VISUAL 1

Future of Work S & T 14 . 11. 2014

The status quo no longer exists

VISUAL 2 - Grandchildren

VISUAL 3 - format of talk

VISUAL 4 - Predictions!

1. **Prediction is always difficult**

In the 1980s at the Open University I worked solidly for four years on a research project into the development and effects of IT.
In the research I came across the report of an international Seminar in 1978 on Management Education in the 1980's. There is no mention of I.T: in fact the word 'computer' occurs only once.

Actually in 1977 personal computers were already on the market. By 1985 2.1 million Apple ii machines had been sold. In 1991 the internet World Wide Web was launched: only 13 years after clever people had been completely in the dark re the future of IT.

Prediction is difficult - **but in order to prepare it is essential to make assumptions about the future.**

A few starter comments:

1

* There is great interest about the future of work amongst academics, and plenty of data and resources.

* But politicians, and most managers, perhaps most people, are fully engaged in coping with the now, the short term.

* For that reason it is hard to envisage a different work scenario, economics, politics, management, health service, education from what we know.

But we must.

* There are always optimists and pessimists.

*It is extremely difficult to produce change - of opinions, culture, organisations and institutions.

In this talk I will present ideas drawn from the best resources I could locate. (see Appendix 2.)

VISUAL 5 - Paid work

2. **By work I mean paid work.**In any society the numbers of people having paid work has huge implications. The taxes they pay allows governments to invest in physical infrastructure - transport, energy supply and services, and social infrastructure - education, health and social services. How governments tax and invest depend

on a political persuasions and lead to great differences between countries.

[In highly approximate terms:

the U.S. a low taxes with relatively low government investment in public infrastructure,

the U.K. - medium taxes, medium and uncertain public investment,

Western Europe - high taxes, high public structural investments.

Scandinavia - super high taxes and super high public investment,

give the flavour.

You'll probably be relieved that this will not be discussed further in this talk.]

Now, **Back to the Future** - of work.

VISUAL 6

* Paid work is a fact of modern life in the western world. For most of us, it is a major thread in our life story. It's not only how we provide for ourselves and our family, it is also where we find friends, form relationships, develop our skills, make our

mark in the world, and for some, to enjoy ourselves. We complain about work but it is super-important.

It is easy to think 'twas always so, and that it is so everywhere.

3. Brief history

We need a grasp of the past.

Much research has gone into understanding human development: what factors have actually changed the well-being of human-kind? That question is difficult to answer.

VISUAL 7

Domestication of animals - horses, oxen? How about philosophy and religions Great wars ? Rise and fall of Empires? All these had effects

VISUAL 8

But when plotted on a human development /time graph none of the above developments mattered much in human development. For many thousands of year social development was an achingly slow almost invisible upward trajectory. Until about 200 years ago when social development (and population) curved upwards through almost 90 degrees. You know why - the Industrial Revolution.

It was technology and later science that made the difference

A brief look at history:

VISUAL 9

* Humans just like us have been around for 100,000 years. For 90% of that time we lived in caves, or similar, foraging and hunting. Hard work, no paid work, and then you died - early.

VISUAL 10

* Then came AGRICULTURE from 12,000 years ago, : first **GENERAL PURPOSE TECHNOLOGY** - effecting total 'society' - Took 12,000 years to spread -

A **GENERAL PURPOSE TECHNOLOGY** effects a huge swathe of the economy, society and culture, indeed perhaps everything.

VISUAL 11

* **Industrial Period c. 1760 to present.**
Sometimes called 'The Machine Age'
In summary:
physical labour replaced on huge scale by steam power. Massive changes in work.

§ 1945 DIGITAL AGE STARTS

* **Post-Industrial Period? NOW**
Second Machine Age? Digital Age?

The last three are all in action today.

VISUAL 12 the industrial revolution

The Industrial Revolution - brought about the greatest change in human history

GENERAL PURPOSE TECHNOLOGY - it transformed societies

Physical work repced by steam plus machines

Rural / agricultural life replaced essentially by urban industrial life

over about 100 years.

BACK TO THE FUTURE

VISUAL 13

Our world of today faces (at least) three newish heavyweight forces:

globalisation - increased competition, and markets

demographic changes, especial high population migration, and

super-fast technological change

I will focus on the third - super-fast technological change - but we must keep in mind the other two. **Forecasting and negotiating a path through the combined effects will be enormously challenging for governments, organisations and institutions.**

Indeed, probably we are seeing evidence of these difficulties currently. Is it too fanciful to suggest our style of government and politics have already encountered a world beyond their capabilities?

Technologies

Start of truly electronic digital computers was in the mid 1940's. Although the rapidity of advances after that is commonly regarded as amazing, in fact the first thirty years saw relatively slow progress.

Important: It is clear that the rate of development accelerated in each decade.

This effect has been widely commented on. Ray Kurzweil, one of the world's leading inventors, thinkers, and futurists, with a 30-year track record of accurate predictions identified the accelerating development and spread of digital technologies in the 1990's.

VISUAL15

In his no 1 best seller ***The Singularity Is Near: When Humans Transcend Biology, 2005***, he describes his law of accelerating returns which predicts an exponential increase in technologies like computers,

genetics, nanotechnology, robotics and artificial intelligence.

He says this will lead to a technological singularity in 2045, a point at which progress is so rapid it outstrips humans' ability to comprehend it. 2045 is thirty years ahead, well within the lifespan of our grandchildren.

VISUAL 14

If Kurzweil sounds somewhat hyperbolic, try Erik Brynjolfsson and Andew McCafee , professors at MIT. In their much aclaimed book **The Second Machine Age; Work, Progress, and prosperity in a time of Brilliant Technologies**, they observe: the three key characteristics of the 'Second Machine Age' are **exponential, digital and combinatorial.**

They refer to the fable of the request for a grain of rice on the first square of a chessboard, two on the second, four on the third, and so on. Generally humans can understand the numbers in first half of the board. In the second half of the board the numbers rapidly become beyond human comprehension. (In fact total rice grains is more than 18 quintillion - a pile dwarfing mount Everest).

The digital revolution is similar.

And the very fact that it is DIGITAL leads to more jaw-dropping numbers. We were living in an analog world not long ago. Manipulating

analogdata is cumbersome. Once data is transformed to digital everything becomes easier.

Brynjolfsson and McCafee argue the future lies with even more combinatorial developments. Given the extensive number and variety of new technologies already in the pipeline, (see Appendix 1) the combinatorial possibilities are prodigious.

Kurzweil, Brynjolfsson and McCafee say we are heading into a period (forever?) of super-fast technological change.

EFFECTS ON SOCIETIES

VISUAL 16

There is general agreement about effects though estimates of time periods vary

1. We can expect a period of disorienting, disruptive and uncomfortable change.

2. Many jobs will be eliminated, or taken over by technologies. Perhaps 35% of current jobs in next 20 years, 50 % in 30 years.

3. At least 50% of businesses significantly impacted by technologies in next 10 years.

3. Low skilled people at most risk of lose of jobs

4. BUT even middle class jobs at some risk - tasks which have been considered too difficult to be

effected by technologies will increasingly be so. It is dangerous to assume 'this' job is safe!

5. High level professional jobs such as medics, lawyers, accountants will be impacted too. Technologies in pipe-line already for faster, cheaper, more accurate, and perhaps ongoing,medical analysis and diagnosis.

Medical services radically changed - including location of services - upgraded GPs surgeries rather than General hospitals.

Accounting and law vulnerable to tech systems, data mining already.

VISUAL 17

6. At any time higher unemployement obviously reduces income to individuals which reduces buying power, and thus turnover of companies. It also reduces taxes and thus funds available for social and physical infra-structure.

7. More technology will require greater capital expenditure by government and businesses. Capital expenditure will only be increased if the company's (or Government's) bottom line is enhanced, ie higher capital costs are less than reduced labour costs in the medium term.

8. Of course this technology scenario will exist at about the same time across all developed countries. Hence, there will be strong competition in terms of

products and prices, and in timing of more advanced technologies.

9. It could well be that prices of goods and services under such pressure and using high level technologies, will fall.

10. A massive challenge for governments, organisations, endeed all of society lies ahead.

VISUAL 19 -

WHAT NEEDS DOING NOW?

Thoughts:

* Increase awareness amongst politicians, government and private sector of the possibilities and challenges inherent in above scenario.

* Throughout education: prepare all people entering new work culture. Science, technology, engineering, maths, resilence, creativity, innovation, adaptability, emphasis.

* Individuals must take responsibility for their own development in contiuously

acquiring and updating skills. Be aware of learning and training possibilities - new and different approaches to learning - self-directed, technology enabled opportunities.

* Even closer cooperation between education and business.

VISUAL 20 & 21 - Technlogies

Appendix 1: Developing Technologies.

* A.I. based Virtual Assistants.

* Nano-technology

* 3 D printing

* 3 D Bio-printing

* Major changes in Organisational Dynamics

* Big Data

* Wearables e.g. Google Glass

* Robotics everywhere; agriculture

* Drones

* Digital possibly wearable medical assistance

* Machine Learning

* Materials

* Flexible electronics

* Amorphous metals

* Programmable matter

* High-Temperature super-conductivity

* High-Temperature super-fluidity

* 3D displays

* Holography

* Cloud technology

* 4G and 5G mobile communications

* Memory technologies

* Quantum computing

* Personalised medicine

* Brain-computer interface, and neuroinformatics

*Airless tyres

*Driverless cars

* Paper-thin flexible computers and mobiles

* Evacuated tube transport

VISUAL 22 & 23 Resources Appendix 2: Resources

Ray Kurzweil - ***The Singularity Is Near: When Humans Transcend Biology, 2005;*** and TED

Eric Brynjolfsson and Andre McCafee, The Second Machine Age; Work, Progress, and prosperity in a time of Brilliant Technologies. 2014.

Thomas Piketty, Capital in the twenty First century, 2014.

Richard Donkin, The Future of Work, 2010.

Government Report, The Future of Work: jobs and skills in 2030, 2014

The Work Foundation, Lancaster University, reports.

Big Innovation Centre (Will Hutton) Publications

Deloitte Reports

VISUAL 24 -