Innovation and public attitudes in Britain: Challenges for policy-makers

Responding to the fourth industrial revolution

1. Innovation: impacts and public attitudes

Innovation is crucial for the UK's economic future. Arguably, we are now at the beginning of a "fourth industrial revolution" based around the implementation of a range of new technologies, including artificial intelligence, robotics, nanotechnology and others. But innovation and economic growth are about people as much as they are about technologies – public attitudes and perceptions will also be key to their success.

While "innovation" is often presented unproblematically as a social and economic good, in practice, it can and has been detrimental to individuals' way of life and economic welfare, and can present itself as threatening, authoritarian, and heedless of personal and social impact. In fact, as Goodin has pointed out,[1] the word "innovation" had a pejorative connotation for several centuries in the context of religious doctrine – a year before the publication of the Book of Common Prayer in 1549, Edward VI, King of England, issued "A Proclamation Against Those that Doeth Innovate". Modern national leaders are more likely to proclaim against those that Doeth Not Innovate.

Previous economic transformations have had serious and sustained negative impacts on communities and individuals. In the past, governments and policy-makers have failed to plan for and manage change, ensure that benefits are widely distributed and mitigate negative impacts. Can we do better this time? Andrew Yang, a tech entrepreneur seeking the Democratic nomination for US President in 2020, points out that there are over 3 million Americans who work as truck drivers, 94% of whom are male, with an average age of 49 and typically a high-school education or one year of college. As self-driving trucks become a reality, their jobs along with related jobs in businesses such as truck stops, diners, hotels amongst others will be at risk.

In this paper, which draws on contributions from researchers at King's College London, Ipsos MORI and the Centre for London, we set out briefly the challenges in developing Artifical Intelligence, review public attitudes to innovation, and summarise the key challenges for policy-makers. This paper is very much a first contribution to one of the crucial public policy issues of our time, and we intend it to stimulate further debate and discussion.

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2. What are the challenges in developing artificial intelligence?

AI technologies are increasingly prevalent, with the potential to fundamentally change many aspects of our lives. Over recent years there has been development of a wide range of AI techniques across robotics, autonomous vehicles, health, chatbots, computer vision, and much more. Some of these techniques, and in particular some forms of machine learning, have seen a lot of success recently. However, we are still very far from general intelligence in machines, and there remains a need to pursue research and development of the full range of areas in AI.

Current technologies typically address tasks that are routine, with the potential to relieve people of much of the less interesting aspects of their roles. More generally, however, the real prospective area of reward is in *augmented intelligence*, by which humans will work together with machines rather than being replaced by them. In this context, while some of the current *data-driven* approaches to AI (specifically, machine learning) have had some very visible successes in recent years, they tend to be difficult to analyse in terms of their safety, trust, transparency and accountability.

There have been many examples of problems with computer systems, and the introduction of AI, especially when it is a *black box*, makes this even more challenging. As a result, there is a real risk that AI may be rejected by society on safety grounds. Thus, even when AI methods function to high standards of correctness, decisions are often not explained to users, can be distorted by bias in data or algorithms and, at times, cannot even be understood by the engineers who develop them.

Model-based approaches to AI (in which an explicit model is used to represent and reason about knowledge) bring systems that can be verified to be safe and correct, and provide a shared and explicit understanding that supports trust and allows humans to engage with their reasoning. This is relevant across both technical development and technology usage, and suggests a need to complement current work with investment in R&D in technologies for systems that are:

- **safe** – where we can provide some assurance over their behaviour; and
- **trusted and trustworthy** – where we can have some confidence in the decisions they make.

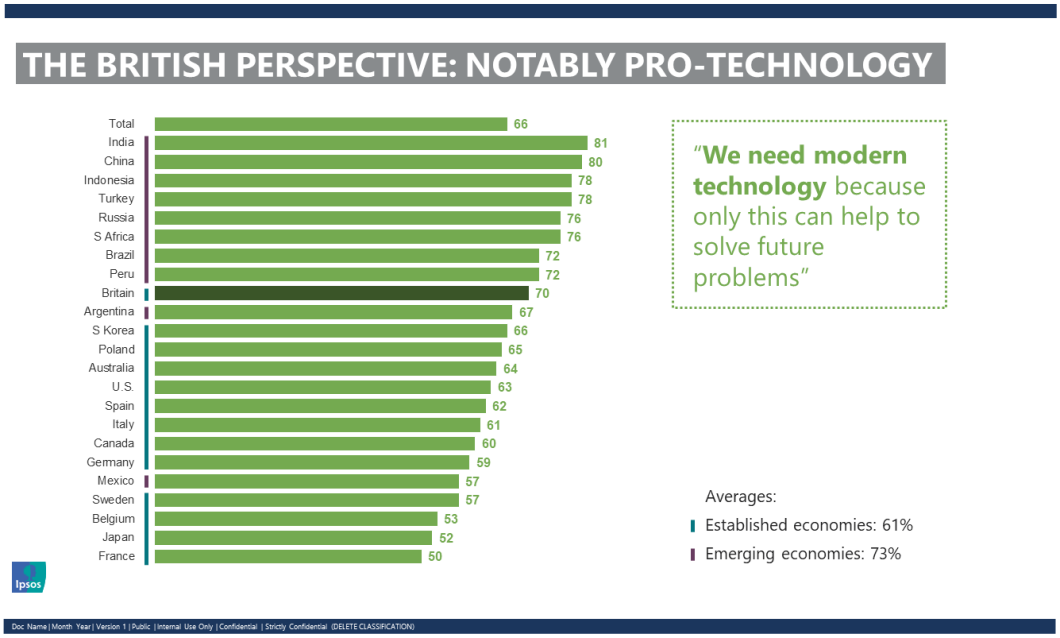
> “There is a need to develop a compelling vision of AI...with machines working in concert with humans, collaborating to provide a more coherent and more effective whole in which both humans and machines play their part.”

Against this background, there is a need to develop a compelling vision of AI in which it is conceptualised as *augmented intelligence*, with machines working in concert with humans, collaborating to provide a more coherent and more effective whole in which both humans and machines play their part. In this view, the human dimension is not removed, but enriched. This vision poses many important unresolved questions, including how to establish trust and reputation in human-machine partnerships to enable powerful and effective collaboration; how to leverage social norms and organisational structure in analogous ways to human societies where they help to provide assurance and order; how to ensure transparency and accountability of AI systems; how to provide the needed explainability for AI to become trusted by society; and more generally, what are the legal, social, ethical and philosophical implications of all this?

3. What do we know about public attitudes to innovation?

Britons are more optimistic than our neighbours about tech

The British public are relatively optimistic about the overall potential of innovation and have an open attitude towards technology, according to data from Ipsos MORI's Global Trends Survey. In the UK our belief in tech fixes is high: seven in 10 (70%) Britons agree that only modern technology can solve future problems. Our faith here is much higher than other western countries – in the US 63% agree, while in France the figure is just 50%.



This positive outlook is evidenced by behaviour as well as attitudes. Britons are engaged digital consumers, much more likely to shop online than others in Europe. In 2017, 17.8% of all retail trade in the UK was conducted through e-commerce, higher than Germany (15.1%) and the US (14.8%) and well ahead of the EU average of 8.8%. We are also among the least likely to feel overwhelmed by the speed of technology – less than half of Britons (46%) agree that they cannot keep up with science and technology as the speed of developments is too fast. While this might seem like a large proportion, only four of 23 countries in the poll are less likely to agree – Japan, Russia, Poland and Sweden.[2]

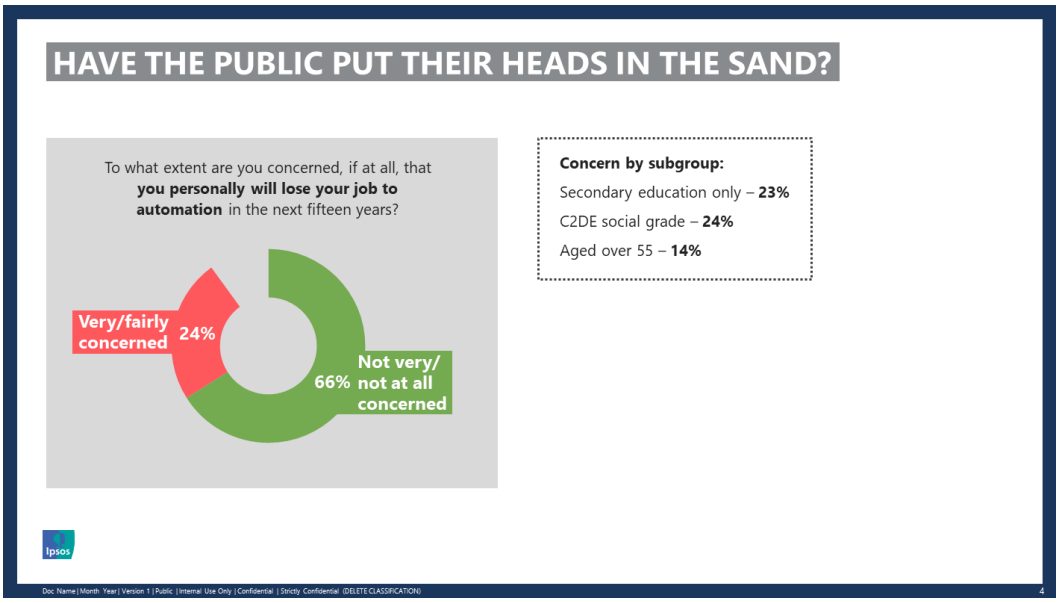
Views of automation's effect on the workforce are more negative

Despite being positive in general, the public are by no means experts in understanding data science, machine learning, AI and automation. As a key example, recent Royal Society of Arts, Manufactures and Commerce (RSA) research found that only half of the public are aware of the use of automated algorithms in deciding which adverts are seen by whom online.[3]

Our top-level openness and optimism about new tech can fade quickly under certain circumstances. Concerns can escalate when people are faced with innovations in

contexts where they will feel negative impacts directly, and where societal anxiety is already high. The impact of automation on work, for example, is an area of some public concern.

While consultancies are modelling futures in which there is more hiring than firing as a result of automation,[4] the default public assumption on employment is that automation will mean fewer jobs for humans. A survey by Ipsos MORI in 2017 found that 54% of the British public believed that more jobs will be lost than gained due to automation in the next 15 years, with just 11% disagreeing[5]. A survey of employees in four countries carried out the same year found that their biggest concern over the next 10 years was a lack of job security, mentioned by 37%, and in Britain this figure was higher still, at 44%.



How to understand public views

Much of the public simply don't yet know enough about how AI or automation works, or where innovations might be used, to make an informed decision on whether they support or oppose them. This creates a vacuum of information, into which negative narratives about Britain's future are just as likely to take root as positive ones.

We already see this in the media, where context is key. Recently, for instance, the use of facial recognition to ease the check-in process at airports (as was recently announced at Heathrow[6]) led to some questioning, but not to a huge public backlash. However, a story about the Metropolitan Police identifying known criminals in the crowd at a Taylor Swift concert prompted wider unease about the use of the same facial recognition technology.[7]

On nuanced topics such as these, surveys by themselves are rarely the answer. More dialogue is required to understand public attitudes, and this should be used to discern the principles by which innovation should be rolled out in society.

4. Key challenges for policy-makers

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Falling prices, machine learning and advanced pattern recognition are set to enable automation of more non-routine and cognitive tasks in the coming years, in services as well as in manufacturing. These factors, combined with upward pressure on wages, may combine to accelerate adoption of automation in many professional and service sector roles.

Challenges for unlocking the benefits of AI and automation

Automation could unlock higher productivity, and new jobs are expected to be created in everything from design and management, to health and fitness. Professional services firms in London are already responding to innovation by "moving up the value chain", offering value-adding consultancy rather than just services such as audit and property search. This in turn implies an emphasis on "broad" and transferrable problem-solving, interpersonal and client-facing skills, rather than "deep" technical professional skills, and presents challenges to traditional models of progression in professional services firms.

The application of AI to financial work is likely to lead to supplementing existing professions rather than replacing them, with the World Economic Forum predicting overall more jobs being created in financial services than being displaced.[8] Firms are likely to move towards high-value activities supported by automated routine work. Increasing demand is already evident in financial services for graduates with computer science skills, as well as the ability to communicate technical information effectively and in an accessible manner.

But there are challenges: both productivity gains and jobs may accrue overseas rather than in the UK. Research undertaken by King's College London academics[9] in the fields of audit and investment management is revealing that the adoption of AI and Big Data methodologies goes hand in hand with offshoring. Audit firms and investment banks are making increasing use of cheaper professional labour forces in countries such as India to perform some of the more routine work related to data analysis. Therefore, while AI and Big Data are making firms more efficient and effective in their operations, these gains are globally distributed and may actually end up with fewer graduate jobs being created in the UK. Professional service firms are talking about their traditional pyramid structures being replaced by diamonds, with middle and senior management positions remaining relatively stable but supported by fewer and fewer entry level positions This may in turn create challenges for recruitment and professional development of future cohorts of management.

Further issues are raised by the general move towards algorithmic management. Organisations such as Uber and Amazon have captured the popular imagination, but increasing evidence shows that working for these platform companies entails significant subjection of employee schedules as well as performance measurement of employees undertaken by computerised forms of management. This is disrupting traditional forms of employment relations and the social contract between employees and the firms they work for. The rise of zero hours contracts is particularly prevalent in sectors where algorithmic management is more pronounced, suggesting that such management may result in more precarious work. We therefore need to grapple with the issue of how we make algorithms accountable in this new economy.

To take another example, the introduction of fully autonomous – or self-driving – vehicles (FAVs) on our roads may have a transformational impact on the way people travel. But it is difficult to plan for their introduction because the timescales for their roll-out are highly uncertain. Roll-out may be slower than expected because of technological challenges, public acceptance, challenges dealing with mixed traffic of FAVs and traditional vehicles, and/or data sharing, governance, security and infrastructure requirements, as with 5G. On the other hand, roll-out may be faster than expected because of monetary savings from the use of potentially shared, electric and autonomous vehicles for users, with potential consumers shifting from ownership to use of transport services and/or individualisation of services. Governments need to plan for both cases.

Moreover, many of the changes brought about from FAVs may be positive for society. For example self-driving cars are likely to reduce the number of road accidents and fatalities,[10] provide much needed accessibility to the elderly and disabled, increase our ability to be productive while travelling, free up substantial tracts of urban land that are currently used to park vehicles, and reduce the cost of freight. However, some changes may be negative, including the impact on jobs.

Furthermore, the scale of this impact of FAVs on jobs is also highly uncertain. Some jobs will be directly impacted, for example taxi drivers, lorry drivers, bus and train drivers would be replaced by self-driving vehicles, although given the uncertainties in roll-out it is likely to take a number of years or even decades for these jobs to be fully replaced. But planning for these outcomes should happen now. Other jobs may be impacted indirectly. For example, the improved safety of FAVs may mean that the insurance sector and jobs in this sector may contract. There are also questions about how FAVs will be serviced – will new software updates and servicing be provided by vehicle producers or service providers or others, and will this impact the jobs of mechanics? The combination of technologies, like electric, autonomous and shared services could disrupt the oil economy and its workforce.

Of course, there will be new jobs too. And many believe that the new jobs that will be created will outnumber the ones that are replaced. But the challenge for governments is how to ensure that those people who lose their jobs can continue to be productive. This is the perennial challenge of new technologies – but we have to do better in the fourth industrial revolution than in previous transformations.

5. Policy options

The impact of AI on the economy and society is likely to be both very wide and very deep. As a result, the policy response and the management of change will have to encompass a number of different policy areas. Here we can do no more than sketch out some of these areas of development.

Industrial policy

Although technology is evolving at unprecedented speed, its rate of diffusion among firms still lags far behind its potential. This is mostly due to a number of structural impediments, including the lack of modern and affordable infrastructure, a shortage

of the skills required to undertake digital transformation, and the slow adaptation of the regulatory framework to the needs of the digital economy. Recent technological advancements are having a wide-ranging impact on the UK's business ecosystem and its supportive institutional structure, calling for policy initiatives that reflect the change of paradigm required by the digital age. For this reason, it is crucial to define an industrial policy that breaks down cross-departmental silos and encourages coordinated action across government.

"Building a digitally-enabled business ecosystem should lie at the heart of the government's industrial policy."

This collaborative approach can help address the country's structural barriers to digital transformation and promote the widespread diffusion of new technologies. Building a digitally-enabled business ecosystem should lie at the heart of the government's industrial policy. This can be achieved by providing stronger incentives for digital transformation, not only through tax credits for R&D and technology adoption, especially targeting lagging firms, but also through market policies that facilitate the entry of new businesses and ensure competition.

Furthermore, building capabilities for the businesses and jobs of the future will be increasingly dominant in the UK's policy debate. Digital training should become part of the lifelong professional development of managers and workers. This should aim for wider business engagement, in order to identify key training needs, promote high-quality learning workplaces, and advise on a variety of training options, including online training and qualification services.

With the publication of the Industrial Strategy White Paper, the UK government has committed to creating the structural conditions that support the digital transformation of the British economy, from developing the skills for future jobs to building digital infrastructure. These policy interventions can have a huge impact on the business environment, encouraging wider technology adoption, especially among lagging businesses – the late adopters. Not only should the wider use of technology reduce Britain's digital gap compared with other advanced economies, but it might also tackle the stubbornly low productivity growth after the financial crisis. Despite government's efforts to "build a modern Britain", the path to digital transformation is still intimidating for many businesses, especially for those that were not "born digital". In most cases, these lagging businesses have not developed a long-term digital strategy, either because they are not fully aware of the potential applications of digital technologies in their organisation, or because they lack the necessary managerial and technical skills to embrace the change.

Education and employability

The transformation brought on by both the plannable and unforeseeable aspects of innovation and technological advancement will strongly impact the transition from school, college and university to the world of work, already an area of concern for UK policy-makers. Two separate but connected factors significantly influence young people's ability to respond to an uncertain work environment, and this will be key to maintaining stability in our future workforce.

Firstly, research from the Department for Education shows that having some sort of career plan before completing an educational stage is more likely to lead to success; the same research also highlights the importance of work experience in making effective career plans.[11] The Gatsby Benchmarks and Statutory Guidance are a useful tool to enable career planning, but they need more resourcing to be delivered effectively, and far more clarity is required around Benchmark 4, "Linking Curriculum Learning to Careers"[12] (see second factor below). Gilworth and Thambar's higher education careers registration process of tracking career readiness[13], now implemented in around half of Higher Education Institutions, would transfer effectively to schools and ffurther education providers to give teachers actionable data about young people's career readiness, and this would help schools to plan and ensure the right support is reaching the right young people.

However, the government also needs to broaden its definitions of career success, moving away from salary metrics, such as the Longitudinal Education Outcomes (LEO) data, while also supporting changes to coding of graduate outcomes data that currently doesn't reflect young people's broader definitions of career success. For example, around 15% of students at King's College London in 2018 indicated an interest in self-employment and entrepreneurship, a career outcome which naturally requires the same attributes and skills (e.g. adaptability, flexibility, creativity, an innovative and outward-looking mindset) that support individuals through a fluid and rapidly-changing employment landscape. But self-employment can often attract very low salaries during the measurement periods for LEO, a metric used in the Teaching Excellence Framework, making LEO a poor measure of what might be a very important career outcome in the future.

The second factor which must be addressed is the traditional focus at school, FE and HE on knowledge acquisition over the development of skills, personal attributes and experience that can also improve employability. Employers seek candidates with the ability to learn things in depth, which is developed across all academic subjects rather than, in many cases, specific knowledge specialisms. And more importantly they require and expect self-awareness of a far wider range of transferable attributes and skills than young people currently have the language or ability to articulate. In particular, this self-awareness is fundamental to career agility and adaptability in an uncertain or fast-changing employment context, and it would address aspects of the perceived skills gap.

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While there are gaps in key digital and technological skills such as data analysis, software development and general digital literacy, and fundamental steps should be taken to address this, the skills that will be required to be successful alongside the increasing and diverse role of technology in work are more transferable: creativity, problem-solving, a wide portfolio of nuanced communications skills, and a range of analytical skills. These are innately developed across all subjects but not articulated in curricula, particularly in school and FE. Work conducted at King's College London to understand how employability surfaces through existing higher education curriculums,[14] could help inform an approach in school and FE, with simple additions to the current government GCSE and A-level curriculums to articulate the transferable attributes and skills innate to each subject area. This would give teachers and pupils language within the curriculum to describe the employability value in qualifications, including

the transferable skills they attain. It would help young people understand how those qualifications enable their work-readiness, alongside recognising the importance of continuing education and learning agility throughout their life.

Public engagement

Based on the experience of the Ipsos MORI Public Dialogue Centre, which has worked with more than 1,000 participants in recent years to conduct in-depth dialogue workshops on the ethics of AI, automation and related emergent science, we can discern clear principles for how the public want the use of automation and AI to proceed:

- AI applications should work to increase social equity and demonstrate clear social benefits. The challenge for government is to broker the relationships and create the governance framework that will ensure this.

- Governance of AI should limit profiteering where the private sector is given access to public datasets. There will also be a need for transparency so the public can have confidence that their interests are protected, especially in sectors like healthcare where innovation will require public consent to data sharing.

- Perhaps the biggest concern is the fear of a long-term erosion of choice and a thinning out of our day-to-day experience. Government will need to take the long view of what business and society driven by predictive algorithms might look like, and find ways of measuring and protecting human interactions which the public value.

The challenge for government will be in constructing narratives around the future of work, public life, crime and security, financial services, and other relevant fields. There is a need to address the breadth of topics and applications that the idea of "innovation" contains.

Government may benefit from research into the views of different groups as automation develops. For example, if clerical roles are automated first, this may impact women more than men; then later, if jobs such as warehouse work and logistics are automated, the impact may then be felt more by men. Automating jobs in call centres may affect younger people disproportionately, and there will be considerable geographical variation in how jobs are affected.

There is the potential for great public support for AI and automation if it can deliver "the society of the future" – but also the danger of reputational damage for governments and organisations if these uses are perceived to lead to social harms.

Developing a political narrative

The Industrial Strategy White Paper, published in November 2017, painted a future with broad brush strokes – describing the grand challenges, together with their associated themes of people and place, putting technological advance front and centre of this "whole nation" domestic agenda. Just as a strategy should do. It is not yet clear what approach the government under the new Prime Minister will take, or indeed

whether it will even continue to use the term "industrial strategy", but the reasons for the creation of the strategy in the first place still remain, perhaps even more so.[15]

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Moreover, positive though this long-term thinking is, there are risks and potential casualties. The industrial strategy needs a compelling narrative that speaks to its stakeholders. These include, beyond the businesses and government departments that will drive the strategy, the truck drivers, the research scientists, managers, entrepreneurs, school and college leavers, and many others who will be impacted as the strategy evolves.

For example, the "future of mobility" through autonomous vehicles will mean a very different future indeed if you are employed in the transport sector. Without reassurance to the contrary, a truck driver will see his or her role converted into an algorithmically driven convoy, possibly within the next decade. Redundancy, or the lack of any immediate alternative, will create huge anxieties.

These anxieties may ultimately be addressed through practical solutions such as retraining and upskilling, but they do not provide comfort over the short to medium term

Reassurance at both a society and individual level also requires a clear political narrative, ideally one which reflects a broad-based and cross-party consensus. It should describe the benefits and opportunities within a vision, which is relevant to the individual and provides confidence in terms of quality of life, sustainability and potential access to well-paid employment, all while emphasising what the future of employment will look like.

The narrative needs to be complementary to the strategy and resonate with a message that is both accessible and meaningful. "What does the industrial strategy mean to someone like me?" If that question is successfully answered, the white paper will help build not only "an economy that works for everyone", but also a strategy that includes everyone.

6. Final comments

The fourth industrial revolution is well and truly under way, but we are only just beginning to come to terms with the huge economic, social and political impacts it will bring. The challenge for policy-makers is to move beyond the "silo" approach and change the way we think about policy overall – by recognising the linkages and feedback loops between policy areas, engaging in open and honest dialogue with the public and stakeholders, and planning for and managing this transformation to the benefit of everyone.

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15. At the time of writing, the UK Government's business department has retained the title "Department for Business, Energy and Industrial Strategy".

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