Back to the future

***Jon Herbert* asks if technology can restore efficient performance.**

When it comes to conventional measures of productivity the UK does seem to be dragging its feet. Official figures show that, for reasons no one can quite explain, national output per worker per hour has failed to return to its pre-financial crisis level and remains significantly behind our leading industrial rivals.

The implications are profound. Lower revenues are constraining wage growth. And as more people are exempt from taxation, the Treasury's income is accordingly shrinking to a point that could harm infrastructure investment; a disaster for a nation that plans to compete fiercely in global markets.

However, one relationship that has more or less held constant throughout human history is the link between better productivity and new technology. Olden day ploughmen doubtless had little idea how the increased grain yield produced by horse-drawn mechanisation could be expressed mathematically. Yet from the wheel to the spinning-wheel to the water-wheel that drove the first industrial revolution, being able to leverage and gear up fundamental human forces has improved productivity.

The more they stay the same

Some of today's challenges are not so different from yesterday's. The real impact of artificial intelligence on future prosperity, higher productivity and the variety of jobs available may be as mystifying today as water-powered textile machinery was to nineteenth-century Luddites. But history shows that what was once pioneering quickly becomes the norm.

What next?

Small companies, larger corporates and governments face the trickier problem of what to do next. After consecutive failures to reignite national productivity, the UK Government through Whitehall is making its plans conspicuously clear. Faced with criticism in the past, it is launching a series of strategic initiatives, funding competitions and sector-specific policies ahead of Brexit and other electoral hurdles.

Meanwhile, general and specialist SMEs face a threefold challenge.

The first is to understand how they can make use of, and benefit effectively from, innovative technical breakthroughs already commercialised on the market.

The second is knowing how to make a direct contribution to important technical developments in the pipeline. These need a market demand: simple low-carbon solutions in transport, food manufacturing, or sustainable energy production are potential examples. Or sustainable answers to community waste problems, such as alternatives to the disposable coffee cup and one-time-use plastic straw.

The third involves a deeper appreciation of what ultra-cutting-edge technology means. This is not straightforward: if progress was easy everyone would be doing it. That seems to be the case with the many opportunities surrounding quantum computing.

Quantum ambitions

Quantum computing is a dream that, it is widely assumed, will become a reality. It is based on concepts such as superposition and entanglement — ideas that may seem beyond logical possibility but are known to be fundamental to the universe, or multiverse.

Abstract though this may appear to be, Microsoft researchers at the Niels Bohr Institute in Copenhagen announced at the end of March 2018 that they may have found a way of creating a quantum computer. Their solution involves having reached ultra-low temperatures. As the leader of the team, Professor Charlie Marcus, explained to the BBC, "This is colder than deep space, it may be the coldest place in the universe."

Why is this important? Because if they come to reality, quantum supercomputers will

enable the modelling of complex chemical processes that conventional computers cannot even begin to touch. They harness the odd ability of subatomic particles to exist in more than one state at once. It has been suggested that the ability of quantum-computers to solve an immense number of calculations simultaneously — unlike conventional computers that do calculations sequentially — is because they do so in parallel universes.

Davos summit

The significance was explained to invitation-only world leaders, movers and shakers at the exclusive World Economic Forum held at Davos in Switzerland. Microsoft CEO, Satya Nadella, explained in late January that the world is running out of the computing capacity, adding that the development of a catalyst needed to promote absorption of atmospheric carbon would probably not be possible without the development of superfast computers with the necessary processing power to simulate the behaviour of matter down to an atomic level.

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Nadella's fundamental point was wide. Technological breakthroughs that increase productivity to a level where surplus output can address society's largest communal problems have to be linked to a more equitable distribution of that surplus, he says. Equally importantly, the future will create more employment, but it will be different employment.

An interesting example quoted recently is that there are now more bank tellers than before — but their tasks are different to previously.

The upshot, according to Nadella, is that not only the economic but also social challenges will depend on education and training programmes that truly understand where the labour market is heading, something he feels is often absent at the moment. Reforming school curricula is vital, he insists. Computer science has to be on a par with maths and physics.

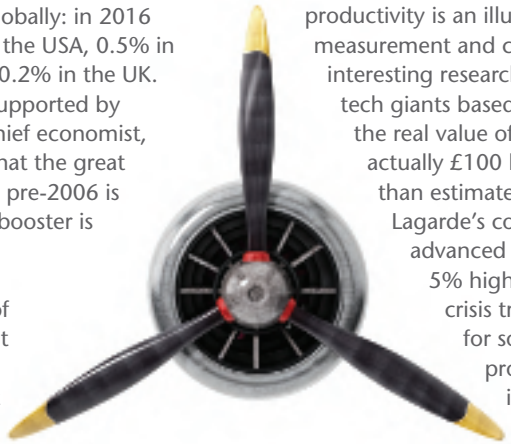
Artificial intelligence will have to be seen not merely as an extension of current IT and digital strategies but as an absolutely fundamental factor to remain competitive. IBM's David Kenny reinforced this message, saying it is so important that anyone "in your company who makes important decisions will need to understand this viscerally".

The links between productivity, innovation, technology and skills are clear.

Global message

Governments as well as companies need to invest heavily in education, cut through red tape and encourage innovation by incentivising R&D, according to IMF MD, Christine Lagarde, who warns that living standards globally will continue to fall unless this happens.

Between 2006 and 2016, productivity growth rates fell globally: in 2016 growth was 1% in the USA, 0.5% in Germany and just 0.2% in the UK. One explanation supported by Bank of England chief economist, Andy Haldane, is that the great productivity boom pre-2006 is over unless a new booster is discovered.



At the beginning of the financial crisis it appeared that low productivity might have been a price worth paying. That is no longer true. The lesson seems to be that improving UK productivity is about much more than simply getting people to work harder. Raising the quality of training, innovation and smart working but also management and leadership in general are crucially important.

Ironically, some UK companies are very productive. But for every successful "frontier" firm there are said to be two or three others pulling the average down. Some 1% of companies have seen a 6% productivity growth each year. Others, meanwhile, are described as mediocre or worse; two-thirds have not experienced improvements since the Millennium. It's suggested that, without low interest rates, a large number would probably have gone out of business before now.

However, the Office for National Statistics (ONS) has pinpointed some anomalies. For example, the energy sector is less productive because many people are now employed in renewable energy. Ditto service industries like finance where people have been taken on to deal with more onerous regulation and reporting needs.

The alternative view is that falling productivity is an illusion resulting from poor measurement and communications. Some interesting research work around the large tech giants based in Ireland suggests that the real value of the British economy is actually £100 billion, or 5%, higher than estimated. This ties in with Lagarde's comments that GDP in advanced economies would be 5% higher if the pre-financial crisis trend had continued for so-called total factor productivity growth which includes elements such as research spending.

"That would be the equivalent of adding another Japan — and more — to the global economy," she told the American Enterprise Institute last year. She also had a warning. "Leaning back and waiting for artificial intelligence or other technology to trigger productivity revival is simply not an option".

Clean Growth Strategy

The Government is concerned about the tardy productivity of recent years that puts the UK behind other large economies. The Chancellor, Philip Hammond, has pledged more funding for infrastructure in the form

of a £23 billion national productivity investment fund.

This acknowledges that past efforts have been hampered by strong jobs growth, albeit on short-term contracts. Many companies have recruited or retained staff, pushing down the national measure of output when divided by total employee figures. Data from the ONS also shows a drag effect from the North Sea oil and gas sector decline, plus heavy financial services losses following the global crisis.

One of the government tools to counter poor productivity is the Clean Growth Strategy. Launched in October 2017, its mission is cutting carbon emissions to combat climate change while driving economic growth. It is at the heart of the Government's Industrial Strategy to both increase productivity and the earning power of the national workforce.

Cutting the cost of energy is intended to drive economic prosperity. The strategy includes £2.5 billion to support low-carbon innovation, with £505 million to accelerate the commercialisation of innovative clean energy technologies and processes.

Business and industrial efficiency measures are also designed to help companies improve their energy productivity by at least 20% by 2030, which by definition is the amount of production that can be achieved per unit of energy. An Industrial Energy Efficiency scheme will help large companies to cut energy use and bills.

Eco-productivity

Productivity usually refers to labour productivity. But the Organisation for Economic Co-operation and Development (OECD) also looks at the concept of "environmental productivity", which is defined as how much national income can be generated per kilogram of CO_2 emissions. The UK falls into the higher European bracket based on 2010 data; significant leaders are Austria, Iceland, France and particularly Norway, Switzerland and Sweden.

Eco-productivity has its roots in the 1992 Earth Summit; the term eco-efficiency was adopted by the World Business Council for Sustainable Development (WBCSD) in 1997 linking environmental performance with the bottom-line and includes the idea of "confidence in technological innovation as the main solution to un-sustainability". The aim has been to create a tool that helps small companies as well as multi-national organisations such

as the OECD, European Commission and European Environment Agency.

Eco-productivity aims to use natural resources such as water and raw materials, plus waste streams, soils, forests and agriculture prudently, while also limiting adverse impacts. The idea is that environmentally productive business practices create better businesses when set against a background where the world population by mid-century is predicted to triple above its 1960 level and exceed sustainable resources by a factor of three.

Human demand by 2020 could already be outstripping the planet's capacity to regenerate by 75%. Sustainable technology has the potential to provide some of the answers and is an argument that is rapidly gaining ground.

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Long history

Since antiquity, technologies improving productivity have improved the human condition, often with scant impact on the environment until the first and second industrial revolutions took off.

Dynamite, steam engines, low-friction ball bearings, metalled road surfaces, pipelines, textile technology, synthetic dyes, agricultural machinery, sanitation, domestic gas, the incandescent light bulb, electric motors, steel, machine tools, concrete, steam, combustion engines, assembly lines, mass production, rubber, petroleum refining, the propeller, the safety bicycle and telecommunications have all played their part.

The third industrial revolution — digital technology — is already being followed by the fourth revolution in the form of cyber-physical systems.

However, the path has not always been smooth. As governments were forced to create more stringent legislative frameworks for business and industry, the fall in productivity has been ascribed to increased social and environmental legislation, particularly in traditional industries that exploited obvious natural resources such as coal, iron and minerals to standards unacceptable today.

A complex debate has also taken place since over the apparent "productivity paradox" created when the rapid development of information technology coincided with a fall in productivity. Reasons suggested include a slow uptake in the technology's full potential through to discrepancies in data measurement. However, the distraction created by computers and mobile devices are often cited as a major cause of reduced workplace productivity!

Where next?

In March, as part of its policy of looking forward realistically to the future, the Government announced that it will be putting £20 million behind pioneering research into the ground-breaking use of quantum technologies. This could see the development of between three and five next-generation prototype quantum-enabled devices that might include, "navigation systems that could operate without GPS, cameras that can see round corners and truly trustworthy methods of exchanging data".

The investment falls within the Industrial Strategy Challenge Fund described as "the greatest single increase in government research and development funding for almost 40 years which brings together world-leading research and businesses to tackle problems of our time".

Projects currently underway include cold atom technology with highly precise sensors for use in space to measure gravity, single pixel camera imaging technology, and quantum gravity sensors capable of finding utilities buried deep underground without the need to excavate. ■

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