

Innovation and Technology Management

OENG1115

Module 1

Welcome to OENG1115

- Embrace opportunities to expand your knowledge and capabilities through all engagements:
 - Teaching team and guests
 - The student cohort
 - Your personal research and reflection
- The Course is at the interface of engineering & management
 - It may be quite different to your previous course experiences
 - As always you will get out of this Course what you put into it
- Please review Part A and B of the Course Guide



Staff Contacts – We are here to help

Prof Stuart Bateman, Course Coordinator

Tel: 9925 6672

Email: stuart.bateman@rmit.edu.au



Dr Jessirie Dilag, Course Tutor

Email: Jessirie.dilag@rmit.edu.au



Dr Abdullah Kafi, Course Tutor

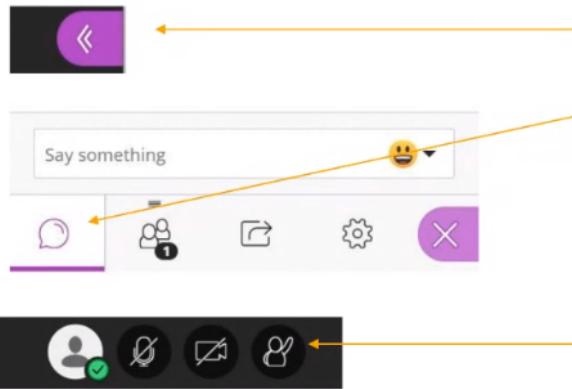
Email: abdullah.kafi@rmit.edu.au



Contact options:

- Book an appointment by sending an email in the first instance
- For all correspondence place **OENG1115** in the subject heading

On-line Delivery: Collaborate Ultra



Open purple tab at bottom right of collaborate screen

Select speech bubble to see chat conversations and find links



Click on raise hand symbol if you want to ask a questions

Microphones and videos on mute during sessions.

Please put these on during breakout groups and coffee breaks to touch base with your colleagues.

If there are technical / internet issues

- Announcements will be made on Canvas

Online etiquette

- Be respectful, supportive and patient
- 'Video off' in the main room to save on bandwidth unless presenting
- Mute yourself during presentations
- Use the 'hand up' function to ask questions
- Use the chat function

Canvas

- Canvas is a key tool you need to review:
- Key information will be shared via Canvas
 - Pre-reading
 - Notes, lecture slides
 - Important updates announced including details of guests, assessment etc

PGRD Semester 2 2020 (2...

Recent announcements

Home Announcements Syllabus Modules Discussions Collaborations Google Drive Assignments Quizzes Grades Collaborate Ultra People Studio Echo360 Conferences Outcomes Pages

OENG1115 Projects and Tutorial Groups
Hi everyone, I wanted to draw your attention to a couple of Course details ahead of next week. 1. The assessment of the ...
Posted on: 24 Jul 2020 at 16:30

Preparation For Module 1
Hi all, Dr Jessirie Dilag, Dr Abdullah Kafi (the Course Tutors) and I are very much looking forward to OENG1115, Innovat...
Posted on: 20 Jul 2020 at 21:00

Module 1.
Dear all, Please see pre-reading and other materials you should review before our first module on the 28th of July in this l...
Posted on: 14 Jul 2020 at 11:45

Innovation and Technology Management (2050)  



5

Learning Objectives

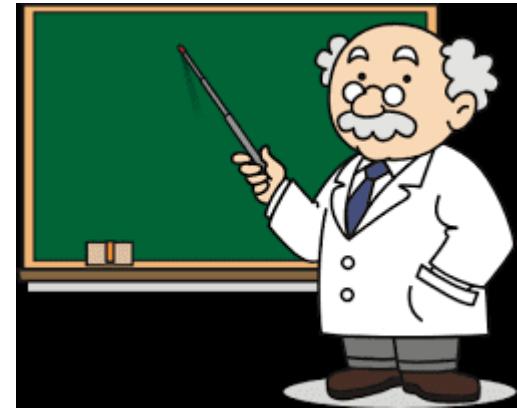
Ultimately you will understand key concepts surrounding innovation and technology management

- Sources of innovation
- Innovation strategies
- Competitive advantage
- Value proposition
- Intellectual property (IP)
- Humanistic aspects: work culture, stakeholders, ethics
- Technology development & implementation strategy
- Building a Business Case
- Making a Pitch



Teaching Schedule

- Innovation and Technology Management will run on Tuesday evenings:
 - Only weeks: 2, 4, 6, 8, 10 and 12.
- The course teaching schedule (inc. subject matter) is subject to change due to unavoidable events. Please review Canvas for updates
- The Course seeks to use a variety of teaching methodologies
 - Project based assessments
 - Blended delivery styles for content, industry guests
 - Lectures start at 5:30 pm (Collaborate Ultra)
 - Tutorials start at 7.30 pm (Collaborate Ultra)
 - Lectures will be recorded



Teaching Content

- **Week 2.** Course overview, key principles strategic frameworks behind innovation and technology management, organisational culture
- **Week 4.** Preparing to innovate, sources of innovation; proposals, presentation pitches, research and development, business canvas
 - [Week 5 Assessment 1 Due: 18th August](#)
- **Week 6.** Capturing value from innovation, internal and external interfaces, change management, knowledge management & intellectual property
- **Week 8.** Technology life cycles, innovation and technology management in large & small firms, managing uncertainty, business plans
- **Week 10.** National and global context, collaboration strategies, incentives, barriers, risks, bench-marking,
 - [Week 10 Assessment 2 Due: 4th October](#)
- **Week 12.** [Assessment 3: Group presentations in class time, 13th October](#)

Project Based Learning



Project Option 1: Light Vehicle Greenhouse Gas Emissions



Project Option 2: Sustainable Options For Road-Rail Separation



Project Option 3: Rolling Stock Rejuvenation

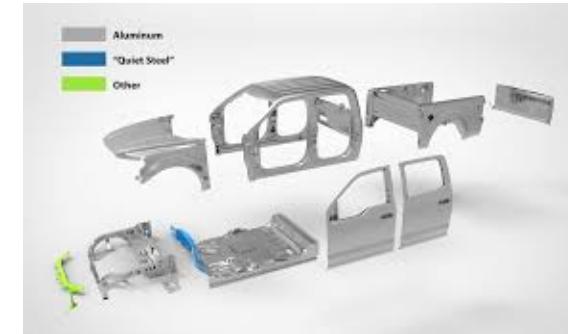
- ❖ Assessment tasks will be completed considering topical projects
- ❖ You can decide which project you would like to use for each assessment task

Project Option 1: Light Vehicle Greenhouse Gas Emissions



Project Option 1: Light Vehicle Greenhouse Gas Emissions

- Australia is considering the adoption of CO₂ emission targets for light vehicles
 - 105 g/km target by 2025 will be inline with other countries
 - currently ~180 g/km is the current Au average
- What innovations or technologies could help us lower our light transportation emissions ?
- Are they practical, cost effective or implementable ?
- Undertake personal research to understand this challenge and technology / innovation options to assist
- See Canvas for initial background resources



Project Option 2: Sustainable Options For Road-Rail Separation



Project Option 2: Sustainable Options For Road-Rail Separation

- The Victorian government is well advanced in its massive rail crossing removal project
- Each rail crossing removal represents unique challenges and business cases for the strategy, design and technologies employed.
- A key objective of the Western Program Alliance is to reduce waste and the environmental footprint of individual projects.
- Can such projects be more sustainable, what new technologies or innovations could be employed, is the value proposition strong ?
- See Canvas for initial resources



Project Option 3: Rolling Stock Rejuvenation



Image Credit: City of Melbourne

Project 3: Rolling Stock Rejuvenation

- Victoria's plan to rejuvenate its rolling stock represents an 'global scale' investment into public transportation.
- Focusing on trams for this project: new rolling stock seeks to improve safety, accessibility, whole of life performance and user experience.
- Boundary conditions include the nature of the fixed infrastructure as well as power supply.
- What innovations could / should be incorporated into a next generation tram - is this feasible and practical?



Image Credits: Rail Projects Victoria., Journal of Transport Geography
Volume 83, 2020, p102657

Assessments

- Detailed descriptions of each assessment tasks are provided in [Canvas – Assignment tab](#)
 - Specific detail for each assessment task
 - The ‘Marking Rubric’ for each assessment task
- Further resources are available in Canvas
 - Library and study support.
 - Policies and guidelines.
 - Plagiarism and contract cheating notes.
- As Masters Students you must undertake your own personal study in addition to Course content to enhance your depth of knowledge



Assessment (1)

- **Assessment item 1:** Innovation and technology management questions
- **Weighting of final grade:** 30%
- **Related course learning outcomes:** 1, 2
- **Description:** You will prepare short answers to questions based on key Course concepts. You will leverage one of the Course project options to provide illustrative examples as necessary.
- **Due:** Week 5, 18th August 2020.

Assessment 1 - Detail

Please provide extended written answers to the following questions utilizing (i) the pre-reading and lecture materials AND (ii) most importantly your own individual research and insights / reflection thereon associated with the project option you have chosen. Write in full sentences, using dot points for clarity only where appropriate and do not forget to reference the points as appropriate.

The total word count for your answers for the three questions combined (excluding references and excluding rewrite of the questions) should be less than 1200 words. The assessment should include a front page clearly outlining (i) your name and student number (ii) assessment title (iii) date of submission (iv) word count.

Question 1.

Outline a number of key areas that should be considered prior to introducing a new technology or innovation into an engineering project. Why is it important to consider these upfront?

Question 2.

Why might you choose a radical approach compared with an incremental approach to innovation? Explain your reasoning.

Question 3.

Briefly describe what is meant by ‘value proposition’. Provide a succinct overview of a new technology or innovation relevant to one of the project options. Outline the new technology or innovation’s ‘value proposition’

Assessment Rubric

Criterion	Fail (NN)	Pass (PA)	Credit (CR)	Distinction (DI)	High Distinction (HD)
Insight (25%)	No or limited interpretation, analysis or scholarly input	Minimal interpretation, analysis, and depth of thinking than what has been 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
Content (50%)	Nil or minimal attainment of requirement, off topic	Meets minimal requirements for content, on topic but gaps, basic input of information	Meets requirements for content, some original content	Meets requirements for content, significant original contributions	Exceed requirements, significant original content throughout
Structure and Language (15%)	Layout and logic is confusing, language is poor, spelling and grammar mistakes	Structure is sufficient to express content, ideas are often present in a disorganised manner. Grammar and spelling issues remain	Content is generally organised logically; some elements need attention generally, language is appropriate	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
Evidence & Referencing (10%)	No evidence to support content, copied materials with no citations	Minimal referencing and support provided, inconsistent citation style	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

Assessment (2)

- **Assessment item 2:** Innovation and technology management report (individual assessment)
- **Weighting of final grade:** 50%
- **Related course learning outcomes:** 3
- **Description:** Based on the project concept, 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
- **Due:** in Week 10, 4th October, 2020

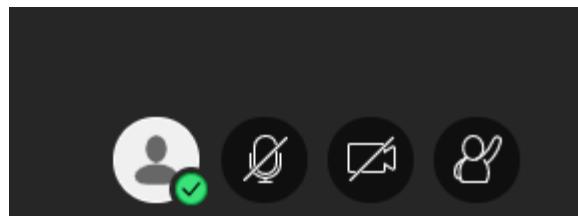
Assessment (3)

- **Assessment item 3:** Integrated project presentation (group assessment)
- **Weighting of final grade:** 20%
- **Related course learning outcomes:** 3
- **Description:** You will work with your group to present and defend the integration and application of key operational aspects of managing innovation and technology to an engineering project
 - Groups of 5 to 7 students
- **Due:** Group presentations in class time, Week 12 (13th October,2020)

Pause:

How is the session going so far for you ?

Digitally put your hand up or use the chat function if you have a question...



Stuart Bateman
Moderator

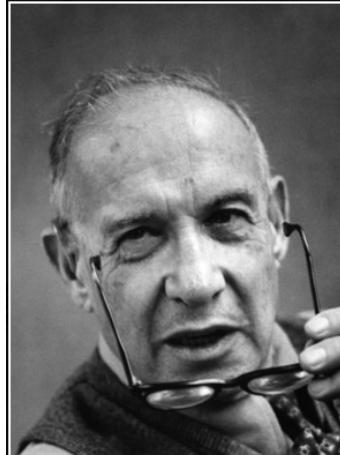
Away Leave session

Feedback

😊 Happy	😢 Sad
😲 Surprised	😕 Confused
⌚ Faster	⌚ Slower

Agree Disagree

Lets Begin Some Course Content



Ideas are cheap and abundant; what is of value is the effective placement of those ideas into situations that develop into action.

— Peter Drucker —

AZ QUOTES



Don't worry about people stealing your ideas. If your ideas are any good, you'll have to ram them down people's throats.

— Howard Aiken —

AZ QUOTES

Source: AZ Quotes

OENG1115



This Course considers why and how best to manage 'doing things differently' (innovation and technology management) to create an advantage

Image Source: ABC and The Age Newspaper

Some Definitions.....

- **Invention**

The Discovery of something new

- It must be useful and is not obvious to persons skilled in the particular field

- **Innovation**

The successful exploitation of new ideas

- Implementation of a new or significantly improved product (goods or service), process, new marketing method or new organisational method in business practices, workplace or external relations.

- **Technology**

Application of (scientific) knowledge for a purpose

- The purposeful application of knowledge in the design, production and utilization of goods and services and in the organisation of human activities

An Invention Example



Wireless Lan (WiFi)

- The invention overcame the issue of multiple, echoed signals traveling from transmitters to receivers.
- The inventive solution was to transmit different portions of a series of signals containing the data over a number of different frequency channels.

United States Patent [19]
O'Sullivan et al.

US005487069A
Patent Number: 5,487,069
Date of Patent: Jan. 23, 1996

[54] WIRELESS LAN

[75] Inventors: John D. O'Sullivan, Ermington; Graham R. Daniels, Willoughby; Terence M. P. Percival, Lane Cove; Diethelm I. Ostry, Petersham; John F. Deane, Eastwood, all of Australia

[73] Assignee: Commonwealth Scientific and Industrial Research Organisation, Australia

[21] Appl. No.: 157,375

[22] Filed: Nov. 23, 1993

[30] Foreign Application Priority Data

Nov. 27, 1992 [AU] Australia PL069

[51] Int. Cl. 6 H04B 7/01

[52] U.S. Cl. 370/94.3; 375/284; 375/348; 455/52.3; 455/65

[58] Field of Search 375/34, 39, 51, 375/57, 58, 99, 101, 254, 261, 279, 284, 285, 346, 348; 370/95.3; 455/56.1, 54.1, 63, 65, 52.3

[56] References Cited

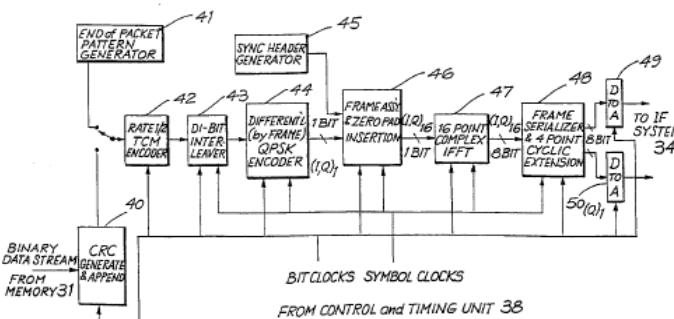
U.S. PATENT DOCUMENTS

3,605,019	9/1971	Cutter et al.	375/58
4,630,314	12/1986	Smith	375/58
4,679,227	7/1987	Hartogs	375/58
4,888,767	12/1989	Furuya et al.	375/58
5,095,535	3/1992	Freeburg	455/55
5,191,576	3/1993	Pommier et al.	370/95
5,283,780	2/1994	Schuchman et al.	455/65

OTHER PUBLICATIONS

Supercomm/ICC'92 vol. 2, Jun. 1992, Chicago US pp. 1025-1031 D. Buchholz et al. 'Wireless In-Building Network Architecture and Protocols' p. 1029, left col., line

72 Claims, 8 Drawing Sheets



An Innovation Example

Solar Panel Integrated Roof Tile

- The innovative use and configuration of solar cells to harvest energy
- Improved aesthetics associated with mounting of roof top solar panels



A Technology Example

Powder Coating

- Polymer powder which is applied electrostatically.
- When heated the powder melts and fuses to form a continuous ‘paint’ film



Source: DuluxGroup,

Staying the same means going backwards.....

Roger Federer



Do you agree ? Yes or No - Please fill in the Survey Poll

Why Do Businesses Innovate....?

Competitive advantage

Capture opportunity or respond to market forces

- The advantage might be economic, social and/or environmental
- New products and services to meet a need
- More efficient production of products and services
- Mechanism to deal with uncertainty,
- Need to consider potentially unintended (negative) outcomes – risk against reward
- Needs to be managed carefully to realise any benefit whilst minimizing risks.

An Australian Context

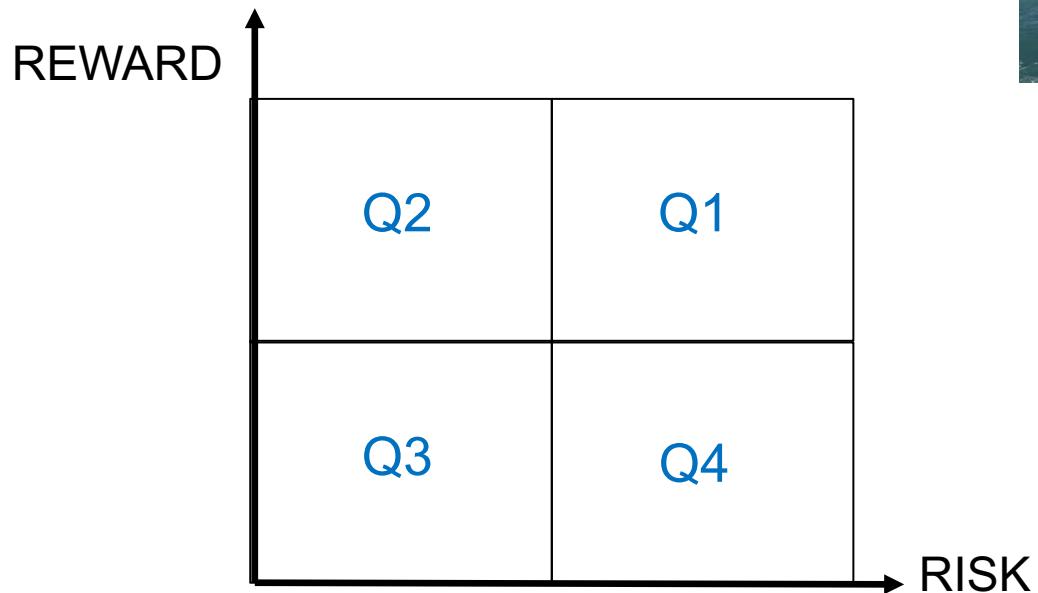
- It's about strategic change to capture opportunities or overcome challenges
 - 92% executives believe it as a main lever to create greater competitiveness¹
 - 91% Australian businesses report a benefit from innovation
- Innovative Businesses are:
 - 31% more likely to increase income and 46% more likely to report increased profitability
 - twice as likely to export and five times more likely to increase the number of export markets targeted
 - twice as likely to increase productivity, employment and training

Risk and Reward

- Risk
 - Of introducing something new
 - Failure
 - Cannibalizing existing offerings
 - Of not doing anything at all
 - How innovative
- Reward (triple bottom line)
 - Economic
 - Environmental
 - Social



Risk and Reward



Which quadrant do business most like to operate in ?

Level of Innovation

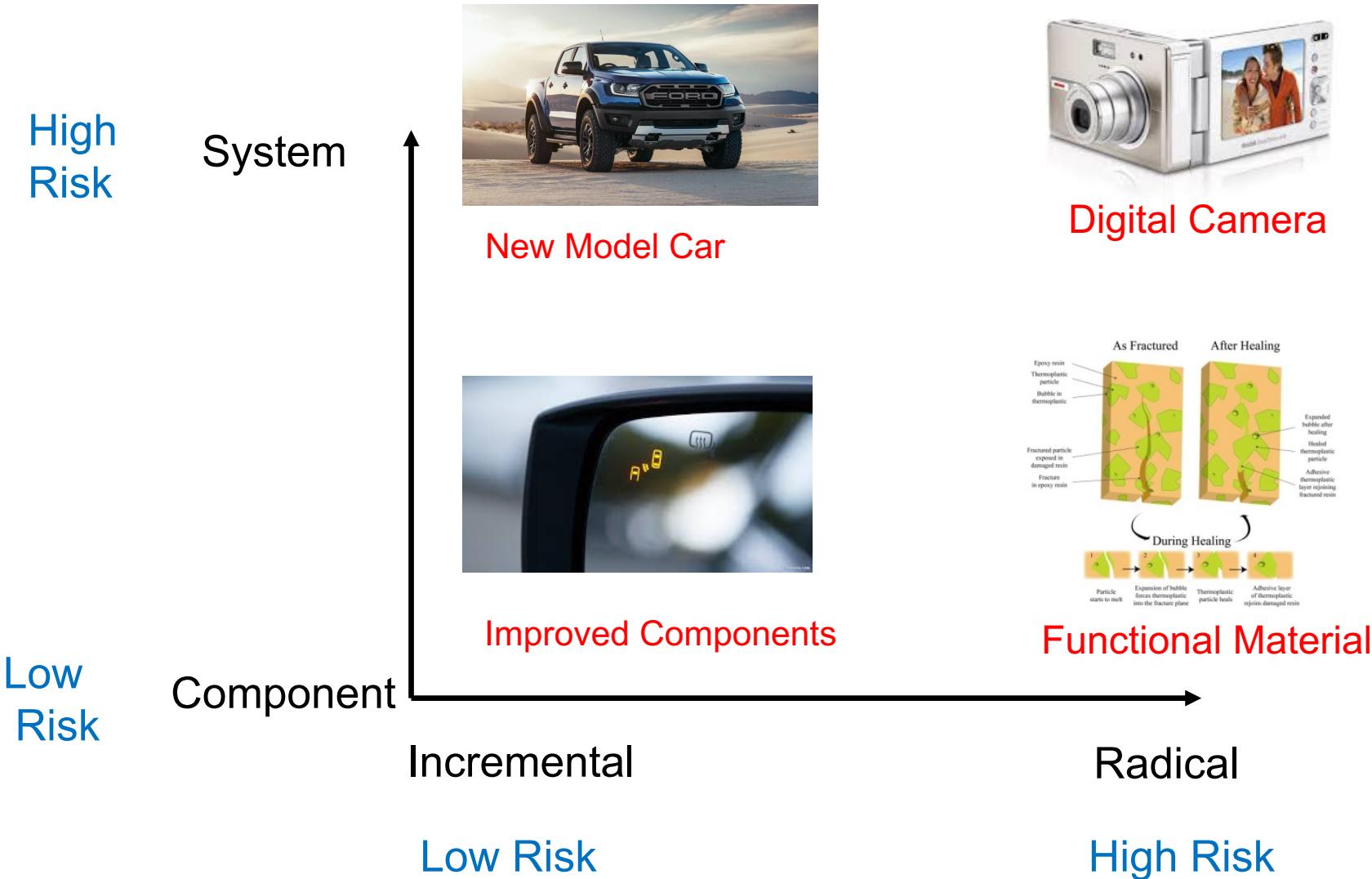


Image Source: Kodak

Types of Innovations

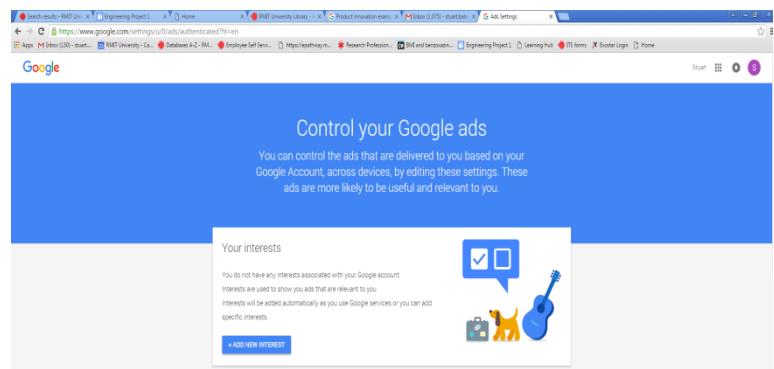
- Product innovation



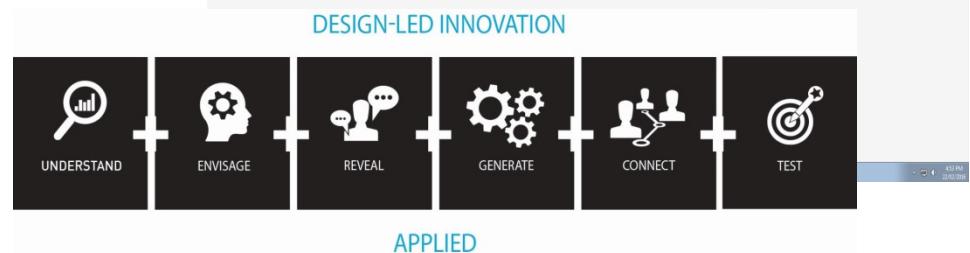
- Process innovation



- Marketing innovation



- Organisation innovation



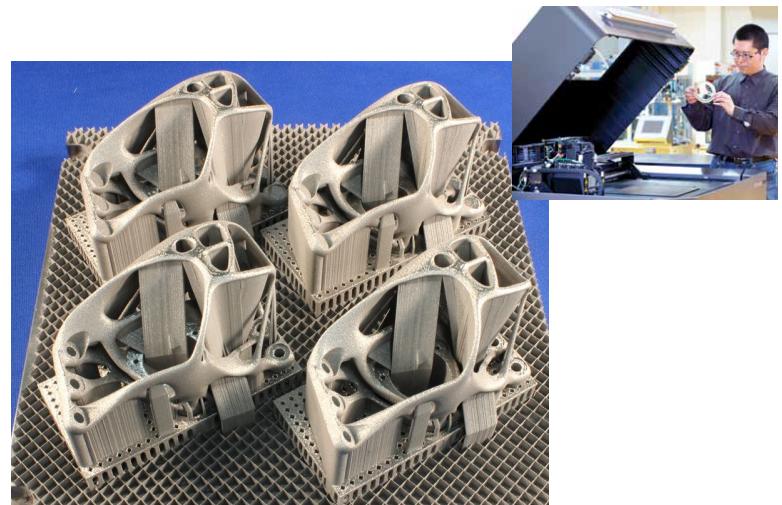
Degree of innovation: incremental

- Small improvements to:
 - Do it more effectively
 - Add a feature
 - Reduce cost
 - etc
- The ball point pen, originally invented in 1957, since then a host of minor refinements, in materials, inks, design have been made.



Degree Of Innovation: Radical

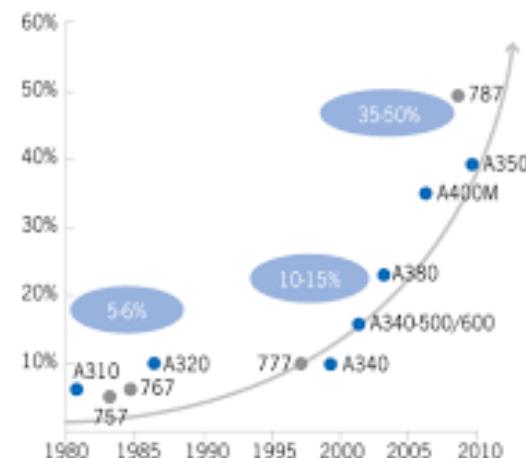
- Additive Manufacturing
 - A radical innovation in the area of manufacturing
- Opportunities
 - Prototyping
 - Customization
 - Direct manufacture of products
 - Part integration
 - Digital – physical link
- New business models
- Even so...stereolithography dates to the 1980s



Iterative : Composite Aircraft

Composites in aircraft have been an evolution

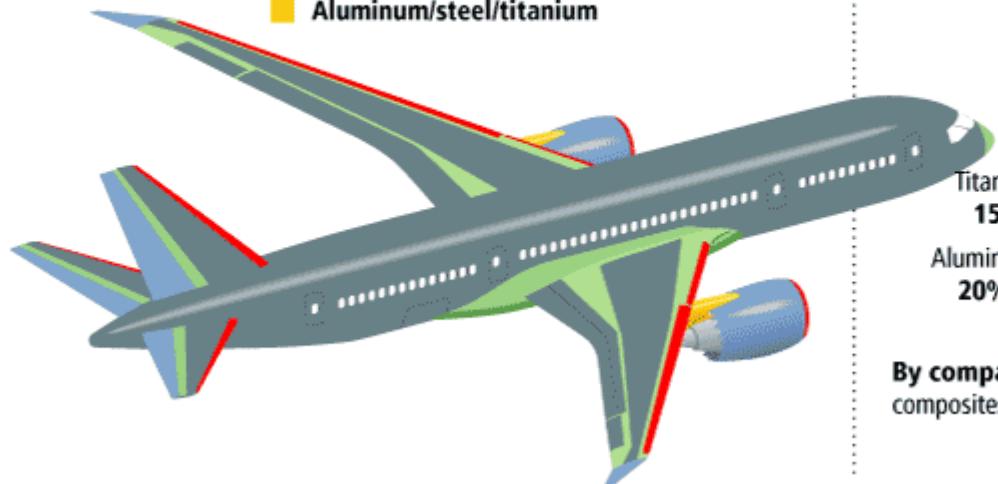
- 707 – 2% glass fibre reinforced (1958)
- 787 - ~50% fibre reinforced (2011)
- Highly regulated industries...an evolution



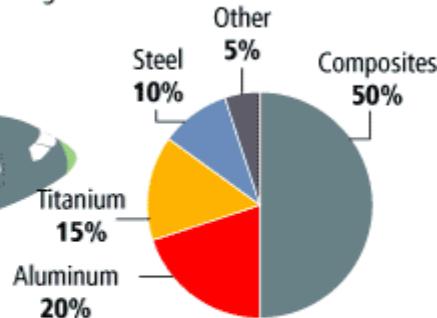
Source: Hexcel Corp., Aerostrategy

Materials used in 787 body

- Fiberglass
- Aluminum
- Carbon laminate composite
- Carbon sandwich composite
- Aluminum/steel/titanium



Total materials used
By weight



By comparison, the 777 uses 12 percent composites and 50 percent aluminum.

Image Source: Boeing

Discontinuous Innovation Triggers

- Unexpected game changer events
- Opens up new market field
- Some triggers
 - Political environments
 - Regulation (export compliance, toxic materials)
 - Events (war, disease outbreak)
 - New business models (eg: open innovation)
- Strategic (anticipating or creating a future state)
- Responsive (responding to an event)



Image Source: OLEX Cables

Lets Work Through An Innovation

Self Checkout

Allowing shoppers to 'check out' by themselves

Some rewards ?

- Reduced staff costs
- Increased through-put

What are the risks ?

- Theft
- Issues with equipment
- Education
- Reputation



Prior to implementation what tasks would need to have been undertaken?

Lets Consider New Technologies

- We Touched On Technology before
 - *Application of (scientific) knowledge for a purpose*
 - *Powder Coating technology*
- How do new technologies :
 - Enter the market ?
 - Evolve over time ?
 - Influence products and processes ?

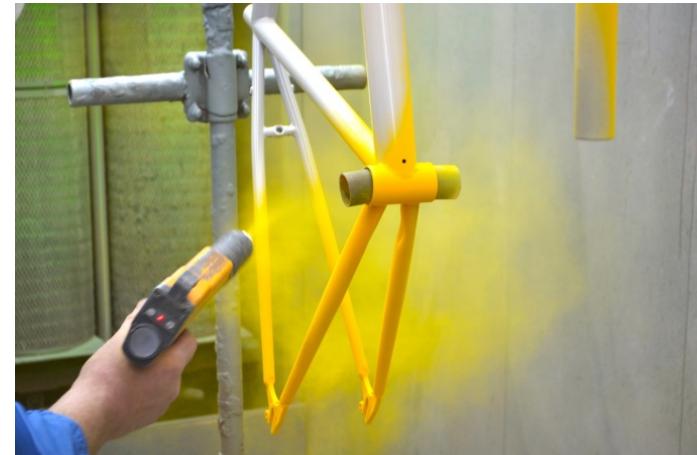
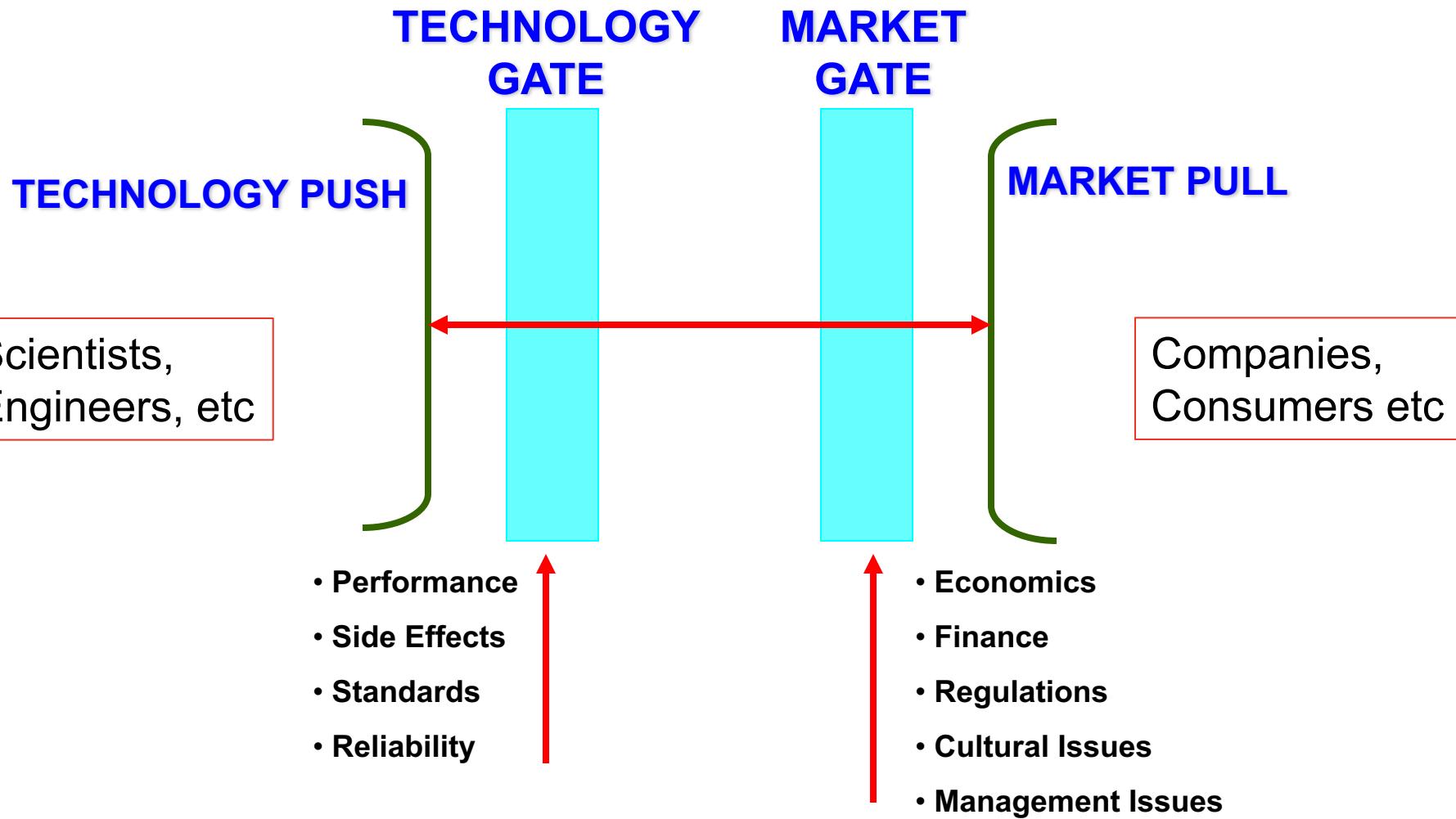


Image Credit: Dulux group

HOW TECHNOLOGIES ENTER SOCIETY



Technology Push

Technological and scientific developments that are used by design teams to produce new products. You might not know you wanted one before.



A focus on a search for technical or scientific knowledge

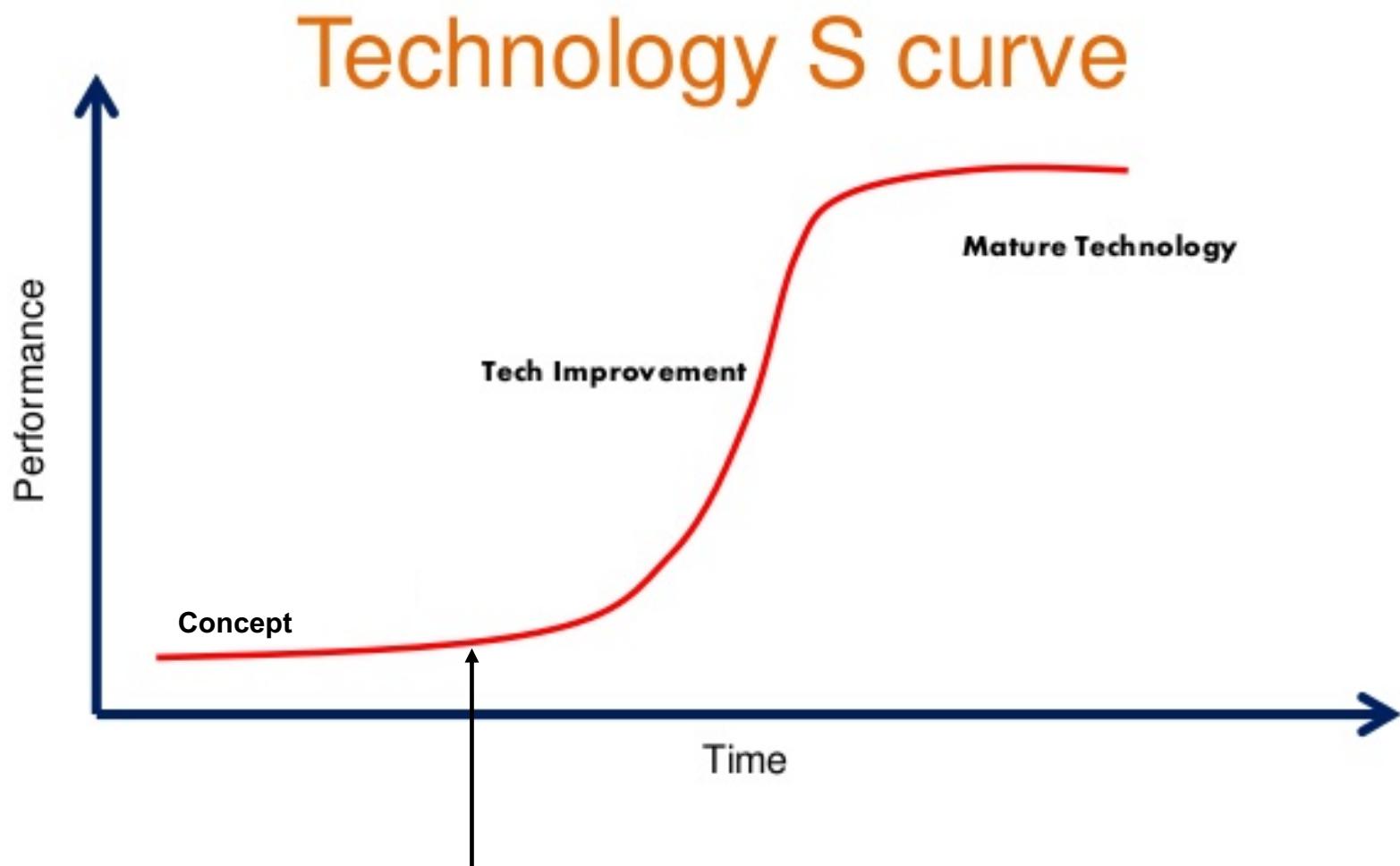


Develop an innovative technical solution to offer the market place not in response.

Market Pull

Inspiration for new products often comes from the needs of society. The needs of society and the demands of a product are changing all the time meaning research and development teams often modify existing products for changed markets. These are often updates to existing ideas.

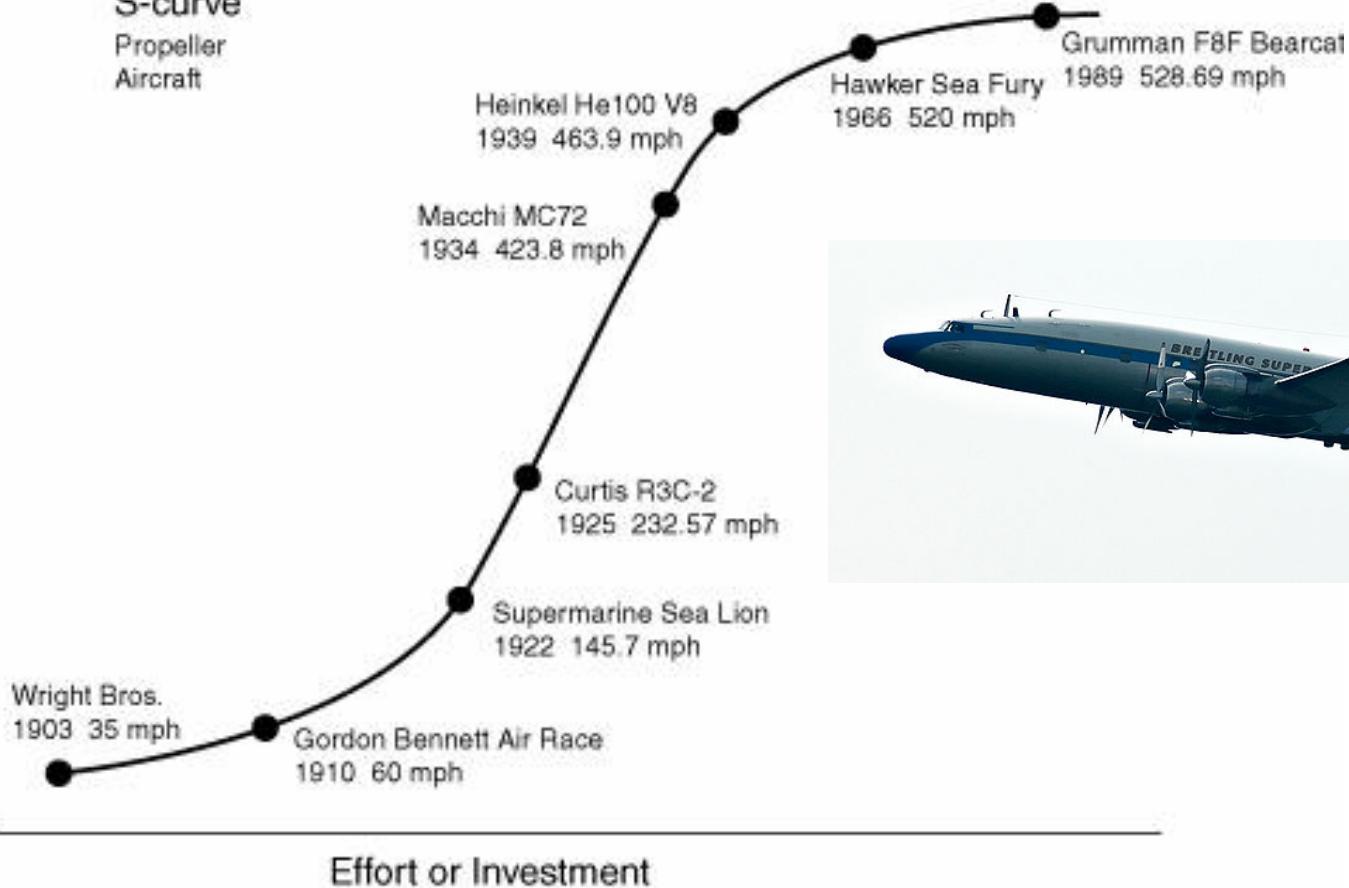




Minimal Viable Product Illustration

Piston / Propeller Driven Aircraft

S-curve
Propeller
Aircraft





COPYRIGHT RASCHOOLFIELD COLLECTION



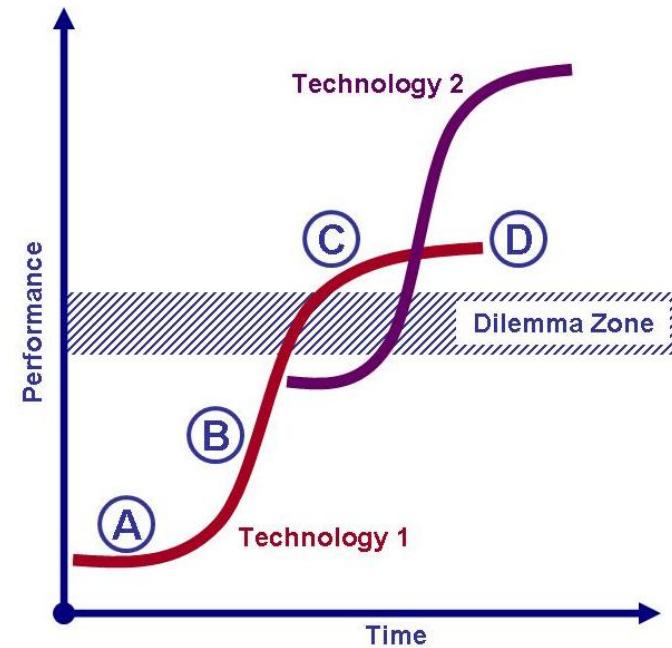
Technology S-Curve

A: A new technology in its infancy. Performance improvements are hard to generate as the innovation is becoming understood. Generally, innovations at this point are only used by very early adopters and the value of the product offering may be limited.

B: Rates of performance advances are peaking, rapidly catching up to incumbent technology. The technology becomes commonplace and even the industry standard. New competitor technologies look hobbyist or misaligned.

C: The technology matures, performance advances are harder to generate as the limitations of the technology are found. Most people who might use the technology are doing so. New competitor technologies seem to have higher potential and are gaining acceptance.

D: The technology fades. People stop using the technology and choose others. A new technology becomes the industry standard.



SWOT Analysis: An Effective Business Tool

A SWOT analysis could assist in gaining an insight into the state of your business.

Strengths

- Capabilities
- Competitive advantages
- Resources, assets and people
- Experience, knowledge and data
- Financial reserves, returns
- Marketing, reach
- Innovative aspects
- Location, geographical
- Price, value and quality
- Processes, systems, it, communications
- Advantages of proposition

Weaknesses

- Lack of capabilities
- Gap in competitive strengths
- Reputation, presence and reach
- Timescales, deadlines and pressures
- Financials
- Cash flow, cash drain
- Continuity, supply chain
- Effects on core activities
- Reliability of data, plan and project
- Management cover & succession

Opportunities

- Market developments
- Industry or life style trends
- Innovation and technology development
- Global influences
- Market dimensions, horizontal, vertical
- Target markets
- Geographical import, export
- Major contracts, tactics and surprises
- Business/product development

Threats

- Political and economical effects
- legislative effects
- environmental effects
- Competitive intentions
- Market demand
- Innovation in technologies, services and ideas
- New contracts and partners
- Loss of resources
- Obstacles to be faced
- Poor management strategies
- Economic condition home, abroad

Developing A Value Proposition

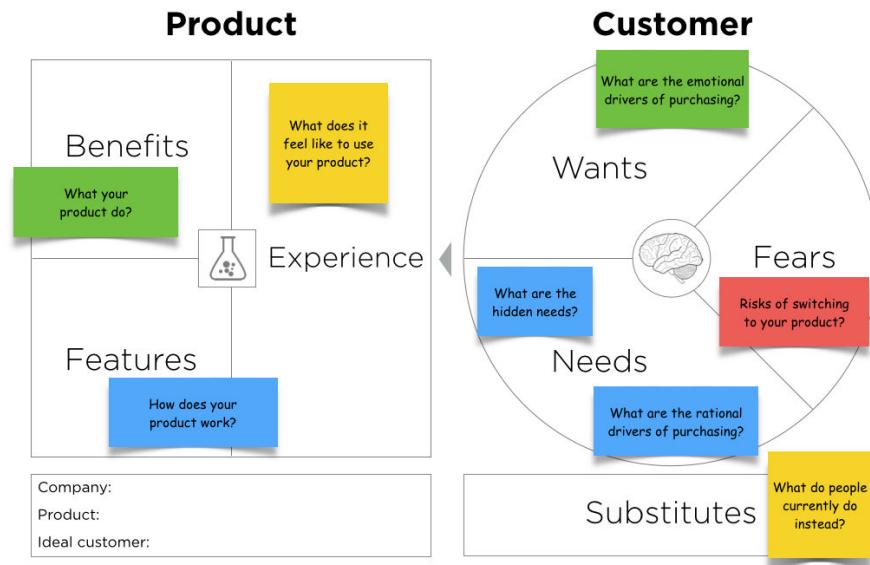
- Change requires convincing people what you propose is a good idea
 - Funding Source eg: A Bank
 - Your Manager
 - Key Stake Holders
 - Government
 - Organisation
 - Consumers
- A **value proposition** puts forward the case eg: the advantages (or reward) relative to the risks (or disadvantages)
 - Not just economic
- Mounting a value proposition is a mechanism to assist you in convincing others
- Consideration of ethics is central to any value proposition

Value Proposition

In a nutshell, value proposition is a clear statement that:

- explains how your offering solves problems or improves the situation (relevancy),
- delivers specific benefits (quantified value),
- tells the stakeholder why they should take this action from you and not from the competition (unique differentiation).

Value Proposition Canvas



Shifting the S-Curve

Often occurs from new business entrants even though existing organisations in the market continue to innovate:

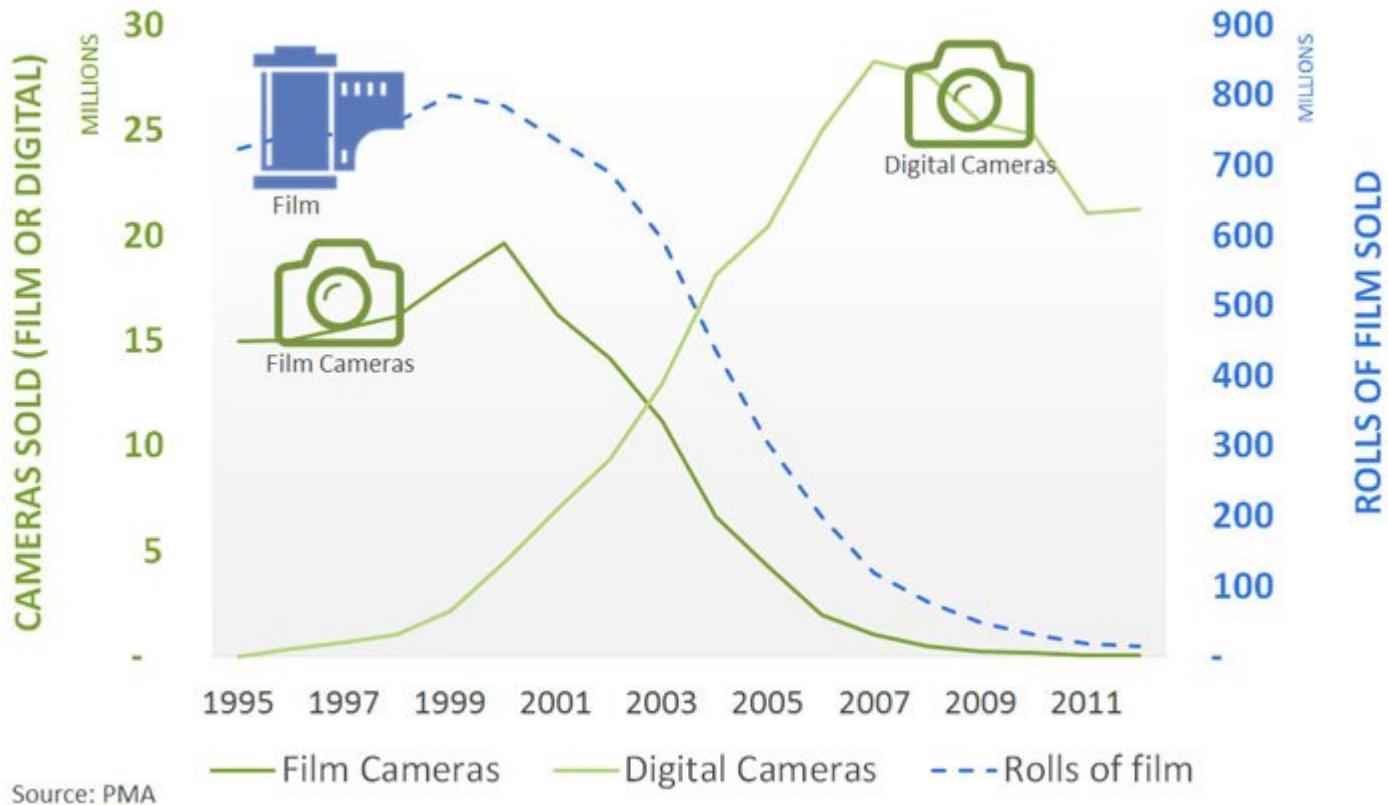
- Incumbents often have little incentive to introduce technology
- Incumbent have investments in existing technology
- Products based on new technologies cannibalize sales of existing ones
- Often managers do not see new technologies as a threat
- Incumbent firms can improve performance of their technology iteratively but only to a point
- Incumbent firms often face internal obstacles changing their products
- Eg: Kodak invented digital photography in mid 1970s, they filed more than 1000 patents but were slow to move – Sony, Olympus, etc took the lead



Kodak first digital camera 1975



The Tidal Wave of Digital



Kodak

- <https://www.youtube.com/watch?v=MK6sddsH7-o>