Innovation and Technology Management

OENG1115

Lecture 3

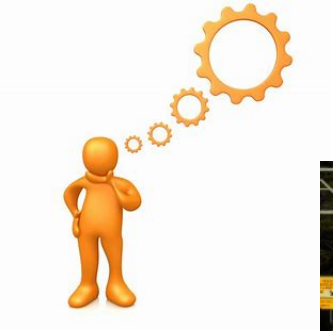
Today's Session Overview

Time	Activity	Comment

5:30pm	Lecture	• Welcome
		• Course Content
		  • Innovation and Technology Strategy
		  • Intellectual Property Strategy (Dr Hishani Prabaharan, Patent and Trade Mark Attorney)

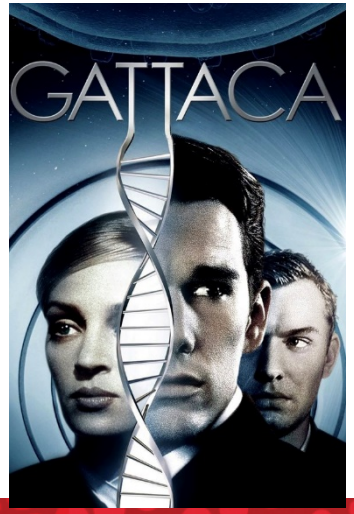
7:30pm	Tutorial	• Activities to cement you understanding • Question and Answer • Assessment 2 Overview

Lets recall last time.....



- Project overviews:
  - Richard Taube (FORD), Light Vehicle Emissions Project
  - Marcos Anastassiou (RMIT), Road – Rail Separation Project
  - Christopher Wong (Dept. of Transport), Rolling Stock Project

- Humanistic aspects of managing innovation and technology



Industry Competition

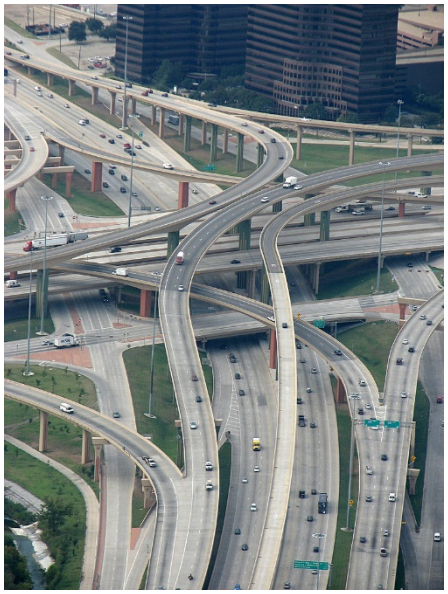
Businesses develop strategies to build defences against competitive forces or to open up an area where the forces are weakest.

Being innovative and introducing new technologies is one effective strategy to compete and win.

Strategy

To Achieve A Goal

You Need A Strategy



and….Backup Plans

Images Credit https://www.trekkingteamgroup.com/blog/the-great-himalayan-trail-
Dallas Interchange – Wikipedia, https://en.wikipedia.org/wiki/Interchange_(road)

Strategy – Its Essence

Higher level plan summarizing the key elements and actions required to achieve a goal

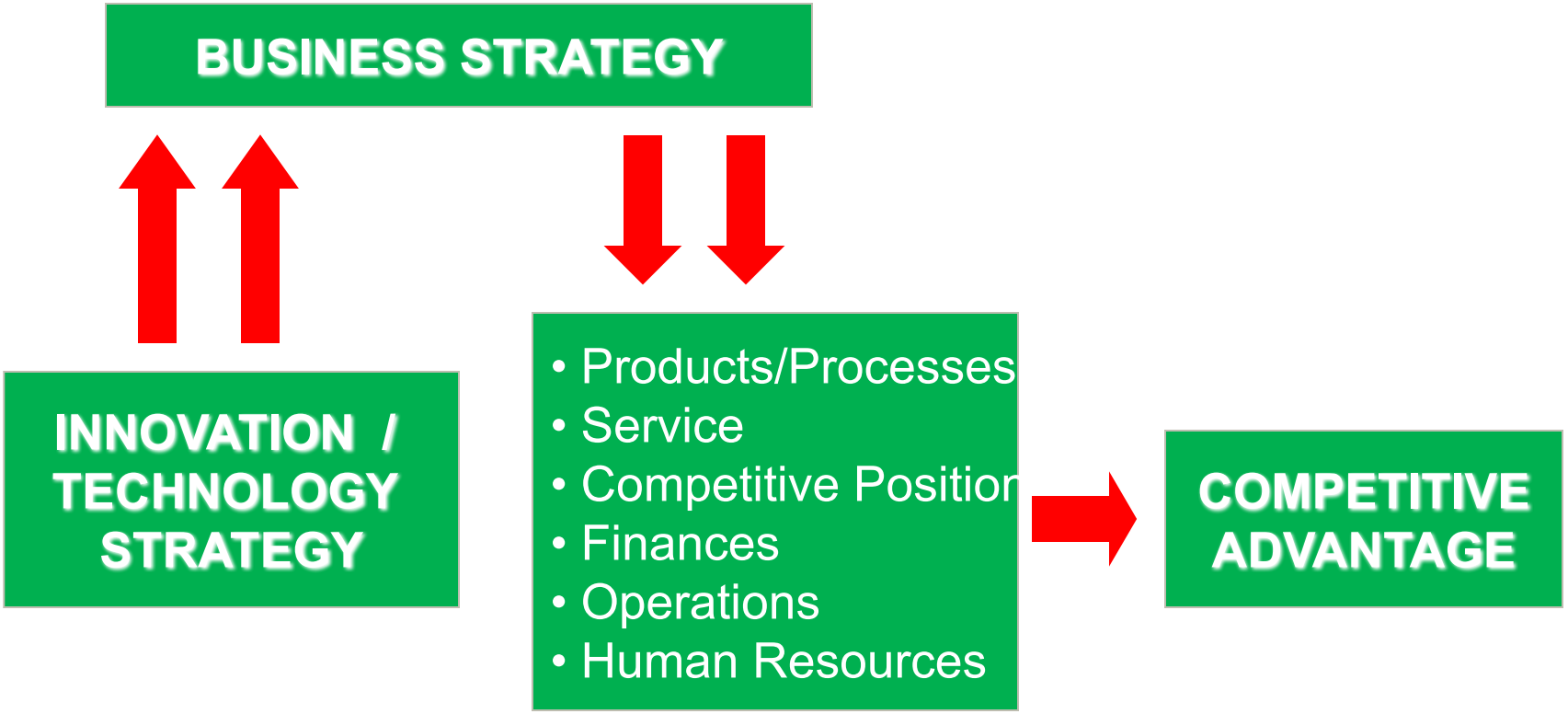
- **Where are we now?** Your current strategic position and clarify your mission, vision, and values.
- **Where are we going?** Establish your competitive advantage and your vision of the future
- **How will we get there?** Lay out the road to connect where you are now to where you're going. Strategic objectives, goals, and action items and how you'll execute your plan.

Innovation and Technology Strategy

A plan to achieve an outcome focusing on how innovation and the application of new or existing technologies can support the business achieving its goals (its competitive position).

- More than managing intellectual assets (see future Course modules)
- It connects to the overall business strategy and sub-plans thereof such as:
  - Human resources
  - Marketing
  - Sales
  - Asset management
  - Capital expenditure
  - Compliance management: warrantees, standards, codes

INNOVATION / TECHNOLOGY STRATEGY MUST SUPPORT AND SHAPE BUSINESS STRATEGY



Innovation & Technology Strategy

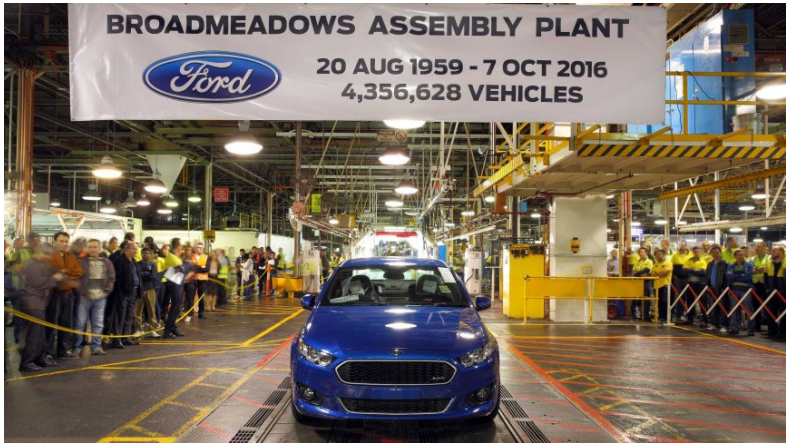
According to Rieck and Dickson: there are six key elements:

1. Setting horizons
2. Industry forecasting
3. Technology positioning
4. Technology availability
5. Appropriating technology
6. On-going management of the technology

1. Setting Horizons

Images Credit https://devpolicy.org/five-trends-for-the-future-of-development20110420/

The Future Business



- Understanding the future business
- What industry sector/s do we want to be active in the future ?
- How will we compete?

Example:
Diversification of the Australian automotive supply chain post closure of assembly

Diversification requires:

- Innovative culture
- Agility
- New skills
- New technologies
- New business models
- Capital
- Markets

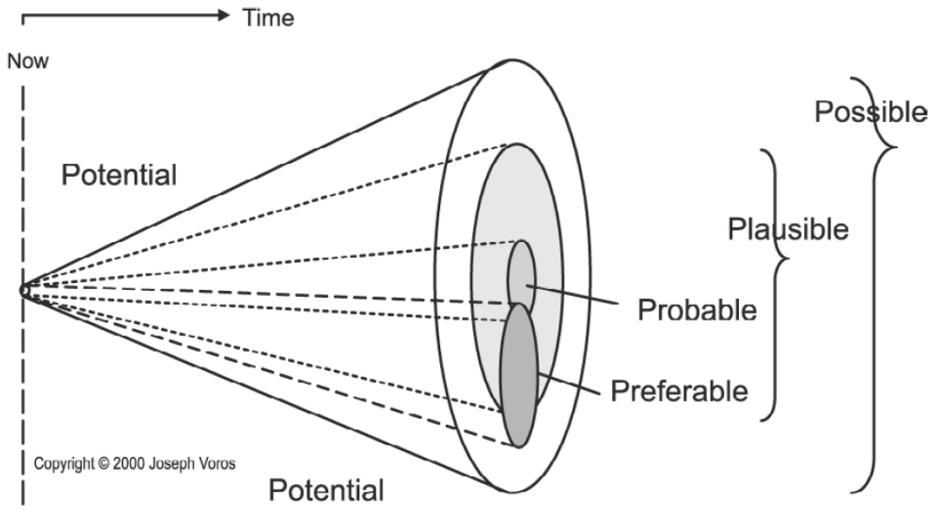
2. Forecasting

What Can We Predict

Once we know what sort of business we want to be:

- What does the future of this industry segment look like?
- Need to consider:
  - The future is not predetermined.
  - The future is not predictable.
  - Future outcomes can be influenced by our choices in the present.

Different futures



Joseph Voros, A generic foresight process framework, Foresight, (2003), 5 (3), p10-21

Mega Trends

- Overall trends that shape our future
- Comprised of many trends
  - Technological
  - Societal
  - Environmental

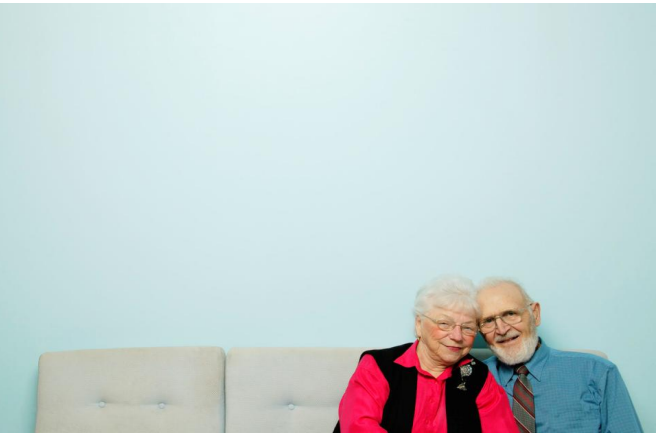
- Can be influenced by:
  - Radical discoveries
  - Radical events (disease, war etc….)

Mega Trends: CSIRO

1. More from Less

2. Going Going Gone

3. Silk Highway

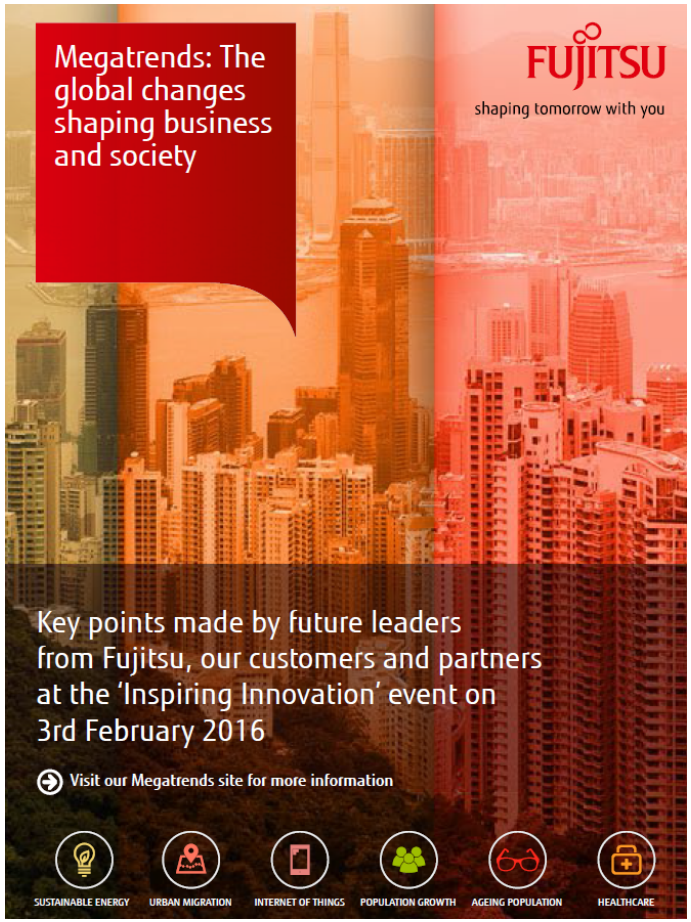


4. For Ever Young

5. Digital Twin

6. Great Expectations

Major Corporations Consider The Future



Frost and Sullivan: TechVision

Imagining The Future of Automotive

- https://www.youtube.com/watch?v=VwsusVukikg

- Beyond the marketing the clip demonstrates how innovation and technology strategy is focused on delivering benefits across multiple fronts:
  - Economic
  - Environmental and
  - Societal

Government Priorities Influence The Future

Government and government agencies influence/set

- Key policies (eg: trade)
- Compliance to global accords etc (eg: emissions)
- Regulations: safety, environmental etc
- Financial settings
  - Taxation
    - R&D tax concessions
    - Recall the carbon tax from 2012
  - Grants: Start ups, R&D, industry support packages
- Government purchasing power (eg Defence contracts)
- Uncertain government policy settings can lower confidence, expenditure and entrepreneurship / intrapreneurship.
- Organisations often need to think beyond the policy settings of the day

3. Technology Positioning

How Will We Compete

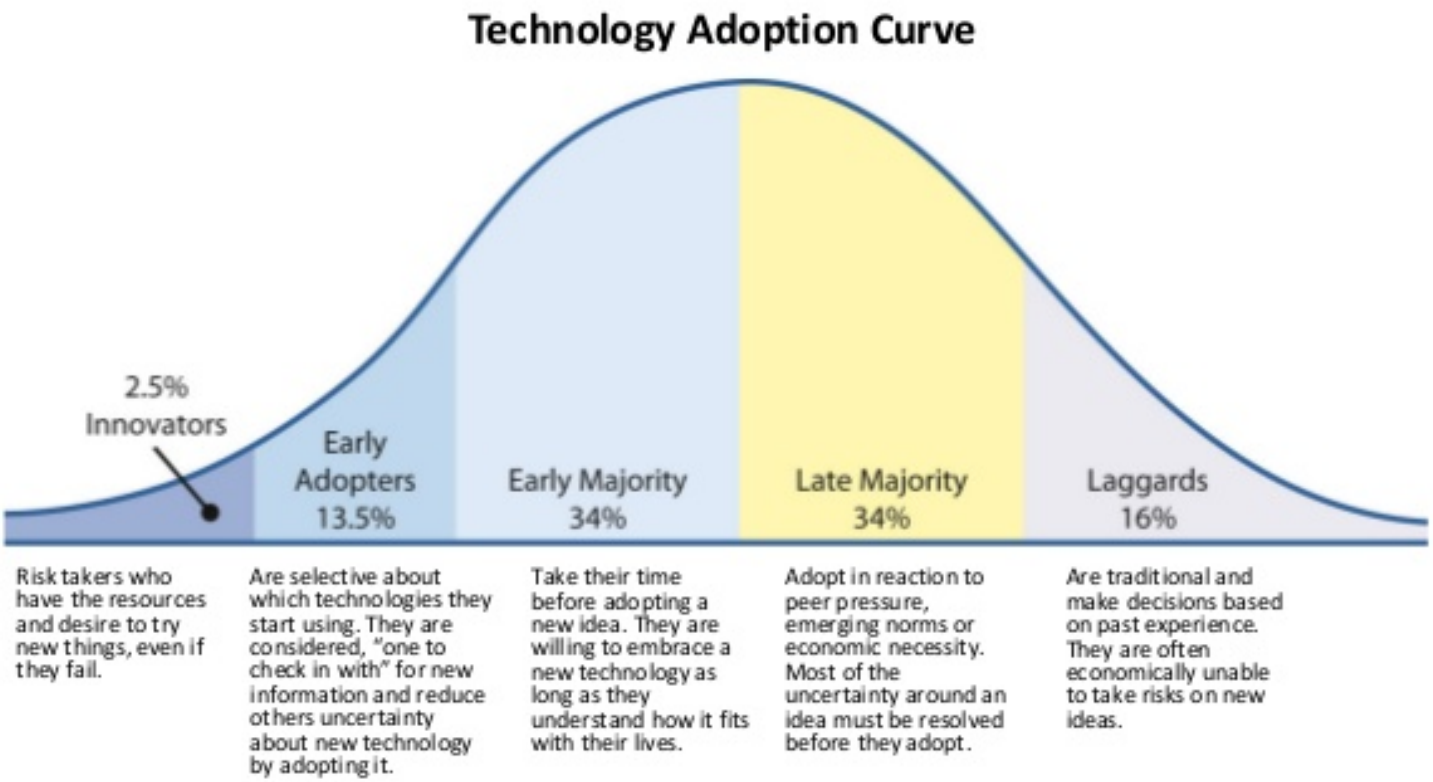
- How will the technology/innovation be used for advantage ?
- Linked to the overall business plan:
- Timing is key
  - Offensive, defensive, reactive, strategic
- How close to the technology edge is the company comfortable
  - Industry dependant
  - At the cutting edge, close follower, laggard etc etc.
- Useful to consider stakeholders appetite for new innovative technologies
  - Customers
  - Workers
  - Management
- Consider SWOT analysis & RISK analysis

To Lead or Not To Lead…..

- Leading requires resources and time to develop it
  - How much distance do you want to put between your competition
  - Type of industry (high tech or low tech)
  - R&D carries risk
  - Will market accept the new concept / will you work force embrace change
- According to Porter the technological follower takes advantage of
  - Irreversibility's afflicting the leader by moving first
  - Potentially lower cost of adapting rather than creating technology change
- Entrepreneurial companies (including Startups):
  - First to market – minimal viable product
  - Agile and responsive

Porter: The Technology Dimension of Competitive Strategy, Research on Technology Innovation, 1, (1983) p1

Technology Adoption Curve



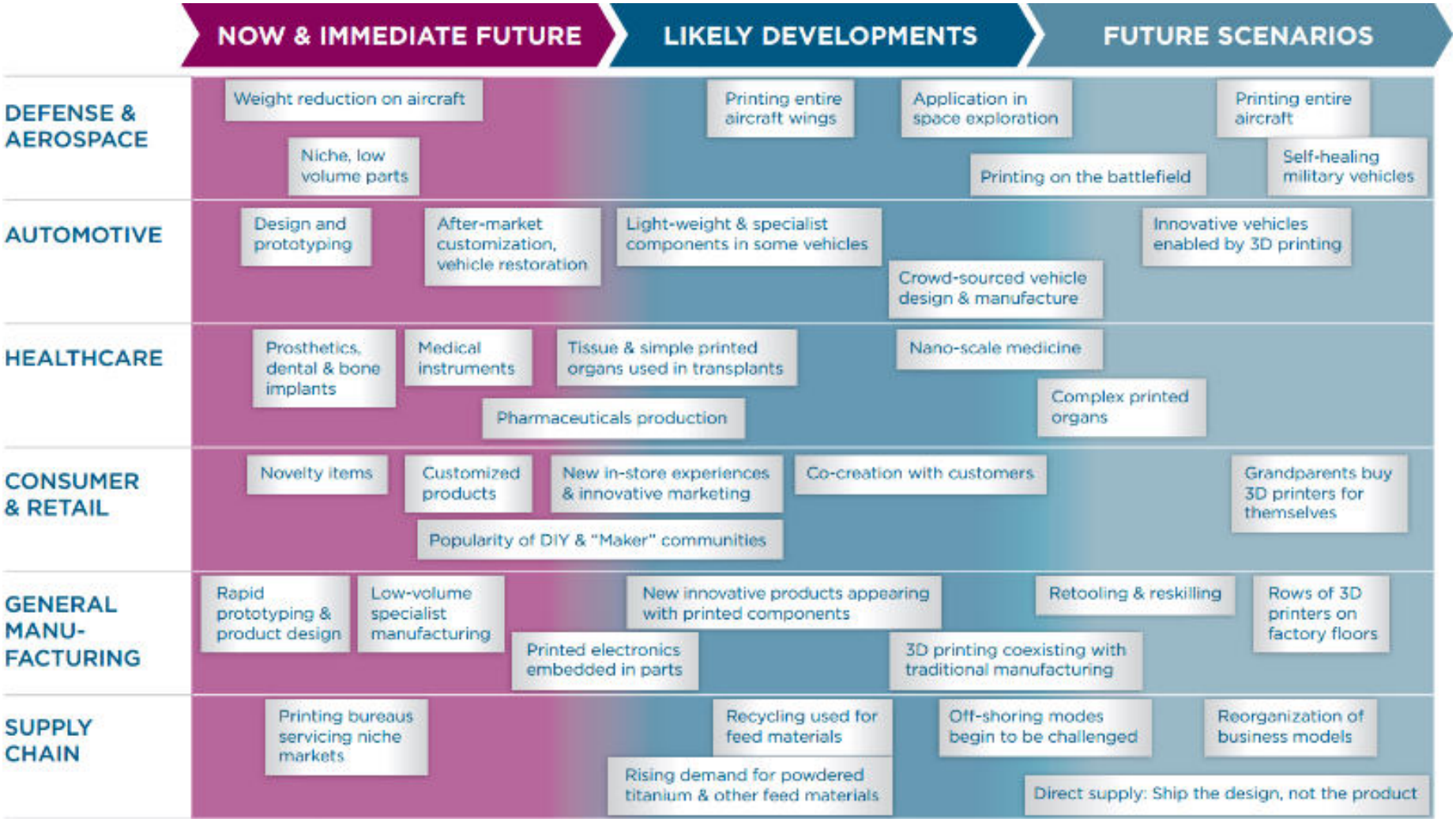
Popularized by Everett Rogers in the book *Diffusion of Innovations,* people tend to adopt new technologies at varying rates. Their relative speed of adoption follows a bell curve, with the primary difference being individuals' psychological disposition to new ideas.

For a fun example relating to this see "Dancing Guy": https://www.youtube.com/watch?v=hO8MwBZl-Vc

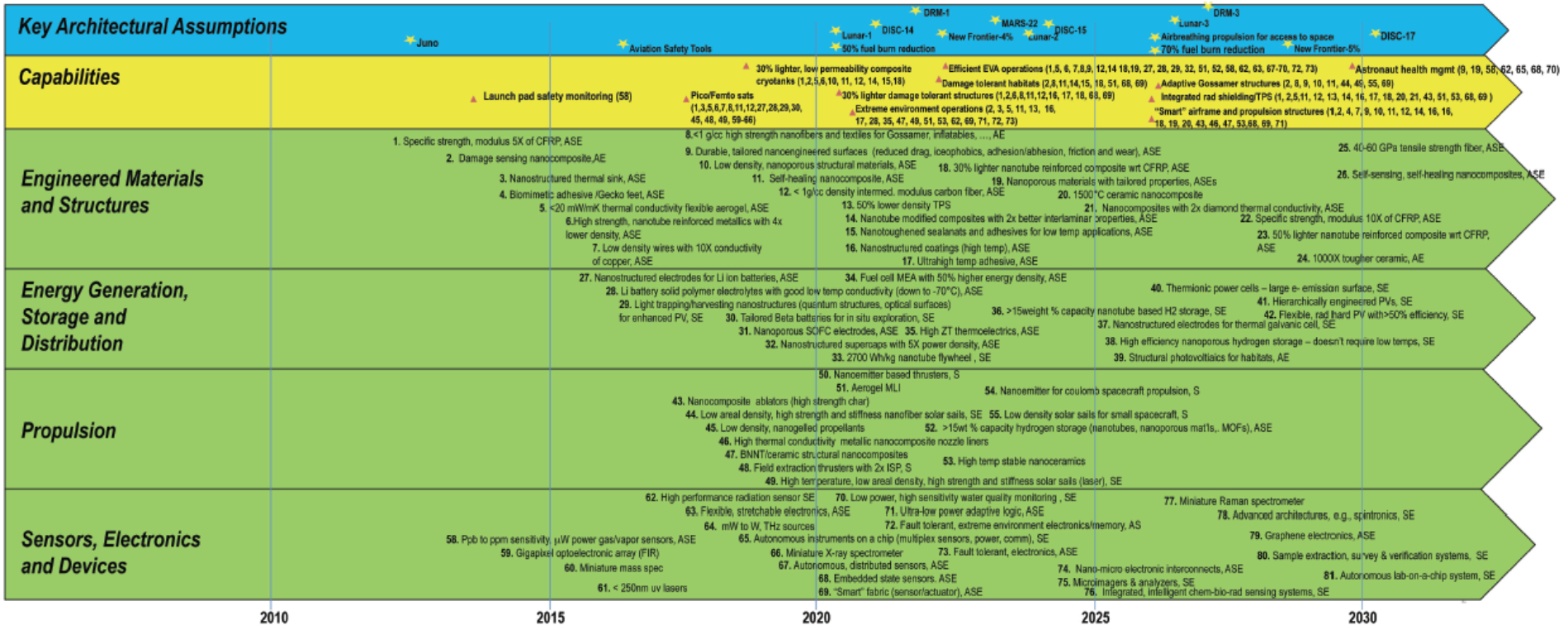
Technology Roadmap

- Industries utilize technology roadmaps as a mechanism of planning for the future
- Provides a strategy to reach company goals
- Guides R&D plans or technology/capability acquisitions, identifies key gaps and vulnerabilities
- Significant due diligence behind each point on the map

Technology Roadmap – 3D Printing



Nanotechnology Roadmap - NASA



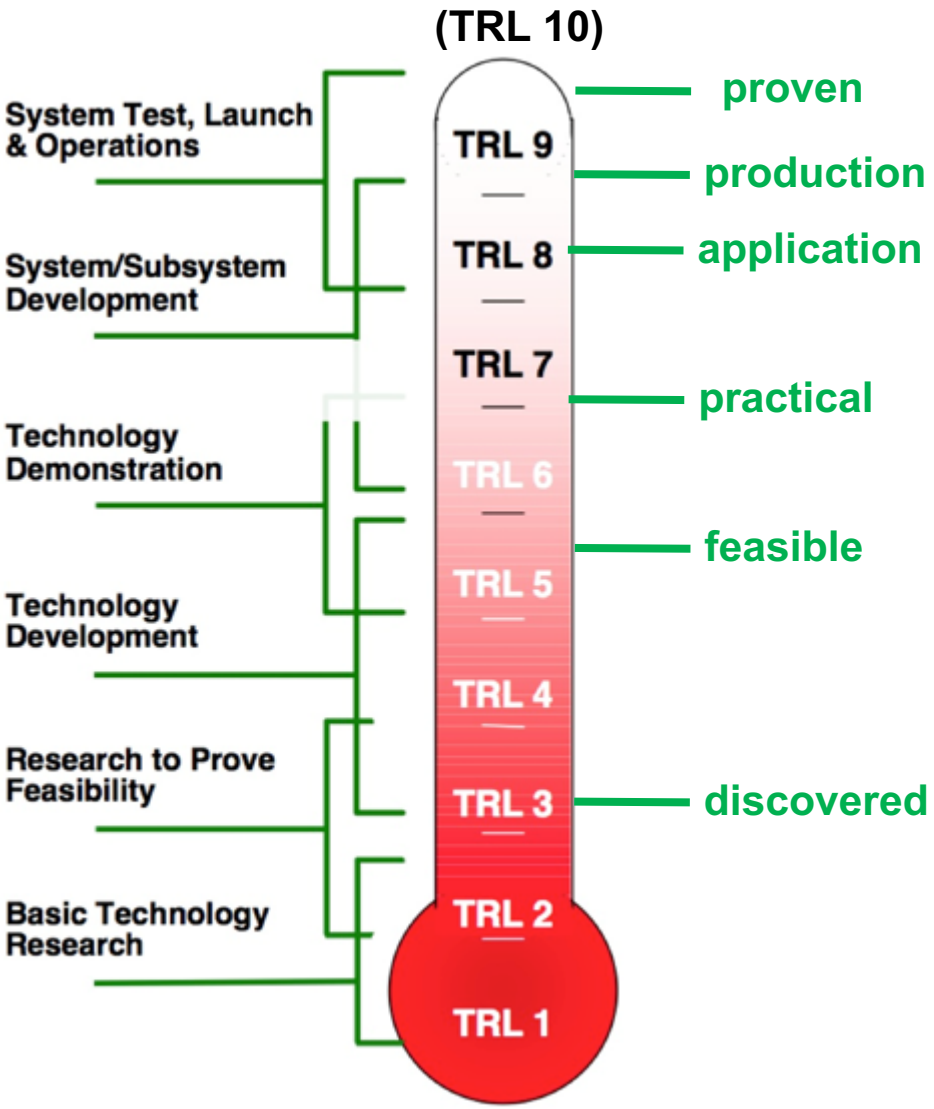
Source: NASA Nanotechnology Roadmap

4. Technology Availability

Access To Winning Technologies

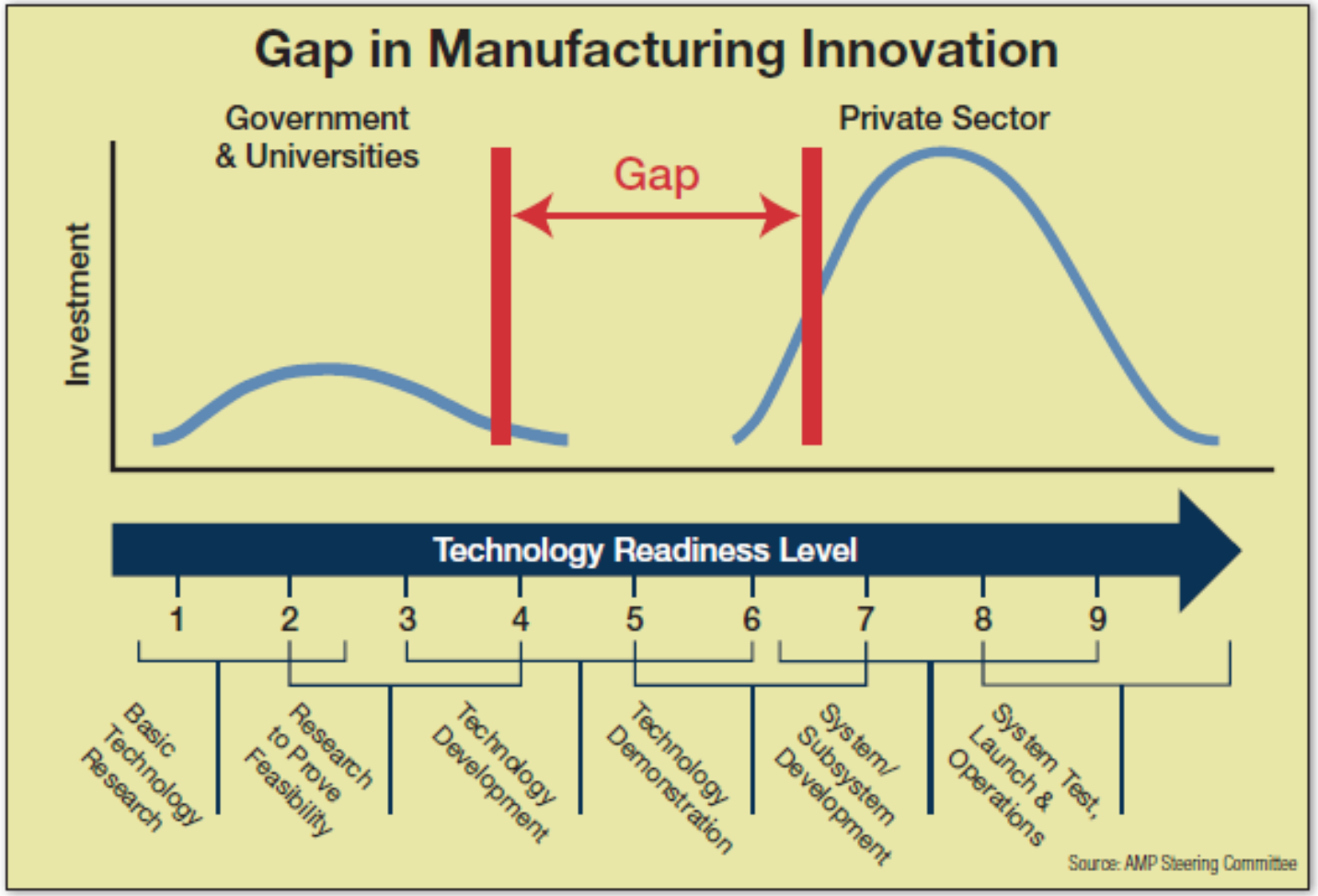
- Once the firm has identified the technology requirements it must be sourced.
- Internally sourced
  - Develop the technology in house and protect it (patent, design etc)
  - Conduct Research and Development
- Externally source it
  - Purchase it (or take a license), hire new staff, adapt technologies from other industries, utilize expired patents
- Partner: joint venture, collaborative research
- Need to complete a technology audit
  - What do you have and what do you need – understand the gaps
  - Consider facilities, processes and people to deliver
  - Safety and environmental impact

Technology Readiness Level (TRL)



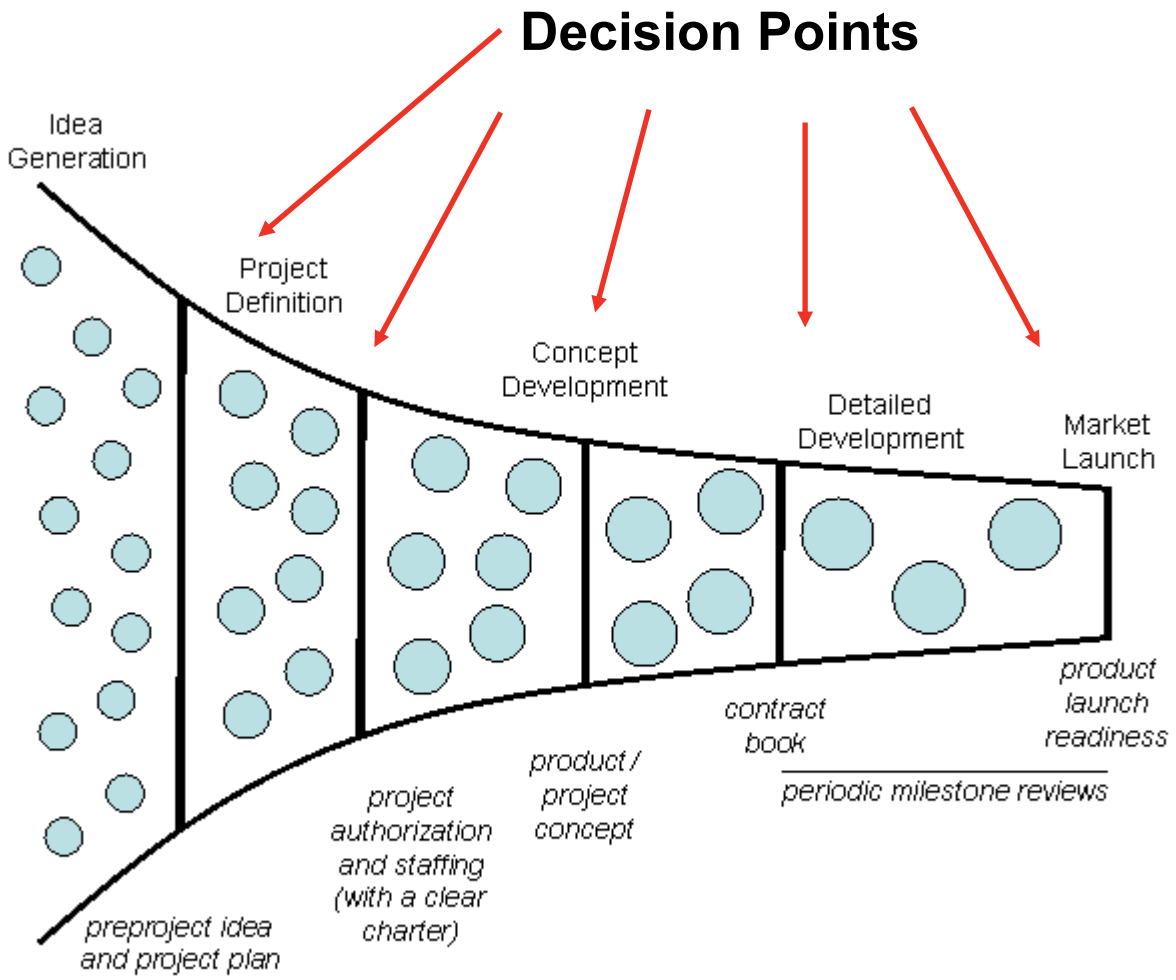
TRL 9	Successful full scale operations
TRL 8	System proven through successful operations
TRL 7	Ready for full scale production
TRL 6	System completed & qualified through tests + demos
TRL 5	Prototype demonstration in an operational environment
TRL 4	Prototype demonstration in a relevant environment
TRL 3	Validation in a relevant environment
TRL 2	Component validation in a lab environment
TRL 1	Proof of concept
	Concepts and/or applications formulated
	Basic observations made and reported

Valley Of Death



Source: Manufacturing Engineering, 2015
http://www.sme.org/MEMagazine/Article.aspx?id=8589934630

Project Funnel.



Portfolio approach:- spread the risk

What are the Decision point criteria?

What are the questions to kill off ideas?

Heilmeier's Catechism

- Contains 9 questions you should be able to answer (from DARPA (Defence Advanced Research Projects Agency, USA)

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?
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

RMIT UNIVERSITY

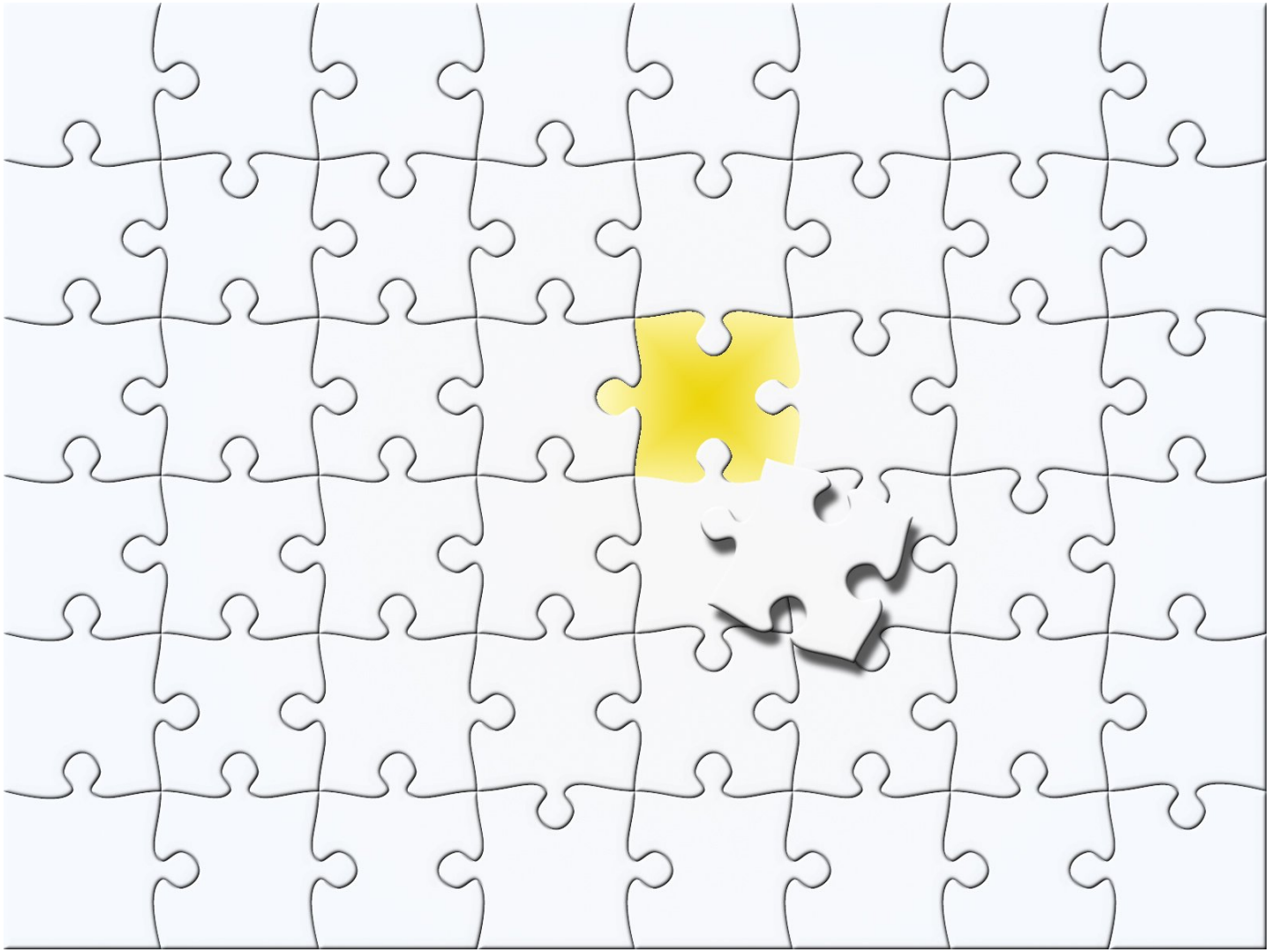
Other Strategies: Crowd Sourcing…..

- Innovative companies are turning to the Web :
  - Solutions to problems: ask the community…….
  - New ideas
  - Designs
  - Diversity of views
  - Leveraging wisdom of crowd is greater than individual / organisation
- Issues include:
  - Management of IP
  - Competitive position
  - Administration
- InnoCentive: R&D challenges - professional recognition and financial rewards to solve challenges (DuPont, P&G leverage this)
- Ninesigma: Open Innovation on-line porthole.

Concepts Surrounding Crowd Sourcing

	PURPOSE	CHALLENGES	BEST USE
Contests	Generating high-value solutions to complex or novel problems through large-scale and diverse independent experimentation	The problem must be generalized and stripped of company-specific details	Highly challenging technical, analytical, and scientific problems; design problems; creative or aesthetic projects
Collaborative Communities	Aggregating a large number of diverse contributions into a value-creating whole	The crowd lacks the shared culture and cohesiveness of a company, making it harder to control; intellectual property can't be protected	Customer support communities; wikis; open-collaboration projects for information and software products with complementary assets inside the firm; FAQs
Complementors	Encouraging innovative solutions to users' many different problems with your core product	It can be technologically daunting to provide access to the functions and information in the core product while protecting your assets	Open operational, product, or marketing data initiatives; content mashups; apps
Labor Markets	Efficiently and flexibly matching talent to discrete tasks	Identifying which problems to farm out and who in the organization will manage the labor pool may be difficult	Well-established categories of work that can be clearly described and evaluated; human computation; repeated tasks

5. Technology Appropriation



https://www.freeimages.com/photo/puzzle-1-1161337 Images Credit

5. Integration Of Technologies Into The Business

- Capability of a firm to actually implement an innovative technology is the key element to its success:
- Absorptive capacity
- Technology transfer
  - 'Knowhow required to practically get a technology to work'
    - Skills and know-how is often not written down (RISK !)
  - Facility requirements
  - Business systems
  - Supply chain
- Technology often out paces the skill of workers to implement it
  - Training
  - Key Human Resources decisions to be made
- Safety – employees, consumers, general public

Strategies To De-risk

- Pilot runs, simulation / modelling
- Beta testing (games)
- Test the market prior, during and/or following the development of technologies
- “Voice of Customer”
  - Could be internal customer as well as external
  - Beta testing (games)
  - Minimal viable product
- Need to have written processes, staff shadowing, opportunity for ‘augmented reality’ techniques
- Larger companies often ‘spin out a new company’ to try the idea thereby protecting the parent companies brand (see later)

6. Managing Implemented Technology

6. Getting The Most Out Of What We Have

- Cannot maintain position via ad hoc implementation of technology
- Culture of continuous improvement
- Total quality management (e.g. six sigma, lean manufacturing, ISO9000)
- Basic Principles:
  - Customer focused
  - Employee engagement
  - Process centred
  - Integrated systems
  - Strategic approach
  - Continual improvement
  - Fact based decision making
  - Communication

Final Words On Strategy……..

*Peter Drucker
http://www.strategyand.pwc.com/media/file/Katzenbach-Center_Webinar_Culture-Eats-Strategy-for-Breakfast.pdf