SIR JOHN CASS FOUNDATION LECTURE 2015

The Intelligent Hand

By Lord Baker of Dorking CH

As we are in the City of London, the very heart of our country's wealth, may I start with a question? How many of you can name the two people commemorated on the back of the fifty pound note? I do beg you not to take out your purse or wallet to check, but if I may give you some clues? They are two men. They were active in the late 18th century and for a time they made our country the most prosperous and successful country in the world. They were not politicians. They were not Nelson or Wellington. One was an inventor and the other a capitalist with inventive insight. They were James Watt and Matthew Boulton.

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What Boulton and Watt realised is that the power of steam was one of the most revolutionary discoveries in the world. They were not the first to discover this. Back at the beginning of the 18th century Thomas Newcomen spent 10 years working on the design of an engine which could draw up water from a mine. The success of this hinged upon the accuracy and speed of valves controlling the entry of steam and the entry of water to cool the steam, returning it to water. Newcomen demonstrated his first working model in 1712 at the Conygree Coal Mines near Dudley.

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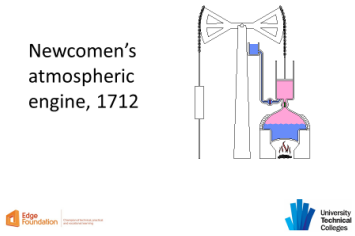

Newcomen had been a blacksmith and an ironmonger, that is to say a practical engineer. Matthew Boulton did not go to university; instead he joined the family business at the age of 18 producing metal goods for the home. Boulton was so successful that he built the first large manufacturing factory Soho in Birmingham. James Watt also did not go to a university, but started as an apprentice mathematical instrument maker. In 1769 he had his eureka moment when he added to the Newcomen engine a second condenser which improved its efficiency dramatically by reducing the fuel use by 85%.

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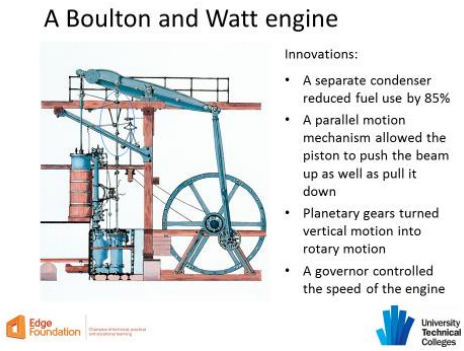

Watt went on to convert the reciprocating motion of the mine engine into rotary power which led to the power of steam being used in cotton mills, in steam hammers, and in railway locomotives like the Rocket.

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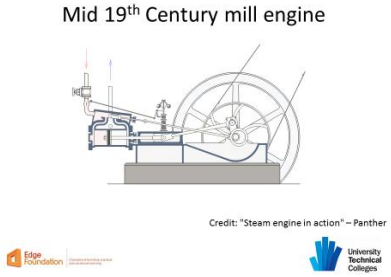

As soon as Watt received his patent, Boulton wrote to him to establish a partnership to make these engines for “all the world”.

They were part of the Industrial Revolution – the most inventive period in our history - which flourished form 1710 to 1840.

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The Industrial Revolution was created by people who understood technology and made it better.

The striking thing about this period is that none of the inventors, like Watt, Arkwright with his Spinning Jenny, Compton with his loom, Wedgwood with his pottery, Abraham Darby with coal furnaces, Bramah for locks, Maudsley for iron lathes, Brunel – father and son, Trevithick, Stephenson –father and son – not one of these went to a University. Indeed the only practical university at this time was Glasgow, for Oxford and Cambridge had become vocational colleges for the Church of England. These inventors started as apprentices, usually at the age of 14.

The Government has set a target of creating 3 million high quality apprenticeships in the lifetime of this Government, and certainly we will do everything we can to help. One thing the Government should avoid is insisting upon the terms which Josiah Wedgwood, at the age of 14, was obliged to accept when he was apprenticed to his brother for five years to become a master potter. These were “At cards, dice, unlawful games he shall not play; taverns or alehouses he shall not haunt or frequent; fornication he shall not commit, matrimony he shall not contract.”

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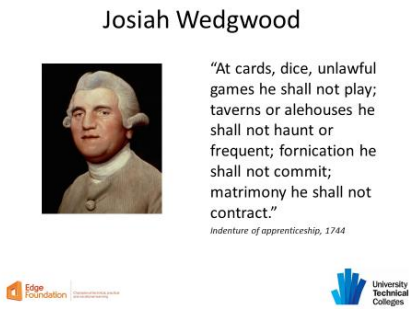

However it was not just the hand that was trained: the mind had to be trained as well. Mathematics were an essential element of all apprenticeships just as they are essential elements in the new colleges we have today – University Technical Colleges. What is needed today is 'The Intelligent Hand' – a phrase coined in 1820s by the Scottish neurologist and theologian Charles Bell. The hand has led the brain to evolve just as much as the brain has led the hand and that is why Matthew Boulton, when he was recruiting a man for his factory, asked "Shall we find him among the unlettered Birmingham handicraft men or shall we find him amongst the speculative theorists whose knowledge has been drawn from Books, no neither will do: he is one that is both." So when today we talk of a skills shortage we are talking of a shortage of intelligent hands.

The symbol of the UTC movement is a hand.

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In the twentieth century and particularly in post-war Britain apprenticeships fell out of favour. In 1924 the predecessor of the CBI said that industry wanted the education system to produce people who were "numerate, literate and obedient". The Royal Academy of Engineering has estimated that we will be short of 40,000 STEM graduates a year up to 2020.

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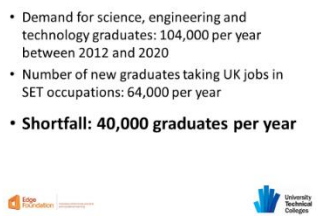

The need for technicians with skills at A-Level – Level 3, HNC Level 4, and Level 5 the Foundation Degree is 850,000. Don't think for the moment that all of these will be in manufacturing – engineering pervades a wide range of the activities of the human world: the Health Service needs technical engineers to maintain and update the machinery in hospitals and particularly those that keep patients alive; and it also needs expert analysts for the personal data of patients; agriculture needs technical engineers as crop sprayers are now guided by GPS and drones survey fields; and the Royal Navy needs skilled technicians to man the aircraft carriers which are large islands of floating technology, and buildings like this need mechanical and electrical engineers.

The greatest problem facing our educational system is that it is not being geared up to providing what industry, business and commerce require. That has led to the extraordinary position of people without jobs and jobs without people.

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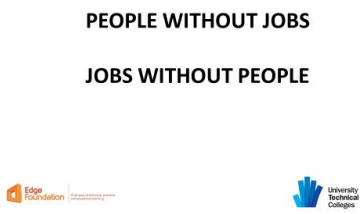

In the past schools didn't have to bother too much about whether leavers got a job. Indeed in many cases the principals did not consider it was one of their responsibilities because there was a mass of low skill jobs to be filled. A lot of these have now disappeared.

When for example you place an order with Amazon the first time that a human hand is likely to touch it is when someone knocks on your door to deliver it. Even that

could soon disappear as Amazon is establishing pick-up points at petrol stations and they have asked for space over London for drones to deliver direct to your door.

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One of my first jobs was to run a warehouse in Golden Square – I was well-suited to do this after an Oxford education – and there were several people who checked-in the goods, ensured their quality was correct, and when ordered remove them from the shelves, pack them, prepare an invoice and take them to a truck. All this can now be done by computers and robots.

Employment across our country is clearly changing. In the 1980s and 1990s many blue collar jobs were replaced by robots and mechanical systems, now it is the turn of white collar jobs to fall away. The Civil Service today has 140,000 fewer people than there were ten years ago. Banks also used to provide several relatively unskilled jobs, but Barclays has recently announced it intends to reduce its workforce by 30,000. Centrica will reduce its staff by 6,000 and Shell by 6,500. These are mainly office-type jobs because for many people your office is where your laptop is.

We are in the early stages of a digital economy which is going to change fundamentally the pattern of education, training and employment. A report by McKinsey Global Institute has estimated that by 2020 the world will have 95 million more low-skilled workers than employers require and 85 million too few educated workers to fill jobs. The agents of the digital economy – artificial intelligence, drones, robots, driverless cars and lorries, and 3D printers – will require highly skilled operatives. It will also probably change ownership patterns. Someone coming to this lecture in, say, 10 years' time, say from Harrow-on-the-Hill will be able to summon through Uber his driverless car, guided by Google map, and safely

drive him to EC1Y 8TZ, and there will be no need for that person to own that vehicle.

Something that could revolutionise technical study in schools is the invention of the 3D printer.

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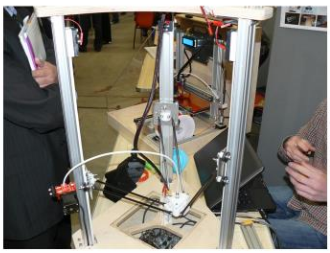

I am sure you have heard of these and probably seen footage of what they can do. May I ask another question? Can anyone in this audience actually operate a 3D printer? I see just a few hands. If that question were to be asked, say, in 10 or 15 years' time a forest of hands will shoot up for 3D printers will be used by young people as easily as iPads and iPhones are today. The first skill you have to master is to design a three dimensional object on your computer - students at our University Technical Colleges pick up this skill quickly - and that will become even easier in the future as from September this year primary schools have to teach computer coding.

The Liverpool Life Sciences UTC which specialises in Science and Healthcare shows how 3D printers can stimulate inventive and entrepreneurial activity. They use many glass vessels in their laboratories – pipettes, test tubes and flasks - and the college has to buy plastic stands and holders for them which can cost as much as £75. A group of students made on their 3D printers their own plastic holders and found they could produce them for a few pounds each – so a small business has been set up to supply them not only to their own college, but to sell them to others as well. A good example of the intelligent hand at work.

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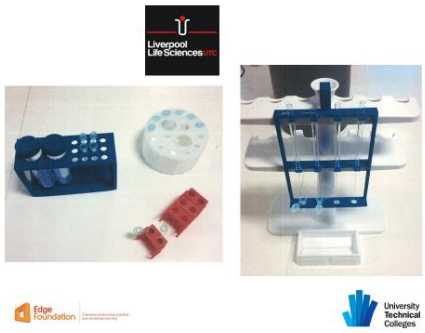

It is interesting that the number of self-employed people has risen from 13% to 15% and is on course to rise to 20%. A person who takes the risk of being self-employed has to have some special knowledge or expertise that is of value to other people, or a technical skill that can be sold in our new digital economy – self-employment is not for the unskilled.

At the university end we now have graduate unemployment as many students take degrees in subjects that have not led them to a job. Only one in four of the students who studied Law in 2014 are working in well-paid legal jobs, many of the others are clerking or working in hotels, bars or restaurants flipping hamburgers.

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There is a disconnect between what students study and what the world of work wants. Students graduating this year are likely to have debts of between £30,000-£50,000. If they remain unemployed or underemployed they will have great difficulty paying off those debts.

So what can we do about this? First revive technical subjects in the school curriculum. Design & Technology – which I introduced as a technical subject GCSE in the National Curriculum in 1989 – allows students to study resistant materials, product design, electronics, food technology, and systems control. Today only one student in three take that subject and the numbers both at GCSE and A-Level have declined over the past five years. That is bad news.

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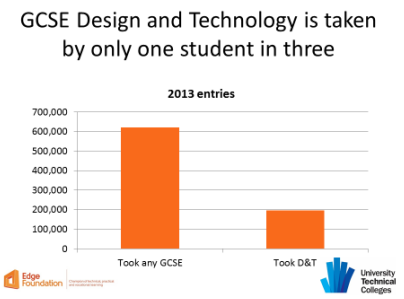

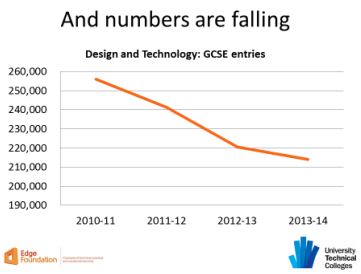

The digital economy will not only affect education but also employment. What is very clear is that a variety of skills will be needed: human as well as technical – an ability to work in teams, solve problems, in a world where there will be flexible contracts and very fluid working lives.

We as a country have never really had a stream of good technical, practical, professional hands-on learning in our schools. That is why only seven years ago Ron Dearing and I decided that we should create new high quality technical colleges providing a different pathway of success. We did have 300 of these in 1945, but within ten years snobbery closed them as parents most wanted their children to go to the Grammar school on the hill, not the one in shabby premises with dirty jobs and greasy rags. This was a massive mistake which Germany, who adopted our education system, did not make – and that's one of the reasons why Angela is ruling the roost.

A University Technical College is different in four important ways:

- Age range 14-18
- Employers introduce projects to the school and help to teach
- Universities mentor students
- 8:30am – 5pm working day
- 1300 teaching hours a year instead of 900 hours

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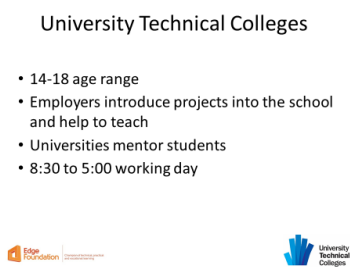

The first opened in Aston, Birmingham - just a dream six years ago -

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There are now 39 UTCs open – another 20 will open over the next two years.

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This year there will be over 10,000 students and when the full network is developed there will be over 35,000 students.

The benefits of UTCs are:

- Students are work ready
- Students have worked in teams on projects
- Students have been worked in practical problem solving
- Higher Apprenticeships at Level 3 and 4
- No NEETS

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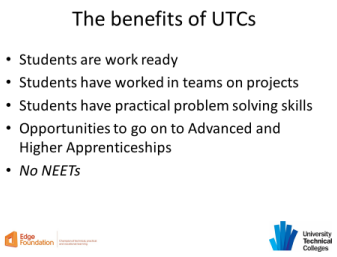

When there are 100 UTCs open in the next two or three years, they will have over 60,000 students. It sounds a lot but that only represents 1.7% of the 14-19 school population – and that is not good enough.

CONCLUSION

Ladies and Gentlemen, we are moving into a new digital age which we have done before and we will do again. Old jobs will disappear and new jobs will emerge. It is our duty to equip the young people of today with a variety of skills, some practical and some technical, some soft like communication, cooperation, imagination and innovation, which will give them the power to adapt to the new challenges and opportunities. Their working lives are likely to be more fluid than that of their parents and certainly their grandparents. It will include a variety of experiences, some part-time, some self-employed, some working in small teams in offices or plants they hire for a day. All this variety will need a mass of varied skills to sustain it. So let us over the next years elevate the importance of technical, practical, vocational, hands-on training and learning to give our young people the capacity to find work wherever it may be. We are at the early dawn of what could be a great day.