

# Innovation and Technology Management

OENG1115

Lecture 4

# Today's Session Overview

Time	Activity	Comment
5:30pm	Lecture	<ul style="list-style-type: none"><li>• Welcome</li><li>• Course Content<ul style="list-style-type: none"><li>• Review of Module 3</li><li>• Corporate strategies for innovation</li><li>• Business planning</li><li>• Assessment 2</li></ul></li></ul>
7:30pm (approx)	Tutorial	<ul style="list-style-type: none"><li>• Assessment 1 - General Feedback</li><li>• Assessment 2 - Deep Dive<ul style="list-style-type: none"><li>• General Questions</li><li>• Specific Assistance</li></ul></li></ul>

# Lets Briefly Revisit Last Session

Strategy



To Achieve A Goal



You Need A Strategy



and....Backup Plans



Intellectual Property is a Source of Market Power

IP refers to *products* or *processes* that result from creations of the mind



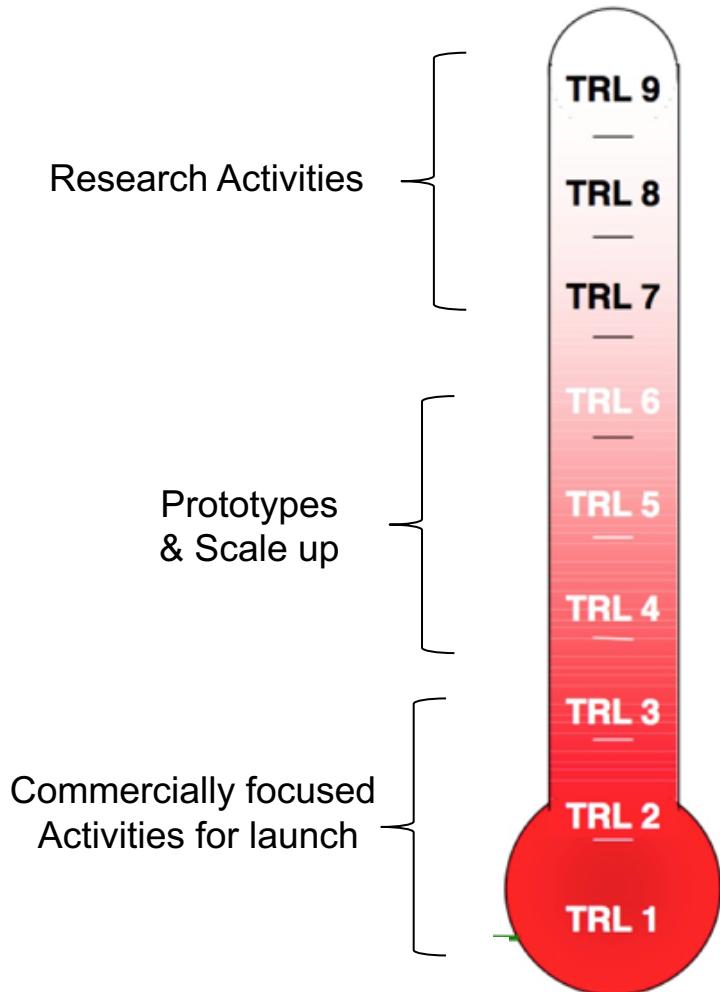
# Long Term Innovation & Technology Strategy

- Goal to achieve: an enduring competitive advantage (triple bottom line)
- According to Rieck and Dickson: there are six key elements:
  1. Setting horizons (*what industry do we want to be in into the future*)
  2. Industry forecasting (*where is that industry segment heading – road mapping the future of that industry*)
  3. Technology positioning (*what technology {capability} will we need to reach our goals, now and in the future*)
  4. Technology availability (*where will we source it:- ‘buy it’ or ‘invent it’ or ‘license it in’*)
  5. Appropriating technology (*how will we best integrate the technology into our business, do we have the skills*)
  6. Managing technology (*how will we maximize the value of our technology {portfolio} within our business over time*)

# Technical Readiness Levels

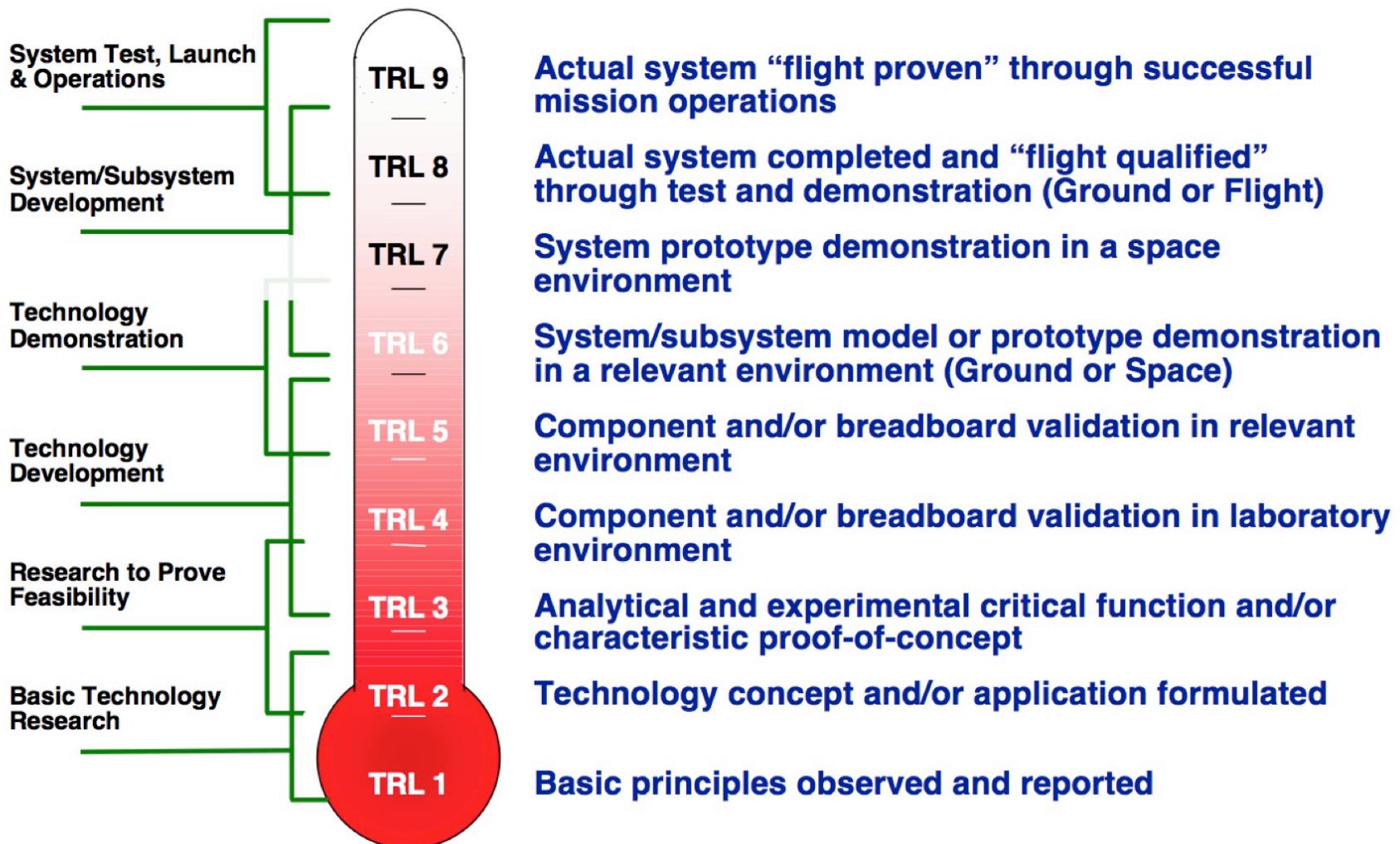
Technology Readiness Levels described in the diagram accurately identify what stage of maturity a technology is at.....

Yes or no ?





# NASA/DOD Technology Readiness Level



# Intellectual Property (IP) Management

- Intellectual property can be considered like residential property.
- Consider patents
  - You can buy and sell patents
  - They give you an opportunity to exclude others from your patented space
  - You can license them out (akin to renting them out)
  - You can license in others patents (akin to paying rent to use)
    - Note: A license is simply contractual terms (in the form of a contract) surrounding the patents use and compensation thereof back to the patent owner.
- There are many different types of intellectual property such as:
  - Patents
  - Registered designs
  - Trade secrets



# Intellectual Property (IP) Management

- Important to develop an IP strategy up front:
  - What sort of business you are in
  - What do you want to protect
  - Its importance to your goals
  - Your budget (to file and potentially defend)
  - Your tolerance to it entering the public domain
  - The countries relevant to your market
- Engage professional advice
  - Consider your options
  - Consider confidentiality agreements to protect conversations



# Intellectual Property.....

Question 1.

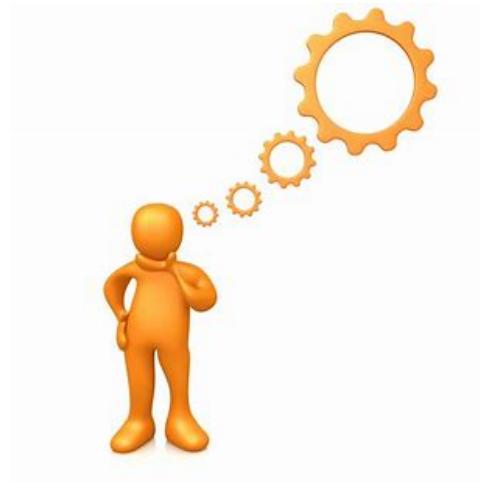
- Patents keep your invention a secret
- Yes or No ?



# Intellectual Property.....

## Question 2.

- My worldwide patent will protect my invention everywhere
- Yes or No?



# Intellectual Property.....

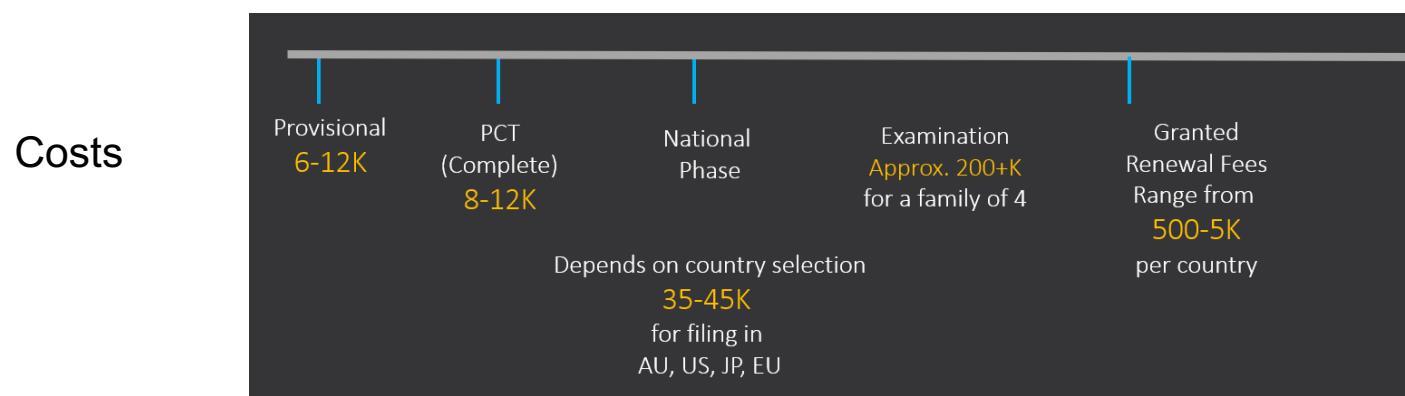
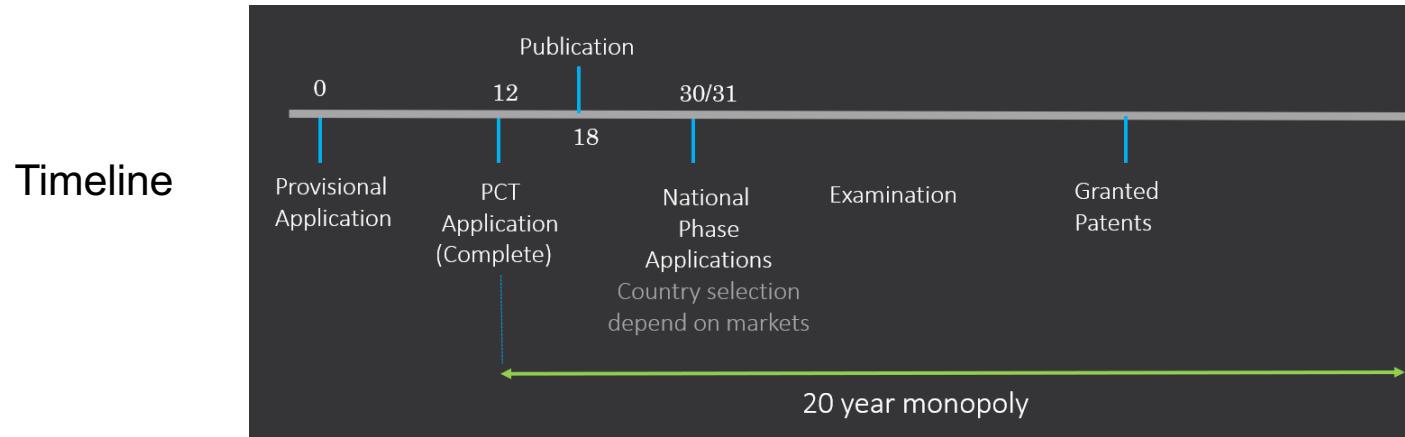
Question 3.

- My patent allows me to exploit my invention without concerns
- Yes or No?



# Intellectual Property (IP) Management

- Patents can be expensive and the process time consuming.



## Pending the industry it can take significant time INVENTION TO COMMERCIALIZATION

Materials Technology	Invention	Widespread Commercialisation
Vulcanised rubber	1839	late 1859
Low-cost aluminium	1886	early 1900s
Teflon	1938	early 1960s
Titanium (used as a structural material in the aerospace industry)	mid 1940s	mid 1960s
Velcro	early 1950s	early 1970s
Polycarbonate (used in bullet proof “glass”)	1953	about 1970
Gallium Arsenide (used in semiconductors)	mid-1960s	mid-1980s
Diamond-like thin films (used to coat hard disk drives)	early 1970s	early 1990s
Amorphous soft magnetic materials (used in transformers)	early 1970s	early 1990s

# Organisational Approaches To Innovation

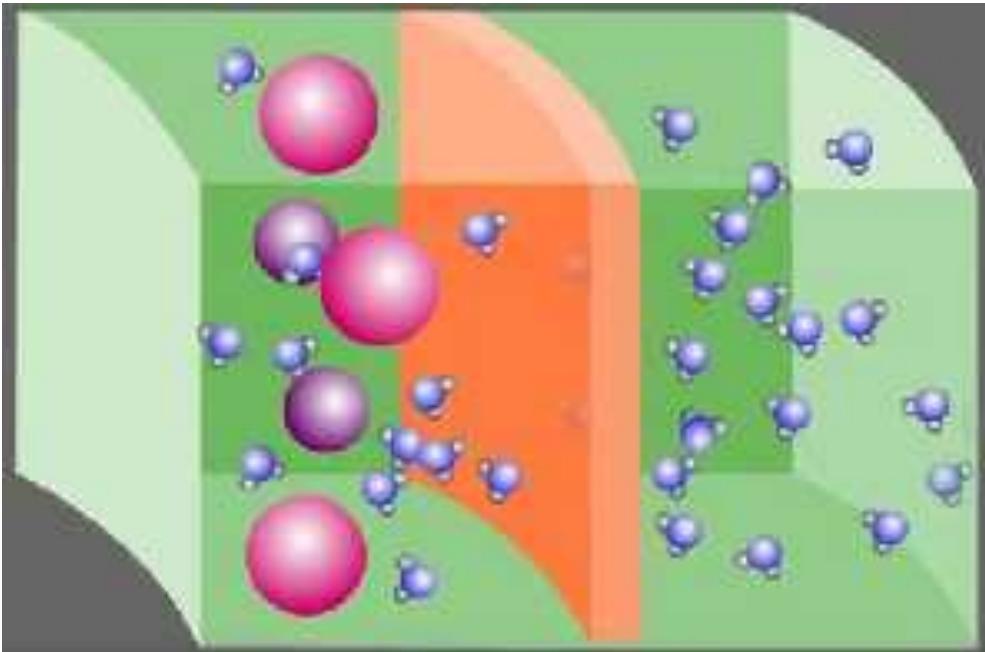
- Organisational strategies to promote and capitalise on innovation vary.
  - Culture of the organisation
  - Based on the topic
  - Its strategic importance now and into the future
- How might the company fulfil ambitious goals ?
  - Everyone has limitations on budget, time, staff capability or infrastructure?
  - Can an organisation do it alone ?
  - How might an organisation keep up-to-date with the latest developments ?

# Organisation 1. Closed Approach



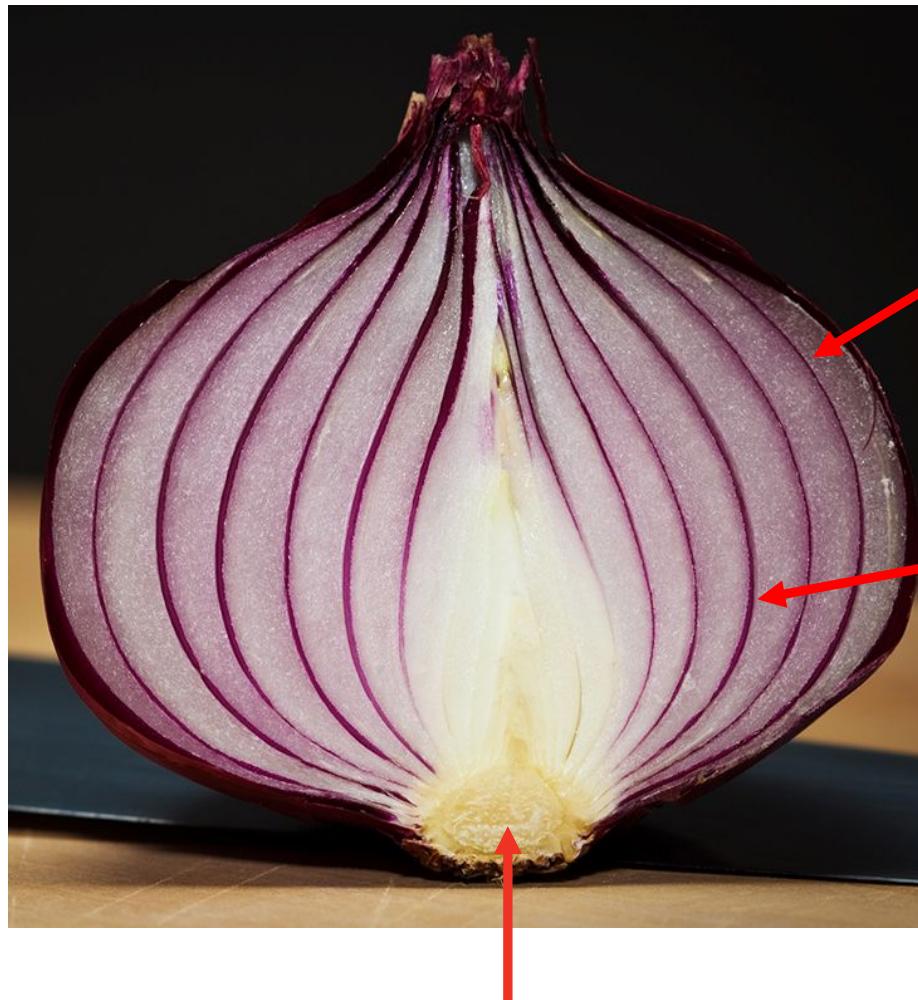
- A non-permeable exterior for competitive advantage
- Trade secrets
- Typical of smaller organisations.....why ?
- Viable long term ???

# Organisation 2. Open Innovation



- A permeable exterior
- Requires more sophisticated organisations and systems
- Recognition that delivering on their goals (competitive advantage) may require technologies and skills outside of their organisation

# Organisation 3. Hybrid Model (More typical)



Collaborate  
based on trust:  
New Relationships  
(Open)

Collaborate  
based on trust:  
Strategic Alliance  
(Open to some)

Core elements: Trade secrets (Closed)

# Open Innovation (i)

- Open Innovation is the purposeful use of inflows and outflows of knowledge to:
  - i. Accelerate internal innovation, and
  - ii. Expand the “markets” for external use of innovation
- Chesbrough realized that it is possible to distinguish two conceptually separate dimensions of Open Innovation:
  - i. Inbound (outside-in) open innovation,
  - ii. Outbound (inside-out) open innovation

<http://www.innovationmanagement.se/2013/07/17/open-innovation-past-and-present-an-exclusive-interview-with-henry-chesbrough/>

# Open Innovation (ii)

## Inbound Open Innovation

- The practice of “leveraging” the discoveries/capabilities of others.
- Entails opening up to and establishing relationships with external organisations with the purpose of accessing their technical and scientific competences for improving the firm’s innovation performance
- Examples include:
  - University - Industry collaboration
  - Research contracts
  - Licensing in technology
- Process is well established for both high tech companies as well as traditional industries

# Open Innovation (iii)

## Outbound open innovation

- “Rather than relying entirely on internal paths to market, companies can look for external organisations with business models that are better suited to commercialize a given technology”.
- It is the practice of establishing relationships with external organisations with the purpose of expanding their capacity/channels to commercially exploit innovations
- Examples include:
  - Licensing technologies out to another company
  - A technology companies main business is the commercial supply of technologies
- Strategy generally less utilized in traditional industries

# Technology Licensing



LICENSING

Get in touch with our Licensing Team

Licensee Login



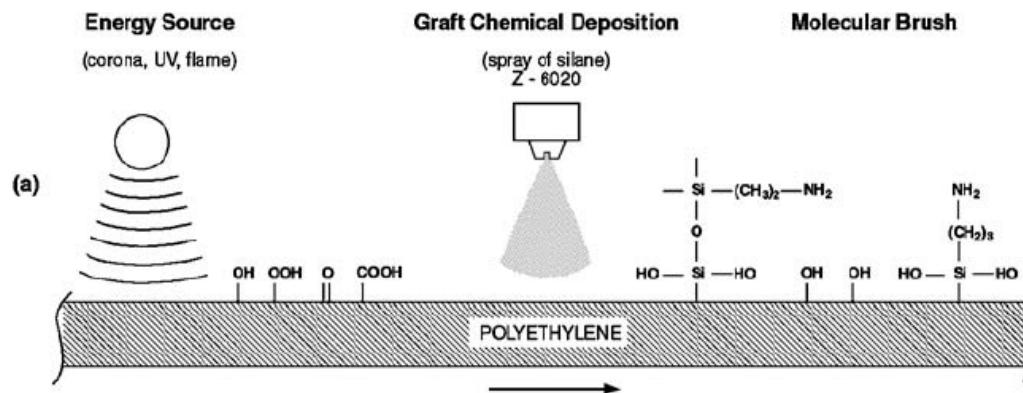
Partnering to Lead and Define the Future of  
Industries

Click to View Video →

## Licensing

New technology is challenging, costly and time-consuming to develop. In today's fast-paced world, partnering to use technology in new and better ways can be as effective as creating the IP itself. GE's Licensing team provides access to GE's patent portfolio and technical and intellectual resources. Licensees receive world-leading technology paired with advice and guidance to accelerate their technology development and achieve market differentiation.

# Example: Surface Treatment Technology

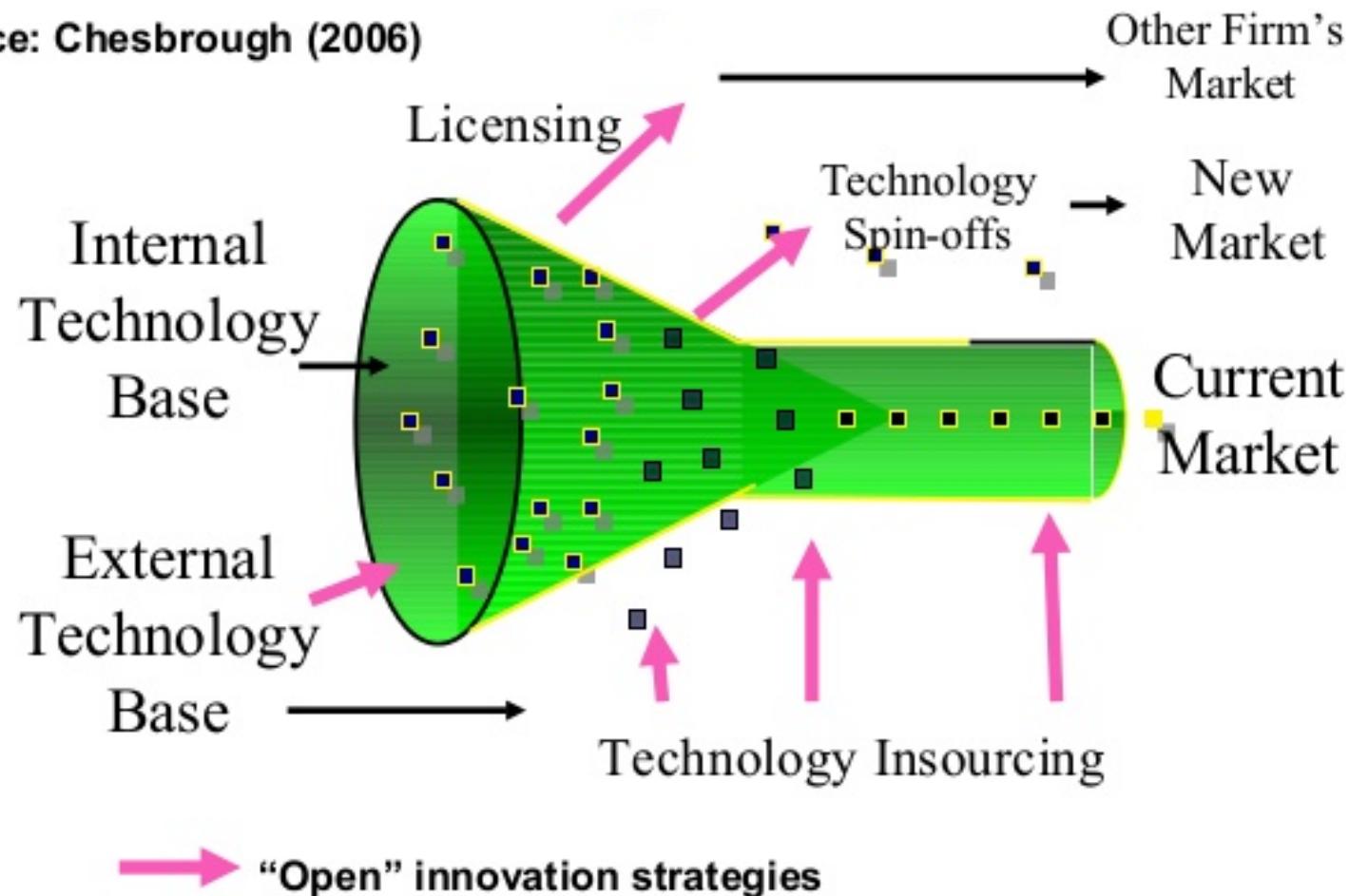


# Due Diligence

- Need to do your homework
- What are we looking to achieve..... is this the best way?
- Must understand the:
  - Technology or opportunity and what it is worth to you
  - IP landscape, do you actually need a license ?
  - Partner organisation, its motives, credentials and capabilities
  - Your ability (capability) to actually implement the technology
  - Companies business model and longer term objectives.
  - On-going management, costs and markets opportunity

# Open Innovation Funnel

Source: Chesbrough (2006)



# Open Innovation Traps

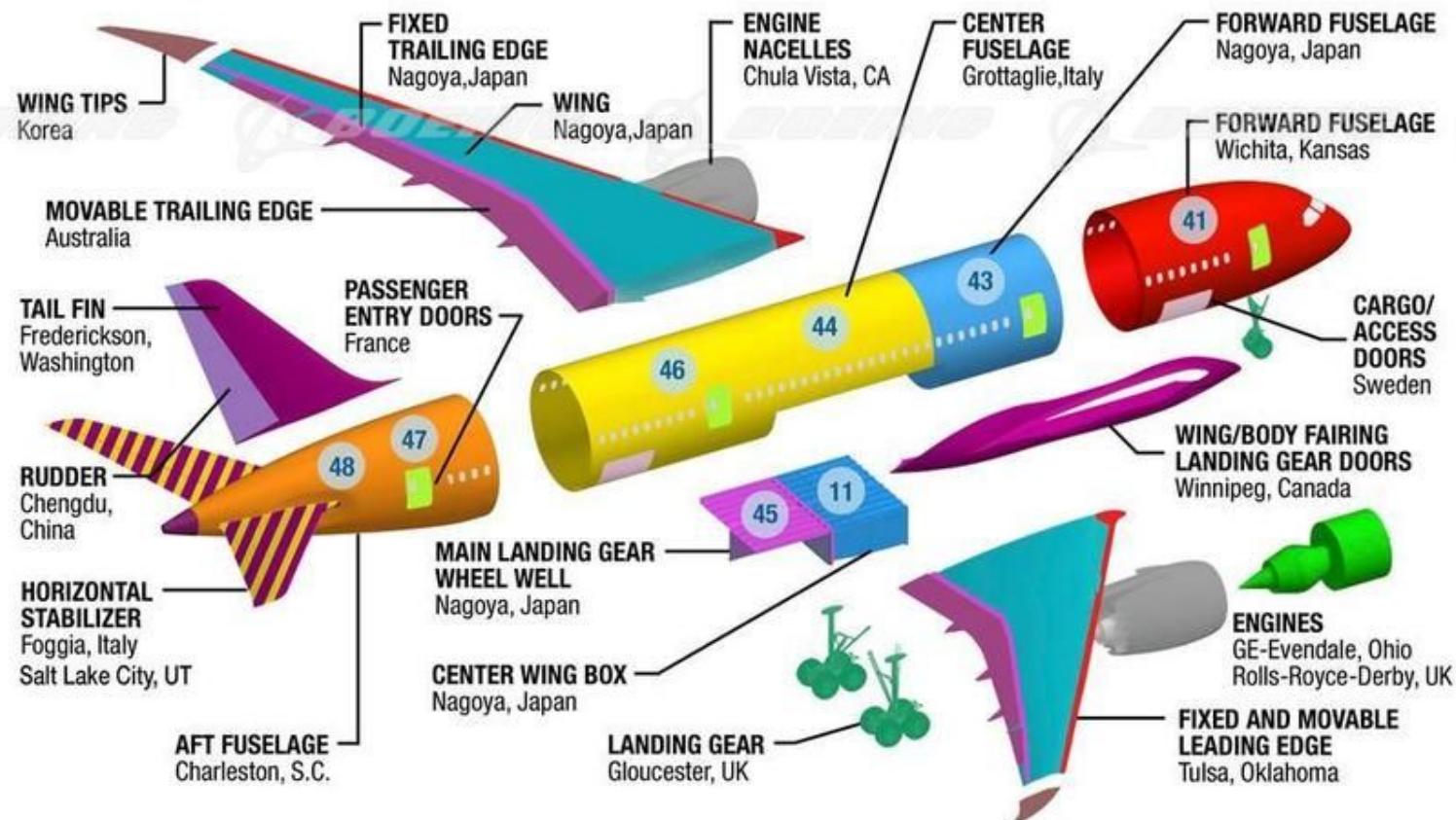


## Boeing 787 – A case for too much open innovation ?



# Partners across the globe are bringing the 787 together

THE COMPANIES				
U.S.	CANADA	AUSTRALIA	ASIA	EUROPE
Boeing Spirit Vought GE Goodrich	Boeing Messier-Dowty	Boeing	Kawasaki Mitsubishi Fuji KAL-ASD Chengdu Aircraft Industrial	Messier-Dowty Rolls-Royce Latecoere Alenia Saab



# Transportation



# Assembly



# Lesson Learnt

- Boeing used a “very” open innovation approach to develop and supply 787 components
- Amount of outsourcing/partnering for 787 over earlier planes grew from 30 to 50% for their previous models to 70% for the 787.
- Boeing embraced outsourcing in the 787 as a means of:
  - reducing costs
  - the time for development,
  - co-design principle
  - tap into the world’s best !!!
- What could go wrong??



# Lessons Learnt

Boeing made it work but.....

## Lack of coordination:

- Hart-Smith from Boeing stated, “It is necessary for the prime contractor to provide on-site quality, supplier-management, and sometimes technical support. If this is not done, the performance of the prime manufacturer can never exceed the capabilities of the least proficient of the suppliers.

**Recognition of the cultural and language differences and the physical distances:** involved in a lengthy multi-national supply chain create additional risks.

- “Mitigating them requires substantial and continuing communications with the suppliers and on-site involvement, thereby generating additional cost” Hart-Smith added



# Business Planning and Mounting A Business Case.....

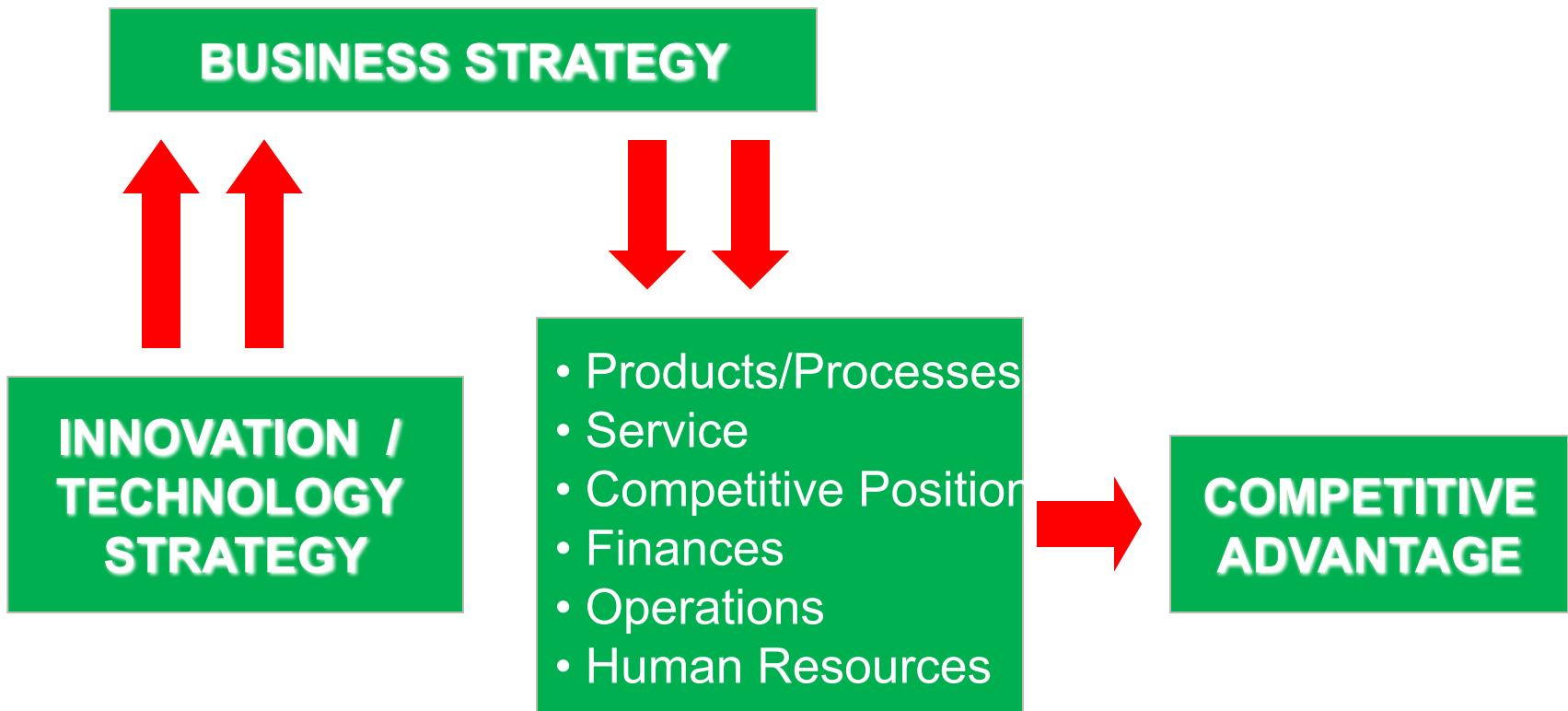


# Planning

Whether the company is large or small, a key determinant of success is its ability to plan and effectively execute those plans – **success rarely happens by accident.**

- A business plan will help to determine if the business idea is viable and assist with the development of the path forward to reach goals
- It gives your business direction, defines your objectives, maps out strategies to achieve your goals and helps you to manage possible bumps in the road.
- Preparing a business plan will help you work out the goals you want to achieve, and the strategies to achieve them.
- The planning process also helps you to consider possible bumps in the road and put a plan in place to better manage them if they do come up.
- Technology or Innovation strategy should be an input to the overall business strategy (as articulated in the business plan)

# INNOVATION / TECHNOLOGY STRATEGY MUST SUPPORT AND SHAPE BUSINESS STRATEGY

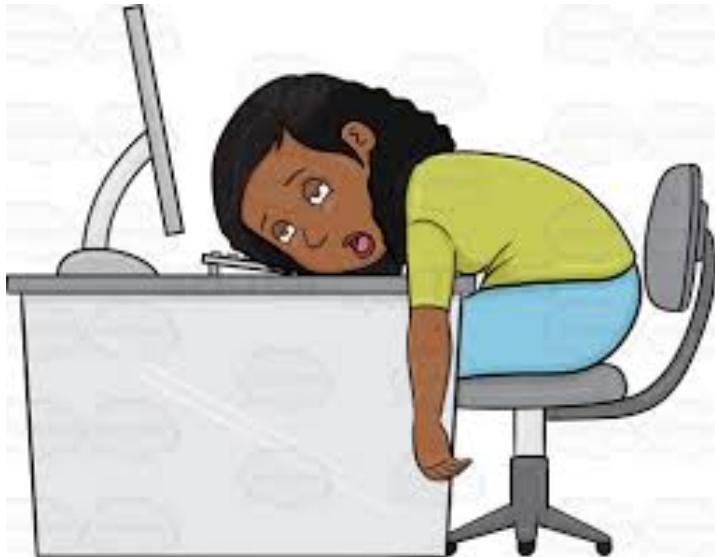


# Business Plan – Should Consider:

- Company Purpose: Vision, Mission, Values
- Industry, market and competitors
- Where you are in the market and where you're headed
- Identify challenges you may come across and work out strategies to avoid or overcome them
- Understand your business finances, including managing cash-flow and determining your break-even point
- Set specific goals, timeframes for achieving them and how you'll measure performance
- Make sound business decisions that focus your activities, maximise your resources and give you a competitive edge.
- The winning team
- See resources on Canvas for business plan templates

# Business Planning.....

This seems exhausting – is there another way to get started ?



# Lean Start Up Concept

- Recognition that conventional methods of business planning are often ineffectual for start-ups.
- In some industries business plans are often off target or outdated before they can be implemented
- Lean Start Up methods favour experimentation over extensive business planning
  - Minimum viable product (or representation of the idea)
  - Test voice of customer
  - Redesign using market pull approach –then iterate or pivot
- Even large organisations like GE also adopting this approach to become more agile and get to market fast.

Why the Lean Start-Up Changes Everything, Steve Blank, HBR, May 2013.

[http://www.vto.at/wp-content/uploads/2013/10/Why-the-Lean-Startup-Changes-Everything\\_S.Plank\\_HBR-052013.pdf](http://www.vto.at/wp-content/uploads/2013/10/Why-the-Lean-Startup-Changes-Everything_S.Plank_HBR-052013.pdf)

# Lean

# Traditional

## Strategy

Business Model  
Hypothesis-driven

Business Plan  
Implementation-driven

## New-Product Process

Customer Development  
Get out of the office and test hypotheses

Product Management  
Prepare offering for market following a linear, step-by-step plan

## Engineering

Agile Development  
Build the product iteratively and incrementally

Agile or Waterfall Development  
Build the product iteratively, or fully specify the product before building it

## Organization

Customer and Agile Development Teams  
Hire for learning, nimbleness, and speed

Departments by Function  
Hire for experience and ability to execute

## Financial Reporting

Metrics That Matter  
Customer acquisition cost, lifetime customer value, churn, viralness

Accounting  
Income statement, balance sheet, cash flow statement

## Failure

Expected  
Fix by iterating on ideas and pivoting away from ones that don't work

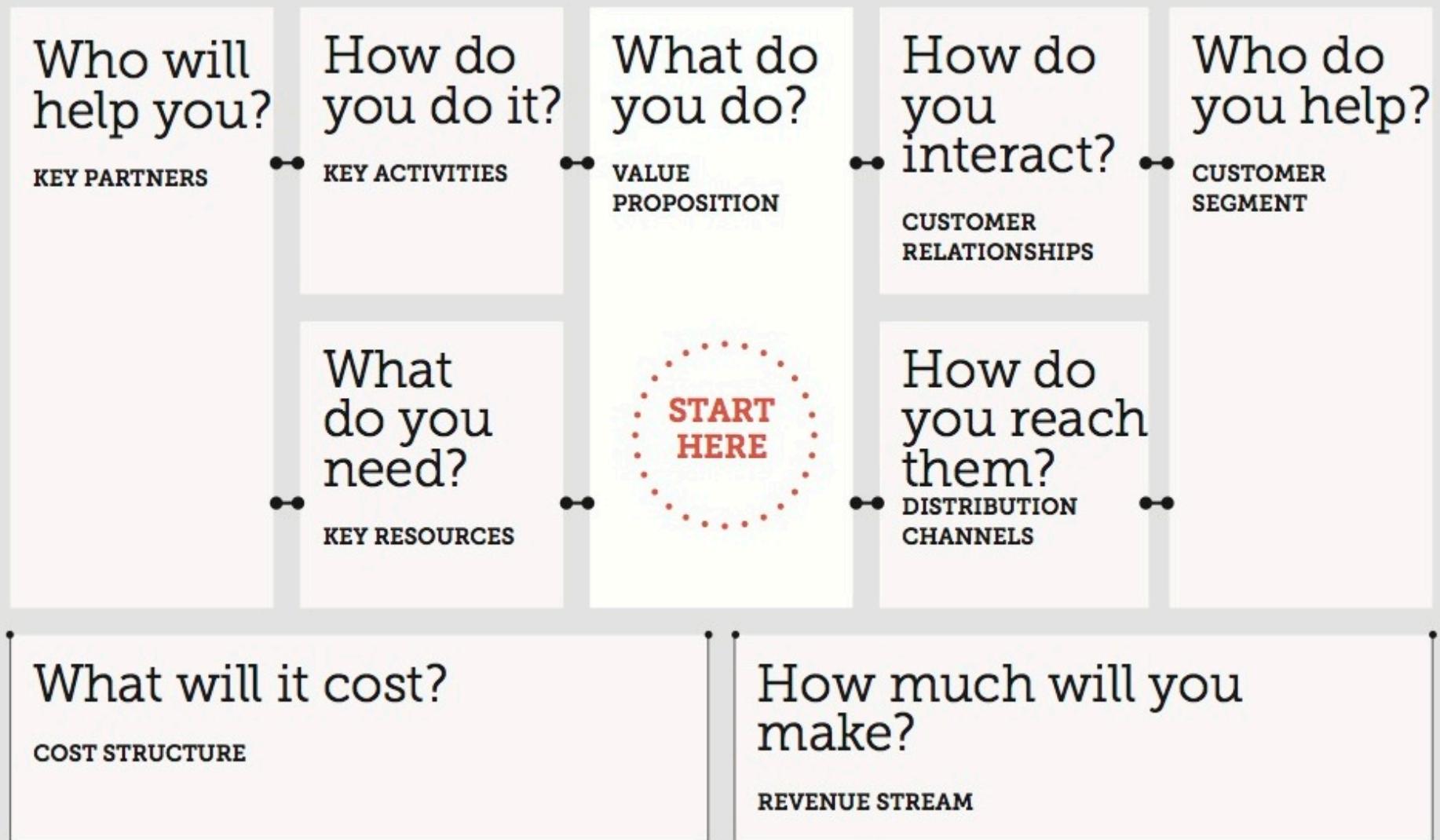
Exception  
Fix by firing executives

## Speed

Rapid  
Operates on good-enough data

Measured  
Operates on complete data

# Business Canvas: all on one page



# Business Model Canvas

<http://diytoolkit.org/tools/business-model-canvas/>

# Mounting a Business Case For A New Technology or Innovation

- A business case is an extension of developing a value proposition.
- Comprehensive case for why change is warranted
- Articulates what is being proposed with reference to alternative options (including do nothing) – its value proposition
- Demonstrates how the proposal supports the overall business goals and is cost effective, safe sustainable and achievable
- Identifies who is responsible and stakeholders interested (both internal and external)
- Documents when eg: a timeline and what is next as a technology roadmap



# Example

Degradable (polyethylene) plastics for single use items like plastic bags.

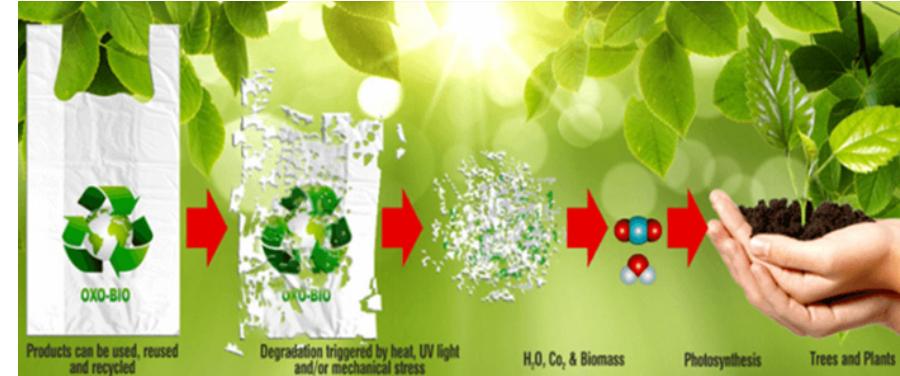


## Background:

- Environmental impact of single use plastics
- Pending regulations
- Loss of market share
- Opportunity for higher value products
- Growing public awareness and brand damage



# Degradable Plastics



## Why:

Environmental impact, brand damage, sales, value add etc

## What:

Place pro-degradant additives into the plastic, alternatives: change plastic type, discontinue product line.

## How:

Maintains business continuity, adds higher value products for low cost, branding, minimal product disruption, potential patent outcomes. Risk - need to validate properties

## Who:

Leadership buy in, outsource research and development, plant trials, test voice of customer, government, regulators, interest groups, general public

When: 2 year horizon to test market, longer term bio-sourced and bio-degradable plastic

# Heilmeier's Catechism: Can be used to assist you in preparing a Business Case

1. What are you trying to do? Articulate your objectives using absolutely no jargon. What is the problem? Why is it hard?
2. How is it done today, and what are the limits of current practice?
3. What's new in your approach and why do you think it will be successful?
4. Who cares? Should mention key stakeholders.
5. If you're successful, what difference will it make? What impact will success have? How will it be measured? What is the risk of doing nothing ?
6. What are the risks and the payoffs?
7. How much will it cost?
8. How long will it take?
9. What are the midterm and final "exams" to check for success? How will progress be measured?

George H. Heilmeier

*IEEE Spectrum*, Volume 31, Issue 6, June 1994, Pages 56 – 59

# Assessment 2

# Assessment 2 Overview

- **Assessment item 2:** Innovation and technology management report (individual assessment)
- **Weighting of final grade:** 50%
- **Related course learning outcomes:** 3
- **Description:** Based on one of the project concepts, you will submit an individual report on your work integrating and applying key operational aspects of managing innovation and technology to a collaborative engineering project –
- **Report length:** The report will be 2500 to 3000 words (excluding references, images, tables, graphs and captions thereof)
- **References:** Expected to be at least 15 min
- **Due:** 4<sup>th</sup> October 2020, 11.55 pm

# Assessment 2 Detailed Task.

Based on either project option 1, 2 or option 3 you will prepare a detailed report for managing innovation and technology to deliver a specific and defendable operational outcome. You will:

- Briefly research and outline a specific technology or an innovation that would benefit the project and the objective behind implementing it
  - *Tip: pick one technology or one innovation only. This does not need to be ‘new to the world’ or your personal new idea but rather something that is not normally used in that project area*
- Outline a succinct business case and risks underpinning why the project managers should consider proceeding with your approach
  - *Tip: consider using the Business Canvas and Heilmeier Catechism to help with this*
- Outline a detailed strategy based on sound theoretical reasoning for sourcing / developing the technology or innovation and its integration / commercialization. You will also consider its longer-term management post integration as relevant to the project.
  - *Tip: Consider the whole life cycle from the inspiration for the new technology or innovation through to how you will implement it and manage it longer term*
- Consider implications of intellectual property and its management if applicable.
  - *Tip: Even if you do not view the management of intellectual property as important in your circumstance still note the reasons for why you feel so)*
- Consider organisational culture and key internal and external stakeholders
  - *Tip: who do you need to influence to ensure your new technology or innovation can be successfully implemented)*

# Assessment 2 Rubric

Criterion	Fail (NN)	Pass (PA)	Credit (CR)	Distinction (DI)	High Distinction (HD)
<b>Insight (25%)</b>	No or limited interpretation, analysis or scholarly input	Minimal interpretation, analysis, and depth of thinking than what was presented in lectures	Some interpretation, analysis and depth of thinking over and above lecture materials and readings	Significant interpretation, analysis and depth of thinking. Useful conclusions and approaches	Exceeds expectations in terms of interpretation, analysis and depth of thinking, novel and insightful conclusions and approaches
<b>Content (50%)</b>	Nil or minimal attainment of requirement, off topic, Report is not coherent	Meets minimal requirements for content, on topic but gaps, basic input of information. Broadly report is coherent	Meets requirements for content. Report is coherent	Meets requirements for content, some original content. Report is coherent	Exceeds requirements, significant original content throughout and thorough understanding demonstrated. Report is coherent
<b>Structure and language (10%)</b>	Layout and logic is confusing, language is poor, spelling and grammar mistakes	Structure is sufficient to express content, ideas may be presented in a disorganised manner. Some grammar and spelling issues	Content is generally organised logically; generally, language is appropriately crafted to reflect intent	Structure is sound and supports logical exposition. Easy and interesting to read and digest	Outstanding presentation of materials that supports all requirements. Interesting and insightful language
<b>Evidence &amp; Referencing (15%)</b>	No evidence to support content, copied materials with no citations, weblinks only	Minimal referencing and support provided, inconsistent citation style, mainly weblinks	Most points are supported by evidence with citation generally appropriate and consistent	Excellent integration of evidence into the work, often primary sources used, citations and referencing appropriate and consistent	Outstanding integration of significant research efforts to support arguments. Primary sources used appropriately and consistently