



FUTURE OF SKILLS

EMPLOYMENT IN 2030

CONTEXT AND HIGH-LEVEL FINDINGS

Preparing people for the jobs of the future is core to Pearson's mission of helping people make progress in their lives through learning. A student entering formal education today will be making decisions about his or her career by the year 2030.

That's why Pearson decided to work with researchers from Nesta and machine learning expert Michael Osborne of the Oxford Martin School, to build a research project that moves the conversation about the future of work past simplified scaremongering about automation.

It's the most comprehensive research project on this topic to date, and better predicts how major societal and economic trends—and the interactions between them—will affect the future of work.

Much of the current conversation about the future of work revolves around fears of technology making workers obsolete. It imagines a world where people are relegated to unemployment or meaningless work by advances like driverless cars and artificial intelligence. But, if we are only talking about how automation will change the nature of work or machines replacing human workers, we're missing the bigger picture.

We wanted to take a step back and take a deeper look at what's happening with jobs and work.

Through our research we've found that the future of work is brighter than conventional wisdom suggests. This document will provide high-level findings, but the upshot is that many jobs we recognize today will still be in demand by 2030 and beyond. *However*, the job you have today may require different skills for success tomorrow.

We know that megatrends like demographic change, political uncertainty, globalization, income inequality, environmental sustainability, urbanization—along with emerging technology—will all have significant influence over the jobs of the future.

For this research, we convened thought leaders to predict how megatrends will affect the future demand for different types of jobs and the skills needed for that work. We also surfaced the ways that these trends might interact.

For example, although an aging society could lead to increased health care spending, it's possible that technology could deliver productivity advances that would alleviate these spending pressures.

Then we applied advanced machine learning algorithms to our experts' forecasts to predict which jobs would be on the rise, which would be in decline, and the skills needed.

The bottom line of our research: we can all stop agonizing about machines taking our jobs.

The future will be about leveraging both human and machine capabilities, and this research provides a blueprint for how we might reform education to meet the demands of the future head on.

This is a complex and important conversation. We need to cut through the scary headlines so educators, learners, and employers can focus on taking a new, more dynamic approach to education and the careers that drive all of us to a better job and a better life.

We invite you to explore
The Future of Skills:
Employment in 2030.

OUR METHODOLOGY

TREND ANALYSIS

The effect of automation is often the focus of predictions about the future of jobs. This, however, results in a narrow view of the future that doesn't take other factors into account. We wanted to extend this by cataloguing the wider set of trends that will shape the jobs market of 2030. We started by assessing the key trends influencing the labor market - everything from globalization and automation to the urbanization and aging of the workforce itself. The research team gathered data for each of the seven mega-trends we chose to include in a comprehensive document that was used to give our foresight experts a view of the global trends they would need to consider when making their predictions.

FORESIGHT WORKSHOPS

At the foresight workshops, panels of experts - 12 in the US and 13 in the UK - were presented with three sets of ten individual occupations and invited to debate the future prospects of each in light of the trends. The first set of ten occupations were chosen randomly. Participants assigned labels to the occupations according to their view of its future demand prospects (increase, stay the same, or decline), as well as the level of confidence associated with their responses. To sharpen prediction, an active learning method was implemented: the subsequent sets of occupations to be labeled by the experts were chosen by a machine learning algorithm. Specifically, the algorithm chose occupations in areas of the skills space about which it was least certain, based on the previous information it had received. This process was repeated twice to generate a training set of 30 occupations.

PREDICTING JOBS DEMAND IN THE FUTURE

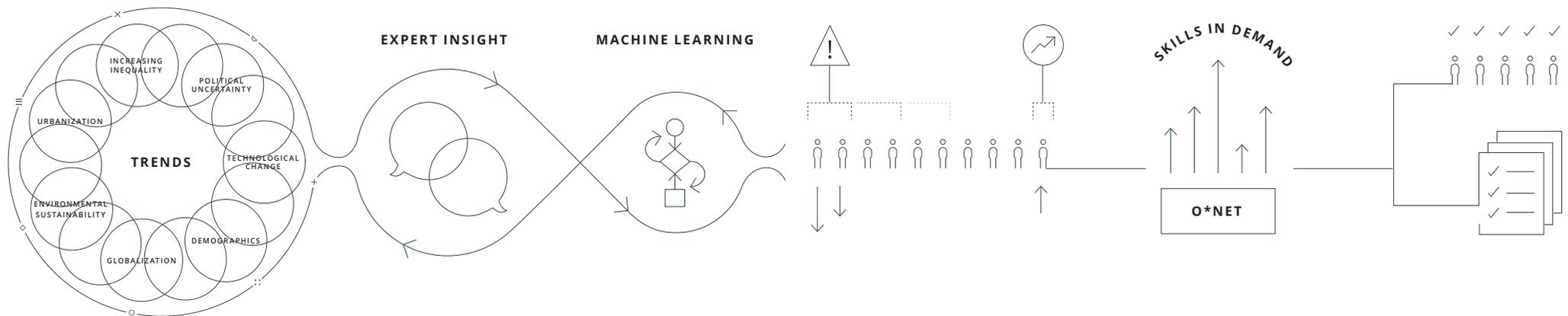
We used all the labels (or predictions) assigned by our experts to train a machine learning classifier, which in turn generated predictions for all occupations. To do this, we relied on a detailed data set of 120 skills, abilities, and knowledge requirements against which the U.S. Department of Labor's O*NET service "scores" occupations (we also map this data to UK occupations using a "cross-walk").

PREDICTING SKILLS OF THE FUTURE

Together with the predictions about changes in occupational demand, the O*NET data permitted us to forecast the skills that will most likely experience growth and decline. Using linear and non-linear analyses, we were also able to drill down into the skills (and skill combinations) that are predicted to drive demand for the future.

TRANSLATING FOR ACTION

We interpreted the results of our analyses with particular attention to the discussions of our experts at the foresight workshops. Finally, we converted these insights into actionable implications for educators, employers, and individuals - both from a policy and a practice perspective.



THE TRENDS

The future of work isn't only influenced by automation. Our methodology included an analysis of these seven megatrends to understand the bigger picture of work.

Key trends influencing U.S. and U.K. labor markets:

TECHNOLOGICAL CHANGE

- Perennial fears about impact of automation on employment.
- Estimates of future automation impact range, from 47 percent of U.S. employment at risk to only 9 percent.
- Conversely, technology amplifies human performance in some occupations—and gives rise to entirely new occupations and sectors.

GLOBALIZATION

- Global labor markets increasingly integrated.
- Benefits (e.g., advanced manufacturing, knowledge-intensive services) and costs (e.g., employment and wage impacts, trade deficits, legacy manufacturing).
- Post-financial crisis headwinds (e.g., sluggish world trade growth, rising protectionism).

DEMOGRAPHIC CHANGE

- Pressures to control age-related entitlements vs. investments in education, R&D, infrastructure.
- Ripple effects through health care, finance, housing, education, recreation.
- Rising Millennial generation, with divergent consumption and work behaviors.

ENVIRONMENTAL SUSTAINABILITY

- Climate change consensus largely intact, but with notable cracks.
- Structural changes resulting from emerging “green economy sector” and “green jobs” vulnerable to political reversals.

URBANIZATION

- More than half of world population lives in cities—70 percent by 2050. Cities attract high-value, knowledge-intensive industries; offer more varied employment and consumption opportunities.
- Uncertainties include fiscal policy, infrastructure investments, high public debt ratios.

INCREASING INEQUALITY

- Rise in income and wealth inequality, middle class squeeze.
- Disparities in education, health care, social services, consumption.

POLITICAL UNCERTAINTY

- Indices of geopolitical uncertainty have remained high since 9/11 spike.
- Mirrored by political and policy uncertainty—capacity of institutions and policymakers to act credibly and consistently.
- Uncertainty negatively affects economic activity in government-influenced sectors, such as defense, finance, construction, engineering, and health care.

INTERPRETING THE RESEARCH

Our human experts and machine intelligence algorithm worked in combination to help our researchers gain a more nuanced understanding of the future of employment and skills than has been previously possible.

1 We forecast that only one in five workers are in occupations that will shrink. This figure is much lower than recent studies of automation have suggested.

Occupations related to agriculture, trades and construction, which in other studies have been forecast to decline, exhibit more interesting and heterogeneous patterns with our research, suggesting that there may be pockets of opportunity throughout the skills ladder.

2 We forecast that one in ten workers are actually in occupations that are likely to grow.

These jobs are in sectors such as education and healthcare, where the overriding effect of technology is likely to be an improvement in outcomes, not a reduction in workforce. Therefore, as trends such as demographic change raise demand for these services, the prospect for employment is also likely to rise.

3 We forecast that seven in ten workers are in jobs with where there is greater uncertainty about the future. However, contrasting the negative outlook of other research, our finding indicate that we can do a great deal to help people prepare for the future.

Our findings rank knowledge areas, skills, and abilities that will be in greater demand in the future. These findings, if implemented by educators and employers, can help individuals better prepare for the workforce of the future.

4 Although there is broad understanding that “21st century skills” will be in demand, this research leads to a far more nuanced understanding of which skills will be in greatest demand.

In the US, there is particularly strong emphasis on interpersonal skills. These skills include teaching, social perceptiveness, service orientation, and persuasion.

Our findings also confirm the importance of higher-order cognitive skills such as complex problem solving, originality, fluency of ideas, and active learning.

In the UK, skills related to systems-oriented thinking (i.e., the ability to recognize, understand, and act on complex sets of information), such as judgment, decision-making, systems analysis, and systems evaluation also feature prominently.

5 Our research definitively shows that both knowledge and skills will be required for the future economy.

In our U.S. results, knowledge and skills are fairly equally represented in the top half of all features we ranked according to predicted future demand.

In the U.K. results, the ranking leans more towards skills than knowledge, but not by a wide margin.

6 Occupations and their skill requirements are not set in stone. Occupations can be re-designed to pair uniquely human skills with the productivity gains from technology to boost demand for jobs.

For example, we know that eventually robots will be able to build bridges and diagnose diseases. But humans will retain the unique ability to engineer a bridge and care for a sick child. How we balance those skills with technology productivity will chart the course of our workforce.

THE TOP 10 OCCUPATIONS PREDICTED TO EXPERIENCE INCREASED DEMAND THROUGH 2030

There are 90 “minor-level” occupation group classifications in the UK, and 97 in the US, as tracked by those respective governments. Using our model, we assessed the probability of each of the occupations experiencing increased demand in 2030. Below are the top ten most likely occupations to experience increased demand in 2030.

 UK
1 Food Preparation and Hospitality Trades
2 Teaching and Educational Professionals
3 Sports and Fitness Occupations
4 Natural and Social Science Professionals
5 Managers and Proprietors in Hospitality and Leisure Services
6 Health and Social Services Managers and Directors
7 Artistic, Literary and Media Occupations
8 Public Services and Other Associate Professionals
9 Other Elementary Services Occupations
10 Therapy Professionals

 USA
1 Preschool, Primary, Secondary, And Special Education School Teachers
2 Animal Care And Service Workers
3 Lawyers, Judges, And Related Workers
4 Postsecondary Teachers
5 Engineers
6 Personal Appearance Workers
7 Social Scientists And Related Workers
8 Counselors, Social Workers, And Other Community And Social Service Specialists
9 Librarians, Curators, And Archivists
10 Entertainers And Performers, Sports And Related Workers

SURPRISED BY THIS FINDING?

Libraries, traditionally conceived, have been going through massive transformations, as the way we create, share, and store information has evolved. We'll still need people, librarians, to help us navigate information both old and new. But like many occupations, the skills profile of a librarian is likely to shift substantially in the years ahead.

THE TOP 10 SKILLS, ABILITIES, AND KNOWLEDGE ASSOCIATED WITH RISING OCCUPATIONS

The top ten skills, abilities, and knowledge areas associated with rising occupations confirm the overall importance of so-called 21st century skills, and point to those that will be in greatest demand.

 UK
1 Judgment and Decision Making
2 Fluency of Ideas
3 Active Learning
4 Learning Strategies
5 Originality
6 Systems Evaluation
7 Deductive Reasoning
8 Complex Problem Solving
9 Systems Analysis
10 Monitoring

 USA
1 Learning Strategies
2 Psychology
3 Instructing
4 Social Perceptiveness
5 Sociology and Anthropology
6 Education and Training
7 Coordination
8 Originality
9 Fluency of Ideas
10 Active Learning

ACTIVE LEARNING (S)
Understanding the implications of new information for both current and future problem-solving and decision-making.

COMPLEX PROBLEM SOLVING (S)
Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

COORDINATION (S)
Adjusting actions in relation to others' actions.

CRITICAL THINKING (S)
Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.

DEDUCTIVE REASONING (A)
The ability to apply general rules to specific problems to produce answers that make sense.

EDUCATION AND TRAINING (K)
Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.

FLEUENCY OF IDEAS (A)
The ability to come up with a number of ideas about a topic (the number of ideas is important, not their quality, correctness, or creativity). E.g., ideation

INSTRUCTING (S)
Teaching others how to do something.

JUDGEMENT AND DECISION MAKING (S)
Considering the relative costs and benefits of potential actions to choose the most appropriate one.

LEARNING STRATEGIES (S)
Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things.

MONITORING (S)
Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.

ORIGINALITY (A)
The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.

PSYCHOLOGY (K)
Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.

SOCIAL PERCEPTIVENESS (S)
Being aware of others' reactions and understanding why they react as they do.

SOCIOLOGY & ANTHROPOLOGY (K)
Knowledge of group behavior and dynamics, societal trends and influences, human migrations, ethnicity, cultures and their history and origins.

SYSTEMS ANALYSIS (S)
Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.

SYSTEMS EVALUATION (S)
Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.

K=Knowledge, S=Skills A=Abilities

IMPLICATIONS

This research on the future of jobs and skills has implications for education systems, employers, and individuals. Some of the ideas described below are already being explored; our findings provide research support for these strategies. In addition, the research points to new areas for exploration by Pearson and our fellow education stakeholders.

FOR EDUCATION SYSTEMS

The research findings have significant implications for education systems around the US and UK:

MOVING BEYOND GENERIC DEFINITIONS OF “21ST CENTURY SKILLS”

Education systems will need to support better understanding, teaching practice, and assessment of the granular skills that will be in greater demand.

DEVELOPING PEDAGOGIES TO SUPPORT DYNAMIC KNOWLEDGE AND SKILL DEVELOPMENT

Educational institutions will need to provide supports to educators as they are asked to teach these new skills. This could require significant retooling of teacher education or faculty incentives in educational institutions.

ADAPTING FASTER TO THE CHANGING NEEDS OF THE LABOR MARKETS

One thing that is clear from the research is that the pace of change will continue to accelerate. Education systems developed 20-30 years ago will actually need to plan for a future 20-30 years away.

OFFERING MORE FLEXIBLE AND ADAPTIVE PATHWAYS

As the pace of change accelerates, learners will demand more ways to convert learning to earning. Although there will likely always be some demand for traditional brick-and-mortar experiences, more learners will want accelerated and flexible pathways, such as credentials or badges.

FOR EMPLOYERS

Employers serious about resolving future uncertainty for their workforce will need to think about:

REDESIGNING ROLES TO BALANCE TECHNOLOGY AND HUMAN RESOURCES

The path to maximizing productivity will be through the effective use of technology to supplement uniquely human skills. In education, we talk about technology supplementing (not supplanting) the educator to personalize learning. This will be true in many other industries as well and employers will need to proactively redesign the jobs most at risk.

MOVING BEYOND THE COLLEGE DEGREE AS THE PRIMARY SIGNAL OF EMPLOYABILITY

As education systems offer more flexible and adaptive pathways for learners, employers will also need to learn how to identify and develop talent. The college degree has long been an imperfect signal for employment readiness and this is likely to become even more complex.

FOR INDIVIDUALS

Despite its technical nature, this research has a very human angle. It forecasts impacts of megatrends on real people and the findings provide a roadmap for how to thrive in the future workforce. Individuals will need to:

DEVELOP SKILLS THAT ARE UNIQUELY HUMAN

Although the advance of automation and artificial intelligence may feel like a losing battle to some, individuals will need to focus on developing the uniquely human skills identified in this research, such as originality, fluency of ideas, and active listening.

COMMIT TO LIFELONG LEARNING AND RESKILLING

The pace of economic change all but guarantees that a single degree started in your teens or a career picked in your 20s will not be everlasting.