim to the unrecognizable page two. Poorly designed digital spaces limit conversion, undermine navigation, and obscure analytics. These ill-favored experiences confuse customers, reduce growth, and can even create regulatory issues.¹¹³

As online shopping and activities continue to replace their in-person equivalents, ensuring a reliable web development skill set across engineering and product teams will increasingly become table stakes for companies. Every company will need a digital-first footprint for its brand and services.

About the Data Science Team at Coursera

The Data Science team at Coursera develops the statistical and machine learning models that power a personalized learning experience, leads the experimentation and inference that informs Coursera's strategy, and builds the products to access data for the company's university partners and enterprise customers.

The team has ideated and launched learner and enterprise-facing products powered by machine learning that have been covered in *TechCrunch*, *Harvard Business Review*, *MIT Technology Review*, and the *World Economic Forum*. See more of their work on the *Coursera Data Blog*.

THE DATA SCIENTISTS BEHIND THE GSI

Emily Glassberg Sands is the VP of Data at Coursera. Emily holds a Ph.D. from the Department of Economics at Harvard and a B.A. from Princeton. Her academic research blends experimentation, econometrics, and machine learning to better understand labor markets and consumer decision-making, and has been featured in the popular press including the *New York Times*, the *Wall Street Journal*, and National Public Radio. She is also a member of the World Economic Forum Council on New Metrics.

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Technical Appendix

OVERVIEW

The Coursera Global Skills Index (GSI) assesses the skill proficiency of learners in each country/industry/field of study, measures which skills are trending globally, and identifies fields of study and roles engaging highly with the essential skills for the future of work.

This GSI report focuses on the 60 countries with the most learners on the Coursera platform and 10 of the largest industries that have both seen major shifts in their skill landscapes. The 60 countries account for 90% of learners on the Coursera platform, and for about 80% of the world's population and 95% of global GDP (based on 2018 World Bank Data).

Building the GSI involves data from several components:

1. The Coursera Skills Graph
2. Skill Score for country/industry/field of study rankings
3. Correlations with Third-Party Data
4. Trending Skills
5. Top Fields of Study & Roles Per Selected Skills

This year's report uses an updated methodology for the country/industry/field of study rankings. For more information on these changes, refer to that section below.

THE COURSERA SKILLS GRAPH

The Coursera Skills Graph maps the connections among skills, content, careers, and learners on the Coursera platform.

For the GSI, in particular, we leverage the following parts of the Skills Graph:

- **Skill to skill:** Describes the connections among skills and generates a skills taxonomy where broad, higher-level skills are parents of more granular, lower-level skills (see Figure 1).
- **Skill to content:** Maps skills to the Coursera courses that teach them.
- **Skill to assessment:** Maps skills to the graded items that assess them. Graded items on Coursera can be of several types: multiple choice quizzes, peer review assignments like essays and projects, or programming assignments.
- **Skill to learner:** Connects competencies, i.e., Level 1 skills, to learners who have demonstrated them by passing relevant graded items. We measure this using a variant of the Glicko algorithm, described further below.

(1) Identifying the set of skills and relationships among skills (*skill to skill*)

We assemble a vast skills taxonomy of over 40,000 skills in the subject areas of business, technology, and data science through a combination of open-source taxonomies like Wikipedia, and crowdsourcing from Coursera educators and learners.

Guided by open-source data combined with knowledge from industry experts, we assemble a structured taxonomy that connects Coursera domains to the set of skills within them, ranging from competencies (Level 1 skills) down to very specific skills (Level 2+ skills). For the GSI, we focus on measuring performance at the competency level.

To illustrate the mapping among domains, competencies, and skills, Figure 1 shows a snapshot of a subsection of Coursera's Skills Taxonomy.

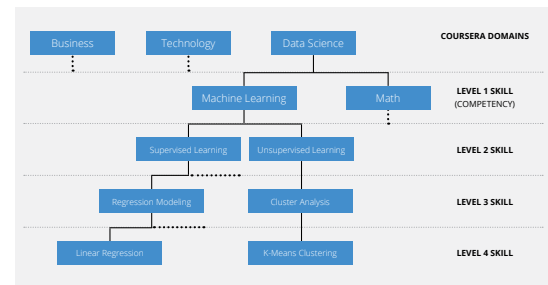


FIGURE 1: SAMPLE PORTION OF COURSERA'S SKILLS TAXONOMY

The full set of competencies for which we measure learner proficiency in the GSI, grouped by domain, are listed in Figure 2 below.

BUSINESS	TECHNOLOGY	DATA SCIENCE
Accounting	Computer Networking	Data Management
Communications	Databases	Data Visualization
Finance	Human-Computer Interaction	Machine Learning
Management	Operating Systems	Math
Marketing	Security Engineering	Statistical Programming
Sales	Software Engineering	Statistics

FIGURE 2: SET OF COMPETENCIES IN THE GSI

(2) Mapping skills to courses and assessments (skill to content and skill to assessment)

The skills in the Coursera Skills Taxonomy are mapped to the courses that teach them using a machine learning model trained on a data set of university instructor and learner-labeled skill-to-course mappings. Features of the model include occurrence counts (e.g., in the lecture transcripts, assignments, and course descriptions) and learner feedback.

With over 1,800 courses in business, technology, and data science from top-ranked university and industry partners around the world, our catalog spans the wide variety of skills that are relevant to the competencies in the GSI.

For each skill-course pair, this machine learning model outputs a score that captures how likely it is that the skill is taught in the course. To define the set of skill-to-course tags that power the GSI, we tune a cutoff threshold based on expert feedback from our content strategy team.

When a skill within a competency is tagged to a course, we extract the graded items in that course as being relevant for assessing a given competency. These competency-to-assessment mappings were reviewed with industry experts to ascertain their fidelity and adjusted as needed. This final set serves as the pool we use to measure individual learners' skill proficiencies.

SKILL SCORE FOR COUNTRY/INDUSTRY/FIELD OF STUDY RANKINGS

(1) Measuring individual learners' skill proficiencies (skill to learner)

With the set of assessments for each competency defined, we consider grades for all learners taking relevant assessments and train machine learning models to simultaneously estimate individual learners' skill proficiencies (i.e., how proficient each learner is in each competency) and individual assessment difficulties (i.e., how challenging each assessment is). Each domain and competency has its own model to estimate these parameters, resulting in 21 separate models.

Technical Appendix (cont.)

This methodology allows us to measure learner skill proficiencies adjusting for item difficulty. This is essential because the Coursera platform contains a wide variety of courses ranging from the introductory college level to the advanced graduate level. Adjusting for item difficulty ensures we neither penalize learners for taking difficult courses nor over-reward learners for strong performance in easy courses.

Because learners attempt various numbers of graded items at various levels of difficulty, we also assess the precision with which we are measuring skill proficiency for each learner through the calculation of standard errors.

In contrast to the 2019 edition of the Global Skills Index, we transitioned our underlying skills proficiency measurement from an Item Response Theory (IRT) model to a variant of the Glicko algorithm.¹¹⁴ Because of this update, the country and industry rankings in this year's report are not fully comparable to last year's rankings and should be treated independently.

Our updated methodology confers several advantages over the old methodology. Glicko better accounts for selection effects; for example, that more skilled learners on average are more likely to take challenging content. A more complete comparison of the methodologies' properties is in the table below:

Property	Glicko	IRT
Allows for time-varying skill proficiency	✓	
Accommodates selection effects	✓	Partial
Enables explainable updates	✓	
Is computationally feasible at scale in real-time	✓	

(2) Measuring country / industry / role skill proficiencies

We use the skill proficiency estimated above as a measure of the relative ability of each learner within a domain or competency. Aggregating across learners in an entity (country/industry/field of study)¹¹⁵ reveals the average proficiency in that group.

We calculate the weighted average of skill proficiency estimates, where weights are the inverse of the standard error for that learner. To avoid undue influence of any individual learner, weights are trimmed to be at or below the median value of the overall distribution of weights within each domain/competency.

This weighted average for each domain and competency is the GSI estimate of an entity's skill proficiency. We then compare groups to each other via a percentile ranking of all GSI estimates. Performance bands for a group's skill proficiency are computed by segmenting skill proficiencies into quartiles:

- Cutting-Edge for 76th percentile or above
- Competitive for 51st to 75th percentile
- Emerging for 26th to 50th percentile
- Lagging for 25th percentile or below

Coursera's 65 million registered learners span the globe and myriad industries, and the GSI reflects the average skill proficiency of learners in each entity on the Coursera platform, accounting for the precision with which we measure each individual's skill proficiency. Note that the GSI estimate

may not reflect the average skill proficiency of all members within an entity because Coursera learners are not necessarily representative of a country, industry, or role.

CORRELATIONS WITH THIRD-PARTY DATA

We take our country rankings and compute the average skill proficiency per entity across business, technology, and data science. This allows us to correlate the rankings with external metrics of interest. We take the following metrics from publicly available external sources:

- GDP per capita by country (World Bank)
- Fraction of jobs at risk of automation by country (McKinsey)
- Share of income held by top 10% (World Bank)

For the industry correlations, we compare the industry rankings in each domain to the one-year stock returns by industry in the S&P 500 index. Return data was sourced from Fidelity.

TRENDING SKILLS

We measure trending skills¹¹⁶ within each domain (business, technology, and data science) on a quarterly basis, incorporating several measures of internal and external demand for each skill into a single, weighted index:

Learner enrollments: The average enrollments per course by learners in content tagged to a particular skill.

Search trends: The number of searches on Coursera by logged in learners for a particular skill.

Google trends: The Google Trend Index for a particular skill, which provides a measure of search activity on Google pertaining to specific keywords and topics.

Labor market value: The estimated dollar value of a skill based on the relative frequency in job postings, career salary, and general return to skills from the literature,¹¹⁷ based on U.S. data only.

For a given domain, we calculate the above fields for each skill. To ensure all metrics are on the same scale, we first compute the z-score of each attribute within its domain and then generate a weighted average of z-scores to calculate the index value for a skill in a particular quarter.

Tracking the value of this index over time allows us to see what is increasing and decreasing in popularity.

TOP FIELDS OF STUDY & ROLES PER SELECTED SKILLS

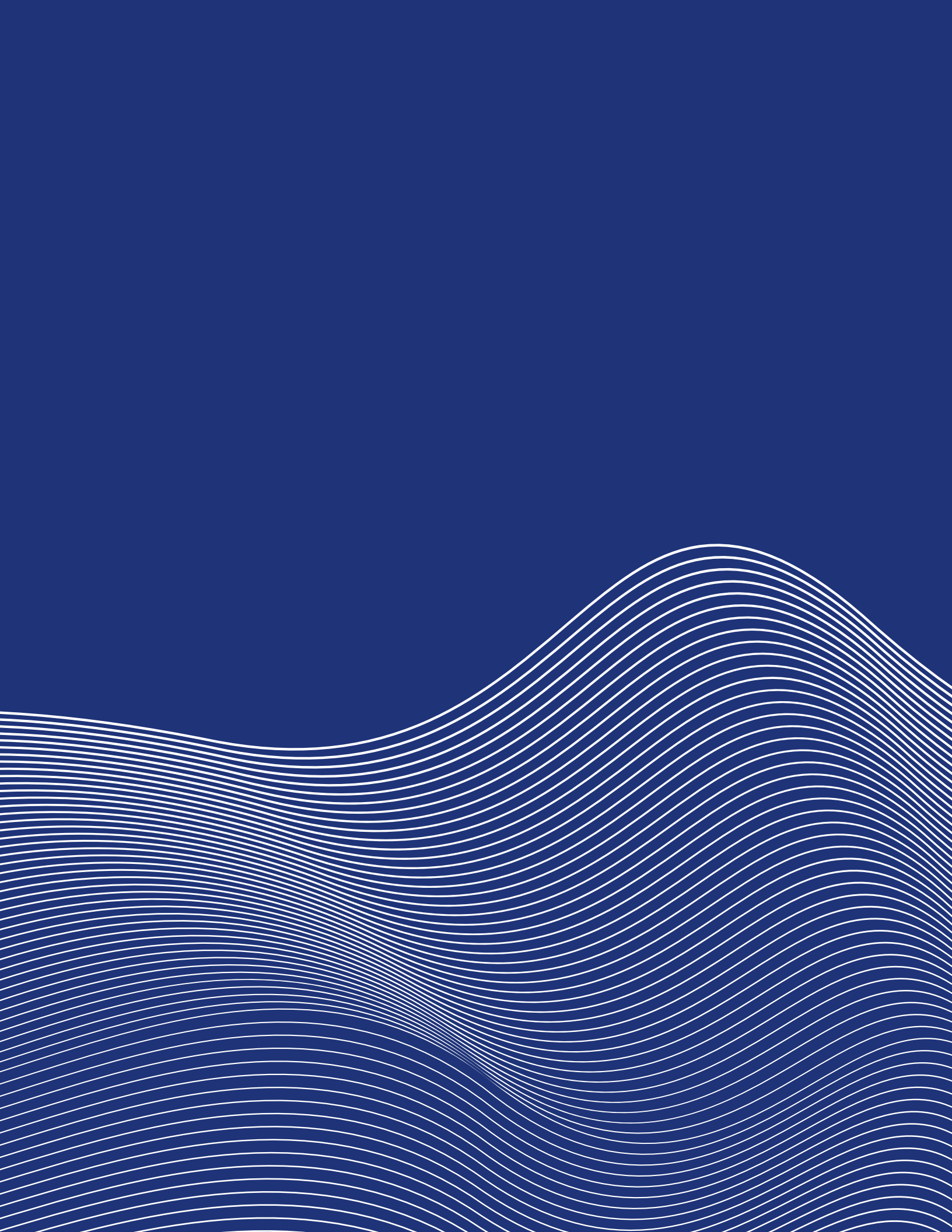
For a subset of the top trending skills identified as being crucial to the future of work by domain experts, we identify the top three majors and top five occupations that are most engaged in learning that skill on Coursera. Within each skill, we identify the fields of study and roles whose enrollment rate into relevant content teaching that skill is the greatest number of standard deviations from the platform-wide enrollment rate.

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