



Chief Scientist &
Engineer

Research engagement and consequential productivity

Innovative Research Universities –
Senior Staff Forum, 7 July 2011

The Division of Labour

- Stan Metcalfe in Hayden Williams fellowship lecture 2008 at Curtin University - examines the relationship between business and universities:
- ...draws from Adam Smith:
 - “... philosophers and men of speculation, whose trade is not to do anything, but to observe everything: and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects...” (Smith 1776)
- Metcalfe: “We can all understand that it would be as unwise to expect firms to behave like universities as it would be to expect universities to behave like firms. The division of labour is there for a purpose, it should be respected.”

University & Industry engagement

- Firms cannot manage all knowledge development in-house given the speed of changes in knowledge and technology
- Firms need new supplies of workers with up-to-date knowledge (good graduates)
- Unis need innovative firms to stimulate demand for knowledge and expertise
- But the conversation is bedevilled by differences in focus, size, longevity, openness

Research engagement leads to different types of hi-tech productivity – 4 examples

- Autonomous systems –big impact through big companies with a problem or vision
- Photonics – pushing research boundaries and spinning off
- Solar Photovoltaics – student & mentor prove a winning combination
- Biotech – thinking outside the research discipline and collaborating

Robotics - big impact through big companies with a problem or vision

- Australian Centre for Field Robotics – Sydney Uni
- ARC funding 2003-10 - \$15.2m
- Australia – natural fit for automation: mining, agriculture, cargo holding, transport and logistics
- Container site established at Brisbane in 2005 using automated handlers (operated entirely from Port Botany) now breaking waterfront productivity records around the world – partnering with Patrick stevedores
- Automated mine – major Rio Tinto investment

Photonics – pushing research boundaries and spinning off

- ARC larger grants in photonics
- Photonics CRC 1993
- Growth of companies
- e.g. Finisar Australia
 - INDX: Spin-off from Australian Photonics CRC
 - Started with a \$10K loan in Sept 1995
 - Engana founded 2001- intelligent optical subsystems
 - Acquired by Optium 2006
 - Merger with Finisar
 - Finisar Australia: world leader in WSS
 - Revenues >\$120m pa – 350 employees
 - Growth at around 30% per quarter for past 7 qtrs
 - Optical, electrical, mechanical and software design

CUDOS

- Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS)- ARC Centre of Excellence
- Lead University - Sydney
- ARC funding 2003-18 - \$42m
- CUDOS program joined by 2 NSW-based companies:
 - Finisar (@ Waterloo) – rapidly growing – develops telecommunications subsystems
 - Silanna – (@ Homebush) – fabrication of microelectronic circuits and potentially advanced photonic devices
- CUDOS partners have developed suite of patents – working actively to establish commercialisation vehicles for this IP

Solar photovoltaics – student & mentor prove a winning combination

- Prof Martin Green – world leader in solar photovoltaics for 30 years
- Dr Zhengrong Shi – PhD student under supervision of Prof Green
- Spotted opportunity
- Suntech Power – multibillion dollar company – first of its kind in China – world's biggest producer of solar panels in 2010
- Major productivity gain

Biotech collaboration - Thinking outside the research discipline

- Newcastle University's Laureate Prof John Aitken – Centre of Excellence in Biotechnology and Development:
- Work on male infertility and DNA damage in human spermatozoa
- Clinicians, engineers and gamete biologists collaborated in developing an electrophoretic device for assisted conception purposes
- Successfully completed clinical trials at Westmead Hospital and set for full commercial rollout in the next 12 mths
- CoE partnership with cohort of commercial stud farms in Upper Hunter & Harness Racing Australia – using gamete biology expertise to increase efficiency of Aust. horse breeding industry

Research Training – early intervention is the key

- Consider productivity measures at the very early stages
- Expose undergrad students to high level research
- Students work on Linkage Grants
- Centres of Excellence
- Companies spot the talent and take it on
- Highly trained students lead to a super trained workforce

Newcastle – Energy capital

- Biggest coal port in the world
- CSIRO energy headquarters
- Energy Transformed Flagship
- Newcastle Institute for Energy & Resources
- Australian Solar Institute
- Enterprise Connect Clean Energy Innovation Centre
- Smart Grid, Smart City
- Centres of Excellence
 - Complex Dynamic Systems and Control
 - Geotechnical Science and Engineering

Future models - the rise of competitions

- A new and inclusive way of stimulating productivity
- **e.g. Kaggle** – participants predicted travel times on M4
 - \$10,000 prize for creators of winning algorithm
 - NSW first to use this innovative technology
 - Competition ran from Nov 10 to Feb 11
 - Hotly contested, leader board changing regularly with new entrants
 - More than 47 countries entered
 - Winners from CMU and University British Columbia

The U.S. DARPA model

- Focuses on 'big-jump' research – revolutionary - bridges gap between fundamental discoveries and major moves in military use
- Military problems set up in a civilian way so universities can be harnessed
- DARPA uses range of competitive structures to engage external groups whose expertise and innovative capacity can turn in results daily
- Model has spawned ARPA-E and ARPA-ED

Conclusion – university and industry engagement

- Remember Adam Smith and division of labour...
- Perhaps unis and firms maintain a necessary tension
- Universities are distinctly special
- And this difference - if used in the right way - can be very useful for productivity