Keynote Address

Innovation and Regulatory Developments in Telecommunications

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Technological & market conservatism

A challenge for innovators and regulators:

"Nothing is more difficult than to introduce a new order. Because the innovator has for enemies all those who have done well under the old conditions and lukewarm defenders in those who may do well under the new"

Nicolai Machiavelli, 1469 -1527 A.D.

Innovation in telecoms – early foundations

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- Electricity and electronics – e.g. Volta, Ampere, Ohm, Oersted, Faraday, Heaviside, Hertz, Maxwell, Kelvin, Rutherford, Planck, Fleming

Early developments

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- Radio – Marconi, Kelvin, Lodge, Franklin, AT&T and British Post Office engineers

- Broadcasting – Sarnoff, Eckersley brothers, Round, Armstrong, Blumlein, Nipkow, Campbell-Swinton, Zworykin, Logie Baird

20th Century Innovation - 1

- **Telephony**: handsets, exchanges and switches

- **Cables**: copper, co-axial, optical fibre, HFC

- **Wireless**: microwave, satellite, free-space optics

- **Networks**: voice, data, video, Internet

20th Century Innovation - 2

- **Multiplexing**: FDM, TDM, STDM, CDM, WDM, DWDM

- **Switching**: circuit, packet

- **Network infrastructure**: PDH, SDH, Intelligent networks, NGNs, IP

- **Electronics & optics**: valve, transistor, microchip, laser, LED, optical amplifier

- **Data networks**: WANs, MANs, LANs, HANs, PANs

20th Century Innovation - 3

- **Access**: xDSL, cable, wireless & satellite, FTTx

- **Information theory**: bandwidth, signal-to-noise, bit rates, modulation

- **Services**: Fixed voice, telex, fax, sound radio broadcast, TV broadcast, safety, satellite telephony & broadcasting, paging, mobile voice, teleconferencing, text messaging, e-mail, world-wide web, peer-to-peer, multimedia messaging

Tributes to inventors - 1

"The good effects wrought by founders of cities, law givers, fathers of the peoples, extirpators of tyrants and heroes of that class extend but for short times, whereas the work of the inventor, though a thing of less pomp and show, is felt everywhere and lasts for ever" – *Francis Bacon, 1561-1626 A.D.*

Tributes to inventors - 2

John Bray – "Innovation and the Communications Revolution – from the Victorian pioneers to the broadband Internet", IEE, 2002

Names over 300 scientists and engineers who have been responsible for significant technical advances & inventions in telecommunications

Predicting technological innovation

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3. SMS

Technological innovation – some observations

- Inventions mainly since mid-1850s underpin all modern telecommunications
- Pace of innovation has been accelerating - will it continue?
- Scientific fundamentals, discontinuities and incremental changes

Technological innovation & regulation

Where's the connection? Isn't telecoms regulation about:

- Transposing Directives
- Licensing and authorisations
- Running competitions for licences
- Monitoring and enforcing licence conditions
- Resolving disputes
- Spectrum management, etc?

Technological innovation & regulation

Yes – and much more!

- Price, choice & quality objectives
- Market development => vibrant industry
- Highlight opportunities presented by technological innovation
- Help overcome misplaced technological conservatism

Regulatory objectives

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- Encourage technological & commercial innovation – leads to deployment of new & efficient infrastructure & services

  => PCQ benefits

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  => PCQ benefits

- Raise awareness & encourage industry to consider new & developing technologies

  => vibrant industry

Goals of telecoms regulation

- ***Consumer benefits*** – price, choice, quality

- Efficient telecoms marketplace

- Effective and vibrant industry

  => Healthy innovation

Features of good regulation

■ Fair, unbiased and objective

■ Up-to-date and timely

■ Flexible and responsive

■ Light-handed (minimum overhead on sector, allow innovations to surface)

New EU regulatory framework - objectives

- Promote competition - as the best means to achieve innovation, choice, quality, value for money
- Promote the interests of the citizen – universal service, consumer protection, privacy, dispute resolution
- Promote a single European market

EU approach to regulation

- Rely increasingly on competition rules
- New rules reflect 'convergence'
- Separate content and transport regulation – with consistent regulation of all network infrastructures
- Simplify market entry
- Regulate markets not technologies
- Rely where possible on voluntary action by market players, but grant NRAs strong power to intervene when justified

Technological innovation & regulation

Where's the connection?

- Technological innovation helps us meet our 'price, choice and quality' objectives

- Competing technologies help stimulate market competition

- Regulation – managed path to liberalisation and competition (B. Carsberg – mid 1980s)

- Regulation – managed path towards technological, commercial and economic progress

Technological innovation & competition

Technological innovation – a source of healthy competition

- New entrants compete – innovate to fill market voids
- Established players innovate – to head off or respond to competition from new entrants
- Technological innovation – threat of competition ever present
- (Disruption – implications for investment & standards)

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⇒ Technological innovation – overall, an ally of regulators

Market Development

Market Development Forces:

- Technological innovation (T)
- Commercial & economic (E)
- Political & legal (L)

Market Development (M) = f{T,E,L}

Market development & regulation

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(Regulation - proxy for market forces)

=> Regulation (R) = f\{T,E,L\}

Regulatory development

Regulation (R) = $f\{T,E,L\}$

$\Rightarrow$ Regulation must evolve

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How will it evolve?

(Regulation – maximise consumer benefits, encourage vibrant industry and stimulate innovation)

$$R => \max\{P,C,Q\}$$

$$R = f\{T,E,L\} => \max\{P,C,Q\}$$

Outlook for the ICT sector

- Struggling – but some 'green shoots'
- In line with familiar pattern of technology-based upheavals - maturing

A familiar pattern

"As a technology begins to mature, a sense of realism sets in. Inevitably, for some, cash runs out. Companies begin to fold, only the strong survive, and naïve investors lose money in the huge rationalization. Pessimism begins to pervade the marketplace, and stock prices fall across the board. Eventually, the market stabilizes."

Sir John Templeton, in Foreword to "Engines that Move Markets", A. Nairn, Wiley, 2002.

Outlook for the ICT sector

- Struggling – but some 'green shoots'
- In line with familiar pattern of technology-based upheavals - maturing
- Question for regulators – intervene to try to avoid PCQ discontinuities, or allow market to evolve to a more sustainable equilibrium from which steady growth can be built ?

Forward-looking Programme

Activities:

- 'Radar screen' – awareness of future developments (e.g. Software defined radio, nanotechnology, high bandwidth applications)

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- 'Radar screen' – awareness of future developments (e.g. Software defined radio, nanotechnology, high bandwidth applications)
- Medium-term outlook – scenario analyses (e.g. spectrum review, future delivery of broadband)
- Assessment of new issues – Briefing Note Series

Forward-looking Programme - scope

Technological innovation – primary focus

- **Infrastructure**: global, national, local; fixed, wireless
- **Access technologies** (e.g. optical access, 'wireless tails')
- **Network technologies** (e.g. 'next generation', components, reliability & resilience)
- **Applications** (e.g. 'next generation', demands on networks)

Published Briefing Notes

- Optical wireless technology
- Ultra-wideband communications
- High-altitude platform stations
- Broadband VSAT
- Software defined radio
- Next generation networks
- Wireless LANs
- Optical access
- Applications for next generation networks
- Internet Protocol version 6

Applications for Next-generation networks

Applications in areas such as:

- Business
- Education
- Medical
- Home care
- Arts
- Entertainment
- Domestic and retail markets
- Government
- Scientific research
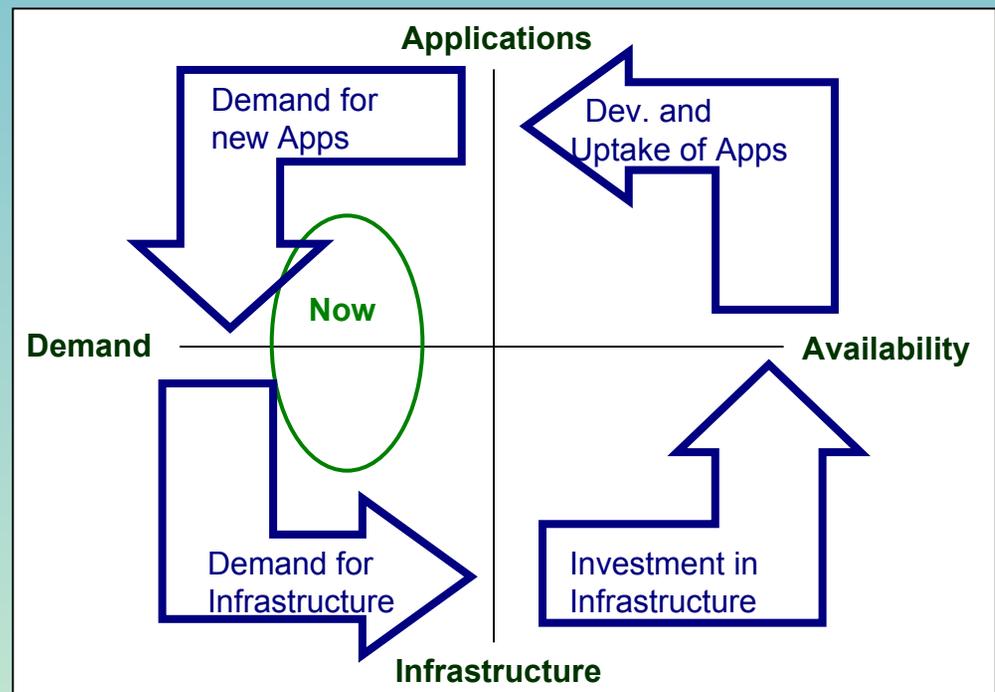
What we don't do…

- Pick technology winners
- Recommend, endorse or underwrite technologies, products or technical approaches
- Market forecasts
- Investment advice

New Issues Conference

Issues identified – (and ODTR responses):

- Infrastructure & access to it - (LLU, optical access, etc.)
- Power of incumbency – (Market Operations and Regulatory Accounts Divisions)
- Quality & continuity of service – (SLAs, NGN, Resilience)
- Scarcity of resources – (Spectrum review & strategy, numbering, IPv6)
- Convergence, divergence & bundling (NGN, NGA)
- Universal service – (Future delivery of broadband)
- Maturing of the sector – (ODTR strategy, NGN, NGA)

Where next?

- Near term

- 'End game'

Some future trends - 1

- Convergence of multiple independent networks

- Resilience, reliability, ease of use, flexibility (self-provisioning of bandwidth & 'quality')

- VoIP, 'Videoconferencing' – growth areas

Some future trends - 2

- Machine-to-machine communications – rapid growth

- Bandwidth => free? (commercial viability?)

- Distance => increasingly irrelevant

- Internet & mobile devices growing faster than fixed phone lines (substitution)

Some future trends - 3

- Competition from ad hoc/parasitic networks - (stimulus or threat?)

- Optical => closer to end users; wireless tails

- Continuing technological diversity in network provision

Future Briefing Notes

- Future DSL

- Next-generation Mobile and Portable Applications

- Voice over Internet Protocol

(ODTR Symposium - Innovation in Communications – Planning for the Future)

Where next?

- Near term

- 'End game' – what is our goal as consumers?

End game – one view

History of information and communications:
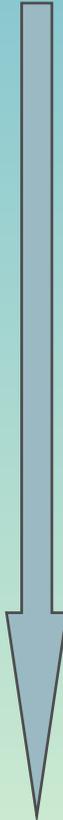
- Paintings and writings – record ideas & events
- Printing press – copy & disseminate literature
- Gramophone – record music, relive concerts
- Films – record & disseminate images and sound
- Telephony – two-way communication
- Sound radio & television – broadcast audio & video
- Tape recorders, VCRs – copy & relive broadcasts
- Camcorders – record & relive personal experiences
- Internet – transmit and receive multimedia, live or recorded
- Mobile phones & PDAs – 'anytime' voice & multimedia
- ??

An underlying trend?

To witness, record, convey and relive experiences - whether they be news events of wide interest, our personal experiences, or pleasure and entertainment – with ever increasing realism…however, wherever and whenever it suits us

An end-game scenario

Technologies enabling real and fictional 'virtual reality' content - live or recorded - to be communicated ubiquitously between individuals, small groups and large audiences

Future R&D implications

- Sensing & recording technologies
- Data storage & processing
- Display technologies
- 'All senses' communication
- Miniaturisation (nano- & biotechnology)
- Communications infrastructure
- Energy consumption & storage
- Heat transfer (superconductivity?)

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- **Prospects for ICT sector** – maturing, relative stability & steadier renewed growth

Conclusions

- Regulation is interdisciplinary – engineering, commercial strategy, economics, law, accounting
- Technological innovation and regulation are allies – PCQ, efficient marketplace (competition), vibrant industry
- Prospects for ICT sector – maturing, relative stability & steadier renewed growth
- Prospects for ICT researchers – plenty of 'headroom' for technological innovation

Conventional wisdom? - 1

"For God's sake go down to reception and get rid of a lunatic who's down there. He says he's got a machine for seeing by wireless! Watch him – he may have a razor with him"

Editor of the Daily Express in response to a visit by John Logie Baird, 1925

Conventional wisdom? - 2

"Drill for oil? You mean drill in the ground and try to find oil? You're crazy"

Drillers whom Edwin L Drake tried to enlist to drill for oil, 1859

Conventional wisdom? - 3

"Rail travel at high speed is not possible because the passengers, unable to breathe, would die of asphyxia"

Dr Dionysus Lardner, 1793 – 1859 AD

Conventional wisdom

"In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual"

Galileo Galilei, 1564 – 1642 AD

Thank you

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