Finding an Ethical Career in Science and Technology

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http://www.sgr.org.uk/

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Scientists for Global Responsibility

- Independent organisation of 1000 natural scientists, social scientists, engineers, architects, IT workers
- Promotes science, design and technology which contributes to reduction of conflict, environmental protection, social justice
- Ethical careers publications and website
- Education and support network

http://www.sgr.org.uk/

Why an ethical career in science and technology?

Current global problems
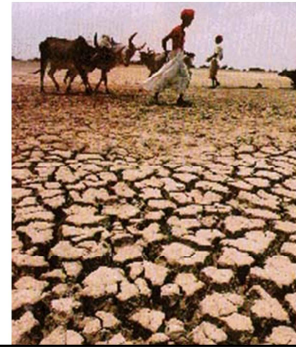
Social/ health problems

- Social justice
  - 1.4 billion people live in extreme poverty
    - Most malnourished, inadequate supply of clean water & sanitation etc
  - People in high-income countries live 20y longer than those in low-income countries
- Disease & ill-health
  - Major killers (1 million+ per year) include:
    - heart disease; cancers; AIDS; diarrhoea; tuberculosis; malaria; road crashes

• Extreme poverty – defined as living on less than $1.25 a day; amounts to 1 in 5 of world's population - World Bank (2008).

• Life expectancy figures - World Bank (2009).

• Disease – heart disease & cancers more prevalent in wealthier countries; infectious diseases prevalent in less wealthy countries - WHO (2004).
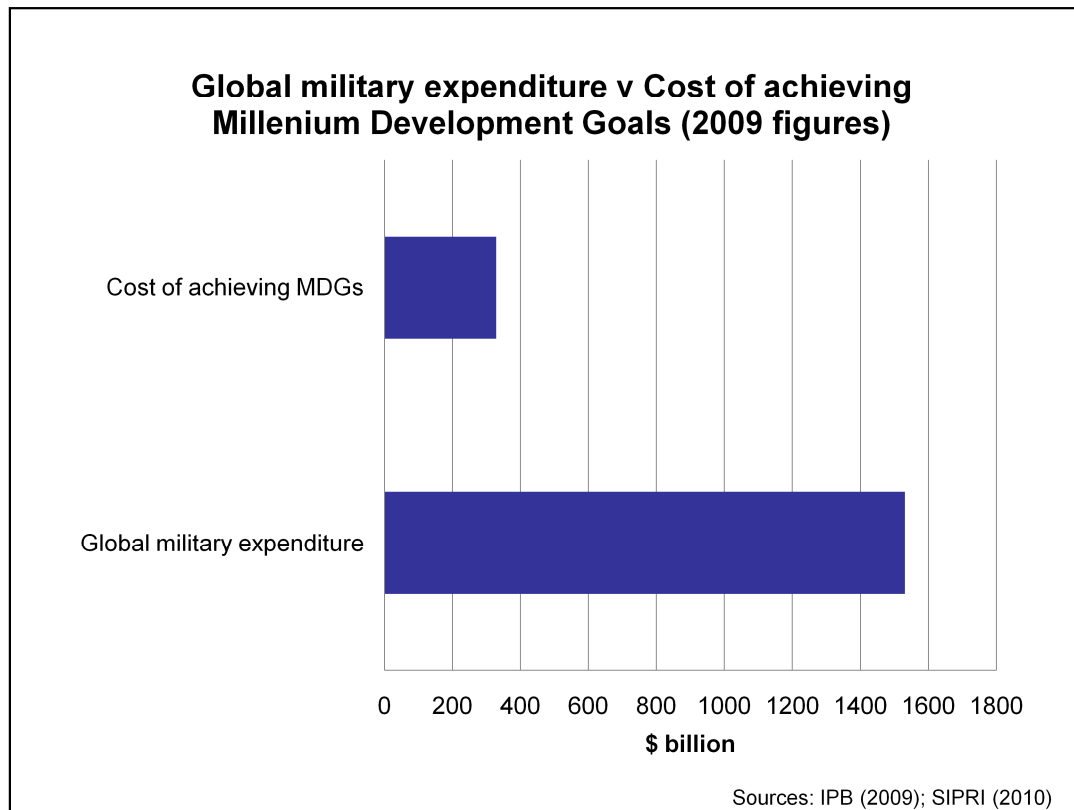
Environmental problems

- Climate change
  - Of 29,000 environmental data sets, 89% show changes consistent with a warming world
  - 300,000 additional deaths per year
    - Kofi Annan's think-tank estimate
  - Wide range of other impacts
- Biodiversity loss
  - 'Sixth major extinction event'
    - Extinction rate is 100-1,000 times that in fossil record
  - Humans very dependent on ecosystems

• Climate change – environmental datasets from IPCC WGII (2007); additional deaths: increases in weather related disasters; increase in ranges of infectious diseases; heat stress etc from Global Humanitarian Forum (2009)

• Biodiversity loss - Human activity has caused between 100-1,000 times more extinctions in the last 100 years than would have happened due to natural processes alone (Millennium Ecosystem Assessment, 2005; UNEP, 2007). Half the world's forests, half the world's wetlands have been destroyed by human activities; over-fishing has caused 90% of large ocean predators to be lost (Worldwatch Institute, 2004, p17)

Security problems

- War and weapons
  - 1/3 million people die each year in wars and other armed violence
  - 17 wars ongoing
  - 23,000 nuclear weapons
  - Global military spending
    - ~$1,500,000,000,000 per year

• Casualty figures - Control Arms campaign (2011).

• Nuclear weapons – >90% held by USA and Russia; more than 2000 on 'high-alert'; UK holds nearly 200 – enough to cause global devastation - Federation of American Scientists (2010).

• Figures for global military spending and number of wars - SIPRI (2010).

Global military expenditure v Cost of achieving Millenium Development Goals (2009 figures)

Cost of achieving MDGs

Global military expenditure

0   200   400   600   800   1000   1200   1400   1600   1800

$ billion

Sources: IPB (2009); SIPRI (2010)

• The figure for the cost of achieving the MDGs is an annual figure *additional* to that already being spent within aid budgets. It is based on estimates from UN agencies, World Bank and other sources.

• The figure for global military expenditure is for the year 2009, and is growing.

• The Millennium Development Goals are eight international goals agreed at a UN summit in 2000 aimed at reducing poverty and related problems by 2015.

• The 8 goals are:

1.Eradicate extreme hunger and poverty

2.Achieve universal primary education

3.Promote equality and empower women

4.Reduce child mortality

5.Improve maternal health

6.Combat HIV/AIDS, Malaria and other diseases

7.Ensure environmental sustainability

8.Develop a global partnership for development

Sources: International Peace Bureau (2009); SIPRI (2010)

Future projections

- Population
  - From nearly 7 billion now to 9 billion by 2050
- Energy consumption
  - 45% increase by 2030
- Food consumption
  - 40% increase by 2030
- Water consumption
  - ~35% increase by 2025
- Climate change, biodiversity loss accelerating
- Depletion of fossil fuels, minerals

• These figures are from mid-range 'business as usual' scenarios (based on stats from international organisations such as IEA and UN FAO) - Beddington (2009).

• 'Peak oil' and other mineral depletion problems will compound Beddington's concerns

A 'Perfect Storm'?

- Prof John Beddington, UK Chief Scientific Advisor, warns about:
  - threat of a 'perfect storm' of global shortages in food, water and energy by 2030

Beddington (2009).

Science and technology can help us tackle these problems or can make them worse

Computer science/ IT

- Numerous applications across economy and society
- 1.25 million IT workers in UK
  - Half employed in IT sector; half in other sectors
- Hence, opportunity to play a critical role in helping to tackle social/ environmental problems

Department for Business, Innovation and Skills (2009).

Difficulties

Govt science & innovation policies

- Ten year strategy from 2004 - 2014
- Economic and military priorities dominant
- Pushing closer collaboration between universities and business
  - Reduction of independence
  - Can undermine reliability of research
- But growing programmes on health and environment

• Source: HM Treasury et al (2004).

• Numerous more detailed strategies have been enacted since 2004.

Government R&D spending by end use 2008-09

Billion pounds

| | 0.00 | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 |

Advancement of knowledge

Military

Health

Political, social systems etc

Environment

Earth sciences

Agriculture

Space sciences

Transport, telecoms & industry

Energy

Source: BIS (2010)
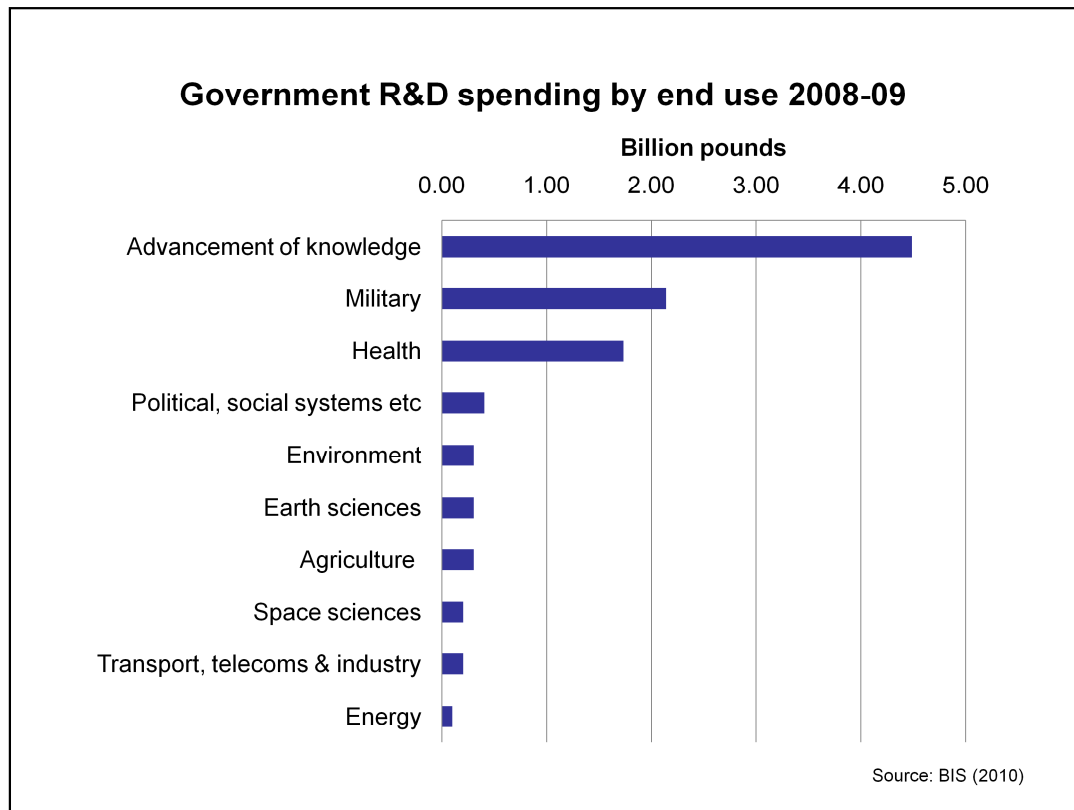
• Source: Department of Business, Innovation and Skills (2010). (Tables 1.2 and 2.4)

• In 2009 the UK Government only spent £84 million on renewable energy research, development and deployment (International Energy Agency, 2010) – little more than 4% of the Ministry of Defence's R&D spending

Ethical concerns

- Military/ Defence sector
  - UK foreign/ military policy
    - Major military spender (4th in world)
    - High offensive capability
      - nuclear weapons; long-range ships/ aircraft
    - 'Illegal' Iraq war
  - International arms trade
    - Sales support 'oppressive regimes' & fuels conflict
    - Diverts funds away from development programmes
  - Corporate misbehaviour
    - BAE Systems fined over £280 million

• High military spending and large offensive weapons capability increases international tensions, fuels arms races and diverts funding from other needs.

Sources: SGR (2006a, 2007); SIPRI (2010); BBC News (2010).

Ethical concerns

- Pharmaceutical industry
  - Encourages focus on drug-based treatment rather than alternatives
  - 10/90 gap – inequality in health R&D
  - Drug R&D
    - Bias in trials
    - Animal experiments
  - Corporate misbehaviour
    - Pfizer fined $2.3 bn for illegal drug promotion

SGR (2009); BBC News (2009).

Ethical concerns

- Agriculture/ biotech/ food sectors
  - Focus on industrial farming
    - High inputs, soil erosion, water & air pollution, biodiversity loss
  - R&D focus on GM crops rather than alternatives
  - Corporate control of agriculture via patents on seeds etc
  - Junk food advertising
  - Animal experiments

SGR (2009).

Ethical concerns

- Energy sector
  - Focus on expanding energy supply rather than improving energy efficiency
  - Fossil fuels
    - Climate change, air pollution, 'peak oil', mining/ extraction impacts (e.g. Deepwater Horizon)
  - Nuclear power
    - Weapons proliferation, radioactive waste disposal
  - Renewables
    - Competition for land, especially biofuels

• BP set up a compensation fund worth $20 bn to cover the costs of clearing up after the Deepwater Horizon oil spill.

SGR (2009). BBC News (2011c).

Ethical concerns

- Information and Communications Technology sector
  - Privacy/ civil liberties
  - Growing dependence on ICT leads to vulnerability to cyber-attack

These and other issues will be discussed in other lectures.

Social/ environmental options

Rise of the 'green collar' sector

- Low carbon and environmental goods and services (LCEGS) sector
- Global market for LCEGS estimated at ~£3,000,000,000,000 and growing fast
- In UK, LCEGS sector employs nearly 900,000 people
- About 2.3 million work in renewable energy industries worldwide

• *Environmental sector* (190,000) **-** including energy, carbon and broader environmental consultancy, air pollution control, environmental monitoring, marine pollution control, waste management, recovery and recycling; as well as the service industries that support environmental management.

• *Renewable energy sector* (260,000) **-** including wind, wave and tidal, biomass, geothermal, hydro and photovoltaic energy generation and the services that support them, including renewables consultancy.

• *Emerging low carbon sector* (430,000) **-** including alternative fuels such as nuclear, and alternative fuels for vehicles, carbon capture and storage, building technologies, energy management and carbon finance.

• NB: figures in brackets refer to employment

• Estimated UK market value is total of £106 bn

• Sources: Department for Business, Innovation and Skills (2009); UNEP/ Worldwatch Institute (2008).

UK low carbon plans 2009

- Low Carbon Transition Plan
- Low Carbon Industrial Strategy
- Renewable Energy Strategy
- Carbon Reduction Strategy for Transport
- Complemented by broader policies in other areas:
  - Energy, transport, building and construction, science and innovation, sustainable development etc

Main points:

• 34% cut in greenhouse gas emissions by 2020 (from 1990 level)

• 15% of energy from renewable sources by 2020 (tenfold increase)

• New nuclear power stations*

• Efforts to substantially improve building energy efficiency

• Working for major improvements in transport efficiency, including cars, trains and aircraft

• Economic measures (eg carbon trading*) to encourage energy efficiency across the whole economy

• R&D especially on marine energy, and efficient cars and aircraft

• Over 100,000 new jobs by 2015

*Most controversial

Main source: DECC (2009).

Recent developments

- UK world leader in deploying offshore wind
- 'Green Deal'
  - National programme for major improvement in energy efficiency
- New manufacturing, e.g.
  - Wind turbines
    - Glasgow & Dundee – Gamesa
    - Hull – Siemens
  - Solar panels
    - Wrexham – Sharp

Jowit (2010); DECC (2010); BBC News (2011a); The Guardian (2011); BBC News (2011b).

ICT sector and low carbon

- Information and communications technology accounts for ~2% of global carbon emissions
- Sector can play an important role in reducing emissions, eg
  - Reducing need to travel through teleworking, online shopping etc
  - Improving energy efficiency through 'smart' ICT
- Greening Government ICT strategy

The Greening Government ICT strategy aims to make energy consumption of Government ICT systems carbon neutral by 2012, and to make them carbon neutral across their lifetime (including manufacture and disposal) by 2020. (Department for Business, Innovation and Skills, 2009).

Green jobs – some examples

- Research
  - e.g. climate scientist, ecologist, computer modeller
- Engineering
  - e.g. renewable energy (manufacturing & installation), energy efficiency in homes/ industry
- Project management
  - Key in making things happen
- Environmental consultancy
  - Advice to industry & government on reducing emissions
- Education and campaigning
  - Including use of distance learning, websites, social networking, email
  - Home energy assessors

UK health sector

- National Health Service
  - Employs 1.7 million people
- Numerous health charities
- Strong R&D
- IT becoming a key aspect of healthcare, eg
  - Information provision on healthy lifestyles, disease
  - Improving efficiency of patient records

NHS (2010).

Arms control/ disarmament

- Key treaties
  - Nuclear non-proliferation treaty; Test ban treaties; NWFZ treaties; US-Russian treaties
  - Chemical weapons convention; Biological weapons convention
  - Conventional forces in Europe treaty; Mine ban convention; Cluster bomb convention; Arms trade treaty*
  - Outer space treaty; PAROS treaty*

*proposed

• NWFZ – Nuclear weapons-free zones; PAROS – Prohibition of an arms race in outer space

• Sources: UN Office for Disarmament Affairs (2010a); Federation of American Scientists (2005).

Arms control/ disarmament

- Arms control treaties operate through mechanisms for monitoring, verification and decommissioning
- These carried out by UN offices/ treaty secretariats/ country officials/ military
- Support also from academics, NGOs
- UK examples:
  - UK Mission on Arms Control & Disarmament
  - Vertic

• IT has an important role to play.

• Sources: UN Office for Disarmament Affairs (2010b); UK Mission on Arms Control and Disarmament (2010); Vertic (2010)

International development

- Dept for International Development
  - UK government ministry
  - Funding increased
  - Employs engineers and scientists
- Practical Action
  - Aid organisation specialising in 'appropriate technology' in developing countries
- Engineers Without Borders
  - Volunteer aid projects overseas

Dept for International Development (2011); Practical Action (2011); Engineers Without Borders UK (2011)

A tale of two sectors...

UK arms industry

- Current employment
  - 215,000
- Shrinking following Defence Review

UK low carbon/ env sector

- Current employment
  - 880,000
  - including 260,000 in renewable energy
- Rapidly expanding

Defence Analytical Services and Advice (2009); Innovas (2009)

Steps towards an ethical career....

Example profile from SGR (2006b)

• Interested in environmental issues at school

• Took a year out volunteering before university

• Became interested in engineering – chose it as degree subject

• Did MSc in environmental sustainability

• After university, took a junior office post in renewable energy company

• Then got a job in building services engineering – energy efficiency is big part

Guiding principles

1. Apply precautionary principle
   - e.g. health/ environmental concerns
2. Guard against malicious use
   - e.g. weaponisation, criminal use
3. Follow democratic principles
   - e.g. corporate benefits before public benefits?
4. Consider distributional effects
   - e.g. improvement for low income communities?

• Precautionary

If possibility/ likelihood of significant health/ environmental harm, must put in place safeguards – sometimes this means not developing the technology. Uncertainties are important and should be investigated. Hi-tech solutions (based on cutting-edge science) are inherently more uncertain.

Consequences: work for organisations with clear environmental/ health goals, or actively applying the precautionary principle through, eg, assessing new technologies for health/ environmental effects, or assessing whether intermediate technology or non-technological options offer a better solution

• Malicious use

How easy is it for you work to be intentionally misused, eg weaponised? Particular concern is military work, eg is it encouraging a focus on military solutions to political problems? Are arms/ equipment being sold to countries with bad human rights records?

Consequences: look at military policies of governments which are funding the work; easiest to avoid working for military or taking military funding, or only working on, eg, disarmament projects

• Democracy

Vested interests such as big corporations and military can direct scientific and technological work in their favour – which is not necessarily in the best interests of society. Public involvement in decisions on science and technology is generally very limited.

Consequences: work for organisations with clear social/ environmental goals and rather than narrow economic/ military ones, and/ or who actively engage with the public over scientific controversies

• Distribution

New technologies can exacerbate social inequalities rather than help tackle them. Hi-tech solutions tend to be expensive, and hence intermediate technologies or non-technological options may be fairer.

Consequences: work for organisations with clear goals in terms of equitable development, and involve public dialogue over technologies

• Look for contribution to peace, social justice, and environmental sustainability

Which Employer?

	Work Freedom	Influence on Policy	Influence on Technology	Ask ethical questions?	Pay
Academia	★★★	★?	★★	★★★	★★
Government	★	★★★	★★	★	★★
Industry (big)	★	★★	★★★	★	★★★
Industry (small)	★	★	★★★	★★	★★
Non-profit (eg pressure group)	★★	★★	★	★★★	★

Tips on being successful…

- Educate yourself on the wider social/ environmental issues affecting your field
- Don't be fooled by 'greenwash'
- Incrementalist or revolutionary?
- Develop your 'transferable skills'
- Get voluntary/ vacation experience beyond science & technology
- Get support

You can make a difference!!

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