Materials Processing Institute

THE 4TH INDUSTRIAL REVOLUTION: IMPLICATIONS FOR ECONOMICS, POLITICS AND SOCIETY

A speech given at an industry dinner in the City of London.

21 May 2019

Introduction

Thank you to Tom and the Odgers team for the invitation to dinner and to speak this evening. I would like to take this opportunity to address the greatest challenge facing Britain today. A challenge that is causing and will cause tremendous upheaval in business, industry and society. A challenge which, if handled properly, presents a great opportunity to transform and improve lives for the better. I am speaking of the 4th Industrial Revolution.

You will all be familiar with the first industrial revolution. Founded in Britain on coal and steam, it was accompanied by a swath of invention that transformed the origin of motion and power, from humans and animals, to machines. The second and third industrial revolutions saw the introduction of electrification and automation. But just as the first industrial revolution replaced muscle with machine, so this 4th industrial revolution seeks to replace minds with machine learning.

You all know what I am talking about; from the new capacities in digital technology and the ability to channel big data to support artificial intelligence through technical advances in robotics and automation.

We are in this industrial revolution right now. It is happening around us and it is accelerating.

We can all conjure early basic images of the first industrial revolution where Stephenson's Rocket or the Spinning Jenny not only transformed Britain and the world's economic output, but also led to the societal disruption of urban relocation and the smokestacks of Victorian England.

So think about the change today, and the work of a company like Boston Dynamics developing a robot to perform the basic human act of turning a door handle that looks part dog, part boa constrictor and part sci-fi dystopian horror from the plot of the Alien films – well in a year, its robots now work in packs and use computer vision to leap across boxes.

If it took just under 150 years to go from the world's first railway between Stockton and Darlington in 1825 to putting a man on the moon in 1969, then the pace of change today is positively intergalactic.

What are the implications, and how do we tackle this?

My approach with regard to how this shift from workers to algorithms occurs is grounded in a sincerely held belief in the value of good work. Its importance in creating a sense of self-worth, of confidence and purpose. The cohesive way in which work holds our families and society together. I say this having experienced what it is like to live in a community where there is a lack of work, to live in a family where there is unemployment. This experience has brought home to me the destructive and depressive power of worklessness and a drive to ensure that as few people as possible will live through it.

At an individual level the change associated with these technologies and the threat of unemployment, causes stress and is contributing to a crisis in mental health.

At a national and international level, this industrial revolution, founded on an explosion of new digital technologies, is a wider sense of dislocation that new uncertainties brought about by technological and societal change – just as we saw before with the cumulative impact of a globalisation that communities have struggled with – can be seen as contributing toward some voters decision to leave the UK's vote to leave the European Union. However it is these technologies and their potential to open new opportunities in energy, materials and efficiency that provide the answer to the climate crisis.

This evening I would like to draw your attention to the profound impact this is having on our economy, our politics and our society and what response we need to make as a country to manage this change.

Impact of Technology on Economics

Turning first to economics, there can be no more fundamental realisation than that GDP, as a measure of our economic progress, our wellbeing, our standard of living, is not enough and has the potential to be fully broken by the technologies and outcomes of an unmanaged 4th Industrial Revolution.

This is a topic I first visited in a speech in Sheffield in April 2017[1], where I highlighted the risk of increasing inequality as a result of focussing wholly on GDP as the measure of economic progress. Since then the GDP measure has been brought to its knees by the rise of intangibles. A theme explored in detail by Haskel and Westlake in their book 'The Rise of the Intangible Economy'[2], published later that same year.

To get an idea of why this is the case I am reminded that Tom told me that at the last of these dinners, Sir George Buckley ended his speech with a song. Tom asked if I would do the same. I do not want to inflict my vocal efforts on you, I do though have a musical anecdote to illustrate this point about the effect of the intangible economy. I am a brass instrumentalist having played in a colliery brass band for many years. I first learned to play the cornet thirty years ago and my tutor at that time was a professionally qualified brass teacher. My early lessons, as stumbling and unmusical as they were, did at least contribute to UK GDP.

This year, in 2019, I have taken up a new instrument and am learning to play the trombone, but this time I am doing so using entirely free tuition from Youtube. Whilst adding greatly to my personal satisfaction, if not that of my family, this transaction is invisible to the wider economy. Both the generation and consumption of the content is free and does not contribute to GDP.

This is an example of the wider sharing economy, which is unquantified, unmeasured and has led to the destruction of many previously important economic activities.

Impact of Economics on Society

As these new technologies have changed our economy, so the changes in economics are disrupting our society.

As we know, the nature of fourth industrial technologies makes process-oriented jobs more susceptible. Future Advocacy, a think tank focused on new technologies such as AI, broke down the impact by region, showing that there is a high degree of regional variation with the Midlands and north of England hit hardest. They suggest that over two-thirds of the top 50 parliamentary constituencies with the highest proportions of high risk jobs are in these regions.

However, it is Shadow Chancellor John McDonnell's constituency of Hayes and Harlington which contains Heathrow Airport and its more susceptible transport, logistics and storage industries which has the highest percentage of jobs, 40 per cent, at high risk of automation. Little wonder that he is more engaged than most politicians in this area!

Therefore, we might expect that if we pursue a similar course of non-intervention as we did with deindustrialisation since the war, then we are likely to see regional inequalities grow even wider thanks to the fourth industrial revolution.

Indeed, inequality is something that we need to be fully aware of as we consider a public policy approach.
For instance, a significant impact of this intangible economy is the unequal distribution of wealth that results. Just as the robber barons of the late 19th and early 20th century managed to accumulate vast riches through their corporations, so the founders of Amazon, Facebook and the like are able to corral a significant proportion of national wealth, but they are able to do this more quickly, with lower capital outlay and with fewer employees, than JP Morgan, Andrew Carnegie and the Rockefeller Family could have imagined.

Increasingly, the digital world enables mega corporations to be established and run by a very small number of people, concentrating wealth still further, driving an increasing gap between rich and poor and creating a more unequal society. This phenomenon is not new, it was also experienced in the first industrial revolution, only this time it is not only faster than before, but reverses a trend of decades.

The impact of these new technologies on productivity is also contributing to this inequality. The hitherto inalienable rule that increased productivity results in increased wages, seems much less certain, as the real beneficial productivity gains are felt in companies such as mine, where highly skilled engineers and designers are able to tackle more complex problems and break new frontiers of science. Meanwhile, many middle ranking jobs are vanishing entirely. Just as manual labour declined in the 20th century, so thinking labour is declining in the 21st.

For the UK I detect an even greater vulnerability. Productivity has flatlined and employment is at historically high levels, but anecdotally my work through both the UK Metals Council and the Federation of Small Businesses, informs me that small businesses are delaying investment in capital equipment during the current Brexit uncertainty and using temporary labour to fill the gap. This means that that there is a latent potential for a wholesale shift from labour to capital that companies are ready to make, as soon as the future trading scene is more certain.

Impact of Societal Changes on Politics

These changes in the fundamentals of our economic understanding of how an economy works are leading to radical shifts in the political landscape.

What is widely referred to as the rise of populism, across Europe and beyond and which in the UK has found some expression in the Brexit debate not just since 2016 but over the past 30 years, is really a tussle between different visions for the future of our society.

We should not forget that the fascism which swept Europe in the 1930's was born at time of the greatest income inequality and social change until the present day.

In the UK there are many new policy ideas being suggested, from political parties and policy organisations, which seek to use these new technologies to address the challenges of climate change and inequality, whilst also meeting long term political aims.

Concerns over future capacity for employment have led to ideas such as the universal basic income and inequality has reignited the desire for greater employee involvement in companies. More directly, these new technologies allow for lower economies of scale and wider distribution of work, beyond natural economic clusters, meaning that decentralisation, as well as democratisation of industry services and infrastructure, is now a practical reality. Technology is both the driver for political change and the enabler of the political solutions.

Solutions

One answer to this is to **connect people more closely with the economy**, by considering new models of ownership for companies. This is a topic I addressed at a recent conference on social enterprises[3] and one that is gaining popularity, with the announcement only last week that BT staff will now receive annual share allocations and that Julian Richer, the owner of Richer Sounds, is placing his company into an employee trust.

I followed a similar path when setting up the Materials Processing Institute, eschewing conventional forms of ownership to create a not-for-profit entity, with a level of employee ownership and a democratically elected

employee director on the board. It is a commercial advantage for the Institute that we have workers who are more engaged in our work. It strengthens decisions running the company and tailoring the innovation offer that we export, including to countries such as Germany, China and Australia.

This aspect of **innovation**, most particularly the development and implementation of technology is also an area that requires attention. The UK has a recognised international strength in university research, but the majority of this research is commercialised overseas. Our pride in having a leading university sector actually means that UK taxpayers are funding fundamental research, which allows our competitors to become more efficient. If we are really to capture the gains of the 4th industrial revolution, then we need to invest significantly more in development and commercialisation in the UK.

Once commercialised these digital technologies are creating unheard of productivity improvements, but are also displacing once valuable skills. My answer though is not to resist change; rather we must **invest in skills and retraining.** We must accept that processes and business models which have served us well for many years, are no longer competitive, that hard-won skills, which have taken decades to hone, are now obsolete. For those who are in work, this means a commitment to retraining and reskilling to the new technologies and jobs. For those who are yet to join the workforce it means being ready to tackle the jobs of the future, before we even know what they are.

This last point may sound almost impossible and yet it is a challenge I have addressed in a recent published article on future skills[4] where I assert that the highly valued skills of the future will be those that combine fundamental disciplines, such as engineering and science, with digital technologies.

Increasingly, the value added jobs, those that benefit from machine learning, rather than those that are replaced by it, require creative thinking. A combination of problem solving at the boundaries of traditional disciplines, combined with an entrepreneurial mind-set, seems to me to be a winning combination.

Investing in these three areas of corporate structures, innovation and skills, will help to ensure that the benefits of the 4th industrial revolution are experienced widely and the social impact is mitigated.

Getting this right for me is personal. I have two small children and I can be sure that whatever jobs they will be doing in ten, or twenty years time, probably haven't even been thought of yet. But returning to where I started, I want my children and everyone's children, to have the opportunity through good work and secure employment, for a fulfilling and purposeful life.

It is important that we get this right as a country, so that by managing the impact of the 4th industrial revolution, we both decarbonise our society and share the economic benefits that technology brings.

[1] British Manufacturing Plan Constructors' Association': 6 April 2017 https://www.mpiuk.com/downloads/speeches/Speech-2017-04-06-British-Manufacturing-Plant-Constructors-Association.pdf

[2] 'Capitalism Without the Capital: The Rise of the Intangible Economy': J Haskel and S Westlake, 2017

[3] 'Passion Profit and Purpose: New Opportunities for Social Enterprises': 15 March 2019, https://www.mpiuk.com/downloads/speeches/Speech-2019-03-15-Passion-Profit-and-Purpose-Opportunities-for-Social-Enterprises.pdf

[4] Skills for the Future': Materials World, May 2019, pp30-31

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Chris McDonald is the Chief Executive Officer of the Materials Processing Institute. The Institute carries out industrial research and innovation in advanced materials, low carbon energy and the circular economy. Chris's background is in industrial research and manufacturing, where he has worked internationally. He led the divestment and return to independent, not-for-profit ownership of the Institute in 2014, the year the organisation celebrated its 70th anniversary.

In addition to leading the Institute, Chris provides expert consultancy support to companies, Governments and public bodies, in technology strategy and the technical due diligence aspects of mergers and acquisitions. He is prominent in the development of public policy, around innovation, steel and SMEs, where he works to support growth and inward investment. He is the policy chair for Innovation and Enterprise for the Federation of Small Businesses, a member of the CBI Regional Council for the North East and is the Innovation Lead for the UK Metals Council. Chris is also a member of the Steel Advisory Board for UK Steel (EEF).

A graduate of Cambridge University, Chris is a Fellow the Institute of Chemical Engineers and of the Institute of Materials, Minerals and Mining. He sits on industrial advisory boards at a number of universities, including Oxford and Sheffield.

He is often called to commentate in the media on innovation leadership and the steel industry.

> "Chris provides expert consultancy support to companies, Governments and public bodies in materials, technology and innovation strategy"

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