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BEIS Committee inquiry into Automation and the Future of Work

British Automation and Robot Association (BARA) response

Businesses

1. What impact has automation had on business productivity to date?

Robots improve productivity when they are applied to tasks that they perform more efficiently and to a higher and more consistent level of quality than humans. In their study focused specifically on robotics Graetz and Michaels concluded that robot densification increased annual growth of GDP and labour productivity between 1993 and 2007 by about 0.37 and 0.36 percentage points respectively across 17 countries studied, representing 10% of total GDP growth in these countries over the time period and comparing with the 0.35 percentage point estimated total contribution of steam technology to British annual labour productivity growth between 1850 and 1910 (Graetz, Georg, and Guy Michaels. 2015. *Robots at Work*. Centre for Economic Performance).

There is a host of international evidence to demonstrate the link between technology uptake and productivity growth. McKinsey Global Institute provided a comprehensive round-up of the benefits of automation, which include higher productivity, better safety records, higher wages, access to cheaper and higher-quality goods and a rising standard of living (McKinsey Global Institute. 2017. "A Future That Works: Automation, Employment and Productivity.").

In the UK, figures from the SMMT illustrate the positive impact automation has had in the automotive sector. The adoption of advanced technologies in the sector has increased productivity (measured as vehicles manufactured per person) by a factor of 3 between 1984 and 2016. Between 2011 and 2016 the greatest rate of growth for vehicle manufacture also coincided with an increase in employment in the sector, from 124,000 to over 150,000.

The UK is lagging behind other advanced nations in overall productivity: UK output per hour worked grew by an average of 0.2% p.a. (2008-2017), compared to France 0.6%, Germany 0.8% and the US 1% per year. This lagging productivity is in part due to UK companies not adopting automation at the same rate as those overseas. To illustrate this point, robot adoption in the UK is significantly lagging our major

competitors. The International Federation of Robotics calculates robot density data, the number of robots per 10,000 employees. Their data shows that the UK has a robot density of 71, below the world average of 74. Examples of other countries include South Korea at 631, Germany at 488, USA at 189, Italy at 185, Spain at 160 and France at 132. (International Federation of Robotics. 2017. *World Robotics Industrial Robots 2017*. International Federation of Robotics). If we continue to fall further behind we will find it increasingly difficult to compete.

We would urge the Government to support the increased adoption of robots and automation technologies to enhance our productivity and competitiveness in an increasingly challenging global market.

2. Could automation lead to reindustrialisation as processes and products become cheaper?

BARA welcomes the proposals of the Made Smarter Review and the subsequent promise of a Sector Deal under the Industrial Strategy.

The Made Smarter Review found that industrial digitalisation could be worth as much as £455 billion to Britain's manufacturers over the next decade. If its recommendations are implemented in full, the UK manufacturing sector could grow at up to 3% per year and create 175,000 new jobs.

Automation can result in radical improvements in cost efficiency allowing work to move back to the UK from low-wage economies and strengthening UK supply chains. As an example increased productivity is enabling firms, such as Whirlpool, Caterpillar and Ford Motor in the US and Adidas in Germany, to restructure their supply chains, bringing back parts of the manufacturing process to the country of origin.

The Reshoring Initiative in the US estimates that 250,000 jobs have been brought back to the country by reshoring and inward-bound foreign direct investment since 2010 (Reshoring Initiative. 2015. "Reshoring Initiative Data Report 2015." *reshorennow.org*. Accessed February 02, 2017. http://reshorennow.org/content/pdf/2015_Data_Summary.pdf). Not only does automation enable reshoring, companies that deploy robots are less likely to relocate or offshore in the first place according to a report prepared by the Fraunhofer Institute for Systems and Innovation Research (European Commission. 2015. *Analysis of the impact of robotic systems on employment in the European Union*. Luxembourg: Publications Office of the European Union). Reshoring also brings other advantages, with the potential for demand spillovers into other sectors, the accumulation of specialist manufacturing know-how that is critical for attracting and expanding talent, and for national competitiveness.

Finally, there is a link between productivity, company competitiveness and increased demand (Graetz, Georg, and Guy Michaels. 2015. *Robots at Work*. Centre for Economic Performance). If the increase in production results in wage increases or increased employment overall, increased demand spills over into other sectors of the economy (Zierahn, Ulrich, Terry Gregory, and Melanie Arntz. 2016. *Racing With or Against the Machine? Evidence from Europe*. Discussion Paper No. 16-053, ZEW Centre for European Economic Research), creating a virtuous circle of increased productivity, increased demand, increased wages and spending power, leading to increased demand for other products and sectors. Economist Tyler Cowen points out that manufacturing, in particular, seems to create strong spillover effects, both within the sector and in complementary sectors (Cowen, Tyler. 2016. *Economic Development in an 'Average is Over' World*. George Martin University).

3. Which sectors are most likely to be affected by a growth in automation? What sort of tasks are most and least likely to be replaced by automation?

Most, if not all, sectors could benefit significantly from increasing automation as even the automotive sector in the UK uses less robots per worker than automotive sectors in other major countries.

The Made Smarter review identified the potential value that automation can deliver to key sectors in the UK. The largest value opportunity is to construction, worth £88.9bn. Food and drink has a value of £55.8bn, Pharmaceuticals £22.4bn and aerospace £17.5bn.

The tasks traditionally most suited to automation are those which are repetitive, high volume, hazardous or arduous, require a high degree of precision or cleanliness, or are high speed. Automation is increasingly becoming applicable to low volume tasks. Successful automation of a process traditionally depended on having known, consistent and ordered inputs. More advanced technologies, particularly the use of machine learning and AI, will significantly increase the flexibility of automation applications and open up more activities to be automated. Tasks requiring creativity and unique, variable and undefined activities will remain the least likely tasks for automation.

There has been much publicity regarding the risk of large scale job losses from automation. More detailed analysis takes a view of tasks rather than jobs being automated (Arntz, Melanie, Terry Gregory, and Ulrich Zierahn. 2016. *The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis*. OECD Social, Employment and Migration Working Paper No. 189, Paris: OECD Publishing). This analysis suggests that less than 10% of jobs can be automated entirely and that the level of potential automation of tasks within a job varies greatly according to job and industry. As McKinsey puts it, 'More occupations will change than will be automated away' (McKinsey Global Institute. 2017. "A Future That Works: Automation, Employment and Productivity"). This is an important differentiation as it paints a picture, supported by BARA's experience, of a future in which robots and humans will work together, each doing what each does best, with positive effects not only for the competitiveness of the firm, with attendant repercussions for employees, but also on the quality of work carried out by people.

Economist David Autor argues that 'When automation or computerization makes some steps in a work process more reliable, cheaper or faster, this increases the value of the remaining human links in the production chain' (Autor, David. 2015. *Why Are There Still So Many Jobs? The History and Future of Workplace Automation*. Journal of Economic Perspectives Volume 29, Number 3). Economist James Bessen points out that the introduction of ATMs in the 1990s did not lead to a reduction in the number of bank tellers that these machines theoretically replaced. Although individual bank branches did reduce the number of tellers per branch, they also opened more branches to remain competitive, and tellers' jobs focused on more high-value tasks in customer interaction (Bessen, James. 2015. *Toil and Technology*. Article, Finance and Development, March 2015).

It is also important to note that the fact that the labour force in one sector is shrinking does not automatically equate to aggregate job losses – the issue is whether the losses in one sector or job type are balanced by gains in another. For example Bessen argues that from a historical viewpoint, new jobs in other sectors such as manufacturing and services have replaced jobs lost in sectors such as agriculture in the USA where employment has fallen from around 40% of the labour force in 1900 to less than 2% today (Bessen, James. 2016. *How Computer Automation Affects Occupations: Technology, jobs, and skills*. Law & Economics Working Paper No. 15-49, Boston University School of Law). Similarly, a survey by the World Economic Forum of member companies predicted robotics will be a strong driver of employment growth in the survey's Architecture and Engineering job family (World Economic Forum. 2016. *The Future of Jobs: Employment, Skill and Workforce Strategy for the Fourth Industrial Revolution*. Global Challenge Report, World Economic Forum).

Consultants Deloitte argue that ‘While technology has potentially contributed to the loss of over 800,000 lower-skilled jobs (*in the UK*) there is equally strong evidence to suggest that it has helped to create nearly 3.5 million new higher-skilled ones in their place.’ (Deloitte LLP. 2015. *From Brawn to Brains: The Impact of Technology on Jobs in the UK*. Deloitte LLP). And countries with the highest robot density, notably Germany and Korea, have among the lowest unemployment rates.

4. Is there enough advice and support available for businesses who want to automate? Does the Government’s Industrial Strategy offer the right support to businesses for automation?

Most UK companies are SMEs, and unfortunately industrial SMEs frequently lack the information, expertise, skills, training, resources, strategy and, moreover, the confidence to adopt new technologies. This means that appropriate support and advice is essential.

The current set up of local and national government institutions can be extremely difficult to navigate and access. This presents a particular problem for SMEs that do not have the time to invest in understanding the web of support and advice available. One of the key barriers to successfully helping the majority of industrial companies in the UK is the difficulty in engaging with SMEs.

The support available to SMEs should be communicated in a simple and co-ordinated manner, through the least number of channels possible, to improve awareness and ease of access for the many SMEs that are currently unaware of the available options. This may involve simplifying the network of institutions, but must at least clearly ‘map’ the institutions in a clear and transparent way.

Made Smarter recommended solutions to provide support to businesses, but over eight months on from the Made Smarter Review, the industry is still waiting for an industrial digitalisation Sector Deal.

Based on our contact with manufacturing we believe there are a number of factors that contribute to the low take up of technologies. Companies tend to not understand the opportunities that new technologies offer, or perceive them too costly or risky to implement.

Skills remain a significant barrier, both in terms of understanding the new technologies themselves, but also how to adopt them most beneficially and adapt existing operations for maximum benefit.

Finally, a number of firms lack access to funding for investment in automation. This is not the result of an absence of financial support, but often an aversion to taking on debt, sometimes a lack of awareness of where to access funding and insufficient time or skills to compile the necessary business case.

5. What opportunities are there for British tech businesses from a rise in automation? How can these opportunities best be exploited for the benefit of British industry?

The UK has been a slow adopter of automation technologies. This has meant that the UK is less prepared than many of its leading competitors to take advantage of the Fourth Industrial Revolution. The EU Digital Transformation Index 2017 placed the UK 11th in an EU ranking of digital readiness, scoring our businesses particularly low for the integration of technologies.

Automation leads to increased productivity and competitiveness. The opposite approach leads to decline and job losses. The Made Smarter Review found that industrial digitalisation could be worth as much as £455bn to Britain’s manufacturers over the next decade. If its recommendations are implemented in full, the UK manufacturing sector could grow at up to 3% per year and create 175,000 jobs.

Increased adoption of automation in the UK will also drive growth in the UK supply chain, to develop and deliver the solutions. These would be tech businesses and growth in this area, which could be significant, would lead to increased employment, particularly skilled roles, and also the potential for growth in exports.

Workers

1. Are there specific demographic groups most at risk? How far can these be mitigated by new roles in these industries?

As indicated above there is a significant evidence that automation within manufacturing leads to an increase in jobs, though they are likely to be different roles requiring different skills. Routine white-collar office functions are most at risk, according to the World Economic Forum, accounting for two-thirds of the jobs impacted. Manufacturing and production roles have good potential for upskilling, redeployment and productivity enhancement through technology rather than pure substitution.

One of the strongest arguments for automation adoption and productivity improvement as an engine of job creation is the fact that the nations with the highest robot density – South Korea, Japan and Germany – also have among the lowest unemployment rates. The German automotive sector, for example, added jobs in step with its increased use of robotic automation between 2010 and 2015, at rates of 2.5 percent and 3 percent, respectively.

The data indicates that mature economies with a high density of industrial robots have lost manufacturing jobs at a slower pace than those that have invested less in robots. This suggests at least that automation does not destroy jobs, even if it does not establish a definitive correlation between productivity and job creation. In some countries, the manufacturing sector has been hollowed out, not by automation, but by off-shoring – a process that can have a more damaging long-term effect on both employment levels and growth. One way to protect against off-shoring, or drive reshoring, is to maintain high levels of productivity at home.

Lifelong learning will become a critical success factor to both individuals and the organisations they work for, with workers having to update their skills and possibly retrain several times during a career.

The current curriculum is not helping the UK to deliver a future fit workforce. In its 2017 Education and Skills Survey, the Confederation of British Industry found that the proportion of businesses who are not confident that there will be enough people available in the future with the skills necessary to fill high-skilled jobs reached 62%, a slight improvement on the 2016 figures, but still too high. This indicates that what children and young adults learn in the first 17 years of their life is not necessarily what they need to know when they get their first job.

In the context of increased automation, artificial intelligence and lifelong learning (particularly the need for regularly updating technology knowledge), it is vital that we prepare young people for the future jobs of industry with some fundamental skills that will be required throughout their careers: leadership, creativity, problem-solving, critical thinking, teamwork and understanding systems. A fundamental understanding of digital technologies and their application will be essential, and the utilisation of these technologies to support learning will better prepare students to enter the workforce. In-depth knowledge of specific technologies will be less valuable as this knowledge will likely be outdated by the time pupils enter the workforce.

It will of course be critical to ensure teachers are properly prepared and equipped to educate the next generation of workers, both in fundamental skills and technology. This should include a good understanding of modern manufacturing, that is, it is not dirty and dangerous, but highly skilled, interesting and well paid.

2. What are businesses doing to offer training to staff, either as a result of or in support of automation? Should Government have a role in retraining workers affected by automation?

BARA believes that personal experience leads to better education. Access to robotics, artificial intelligence, virtual reality and augmented reality in schools and colleges is vital, not only for preparing future generations of workers, but also to help sell careers in digitalisation technologies to pupils. BARA, through PPMA BEST and other activities, as well as activities undertaken by our members, regularly participate in awareness activities for schools and colleges.

Robots provide an excellent educational tool. Not only can they assist teaching by covering a range of disciplines from software to mechanics but they also entice students into engineering courses. This is demonstrated by the strong interest in school robot competitions such as the VEX IQ robotics challenge. Interestingly this has a high proportion of female participants. To equip a significant number of colleges with industrial robot training cells would not require a large investment and would provide the opportunity to significantly enhance the uptake of engineering courses from both male and female students.

As part of the Government's restructuring of technical education, the Government needs to make it more appealing for businesses to provide industrial input to educational institutions to support the development of their future workforce. There is a need for early collaboration to ensure that educational institutions are aware of technology implementation so that skills can be developed that reflect current technologies rather than skills lagging implementation and reducing the effectiveness of new entrants to the workforce. To assist the development of this, Government could play a convening role and draw up a programme that businesses and education providers can then implement. This would make it far easier for smaller and medium enterprises to get involved with any such activity.

BARA would urge the Government to consider providing a mechanism for funding the industry training of everyone from operators and shift supervisors to production managers and company owners in the necessary skills for the Fourth Industrial Revolution. The case for this is clear, and as stated in BEIS's ongoing *'Business Productivity Review: call for evidence'* "...there is a large and growing body of evidence that suggests that better management practices are associated with higher productivity". In principle the Apprenticeship Levy could be an effective method of up-skilling the workforce, but in practice it is too unwieldy.

3. What other actions should the Government be taking to support those affected by automation, such as a 'robot tax'?

In the context of the UK's current weak productivity growth, any policies that would dis-incentivise productivity gains should be avoided. The challenge in the UK is to encourage investment in automation.

This view is supported by the TUC (TUC. 2017. *Shaping our Digital Future*, Trade Union Congress), "These technologies have the potential to liberate working people from routine, tasks and drudgery, and so make jobs more skilled and satisfying." The TUC argues "that where these technologies lead to new wealth, the benefits are shared – both in terms of more free time and more money".

Imposing a robot tax – particularly when no other nation is doing so would result in the UK losing investment and becoming less competitive. We believe a robot tax is unwarranted given the proven positive impact of robotics on employment and wages. It would deter badly-needed investment in robots, undermining the competitiveness of companies. Profits, not the means of making them, should be taxed. Robotics represents a capital investment that improves productivity, creates more jobs than it replaces, and leads to workers moving up the skills/ income ladder.

Unlike other developed nations, the UK's tax system does not incentivise increased automation amongst SMEs. It is vital that the Government supports industry through a more robust capital allowances scheme for adopters of automation solutions.

We also need to upskill our industrial workers in the use of industrial digital technologies ensuring quality training and education can be accessed. Training must be available to support the UK labour force, both re/up-skilling the existing workforce and embedding the requisite skills in people entering the labour market.

Most other developed countries have active government interventions to promote leadership and the adoption of industrial digital technologies (IDTs) within their industrial bases. For example, while the UK lacks a clear narrative, Germany has Industry 4.0, the USA have 'America Makes', China has 'Made in China 2025' and France has 'Industrie du Futur'.

Well-judged interventions in skills, capital allowances and the overall UK narrative can bring huge benefits to the UK's industrial digital capabilities. Government policy should focus on these areas and always aim to be embracing the future.

Consumers

1. What are the potential benefits and disadvantages for consumers of businesses increasing automation?

As stated by McKinsey (McKinsey Global Institute. 2017. "A Future That Works: Automation, Employment and Productivity.") automation leads to cheaper and higher quality goods as well as a rising standard of living.

Automation is changing the nature of demand, in particular by enabling increased personalisation. For example, robots are being used in one factory to cut out customized flip flops based on a 3D laser scan of customers' feet (International Federation of Robotics. 2016. *World Robotics Industrial Robots 2016*. International Federation of Robotics). This level of personalisation would not be feasible without advances in automation technologies.

In addition to the social benefits, of a healthy manufacturing industry providing employment and tax revenue, automation does offer broader societal benefits in terms of reduced consumption and CO2 emissions, through energy and resource efficiencies.

Productivity and efficiency improvements do drive down manufacturing costs and enable lower consumer prices for goods and resilience of supply. In addition, automation can lead to improved product quality, hygiene, traceability and reduced lead times.

British Automation and Robot Association

BARA (British Automation and Robot Association) provides a voice for the Robot and Automation Industries, when dealing with government, industry, financial and academic institutions. The aim of the BARA is to promote the use of, and assist in the development of Industrial Robots and Automation in the UK.

Mike Wilson
Chairman BARA