

# Embedding Entrepreneurship into Engineering Education

## *Accelerating Campus Entrepreneurship: A Pilot Initiative*



Strategic Innovation Fund II

# What is Entrepreneurship?

## *Accelerating Campus Entrepreneurship: A Pilot Initiative*

**“A way of thinking and acting that is opportunity obsessed, holistic in approach and leadership balanced for the purpose of value creation.”**

### **Identify**

Need

Solution  Opportunity

Unfair Advantage

### **Acquire**

Technology Rights  Resources

People, Money

Entrepreneurship is a management process not an individual characteristic

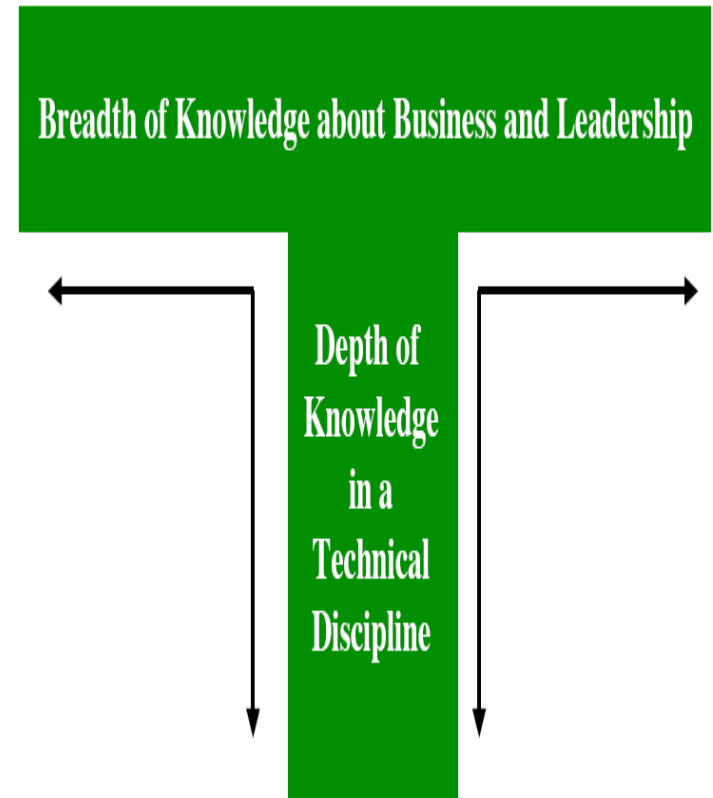
The pursuit of opportunity recognition beyond the resources one currently has under control

**“Entrepreneurship is a management style that involves pursuing opportunities without regard to resources currently controlled.”**

# Why teach Entrepreneurship to Engineers?

***Engineering graduates play many roles in industry, all of which require entrepreneurial skills.***

- *Entrepreneurial Behaviours Correlated with Successful Careers*
- *Self Employment as a Career Alternative*
- *Recognise and Realise Opportunities as they Occur*
- *Win organisational support and backing for major projects*
- *Employer Requirements.*
- *High Proportion of Enterprise Ireland HPSU's driven by Technology Graduates*
- *Pressure on HEI's to Commercialise and Make More widely Accessible their IP*
- *Entrepreneurial researchers more attuned to Commercial Requirements*
- *Create Jobs. Create Wealth*



Source: STVP

# ACE Research: Key Findings



**Entrepreneurship Education in Ireland**  
*Towards Creating the Entrepreneurial Graduate*

2009

- 78% of students expressed an interest in starting their own business at some point in future;
- Entrepreneurship education is not readily available to all students, is fragmented and delivered mainly only in business schools;
- There is a lack of communication about, and visibility of, entrepreneurial supports and policies;
- There is insufficient joined-up thinking between institutions, academics and practitioners;
- Despite some initiatives, industry engagement with the third level sector is neither widespread nor intensive;
- Entrepreneurship education is under-resourced and lacks an articulated strategic policy;
- Higher education institutions need to adopt a framework to embed entrepreneurship education across all disciplines;
- Experiential learning, not theory based lectures, will most benefit entrepreneurial students.



# ACE Research: Development Work

## *Creating the Entrepreneurial Graduate*

### **Targeted Action 1: CIT**

Pedagogies, Teaching and Curriculum Development.

### **Targeted Action 2: DKIT**

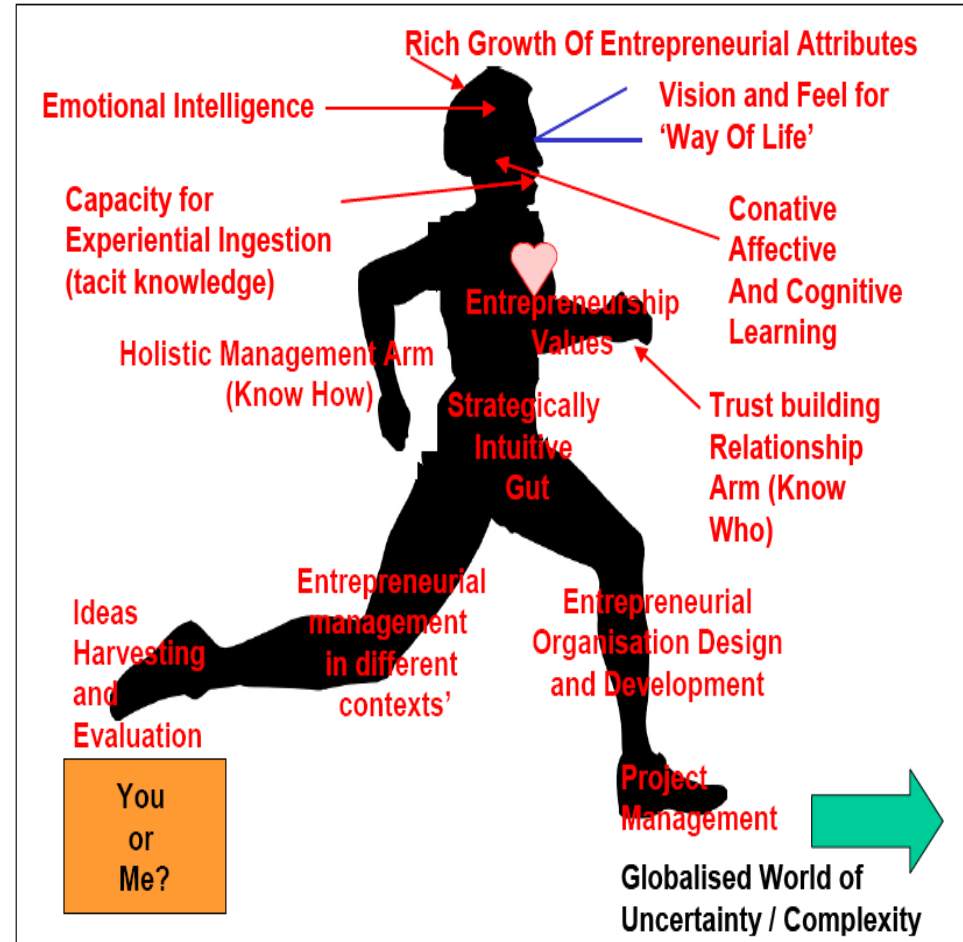
Cross-Faculty Multi-disciplinary approach.

### **Targeted Action 3: ITB / NUIG**

Leveraging of activities from incubation/technology transfer offices.

### **Targeted Action 4: ITS**

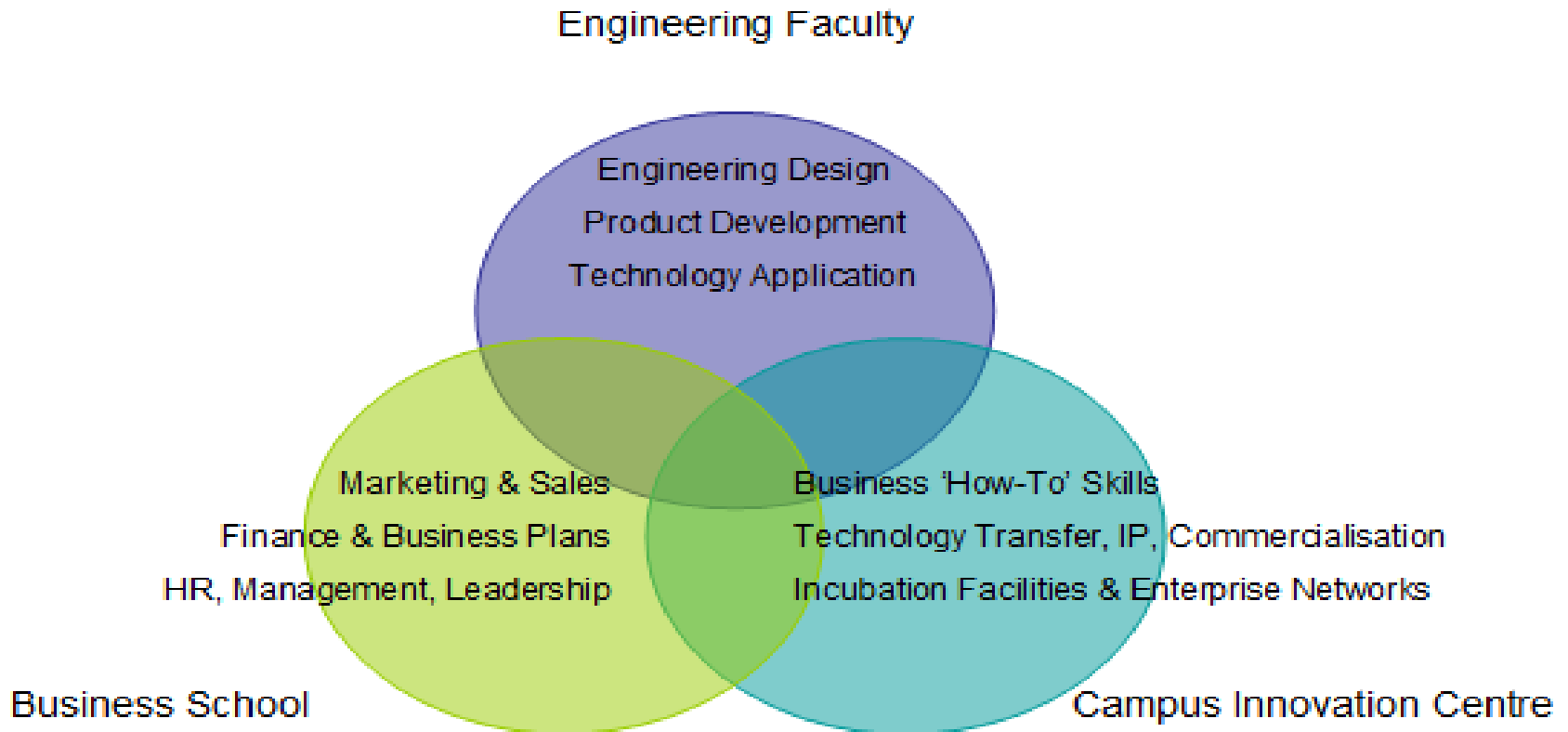
Educational Organisation and Culture Change



Source: NCGE

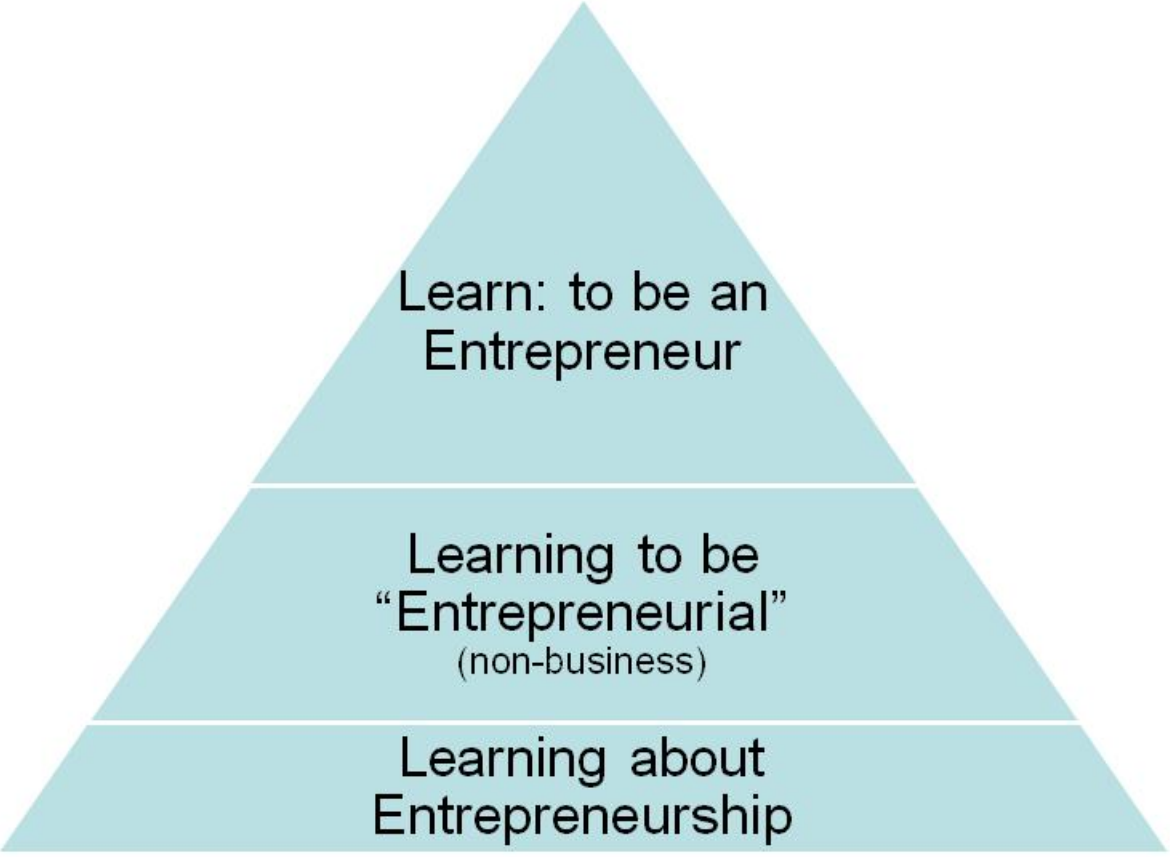
# Cross-Campus Nature of Entrepreneurship Education

*Entrepreneurship is a Team Sport*



# Bloom's Taxonomy of Learning Objectives

## *Creating the Entrepreneurial Graduate*



Learn: to be an  
Entrepreneur

Learning to be  
“Entrepreneurial”  
(non-business)

Learning about  
Entrepreneurship

**Level 9**

Synthesis / Evaluation/  
Create

**Level 8**

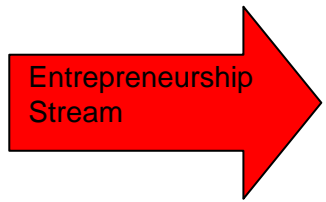
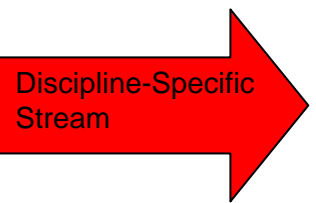
Apply / Analyze

**Level 6 / 7**

Remember / understand

# MSc in Technology Entrepreneurship

## *From Academia to Enterprise*



### Graduate Engineering Enterprise Accelerator

Professional Engineering Design Practice  
5 Credits

Advanced Engineering Design CAD/CAM  
5 Credits

- Commercialisation Workshops (Technical)
1. Design of Experiments (DOE)
  2. Multi-disciplinary Design Optimisation (MDO)
  3. Sustainable Design
  4. Emerging Design Methodologies
  5. Statistics for Engineers Sciences

10 Credits

**PACE 0:**  
Technology Opportunity, Scanning & Market Evaluation Phase

10 Credits  
**PACE 1:**  
Market Research & Eng. Design

10 Credits  
**PACE 2:**  
Development & Prototyping

10 Credits  
**PACE 3:**  
Test & Qualification

**PACE 4:** 30 Credits  
Pilot, Launch & Business Development

PG Diploma  
BN523

Masters:  
BN524

Phase 0  
Exit Review

Phase 1  
Exit Review

Phase 2  
Exit Review

Phase 3  
Exit Review

Phase 4  
Exit Review

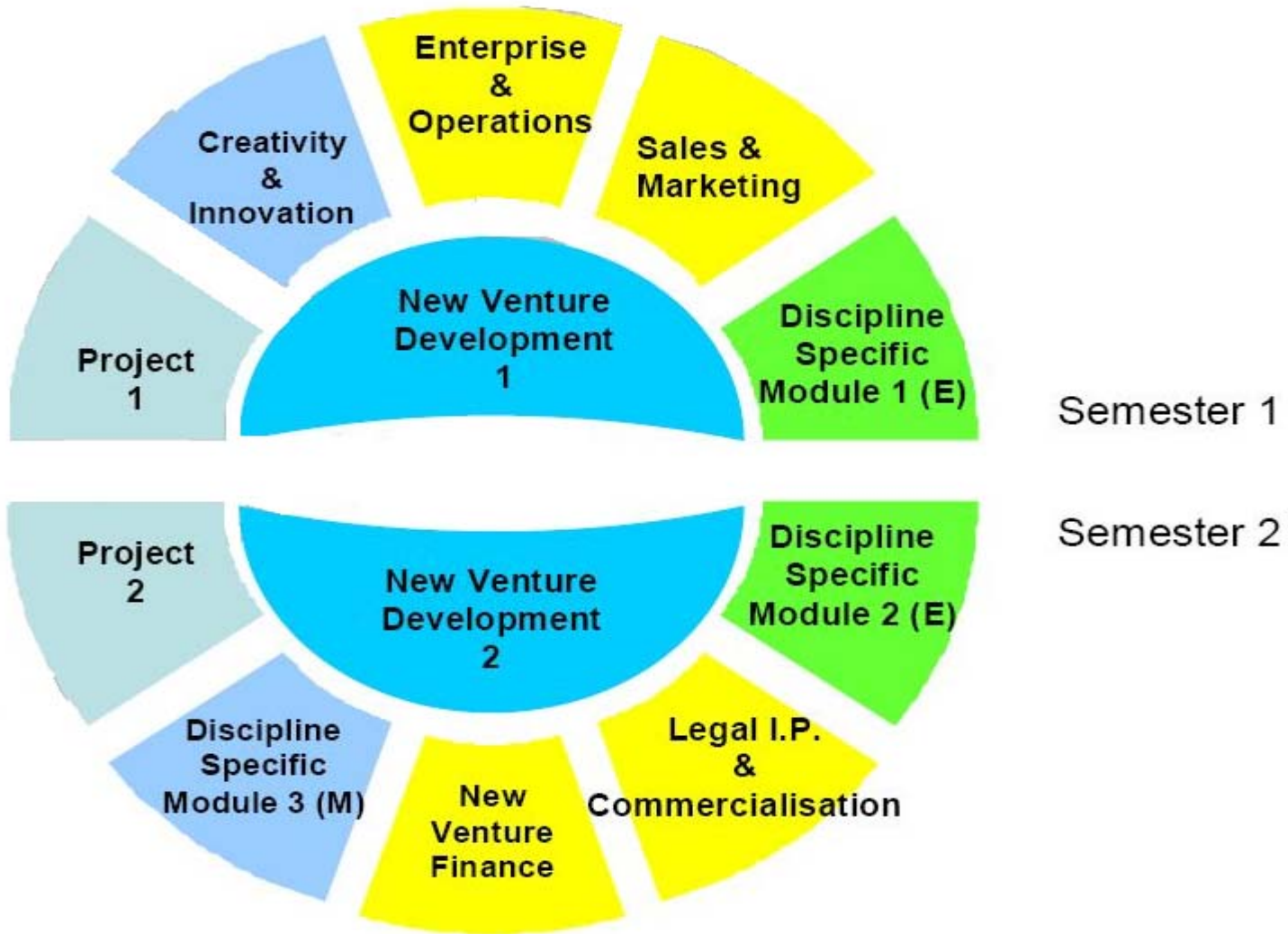
IP & Technology Commercialisation  
5 Credits

Marketing & Financing Technology Products  
5 Credits

- Commercialisation Workshops (Business)
1. Creativity, Innovation, Teambuilding
  2. Tax & Accounting
  3. Legal Issues for Start-ups
  4. Exit Strategies & Investment Science
  5. International Entrepreneurship Week

# BSc (Hons) in Engineering Entrepreneurship

*Creating Entrepreneurial Engineering Graduates*

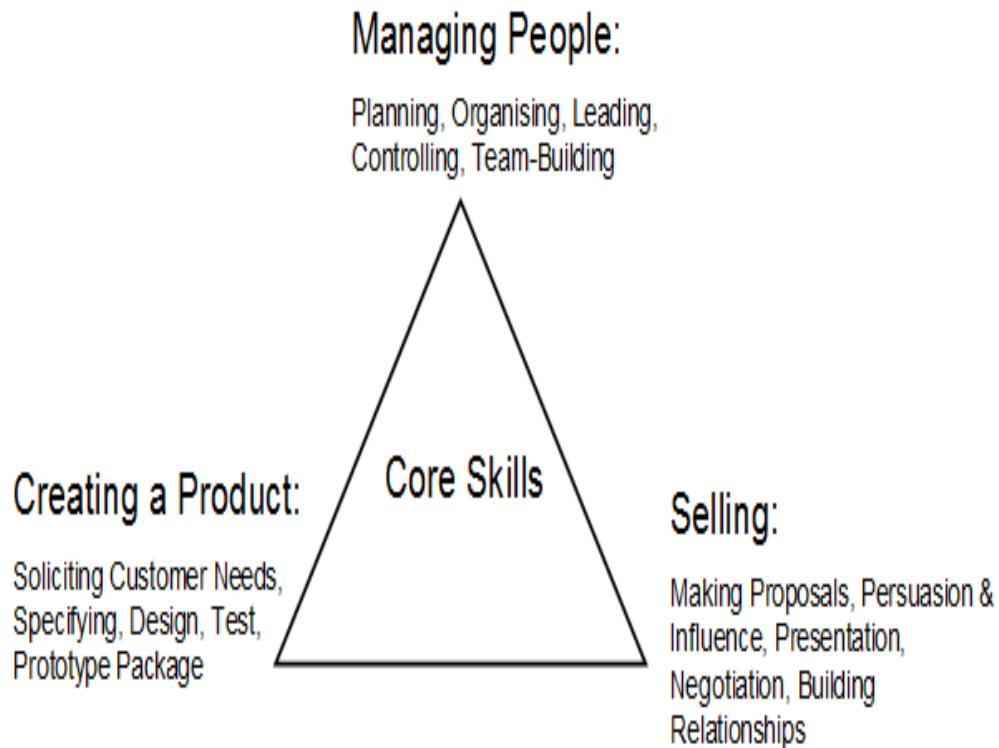


# What issues will these programmes address?

- Technology typically not exposed to Entrepreneurial Opportunities
- Entrepreneurship Currently perceived by Engineers as ‘Business’
- Teaching Competencies outside Business School in HEI’s limited.
- Overriding Pedagogy is the “Business-Plan” not ‘Experiential’
- No Awards & Standards for Entrepreneurship: “Know-Who” is Missing
- Commercialisation Exposure for Researchers Very Limited
- Very few “spinouts” from academia through campus incubator
- Little Involvement by Entrepreneurs and Enterprise Support in the teaching.
- Traditional pedagogies very limited .....
- Science push approach needs to be supplemented by entrepreneurs

# Core Entrepreneurial Skills

*Traditionally Not Addressed in Curriculum*



- \* creative problem solving
- \* persuading
- \* negotiating
- \* selling
- \* proposing
- \* holistically managing  
business/projects/situations
- \* strategic thinking
- \* intuitive decision making under  
uncertainty
- \* networking

# Enterprising Behaviours & Attributes

## Entrepreneurial Behaviours

- \* opportunity seeking and grasping
- \* taking initiatives to make things happen
- \* solving problems creatively
- \* managing autonomously
- \* taking responsibility for, and ownership of, things
- \* seeing things through
- \* networking effectively to manage interdependence
- \* putting things together creatively
- \* using judgment to take calculated risks

## Entrepreneurial Attributes

- \* achievement orientation and ambition
- \* self confidence and self belief
- \* perseverance
- \* high internal locus of control (autonomy)
- \* action orientation
- \* preference for learning by doing
- \* hardworking
- \* determination
- \* creativity

# Alternative Pedagogies

- *Seminars*
- *Case Studies*
- *Problem / Opportunity workshops*
- *Debate*
- *Patent searches*
- *Event management*
- *interviews*
- *Projects*
- *Simulations*
- *Interactive Videos*
- *Games*
- *Service learning*
- *Drawings*
- *Drama*
- *Adventure Training*
- *Teaching Others*
- *teaching Others*
- *Counselling*
- *Role models*
- *Competitions*
- *Audits*

# The Business-Plan:

## A Metaphor for Entrepreneurship Education



Chalk-Talk - 5 Mn  
Key Venture Elements



15 Minutes Formal  
Presentation



Prototype Demo

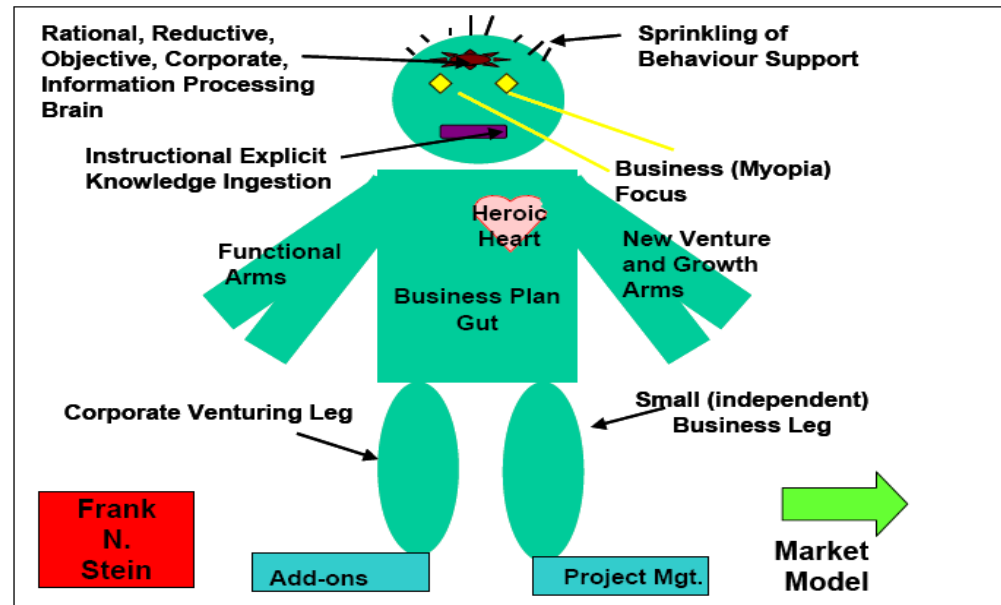


Professional Explanation of  
your Venture



Elevator Pitch  
Synopsis of Core Idea

- Business plan as a verb;
- The business plan is plural
- The business plan is not the goal. The goal is the 'deal'



# Conclusions ....

- Traditional Business-Plan Focus
- Competencies Migrating from Business School
- Enterprising Teaching, Curriculum, Pedagogies that Stimulate Enterprising behaviour.
- Cross - Campus
- Entrepreneurial graduates might not start businesses until their 40's
- Creativity, Innovation & Teamwork
- Roles Models: Improves Self-confidence for Business Entry