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# Enhancing engineering employability in the 21st C; handling uncertainty and complexity through 'new entrepreneurship'



Dr Edmond Byrne  
Dept. of Process & Chemical Engineering  
University College Cork, Ireland



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Transferable

Generic

Enhanced employability related skills a trend associated with all third level programmes/disciplines, in line with greater 3<sup>rd</sup> level participation

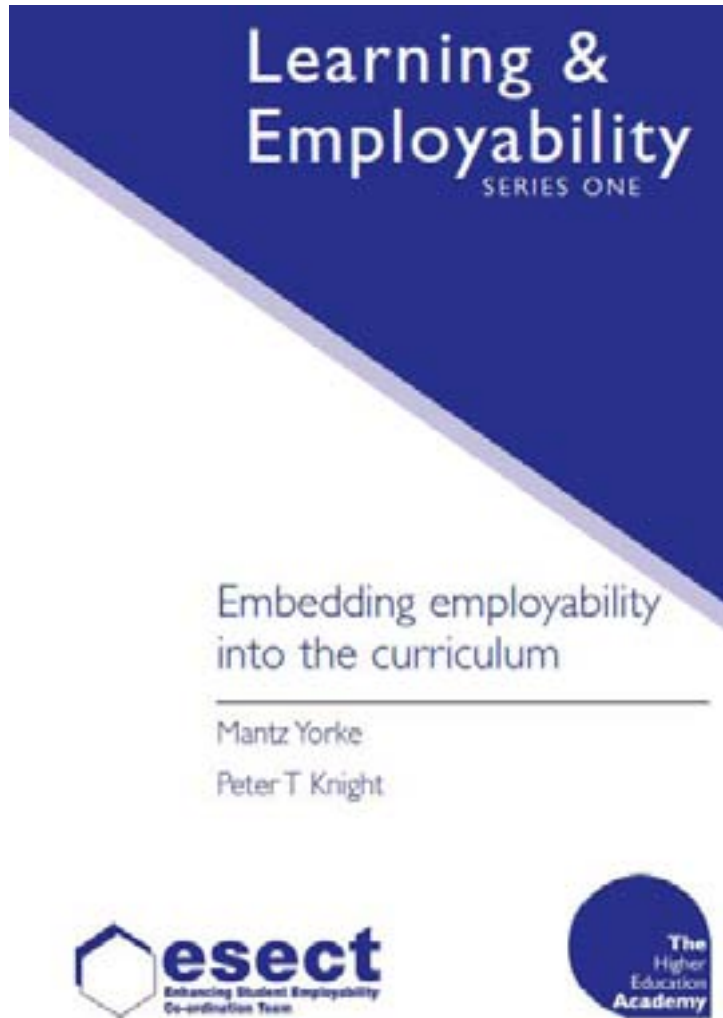
Professional bodies:

**FEANI:** 'transferable skills',  
1 of 6 programme outcomes

**Engineering Council (UK):**  
'general transferable skills',  
1 of 4 learning outcomes

Soft

Entrepreneurial



List of 39 *'aspects of employability'* designed to assist in the *'examination of curricula from [the] point of view of employability'*

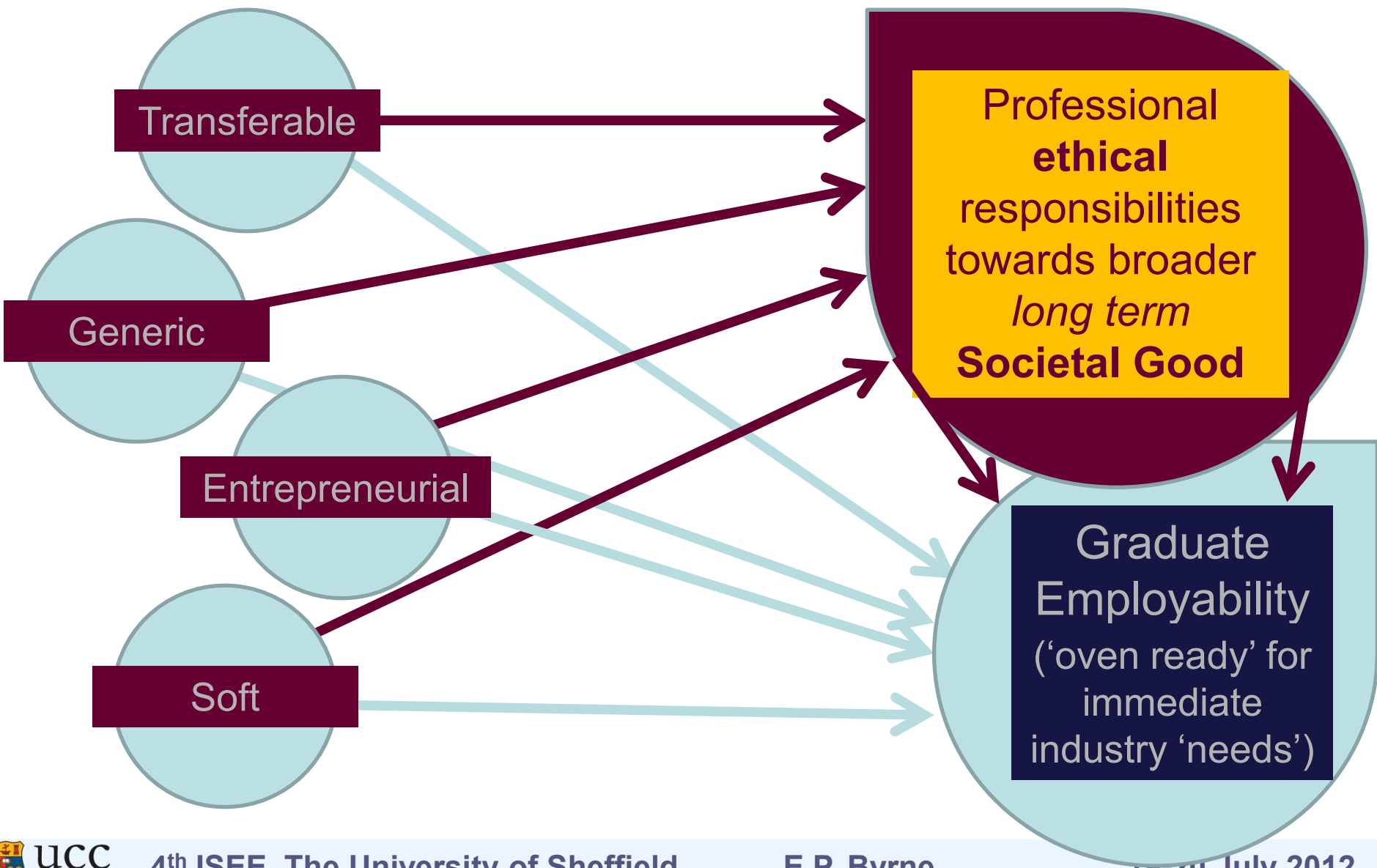
Grouped under three clusters:

- *'personal qualities'*
- *'core skills'*
- *'process skills'*

Yorke & Knight, HEA (2006)



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(2008)

..rather than one which considers engineers' role merely as '**value neutral**' '**guns for hire**'.

Bucciarelli (2008): *'If we, as engineering faculty, still claim that it is our job and responsibility to teach 'the fundamentals', it's time explicitly to recognise that what is fundamental to engineering practice goes beyond scientific, instrumental rationality.'*



## Working Towards Societal Good particularly important for contemporary **21<sup>st</sup> C Engineering**:

1. Addressing **grand societal challenges** of energy, water, food provision as well as effects of accelerated climate change in the face of finite resource and ecological limits.
2. **‘Making a difference to the world’**: Key aspiration and No. 1 among female engineering students (Alpay et al, 2008)



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# A new conception of Entrepreneurship

**Gibb (2002):**

**Entrepreneurship:** Traditionally a '*narrow business orientation*' e.g. heroic figure, owner of start up fast growing tech business.

Gibb: this conception '*does not have full empirical or conceptual underpinning*'.

Do not organisations facing decline or fighting to retain market positions require even *more* entrepreneurship?

Gibb proposes a new conception of entrepreneurship : that which can face '***uncertainty and complexity in the task and broader environment***'.

Thus necessity for this new entrepreneurship extends right across society '*for example, priests, doctors, teachers, policemen, pensioners and community workers and indeed, potentially everyone in the community.*'

Entrepreneurial



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# Entrepreneurship: facing 'uncertainty and complexity in the task and broader environment'.

(un)sustainability

risk

consumerism

finite limits

efficiency

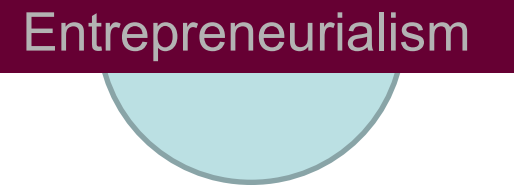
resilience

globalisation

creativity

scale

diversity



Entrepreneurialism

..for a longer term more global horizon than short term organisational 'needs'

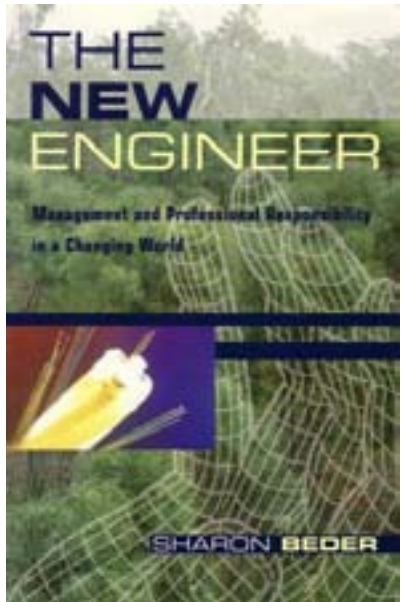
With increasing uncertainty and complexity across society and through engineering practice in the 21<sup>st</sup> century, and the consequent need for critical thought, humility and openness to adopting and integrating new perspectives, the need for such an entrepreneurialism has never been stronger.





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# Entrepreneurship: facing 'uncertainty and complexity in the task and broader environment'.



The New Engineer (Beder, 1998)



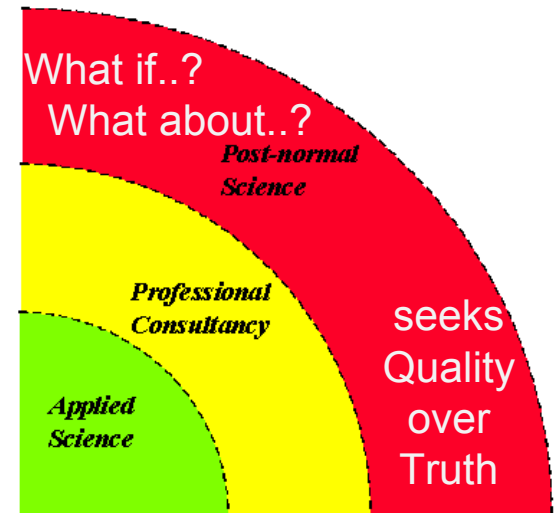
Post Normal Science (Funtowicz & Ravetz, 1994)

Wicked Problems (Rittel & Webber, 1973)



high

Decision Stakes



low

Systems Uncertainty

high

The Research University as Comprehensive Knowledge Enterprise: A Prototype for a New American University

Michael M. Crow



Organizing Teaching and Research to Address the Grand Challenges of Sustainable Development

Building an Entrepreneurial University



## CASE STUDY: PE1006: Professional Engineering Communication and Ethics

Objectives include *'developing [students'] appreciation of professional ethics through application in complex problems and case studies.'*

132 students; formal lectures plus tutorial/facilitation group sessions.

Assessment includes wicked problem assignment, group report and presentation to peers/lecturing team.

A key aim in designing the module was to:

- aid understanding of the context, nature and prevalence of uncertainty and complexity as these relate to engineers/engineering practice
- develop students' critical thinking and openness to new and challenging perspectives

..essentially promoting Gibbs *'new entrepreneurship'*.



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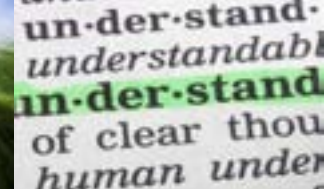
Students surveyed on 39 UK HEA employability attributes (39 resp)

<i>How well developed in PE1006/important for employability is (quite + very):</i>	PE1006 (%)	Employ. (%)
<b>Adaptability</b>	64	<b>86</b>
<b>Stress tolerance</b>	49	<b>86</b>
<b>Creativity</b>	67	<b>91</b>
<b>Commercial awareness</b>	34	57
<b>Ethical sensitivity</b>	<b>75</b>	81
<b>Coping with complexity</b>	<b>68</b>	78
<b>Problem solving</b>	<b>70</b>	<b>83</b>
<b>Influencing</b>	47	58
<b>Arguing for/justifying point of view/course of action</b>	46	74
<b>Comfortable with uncertainty</b>	62	81
<b>Context</b>	<b>71</b>	81
<b>Breadth of knowledge</b>	49	73



## CONCLUSIONS

- The key role/reponsibility for engineers should be to serve societal good.
- Gibb's model for 'new entrepreneurship'; i.e. successfully facing uncertainty and complexity across engineering practice and broader society is a useful tool for achieving this.
- The attributes required to serve societal good in the face of 21<sup>st</sup> century 'grand challenges' align well with defined employability traits.
- A first year professional introductory module has been developed at UCC aimed at developing these skills.
- Students appear to recognise value in this approach.



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Thank you!

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