

Selling our research ideas

Engineers in a wider context

Keynote talk given at Queen Mary, University of London
Electronic Engineering Department Research Open Day, 24 April 2008

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Engineering work will continue to migrate to countries that bother to cultivate engineering

R W Lucky, *IEEE Spectrum*, March 2008

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Engineers in a wider context

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“... we have to train our technology people to think more like business people”

George Voutes,
Enterprise Technology Programs Manager, Deutsche Bank

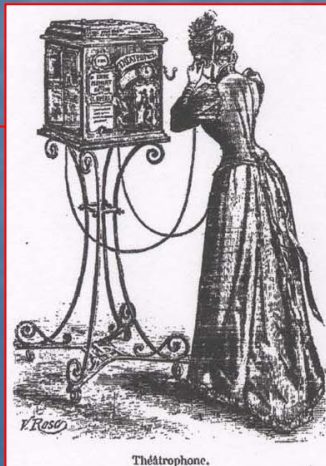
We are particularly interested in projects that not only increase the public's awareness of science and engineering, but also include some level of dialogue between members of the public and scientists and engineers

EPSRC 'Connect', April 2008

Invention should be on the National Curriculum

Trevor Bayliss, *The Guardian*, March 18, 2008

Winning ideas are often doomed by poor execution or by nothing more than being ahead of their time



IEEE Spectrum, Jan 2008

Peer review might work for mainstream, but it excludes radical research

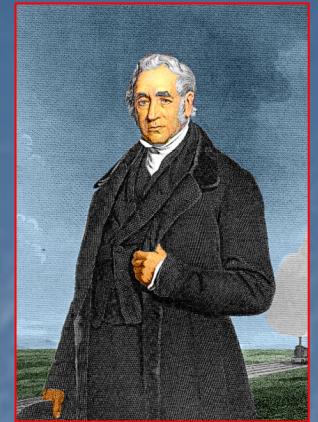
Donald Braben, *New Scientist* Feb 2008

Engineering

- Began as a specialism of soldiering
- Engines of war
- The Royal Engineers
- Developed a life of its own during the Industrial Revolution (started ca 1750s)
- Engineers as heroic figures .

Heroes

- Darby, Wilkinson, Telford, Brunel, Stevenson and others began to shape today's world
- They took ideas and employed them to create:
 - Wealth
 - Innovative and impressive hardware
 - Possibilities for others – travel and transport
 - Expectations
 - A new society – warts and all



George Stephenson
http://en.wikipedia.org/wiki/George_Stephenson

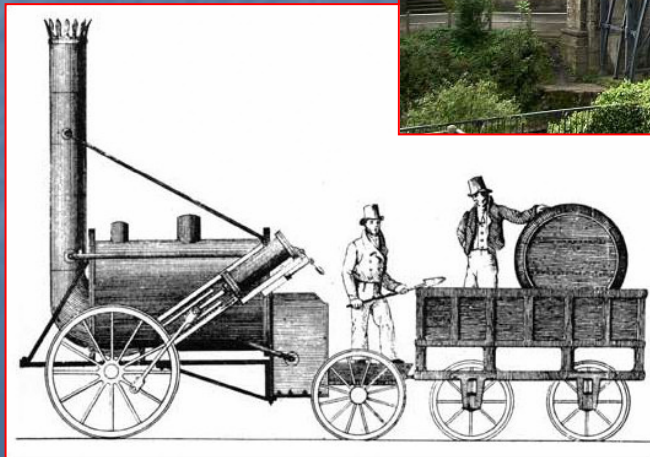


pace Guo Shoujing 郭守敬 and others

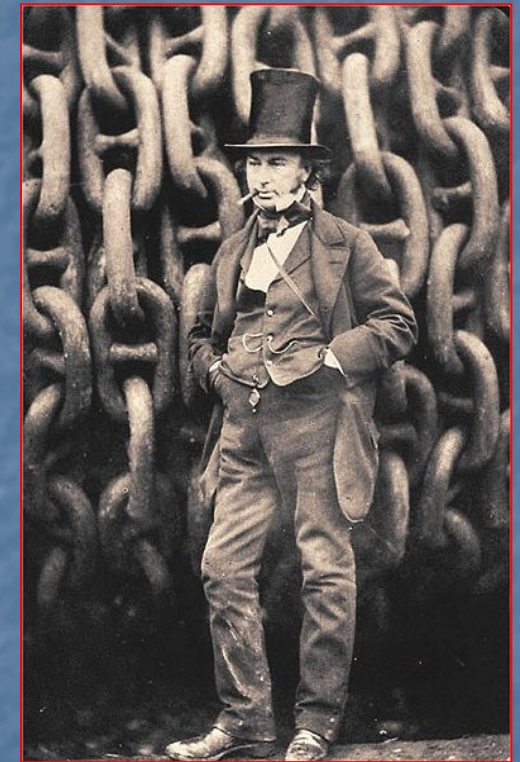
Telford's Menai Bridge, 1826
http://en.wikipedia.org/wiki/Image:Menai_Suspension_Bridge.jpg

An heroic age

Coalbrookdale
Abraham Darby
1779



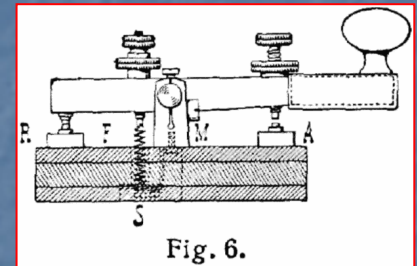
Rocket
George Stephenson
1829



Great Eastern
Isambard Kingdom Brunel
1858

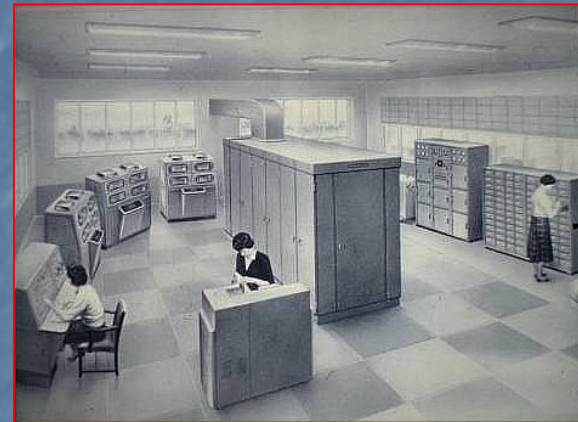
Electrical Engineering

- Electrical power, largely from coal
 - Light
 - Mechanical power where it was needed
 - Communications
 - The telegraph (Gauss & Weber, 1832)
 - Telephone (Bell's patent 1875)
 - Radio (Hertz, Tesla, Popov, Marconi 1890s)
 - Cinema (many contributors, 1878 onwards)
 - Television (Baird, Bell Labs, EMI-Marconi, 1930s)
 - High speed data (1960s onwards)
 - The Internet (WWW Berners-Lee 1989)
 - Mobile phones (1973, GSM 1991)



Computers

- Progress from a room full of glowing electron tubes (valves) (1940s-50s)
- Paper tapes and punched cards



English Electric *Deuce*, c 1961
<http://www.members.optusnet.com.au/deucepix/pjwalker.htm>



IBM Personal Computer 5150
1981

http://en.wikipedia.org/wiki/IBM_PC



Apple Mac with first GUI,
1983

http://en.wikipedia.org/wiki/Apple_Computer#1976_to_1980:_The_early_years

Computers

- Application very much misunderstood by those who developed them as calculating engines
- Now ubiquitous and have largely disappeared from view into everyday objects
 - Mainframes → Desktops → Laptops
 - TVs, CD/MP3/DVD players/mobile phones, telephone exchanges/cash tills/ticket machines/speed cameras...
 - PDAs, PNDs, PMPs, UMPCs....

Twin driving forces

- **Technical possibilities**
 - Pushing the envelope of what can be done
 - Exploiting inputs from science and maths
- **User needs**
 - Useful things to make life easier and more pleasant
 - Realisation of completely new possibilities
 - Creation of new wants
 - Exploitation of human fallibilities
- The division of *technology push* and *market pull* seems too simple to reflect the real situation .

Selling our ideas

- *An idea that no one sells remains an idea*
- The names we remember are often those who saw the market for the idea
 - Marconi, Edison, Siemens, Eastman (Kodak), Ford
- Sometimes we forget the name, but a new idea changes the market (Alec Issigonis)
- Now we remember companies
Bell-Labs, IBM, Sony, Apple,
Nokia...



Our changing world

- On-line in the past week I have:
 - paid bills and checked bank balances
 - booked air tickets and printed my boarding card
 - checked train maps and timetables
 - sourced engineering references
 - placed orders for computer hardware
 - emailed people in 13 different countries
 - found pictures and checked facts for this talk
 - used Skype IM and VoIP
 - checked weather and travel info
 - read my UK newspaper in Japan

Change for the good?



Photo: bsc

bsc

Savi (2½) encountering Internet for the first time

A brilliant resource for educating our children

But there is no access in her community

No money at home for a computer

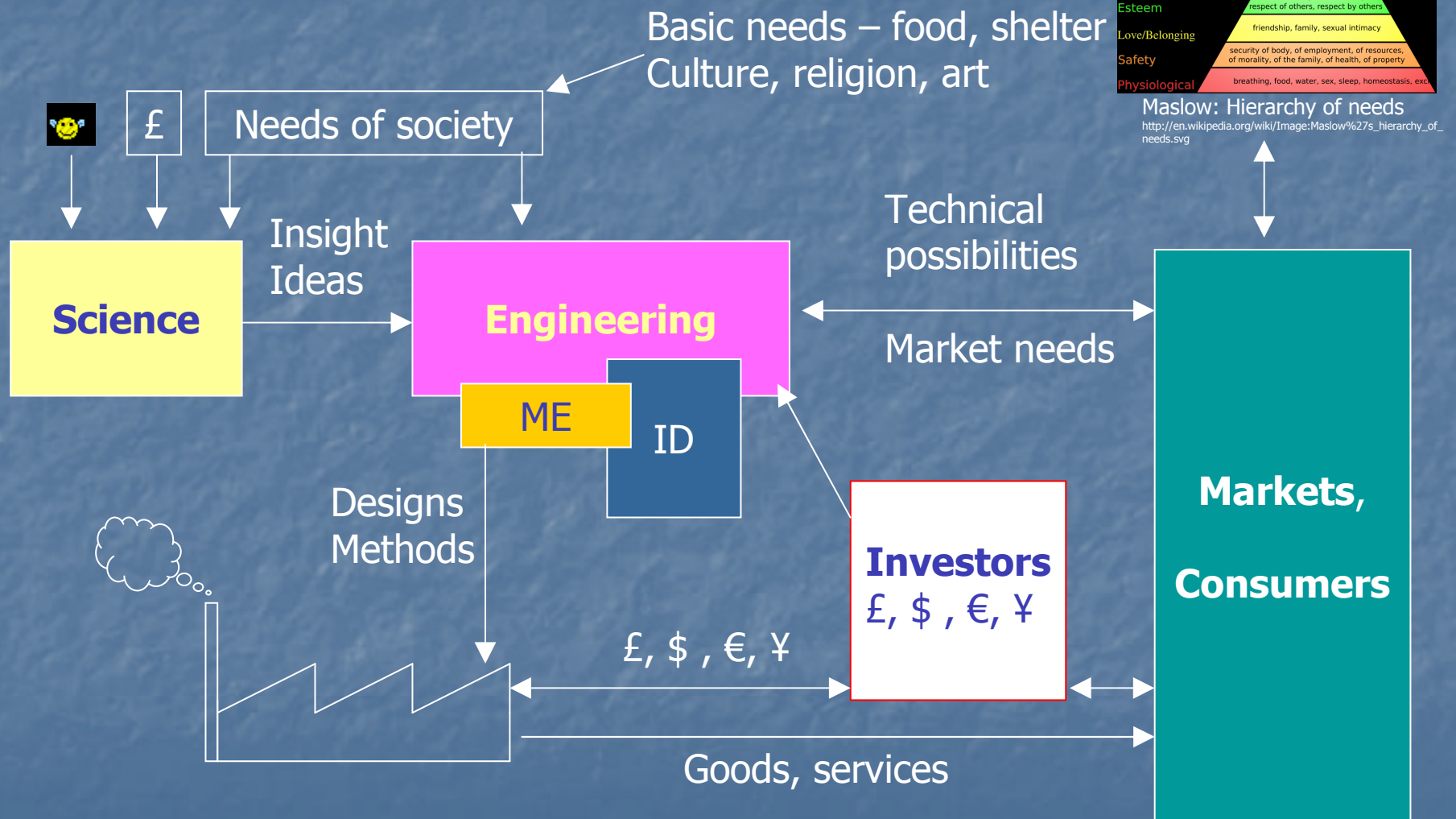
...and copyright restrictions mean valuable Websites can't be viewed

Questions of...

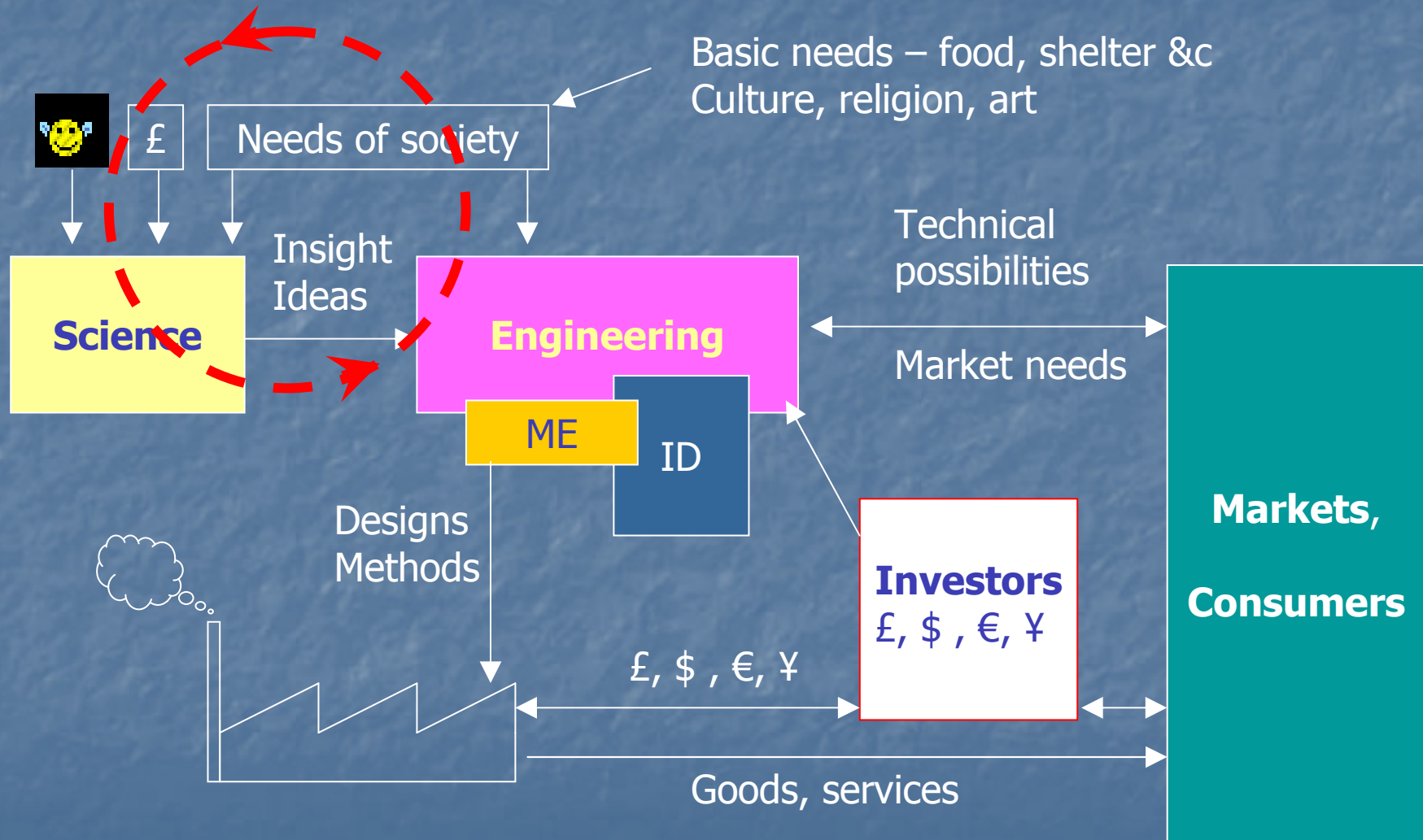
- As engineers our activities involve
 - safety of users, and of those making products
 - security of information
 - privacy
 - intellectual property
 - equality of access
 - political control
 - the use of human, material and energy resources both in making and using products

Do we face up to these responsibilities?

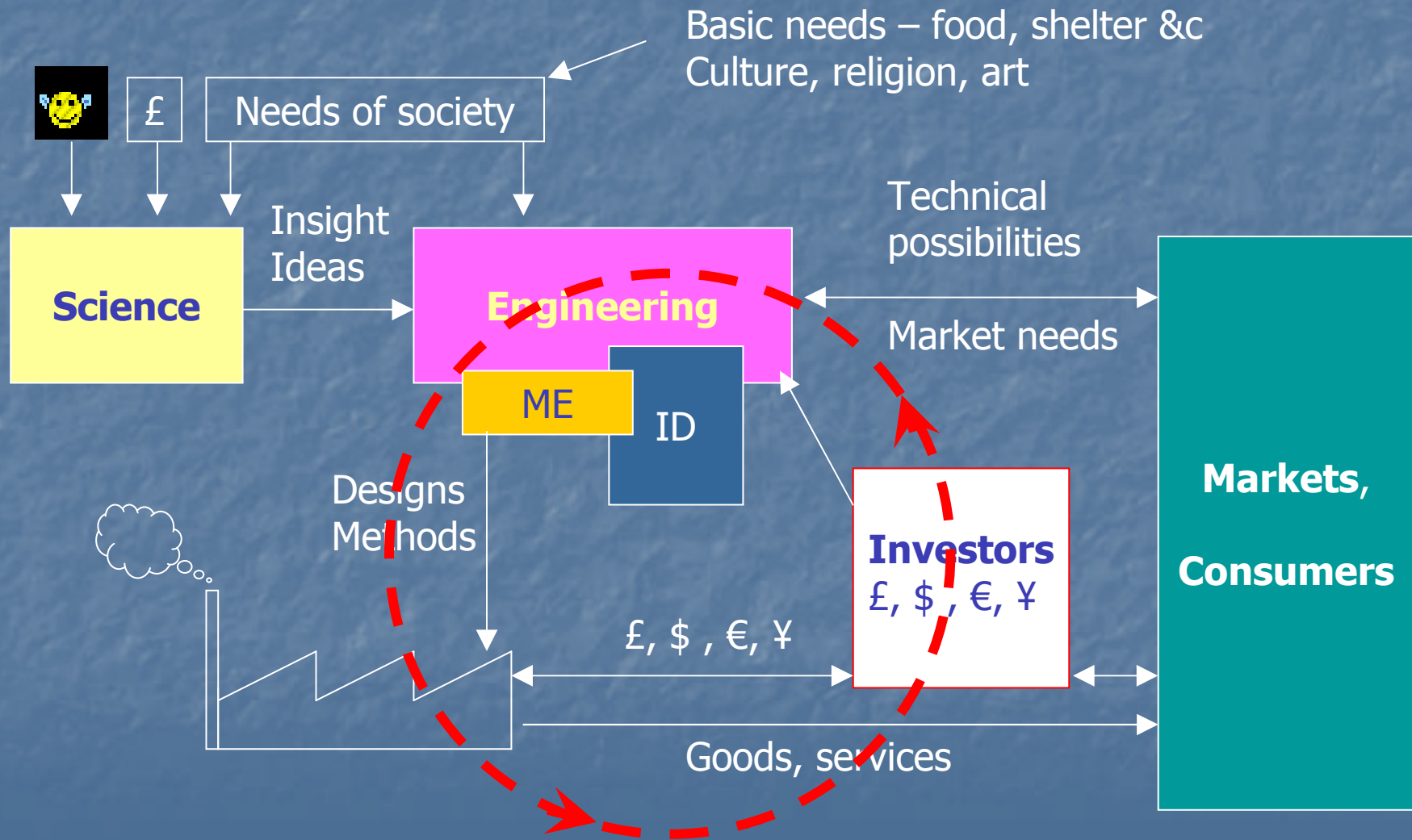
Some relationships



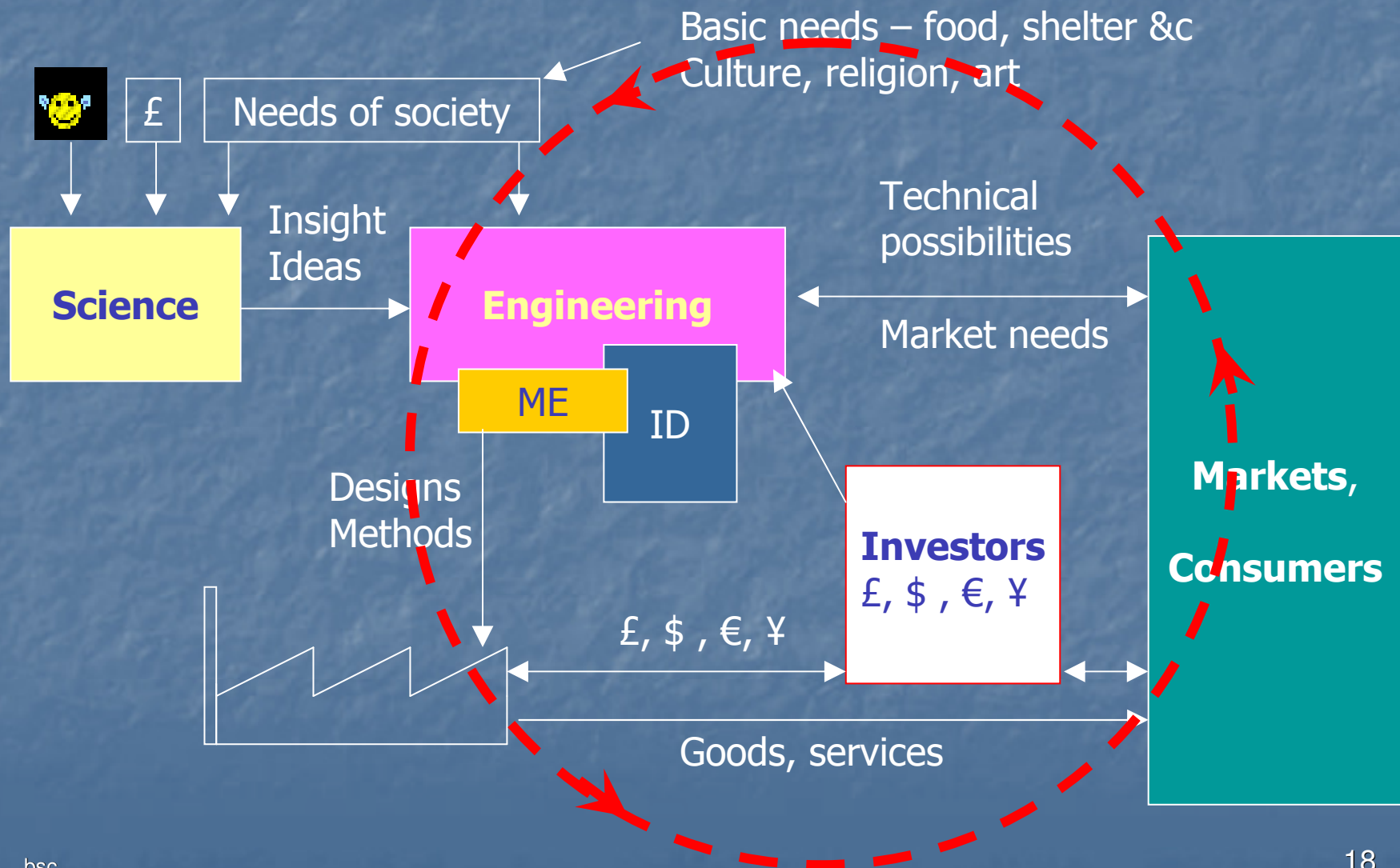
Science



Money



Engineering



Science or Engineering?

- Cosmology, astronomy, particle physics
- Biology, genetics...
- Medicine, pharmacology...
- Agronomy, food production
- Geology, plate tectonics...
- Environmental sciences
- Electrical Engineering

Men (sic) in white coats, working in a laboratory

How does society know us?

Some functions of Engineering

- To provide goods and services to the community
- To create wealth
- what else? .

Some functions of Engineering

- To provide goods and services to the community
- To create wealth
- To communicate the realities of technology to our societies
- To ensure a sustainable future
 - Resource use and recycling
 - Provision and use of energy
 - Pollution – impacts on health and climate

Do we learn?

early 19th C, UK



late 20th C, Australia



mid 20th C, US



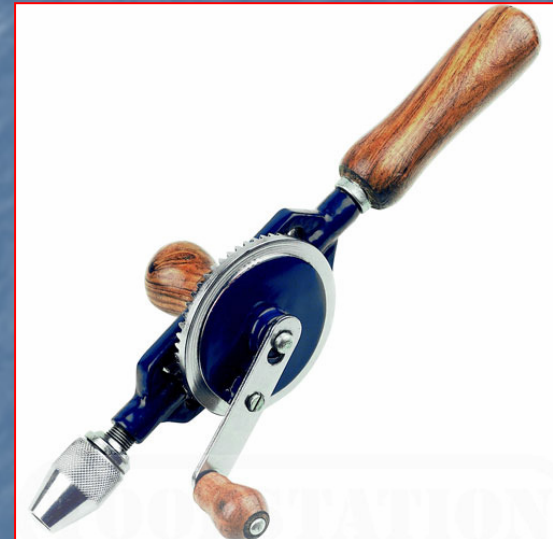
21st C, China

bsc

late 19th C, France

On the lighter side

- Not all our progress is forward
- Do we know what the user really wants?



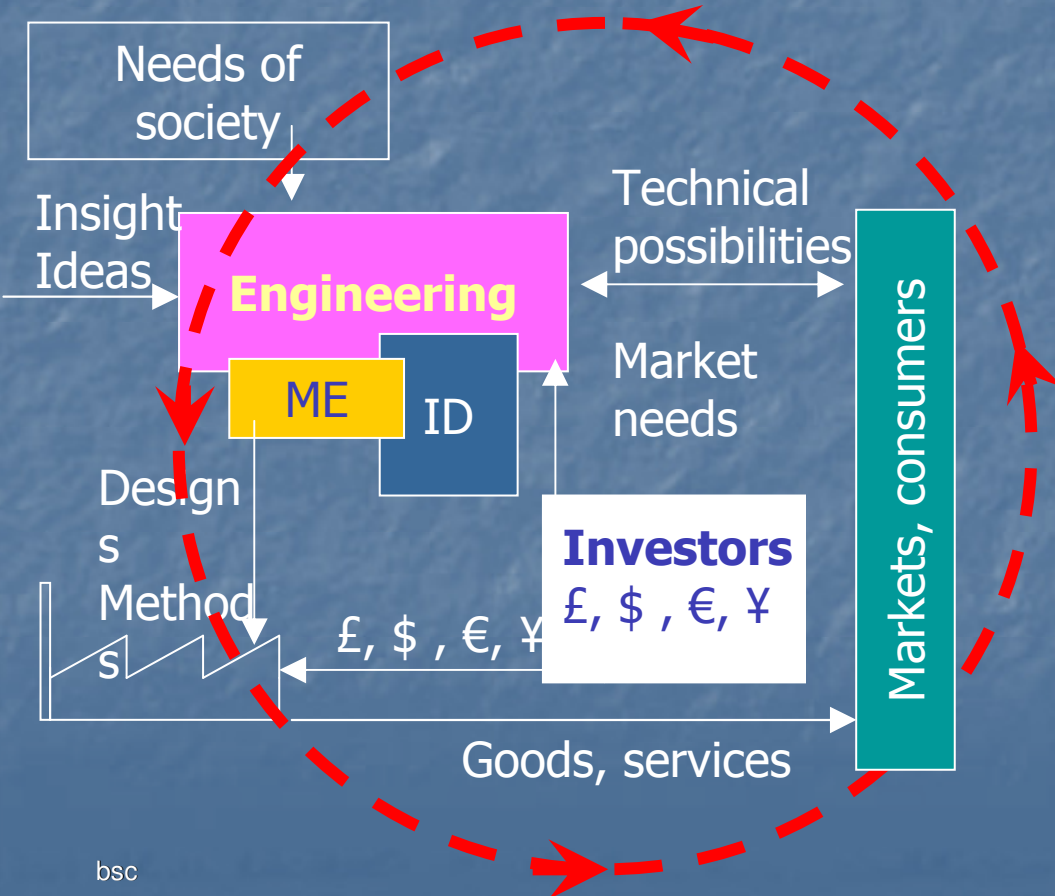
User friendly technology ;-(

Taking and sending a picture on my old phone in 16 easy steps!

- 1. **To take a picture**, from the standby screen, **press** the **Camera** icon.
- 2. **Camera** is highlighted, **press** the centre of the screen.
- 3. **Scroll** left to ensure the camera is set to **Take picture**.
- 4. **Aim** the Camera and **press** the **Shutter** key to take the picture. The picture is taken and saved.
- 5. **Press** the left soft key **Options**.
- 6. **Scroll** to **Send**.
- 7. **Via multi-select** **press** **Select**. The **To:** box is shown.
- 8. To select a contact, **press** **Select**.
- 9. To select a contact, **press** **Select**.
- 10. To select a contact, **press** **Select**.
- 11. To select a contact, **press** **Select**.
- 12. To select a contact, **press** **Select**.
- 13. To select a contact, **press** **Select**.
- 14. To select a contact, **press** **Select**.
- 15. To select a contact, **press** **Select**.
- 16. To select a contact, **press** **Select**.

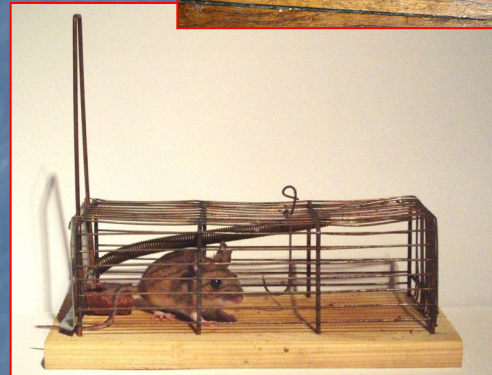
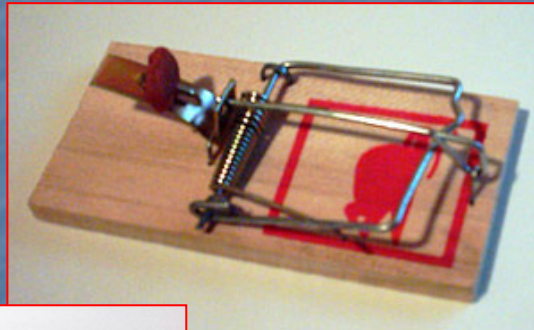
From which planet did the engineer come from who thought this was a good idea?
How did he (she?) come to imagine any one would use this device?
Can we really be so unaware of our customers?

Input drivers to our research



- New technical ideas
- New market needs
- New societal needs and expectations
- Things that will make money
 - Create new markets
 - New applications of old ideas

...a mousetrap

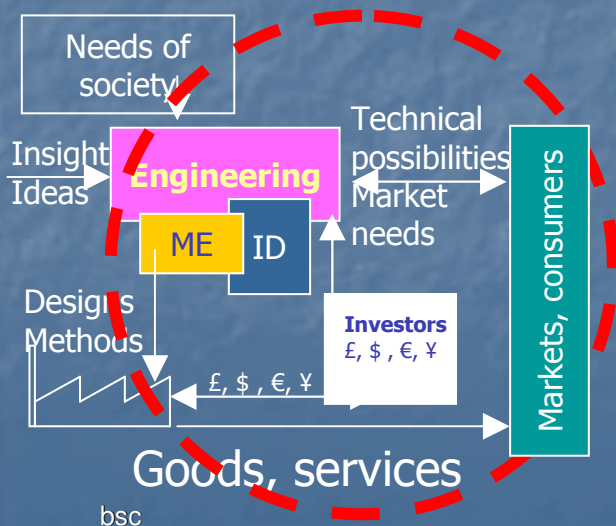


"Build a better mousetrap, and the world will beat a path to your door" (Emerson?)

"If you build a better mousetrap, someone will build a better mouse"

Remember

- Before formulating research goals we must know the state of the art in the marketplace and its rate of progress
- A good idea without an application in the market is, at best, only a good idea



- If we produce good ideas, they are likely to be lost unless they are quickly taken up and **used**

Obvious problems

- With honourable exceptions we have inadequate communication between universities and industry, especially small companies, where much of our innovation occurs
- Industry sees university research as
 - too slow
 - too difficult to direct
 - too insecure
 - too uncertain in outcome
- 3 years is too long in a fast-moving market
- The work-rate of a researcher is far lower than that of an engineer in industry

Market information

- Too many academic papers describe results which are far below the level competitive in today's markets
- Research proposals sometimes specify objectives that do not meet market needs, even at the time of their inception
- Too many technical papers appear long after the problem has been solved in industry

Bandwagons

- It's easy to propose a project that follows today's fashionable subject
 - To cite potential applications with no regard to the limitations of the technique
 - What may really be needed is work to establish the intrinsic limitations
- **This gets the system a bad name**

Sales

- Eventually you will have to sell your ideas – you need to earn a living – so you might as well start now
- You will also have to sell yourself!
- If your potential customers criticise your ideas, listen and learn
- Practice ... use every opportunity!

Market information

- Identify *your* markets
- Talk to companies involved in your markets
 - Understand who may use the results of your research
 - Visit them, get to know them, enlist their support
- Look critically at products and specs in the shops and on Websites
- Think about where these products will go in 1 year, 3 years
- If your research doesn't fit a market or its timescale, understand why and review it

Conferences?

- The **very** competitive nature of industrial design and manufacture means that companies are unwilling to talk about their new technologies in public.
- The audience will be of competitors rather than customers. Exhibitions are better – attended by potential customers as well as competitors.
- Current conditions have put tight constraints on budgets for events that are not sales-oriented.

More problems

- Engineers in industry are oddly reluctant to write and present material about their work unless they have to, even when offered money!
- Engineers get personal publicity from doing these things as well as coverage for their companies, but, in my experience, they are very reluctant and very few seem willing to try

▪

..and worse

- The dominance of 'academic' papers is perceived as rendering events less useful to engineers practicing in industry
- Many authors from universities are uncritical about whether the material is of sufficient currency and completeness to be genuinely useful to an engineer in industry
 - Why are they doing such work anyway?

Changes in industry

- The UK's communications industry has contracted and in many areas is now a collection of niche players
- Large organizations which used to fund new work and generated lots of papers have disappeared or become much more commercial (in the hard sense): MoD, Home Office, BT, BBC, Marconi ...
- There's more competition for people's attention – general and specialist conferences, small colloquia, on-line conferences and so on

Engineers in industry

- Engineers move out of active design work into Sales or Management (often for higher salaries)
- There is a shortage of experienced practicing engineers with something to talk about
- There are very few engineers in industry with more than 20 years experience who are still exercising their core skill

Technical Journals?

- Many papers are by academics writing for academics
- Papers dealing with applications are often out of date or disconnected from the real world
- References are now usually found by searching on-line. Don't assume people read the current issue
- Not the place to sell your ideas
- Trade journals may be better!

Sample antenna journals

	IET	IEEE
Academic authors, state funding	6	11
Academic authors, funding unspecified	4	13
Industrial, military or mixed authors	1	11

IET Microwaves, Antennas & Propagation, Apr 08

IEEE Trans AP, Mar 2008

This is a very competitive world!

- If you don't sell your ideas (and yourself) the market will chose someone else's ideas
- Being first is still important
- Seeing the applications for your ideas is crucial
- If no one in industry is willing to support your project, understand why. Then decide whether to go on.

So what do we do?

- Get to know the companies and their people involved in your market
 - Establish productive relations between them, the researchers and the College
 - Establish a reputation for good work done by committed, innovative specialists and delivered on time
 - Adapt working methods (and degree structures) to meet their needs
 - Deliver value for money

We could do better...

- In some areas we are too impressed by what is possible and loose sight of what the consumer needs
- We create technology that ignores the user
- In some areas our technical capabilities outrun our ability to think of the real-world applications to which our gizmos can be put
- We often ignore the wider impact of our work

..and better

- In other areas our society urgently **needs** invention, innovation, enterprise, overturning of old assumptions –
 - renewable energy
 - reduced resource requirements
 - recycling
 - low-carbon devices of every kind
- In many of these areas we already have the science, and what we need is vision and determination to get it applied
- Engineers have the skills, the experience, the drive to innovate and we can see the necessity for change
- But we have to sell these ideas!

Many thanks for your attention