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THEME 4: UNIVERSITIES AS
INTERACTIVE PARTNERS

Digital Steel: The Australian
Steel Industry Research
Mapping Project

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+ The Project

■ The Problem

- The Steel Fabrication Industry is doing it tough (cost, competition, high \$A, dated technologies)
- *Could it do better with greater access to scientific and technical knowledge generated in Universities and Publicly Funded Research Organisations?*

■ The Premise

- There is a substantial amount of research being undertaken that would benefit industry
- More information about research activity would increase adoption and application of knowledge

■ Proposed solution to test

- Map capability that resides in universities and research organisations
- Set up a data base that publicises capability and facilitates access



The Approach

- Identified fields of research (FORs) that are relevant to steel fabrication – 17 in total (including fields from the sciences, engineering, ICT, design, building, etc.)
- Assembled data on funding (by source), publications, and commercialisation –
 - largest proportion is electrical/electronic engineering (14% of funds); Manufacturing Engineering is 3%.
- Identified Universities with high ERA rankings in relevant FORs (only 2 universities had high rank in Manufacturing Engineering)
- Mapped FORs to steel fabrication functions (crafts) defined in project brief – 15 in total (casting, coating, cutting, forming, joining, machining, robotics, etc.)
- Developed a FOR/functions matrix and a capability map across universities and ROs

+ Fields of Research - Fabrication Matrix

FOR CODE	303	801	806	904	905	906	910	912	913	914	1007	1201	1202	1203
Fabrication Capability	Macromolecular & Materials Chemistry	Artificial intelligence and image processing	Information Systems	Chemical Engineering	Civil Engineering	Electrical & Electronic Engineering	Manufacturing Engineering	Materials Engineering	Mechanical Engineering	Resources engineering & extractive metallurgy	Nanotechnology	Architecture	Building	Design Practice
Automation	-	Y	Y	-	-	Y	Y	-	Y	Y	-	Y	-	Y
Additive Manufacture	Y	-	-	Y	-	-	-	Y	-	-	Y	-	-	Y
Assembly	-	Y	Y	-	Y	Y	Y	-	Y	-	-	Y	Y	Y
Coating	Y	-	-	Y	-	-	-	Y	-	-	Y	-	-	-
Casting	Y	-	-	Y	-	-	-	Y	-	-	-	-	-	-
Cutting	-	Y	Y	-	-	-	Y	-	Y	-	-	-	-	-
Design	-	Y	Y	-	-	-	Y	Y	-	-	Y	Y	Y	Y
Energy Efficiency	-	-	-	-	Y	Y	-	-	Y	Y	-	Y	-	Y
Forming	Y	-	-	Y	Y	-	Y	Y	-	-	-	-	-	-
Joining (Welding)	Y	-	-	Y	Y	-	Y	Y	-	-	Y	-	-	-
Joining (Riveting, Bolting)	-	Y	Y	-	Y	-	Y	-	-	-	-	-	-	-
Building Information Modelling	-	Y	Y	-	-	-	Y	-	-	-	-	Y	-	Y
Machining	Y	Y	-	-	-	Y	Y	Y	Y	-	Y	-	-	Y
Building and Construction Mgt	-	-	-	-	-	-	-	-	-	-	-	Y	Y	-
Robotics	-	Y	Y	-	-	Y	Y	-	Y	Y	-	Y	Y	Y

+ The Approach

- Applied the map to all 39 publicly funded Universities to identify research capability in fabrication functions
- Interviewed DVCRs, Deans and Research Centre Directors to validate capability and discuss interactions with industry
- Interviewed key industry and professional associations, a cross section of fabricators, and innovation intermediaries regarding interactions with universities
- Documented gaps, opportunities, barriers and incentives/disincentives
- Drafted and finalised report with options and recommendations
- Report released and disseminated by client



The Findings

- Many universities have world class research capability in *steel making* – BHP legacy
 - Australia has abundant coal and iron ore resources, but steel making is in decline
- Ten (out of 39) universities had all capabilities relevant to steel *fabrication*
- There are some very strong pockets of capability – e.g. cold formed steel fabrication, casting, welding, coatings, deformation, architecture, design, B&C management
- Few capabilities are ‘aggregated’ across university faculties/departments (disciplinary siloisation)
- Aggregation occurs in specifically funded research centres and institutes, with significant industry links (including international)
- **Generally -**
 - **FORs relevant to steel fabrication are not well funded – and what gets funded gets done**
 - **Academic staff divert research effort to where funding opportunities are greatest – usually in more “exotic” science areas**

+ Issues and implications – supply side

- Little opportunity for knowledge transfer as industry relevant research is not being undertaken
 - Public funding concentrated in science rather than engineering (approximately 10 per cent of relevant FORs)
- Research is not generally organised around industrial application
 - Except in a small number of cross disciplinary research centres and institutes
 - Australia a global leader in steel roof coatings through university collaborations with BlueScope Steel – a long association
- Highly ranked researchers also have strong industry linkages
 - Successful academics have developed strong, long term, relationships with research users
 - Engage directly rather than through a Technology Transfer Office

+ Issues and implications – supply side

- Engagement is supported at senior university executive levels (VC or DVC)
 - VC to CEO relationship is essential for large collaborations
 - *VC to Minister relationship also important in public policy collaborations*
- Several universities and ROs have significant testing/measurement/demonstration equipment portfolios for research and teaching
 - Available for industry projects and collaborations
 - *ANSTO work on welding fractures*
 - Base for consulting on specific industry problems
 - Access, pricing, and capacity issues restricts SMEs

+ Issues and implications - demand side

- Industry is not seen to value research
 - Particularly in current economic climate
- Industry is relatively unsophisticated
 - Many small, old private/family businesses – ‘practical’ people
 - ‘Orders driven’ approach to marketing
 - Tradition of trade protection and subsidies
- Very low demand for steel in civil construction
 - Construction sector dominated by reinforced concrete
 - Flows through to innovation opportunity
- Resources sector adopts global procurement approach
 - Australian firms generally not competitive

+ Issues and implications - demand side

- Industry is becoming technology intensive and design driven
 - Machinery & equipment supplied with significant OEM software (robots, CNC, beam-lines, etc.)
 - CAD/CAM systems allow visualisation and prototyping and link from design to production
 - Some significant 'start-ups' formed around new production and digital technologies, and design – globally focussed (e.g. self piercing riveting system)
- Supply chain is still highly disaggregated
 - Many separate enterprises 'clipping the ticket'
 - Opportunities exist for integration *and transformation* through technology and ICT systems
- Commodity approach to manufacture, mass production mindset
 - Rather than branded product created around design and user wants
- Reconceptualise what manufacturing is and where value is created
 - New forms of business organisation and structure are emerging
 - Manufacturing is no longer just about 'factories'



Addressing issues

- Achieve greater integration of design, processing, production technologies through support for cross disciplinary centres and institutes within universities –
 - *Greater recognition for a scholarship of integration*
- Achieve greater balance in funding for science and engineering research
- Establish workable institutional models for collaboration in research, teaching and ‘problem solving’ – e.g.
 - Designated hubs and precincts
 - A dedicated CRC - model well known, but expensive to establish and maintain
 - Research association models – successful in the mining sector
 - Extend CSIRO role
 - Centre of Excellence for Steel Fabrication Research
- But where’s the money going to come from?
 - Perhaps a broader industry restructuring package
- Establish frameworks for SME engagement with Centres and Institutes

+ Policy issues

- Address the demand for fabricated steel – including its environmental credentials
- Initiate collaborative strategic investment in the steel fabrication sector
 - Several models to examine
- Build management capacity and capability for innovation and marketing
 - Enterprise development programs are important
- Industry restructuring
 - Some Australian industries have restructured around consolidation, management capability, research, and application of science and technology – eg. wine, red meat processing
- Facilitate access by SMEs - voucher schemes, researchers in business programs, etc
- Enhancing data bases and knowledge exchanges may help –
 - But many universities have excellent websites and on-line staff directories (there are some very poor ones)
 - *The problem of knowledge transfer is much broader than communication*