Innovation Management and Strategy

Prof. Dr. B. Van Looy
TA : Jasmien Langhendries – jasmien.langhendries@kuleuven.be

Traditional exam question:
- explain what it implies
- of we have a good funnel, a roadmap, are we then bullet proof in terms of innovation effcetiveness?
No, we have to adress additional concerns:
    - how should we organise those R&D?
Ex: Kodak. They were the first to develop a digital camera, but they missed it. So, the problem is how do you organise the new and old activities in a well-established firm

Content

- **Part 1: Technology and innovation management**
  Key concepts and Insights (Economics of Innovation, Sociology/History of Science/Technology…) – What makes innovation different (from other economical activities)?

- **Part 2: Innovation at the level of the firm**
  Innovation strategy and how to organize/implement such a strategy effectively on the level of the firm (internally + externally) (Innovation Management, Organizational theory, alliances/networks…)

- **Part 3: Operational issues in innovation management**
  How to be effective on the level of NPD projects – how to organize R&D teams effectively (Innovation management, Organizational behavior, ….)

Main goal:
Have the bigger picture of what makes innovation so different and what to do as a firm to handle these things more or less

PART I: TECHNOLOGY AND INNOVATION MANAGEMENT

1.WHY STUDY INNOVATION?

Slides + chapter 1 book

- Because it is the major driver of competition (value creation) (Bolwijn & Kumpe)
    - productivity (60-70s)
    - quality (70-80s)
    - flexibility (80s-90s)
    - innovation (90s - …)

(internationalizing - globalization / societal relevance - ….)

- Innovation is connected to wealth

- **Evidence at firm-level:**
    - 3M, Intel, Apple, Philips, Google, Nintendo, RIM, …
- **Evidence at geographic level:**
    - Clusters and networks (N. Italy, S. Germany, Cambridge, Silicon Valley, …)
- **Evidence at (supra)national level:**
    - OECD data on TFP (Total Factor Productivity) and economic growth
    - OECD evidence on R&D spending (±2-3% GDP)

>>Let's now go to the book and summarize chapter 1<<

The importance of technological innovation

- Technological innovation: the act of introducing a new device, method or material for application to commercial or practical objectives. Two important drivers:
    - Foreign competition
        - new products to protect the margin
        - new processes to lower the costs
    - Advances in IT
        - computer-aided design and manufacturing make it easier and faster to design and produce new products
        - flexible manufacturing technologies make shorter production runs economical and reduce the importance of
        - economies of scale
- Shortened development cycles and rapid product innovations result in greater market segmentation and rapid product obsolescence

The impact of technological innovation on society

If the push for innovation has raised the competitive bar for industries, its net effect on society is more clearly positive. Innovation enables a wider range of goods and services to be delivered to people worldwide. The production of food and other necessities is more efficient, yielded medical treatments that improve health conditions etc. The aggregate impact of technological innovation can be observed by looking at the GDP. In a series of studies of economic growth conducted at the National Bureau of Economic Research, economists showed that the historic rate of economic growth in GDP could not be accounted for entirely by growth in labor and capital inputs. Solow argued that this unaccounted-for residual growth represented technological change: *technological innovation increased the amount of output achievable from a given quantity of labor and capital.*

Sometimes, technological innovation results in negative externalities. Production technologies may create pollution that is harmful to the surrounding communities; agricultural and fishing technologies may result in erosion, elimination of natural habitats, and depletion of ocean stocks; medical technologies can result in unanticipated consequences such as antibiotic-resistant strains of bacteria or moral dillemas regarding the use of genetic modification. However, technology is, in its purest essens, knowledge-knowledge to solve our problems and pursue our goals. Technological innovation is thus the creation of new knowledge that is applied to practical problems.

Innovation by industry: the importance of strategy

While innovation is popularly depicted as a freewheeling process that is unconstrained by rules and

plans, study after study has revealed that successful innovators have clearly defined innovation strategies and management processes.

The innovation funnel

- Only one out of several thousand ideas results in a successful new product
- Only about one in nine projects that are initiated are successful, and those that make it to the point of being launched to the market, only half earn profit
- It takes about 3000 raw ideas to produce one significantly new and successful commercial product
- The innovation process is thus often conceived as a funnel, with many potential new product ideas going in wide end, but very few making it through the development process

The strategic management of technological innovation

- For projects to be technically as commercially successful, a firm needs:
    - an in-depth understanding of the dynamics of innovation
    - a well-crafted innovation strategy
    - well-designed processes for implementing the innovation strategy

Summary of chapter 1

- Technological innovation is now often the single most important competitive drivre in many industries. Many firms receive more than one-third of their sales and profits from products developed within the past 5 years
- The increasing importance of innovation has been driven largely by the globalization of markets and the advent of advanced technologies that enable more rapid product design and allow shorter production runs to be economically feasible.
- Technological innovation has a number of important effects on society, including fostering increased GDP, enabling better communication and mobility, and improving medical treatments.
- Technological innovation may also pose some negative externalities, including pollution, resource depletion, and other unintended consequences of technological change.
- While governments play a significant role in innovation, industry provides the majority of R&D funds that are ultimately applied to technological innovation
- Succesful innovation requires in-depth understanding of the dynamics of innovation, a well-crafted innovation strategy, and well-developed processes for implementing the innovation strategy.

2. KEY CONCEPTS

2.1. Robert Solow

Production function approach:

- Y=F (L, C) (e.g. Cobb-Douglas $Y = aL^bK^g$) (L= Labor, C=Capital)
- Y=F (L, C) *A(T) with A(T) a technological progress parameter (e.g. evolution in R&D expenditures or evolution in patent output)
- R^2: ±20% ==> ±80%

=> If you put indications like innovation, R&D, etc. your model starts to explain much more than when you only put capital and labour

2.2. Innovation is connected to wealth

Evidence at geographical level

Income Levels California (2000 Census data)

Rank	National Rank	County	Per Capita Income	Median House-hold Income
1	1	Marin County	$44,962	$71,306
2	14	San Mateo County	$36,045	$70,819
3	19	San Francisco County	$34,556	$55,221
4	25	Santa Clara County	$32,795	$74,335
5	45	Contra Costa County	$30,615	$63,675
6	49	Ventura County	$29,634	$75,157
7	77	Placer County	$27,963	$57,535
8	96	Alameda County	$26,860	$55,946
9	106	Santa Cruz County	$26,396	$53,998
10	107	Napa County	$26,395	$51,738

10

What do we see?

The underlined names are from Silicon Valley.

→ **Conclusion :**
The income levels are highest in regions that are caracterised by hicghtec, innovation and entrepreneurship

Evidence at firm/product level
The companies that survive are the ones that innovate

2.3. Disciplines that contribute to our understanding of innovation dynamics

- **Economics:**
  - economic impact of innovation
  - market structure antecedents of innovation
  - innovation policies
- **Sociology:**
  - processes of science and technology creation
  - group/community dynamics
  - institutional context for innovation
- **Management:**
  - strategic and operational processes
  - organisational models
  - innovation metrics and performance
- **Psychology:**
  - career dynamics of innovative professionals
  - work climates for productive innovation
  - creativity
- **History:**
  - case study analyses of innovations

The first hybrid car (1898)

- The world's first gas-electric car was built by 18-year-old Ferdinand Porsche as he worked his first job with coach-builder Jacob Lohner & Co from 1898 to 1906

- Propelled by four electric-drive hubs, the gas- and battery-powered car carried almost *two tons* of lead-acid batteries and reached a top speed of 37 mph
- Three hundred were sold during Porsche's eight-year tenure with Lohner. In 1906 Porsche was recruited by Austro-Daimler as chief designer. When he left, Lohner said, "He is very young, but is a man with a big career before him. You will hear of him again."

2.4. Schumpeter

Main questions we ask ourselves:
1. « Who is responsible for innovation and related to new economical activities? »

Schumpeter I
Schumpeter (1912) was already thinking about the role of innovation in the economy.

For him there are 2 types of agents:
Heroic entrepreneurs :

- Only entrepreneurs matter. They are the engine behind economical growth and innovation. They are heroic because they have to overcome a lot of obstacles, and there will be resistance, difficuties and in order to overcome that you need special people who are heroic entrepeneurs
- Entrepreneurs are destabilizing agents because they change the existing relations and techniques of production. They lead the economy toward a better use of capital and knowledge, which is vital for macroeconomic growth and rising productivity
- It is not part of his function to 'find' or to 'create' new possibilities. They are always present, abundantly accumulate by all sorts of people. There're so many new technologies that this is not the rare ressource, the rare ressource is to pick the novel things and to transform them in economical value

Imitators

- They are much more numerous than the entrepreneurs who are merely routine managers and followed in the wake of the heroic pioneers in the first group

=>if that is a full account of what is going on then we should rename the course and call it 'entrepreneurship'
BUT this is not a full account

Schumpeter II

- Schumpeter himself (1928,1942) moved away from his own original formulation, to the extent that one can distinguish between a 'young' and an 'old' Schumpeterian vision.
- We are still in the early days of the Industrial Revolution. Schumpeter recognizes that in large firms, innovation become bureaucratized and that organized and specialized R&D departments play an increasingly important role in the innovation process.
- He concludes that not only heroic entrepreneurs innovate, but also a development engineer in the R&D Department of a large electrical firm could be an 'entrepreneur' (1939) = Schumpeter II

Question 2: *« If both contribute (entrepreneurs/entrepreneurial firms and large established companies), is the nature of the contribution similar? »*

- Schumpeter II said that large established companies would outperform and scale out the entrepreneurs/entrepreneurial firms. But Baumol says Schumpeter was wrong in terms of 'replacement': both type of actors remains present

Illustration I

Rank	Company	ICB Sector	Country	R&D Investment 2006 €m
			Top 1000 Companies	250.455,28
			number of companies for calculation	*1000*
1	Pfizer	Pharmaceuticals (4577)	USA	5.762,54
2	Ford Motor	Automobiles & parts (335)	USA	5.459,96
3	Johnson & Johnson	Pharmaceuticals (4577)	USA	5.403,09
4	Microsoft	Software (9537)	USA	5.400,06
5	Toyota Motor	Automobiles & parts (335)	Japan	5.172,00
6	General Motors	Automobiles & parts (335)	USA	5.004,97
7	Samsung Electronics	Electronic equipment (2737)	South Korea	4.659,97
8	Intel	Semiconductors (9576)	USA	4.453,66
9	IBM	Computer services (9533)	USA	4.303,51
10	Roche	Pharmaceuticals (4577)	Switzerland	4.093,34
11	Novartis	Pharmaceuticals (4577)	Switzerland	4.067,67
12	Merck	Pharmaceuticals (4577)	USA	3.627,01
13	Matsushita Electric	Leisure goods (374)	Japan	3.594,48
14	Sony	Leisure goods (374)	Japan	3.384,55
15	Honda Motor	Automobiles & parts (335)	Japan	3.248,29
16	Motorola	Telecommunications equipment (9578)	USA	3.113,70
17	Cisco Systems	Telecommunications equipment (9578)	USA	3.084,12
18	Nissan Motor	Automobiles & parts (335)	Japan	2.848,58
19	Hewlett-Packard	Computer hardware (9572)	USA	2.723,16
20	Hitachi	Computer hardware (9572)	Japan	2.578,08
21	Amgen	Biotechnology (4573)	USA	2.552,53
22	Boeing	Aerospace & defence (271)	USA	2.469,88
23	Eli Lilly	Pharmaceuticals (4577)	USA	2.373,04
24	Toshiba	Computer hardware (9572)	Japan	2.370,40
25	Wyeth	Pharmaceuticals (4577)	USA	2.357,69
26	Bristol-Myers Squibb	Pharmaceuticals (4577)	USA	2.325,79
27	General Electric	General industrials (272)	USA	2.251,48
28	Sun Microsystems	Computer hardware (9572)	USA	1.970,14
29	NTT	Fixed line telecommunications (653)	Japan	1.963,07
30	Canon	Electronic equipment (2737)	Japan	1.962,18

- A limited amount of industries tends to dominate
- it's not because you spend a lot of money on innovation that you will be successfull, ex: General Motors

Illustration II

World rank	Company	Country	Industry (3-digit ICB)	R&D-2011 €m	R&D 1-year growth %	R&D CAGR-3y %	Sales-2011 €m	Sales 1-year growth %	Sales CAGR-3y %	R&Dint. %
1	Toyota Motor	Japan	Automobiles & parts	7754.5	7.6	-6.6	184798.1	-1.9	-10.9	4.2
2	Microsoft	USA	Software & computer services	7582.5	8.5	2.9	56977.4	5.4	8.1	13.3
3	Volkswagen	Germany	Automobiles & parts	7203.0	15.1	6.7	159337.0	25.6	11.9	4.5
4	Novartis	Switzerland	Pharmaceuticals & biotechnology	7001.3	12.1	7.9	45263.2	15.7	12.2	15.5
5	Samsung Electronics	South Korea	Electronic & electrical equipment	6857.8	8.8	19.0	110716.1	6.9	18.8	6.2
6	Pfizer	USA	Pharmaceuticals & biotechnology	6805.8	-6.4	3.5	52109.9	-0.6	11.8	13.1
7	Roche	Switzerland	Pharmaceuticals & biotechnology	6782.3	-8.0	-1.8	34935.1	-10.4	-2.3	19.4
8	Intel	USA	Technology hardware & equipment	6453.4	27.0	13.4	41733.5	23.8	12.8	15.5
9	General Motors	USA	Automobiles & parts	6278.7	16.7	0.5	116141.9	10.8	0.3	5.4
10	Merck US	USA	Pharmaceuticals & biotechnology	6090.1	-8.3	17.9	37133.5	4.5	26.3	16.4
11	Johnson & Johnson	USA	Pharmaceuticals & biotechnology	5833.5	10.3	-0.1	50258.9	5.6	0.7	11.6
12	Daimler	Germany	Automobiles & parts	5629.0	16.0	8.2	106540.0	9.0	3.6	5.3
13	Panasonic	Japan	Leisure goods	5173.1	9.1	-2.1	78023.7	5.8	-4.7	6.6
14	Honda Motor	Japan	Automobiles & parts	5169.1	12.2	-4.0	79036.8	-7.3	-12.8	6.5
15	Nokia	Finland	Technology hardware & equipment	4910.0	-0.6	-2.6	38659.0	-8.9	-8.6	12.7
16	Sanofi-Aventis	France	Pharmaceuticals & biotechnology	4795.0	9.2	1.3	33389.0	3.2	6.6	14.4
17	GlaxoSmithKline	UK	Pharmaceuticals & biotechnology	4377.0	-2.4	-0.5	32725.1	-3.5	3.9	13.4
18	Sony	Japan	Leisure goods	4310.5	0.4	-5.9	64569.3	-10.0	-9.5	6.7
19	Siemens	Germany	Electronic & electrical equipment	4278.0	0.9	3.7	73515.0	-3.2	-3.7	5.8
20	Nissan Motor	Japan	Automobiles & parts	4256.3	11.1	-2.2	93564.5	25.2	-4.6	4.5

- Cars, electronic products etc are high in ranking

2.5. Technology Push vs. Market Pull

There's a lot of controversy among economists and historians of science and technology about the relative significance of 'demand pull' versus 'science and technology push' in generating and sustaining innovation flows.

- Market pull: it starts from the customer; real value creation starts from customer. Makes sense. Henri Ford: « if we would have listened to the customers, they would have asked for a faster horse and I wouldn't have built a car. »
- Technology push: it starts from the company ~ 'heroic entrepreneur' from Schumpeter I

Different typologies of innovation exist:
- systemic
- major
- minor
- breakthrough
- derivative
- incremental
- radical

Theories

Market Pull

Several researchers say that it starts from the market. It's all about the projects that are emplying the customers.

- In the 60s and 70s demand-led theories of innovation made a considerable impact on policy makers AND managers (CEO/CTO/…).
- Myers and Marquis (1969) surveying over 500 innovations: successful innovations are demand-led.
- Schmookler (1966) provided a more systematic, historical, justification: by analyzing patent data over time, he discovered that usually the peaks of inventive activity lagged behind the peaks of investment activity. From this, he drew the conclusion that the main stimulus to innovate came from the changing pattern of demand as measured by investment in capital goods in various industries.

Technology Push

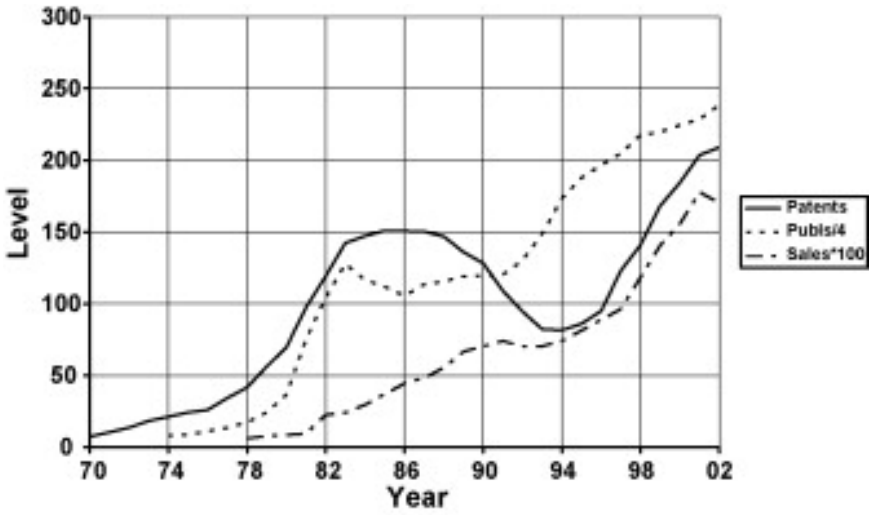
- Scherer (1982) tested Schmookler's hypothesis for a more comprehensive set of (US) industries and found a much weaker relationship (latter on confirmed by Verspagen & Kleinknecht, 1990).
- Mowery and Rosenberg (1979) 'A critical review of the influence of market demand upon innovation.'
- They showed that empirical studies of innovation which in fact were often cited in support of 'demand pull' did not in fact justify these conclusions (problems with both defining the start and the nature of the innovation + confusion about 'needs' – 'demand' – potential/effective - explicit).
- The majority of innovations characterized as 'demand led' in the M&M survey were actually relatively minor innovations along established trajectories and the same was true for the majority of patents analyzed by Schmookler.
- *"The work was fun, but no one was taking it seriously. Everyone was looking at interactive television which was going to be pushed at first by a single killer application: movies on demand. … The internet? It was thought of as a ploy – a low bandwidth ploy. It was nerds and scientists and typing. All that crap. That's what everyone thought – Microsoft and everybody else. I just*

thought that, I might as well work on this now and when I get out of college, go working for Silicon Graphics or Time Warner or TCI." M. Andreessen, August 2000, looking back on the time before Netscape (1994) when he was developing Mosaic. Courtesy www.wired.com

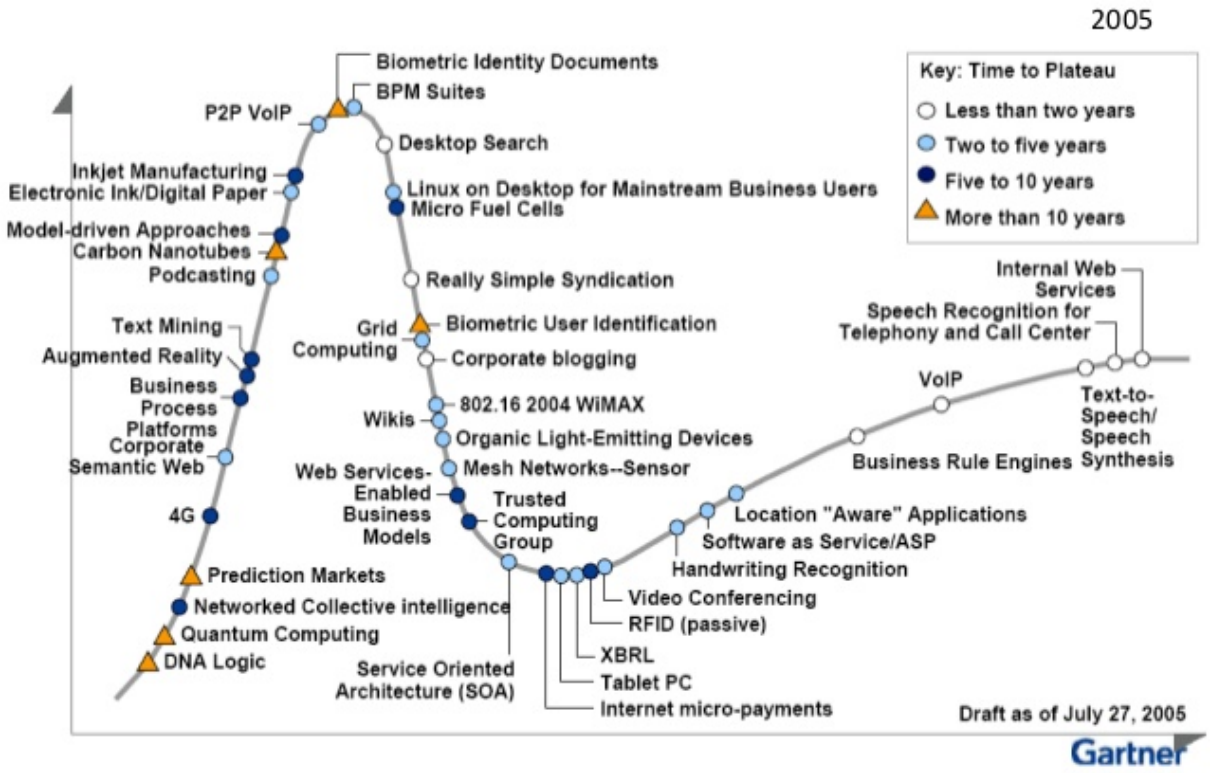
=> So, there's something as technology push. Building something from within a company and offering it to the customers, whitout them asking for it.

=> it's both push and pull, both big firms and entrepreneurial firms in the end that innovate

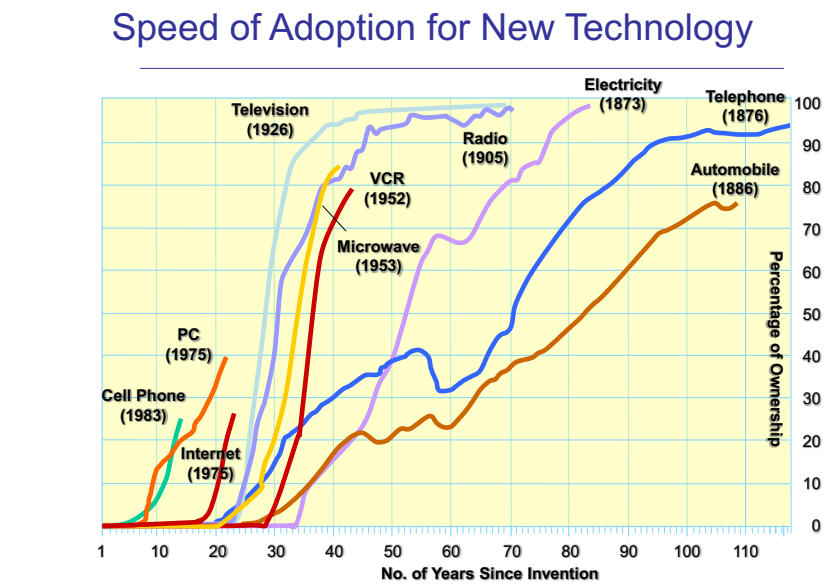
Double-boom cycles and the comeback of science push and market pull -Ulrich Schmoch



- how do we make sense out of this? by bringing in time
- a strategy is completely dependent on the time period of the industry and technology
- graph: duble boom: goes up, then down and then up again
- for example: now there's a huge boom in e-commerce so every entreprneur starts ceating dot coms. But what happens after ? Bubble is created
- don't believe the idea that everything goes fast! it's slow



- graph: how much time does it take for a new product from start to market saturation?
- the world has become smaller (a village) because of the connections, logistics, communication… that's why on the graph it's going up



Source: Rich Kaplan, Microsoft & Ken Morse, MIT, with permission

- Prof does not agree :
- For electricity it took 30 years to control it, and internet only 8

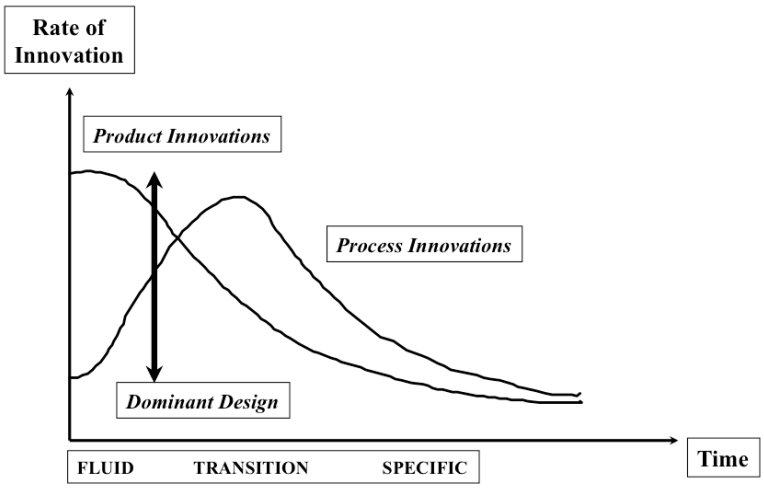
2.6. The Innovation Process (Abernathy & Utterback)

- 'A productive unit's capacity for and methods of innovation depend critically on its stage of evolution'
- The idea of evolution results in a central role of the 'product life cycle' concept (connected also to industry life cycles, see again Schumpeter, and nowadays the work of Tushman & O'Reilly, Christensen…).
- 'Productive unit': a product line and its associated production process <> industry classifications.
- Three stages: Fluid (emerging) – Transitional - Specific (mature)
- You make sure that you scale fast so that you can stay on the game
- You sell the thing to somebody that's going to make it big
- If you want to stay small and beautiful, then you'll go out of business or go in a very small niche

=>Push is dominating in the first phase, and then you better go to the pull dynamic and listen to your client

	Fluid	Specific
Competitive emphasis on	**Functional Product Performance**	**Cost Reduction (Price)**
Predominant type of innovation	**Frequent major changes in products**	**Incremental for product and process with cumulative improvements (<> trivial) in productivity and quality**
Product Line	**Diverse, often including custom designs**	**Mostly undifferentiated standard products**
Production processes	**Flexible and inefficient**	**Efficient, capital-intensive and rigid.**
Equipment	**General-purpose, requiring highly skilled labor**	**Special-purpose/committed, automated**
Organizational form	**Informal and Entrepreneurial**	**Emphasis on structure, goals and procedures**
…		

2.7 Dominant designs and industry dynamics



- the population in an industry overtime. We can agree that we see the same pattern.
- Let's take cars :
    - From 1894 to 1918, 60 firms entered the US Auto industry, and none left.

- Peak of number of firms: 75 (1923)
- In the next two years, 23 firms left or merged; by 1930, 35 exited.
- In 1923 Dodge introduced the all-steel, closed body automobile.
- The new body format dramatically improved the strength and rigidity of the chassis
- Plus: It provided an opportunity to move away from hand forming of exterior body panels to the highly capitalized but efficient process of machine stamping.
- By 1925 fully half of US auto production was all-steel, closed, body cars; by 1926 80% of all automobiles were of this type.
- In Belgium we had 30 start-ups doing cars in the beginning, and now zero.

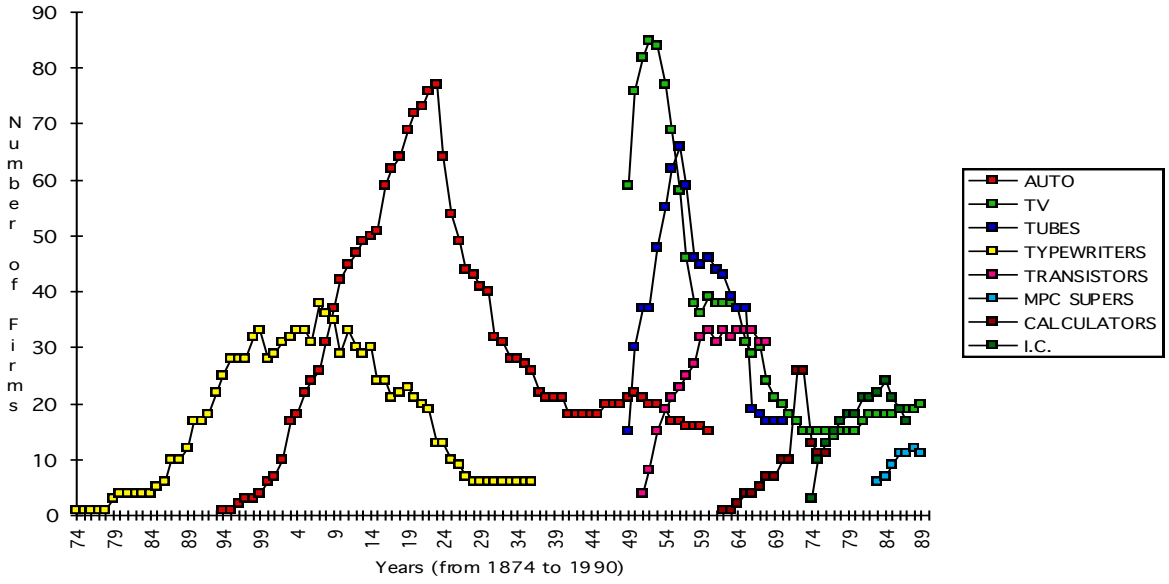


Illustration: the bike industry

In the beginnning there's a lot of product variety. But you see these bikes with high wheels. You need to be young and athletic to ride these.

It was a popular product, it was the skateboard of the 19th century

It was the alternative to horses (very dirty).

But why did it not stay? there was a safety issue, sot hey banned the bycicles from the public streets.

Also, in Vienna they banned the bikes for women bc it was indescent.

=> ambiguity: different people differ in trem of their opinions.

First fase: interpretive flexibility

If there's an issue w/ a high wheel I have to come up w/ a better device w/ the same advantages (speed etc) but with less disadvantages

=> safety bysicle: it's low (problem ladies solved), rubber tire (more speed),

2.8 The Social Construction of Technology (SCOT)

Interpretative Flexibility

- Interpretative Flexibility = each technological artifact has different meanings and interpretations for various groups.
- Bijker and Pinch show that the air tire of the bicycle meant a more convenient mode of transportation for some people, a new sport for others, whereas it meant technical nuisances, traction problems and ugly aesthetics to another group of people.
- These alternative interpretations generate different *problems* to be solved. Aesthetics, convenience or speed issues should be addressed. E.g. What is the best tradeoff between traction and speed? Between speed and safety (for the cyclist but also for pedestrians)?

Relevant Social Groups

- The most basic relevant groups are the *users* and the *producers* of the technological artifact, but most often many subgroups can be delineated - users with different socioeconomic status, competing producers, etc.
- Sometimes there are relevant groups who are neither users, nor producers of the technology - journalists, politicians, civil groups, etc. The groups can be distinguished based on their shared or diverging interpretations of the technology in question. It can be people taking care of the environmental issues of the new product ect.

Design Flexibility (see Fluid Stage – Abernathy & Utterback)

- Just as technologies have different meanings in different social groups, there are always multiple ways of constructing technologies. A design is only a single point in the large field of technical possibilities, reflecting the interpretations of certain relevant groups.

Problems & Conflicts

- The different interpretations often give rise to conflicts between criteria that are hard to resolve technologically (in the case of the bicycle, one such problem was: how can women ride the bicycle decently, in skirt?), or conflicts between the relevant groups (the "Anti-cyclists" lobbied for the banning of the bicycles as they pose a security threat).
- Different groups in different societies construct different problems, leading to different designs.
- (Actual examples: Internet and the diffusion of Music – Stem Cell research/technologies – nanoparticles – genetically modified plants – SUV's….)

Closure

- Over time, as technologies are developed, the interpretative and design flexibility disappears through closure mechanisms.
- Two examples of closure mechanisms:

  i) Rhetorical closure

  When social groups *see* the problem as being solved, the need for alternative designs diminishes. This is often the result of communication efforts (including advertising, example Nuclear Energy).

  ii) Redefinition of the problem by inventive activity

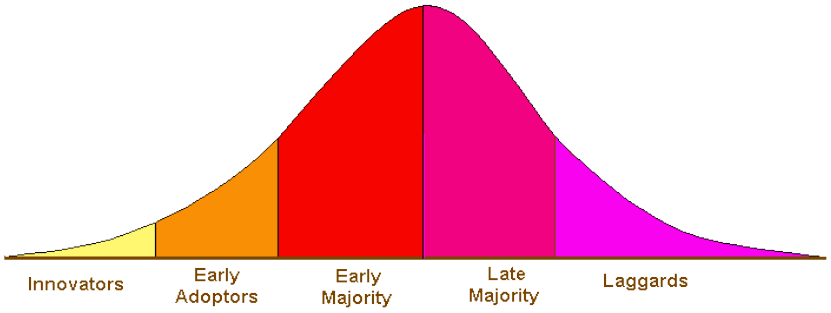
  A design standing in the focus of conflicts can be stabilized by inventing a new design that transcends the current problem (conflict). The aesthetic and technical/functional problems of the air tire diminished, as the technology advanced to the stage where air tire bikes started to

win the bike races. Tires were still considered cumbersome and ugly, but they provided a solution to the "speed problem", and this overrode previous concerns. Ex: Air tire bikes started to win races

- Closure is not permanent: New social groups may form and reintroduce interpretative flexibility, causing a new round of debate or conflict about a technology.
  (For instance, in the 1890s automobiles were seen as the "green" alternative, a cleaner environmentally-friendly technology, to horse-powered vehicles; by the 1960s, new social groups had introduced new interpretations about the environmental effects of the automobile)

2.9. The diffusion of innovation

Rogers – 5 categories of users :



The 5 categories:

1. Innovators (2.5%)
2. Early adopters (13.5%)
3. Early majority (34%)
4. Late majority (34%)
5. Laggards (16%)

It's a social model. Why? If we look at the new technology, there are only a few people who really jump into that (=innovators), people who are intrigued, inspired, they want to explore, they account for 2,5% only.

Innovators

- First individuals to adopt an innovation
- Adventurous in their purchasing behavior
- Comfortable with a high degree of complexity and uncertainty
- Substantial financial resources
- They have an extremely important role in the diffusion of an innovation because they are the individuals who bring new ideas into the social system

Early adopters

- Well integrated into their social system
- Greatest potential for opinion leadership
- Potential adopters look to early adopters for information and advice; thus, early adopters make excellent missionaries for new products or processes

Early majority

- They adopt innovations slightly before the average member of a social system
- They are not opinion leaders, but they interact frequently with their peers

Late majority

- They approach innovation with a skeptical air and may not adopt the innovation until they feel pressure from their peers
- They may have scarce ressources, making them reluctant to invets in adoption until most of the uncertainty about the innovation has been resolved

Laggards

- They base their decisions upon past experience rather than influence from the social network

Moore: argues there is a chasm between the early adopters of the product (the technology enthusiasts & visionaries) & the early majority (the pragmatists). He believes visionaries and pragmatists have very different expectations, and he attempts to explore those differences and suggests techniques to successfully cross the "chasm", including choosing a target market, understanding the whole product concept, positioning the product, building a marketing strategy, choosing the most appropriate distribution channel and pricing.

PC advertising in time

From

to

It's about look, feel, weight but no longer about functionality. Thanks to dominant design.
Dominant design: A product design that is adopted by the majority of producers, typically creating a stable architecture on which the industry can focus its efforts.
If you start seeing women in the advertising, it means that you're entering the 'saturated market'. (pas sure de ce que j'ai ecrit)
Can we account for a complete picture in terms of innovation dynamics?
The answer is no (prof)

Baumol: governments and universities play an important role in the innovation equation as well:

- Provide legal framework conditions that encourage entrepreneurship and investments in R&D – allow/enable free access (to markets).
- Create frameworks/rules for (intellectual) property rights and enforceability of contracts.
- Support Basic Research ('Market failures')
- Introduce Universities (and other public research agencies) as 'engines' of novelty.

(Quantum computing, it's still very unclear, it's going up a bit. But it's already going on dor the 20-30 years, and in the next 10 years it's highly unlikely that i twill go out. So, it's been 40 years!)

2.10 Market failures at work

A company which is there to create value and to make sure that there's a ROI in a forceiable timeframe with levels of uncertainty and risks that are acceptable will not invest in this kind of technology.

!!Market failure doesn't mean google glass! It's not a new product that's has not a lot of succes in the market, it's not taking off.
It's the decision to allocate R&D to some areas and that's not functioning. When you have huge levels of uncertainty and that the timeframe is very long!!

- Innovation implies uncertainty: technical and commercial
- Innovation might imply long time frames introducing 'appropriation' concerns:
    - Will a firm be able to reap the benefits of its investments if they manifest themselves only 10/15/20 years later? This latter point applies especially to innovations of a more radical nature
    - Notice that the nature of knowledge (information) complicates things even more
- The presence of uncertainty and the outcome of inventive activity (information) seems to require activities designed to reduce or mitigate its consequences:
    - Introduce insurance schemes (options) to handle risks? But what about incentive problems?
    - Introduce portfolio of innovations in order to handle risks – requires resources. Monopolists can use/invest excess profits more easily in such portfolio's hence could (will?) be more innovative. The main actors will be large firms and/or monopolists (Schumpeter)?
    - Introduce arrangements that allow information dissemination and exploitation (IP regimes)?

Science
- No immediate economical returns
- Basic research: valuable but at the same time, uncertain.
- (Beneficial) Outcomes often characterized by extended time frames
- Market Failures (K. Arrow)
- Introduction of public funding to address market failures
- Allocation mechanisms/criteria required for funding - Allocation of public sources introduces accountability – governance evolves towards 'Entrepreneurial' Universities ('Third mission' – besides education and research)

Market Failures
- The market, as a coordination device to allocate resources, results in a sub-optimal situation
- Basic scientific work: extended time frames before impact unfolds; results highly uncertain (so often no impact (yet)); creation of information/knowledge which is difficult to appropriate…)
- For rational actors, driven by profit maximizing objectives (~ firms), the rational choice with respect to this type of activities: do not invest
- If all market actors arrive at the same conclusion, investment levels will be low/moderate (equaling voluntarism - sponsorship driven by idealism)
- Society as a whole might be better off if we would allocate more resources … leading to investing taxpayer's money…. (as well as the creation of IP arrangements…)

Arrow - Economic Welfare and the Allocation of Resources for Invention

- Uncertainty & Risks:
  - The economic system has devices for shifting risks, but they are limited and imperfect, hence one would expect an underinvestment in risky activities.
  - It is undoubtedly worthwhile to enlarge the variety of such devices, but the moral factor creates a limit to their potential
  - "any insurance policy and in general any device for shifting risks can have the effect of dulling incentives"
- Cfr. Arrow (1962): Separating innovation and risk bearing is feasible but creates a 'moral hazard' problem
- As a consequence, investors will force inventors/innovators to participate in risk taking (investing) because they will not be able to monitor efforts (information asymmetry)
- This might lead to a situation in which the inventor may be forced to hold more shares in the project than he would prefer and therefore be unwilling to undertake the project at all.

- Invention as the production of Information
  - Information as a commodity (marginal production cost almost zero)
  - In the case of absence of legal protection, the owner of information can not just 'sell' information on the open market as any purchaser can 'destroy' the market
  - So, in this case, the only user is the 'creator'. This is not only socially inefficient, but also may not be of much use to the owner of the information since he may not be able to exploit it as effectively as possible.
- The demand for information also has uncomfortable properties. Besides indivisibilities, there is a fundamental paradox in the determination of demand for information. It's value is not known until (s)he has the information, but then (s)he has acquired it without costs.
- "There are difficulties of creating a market for information if one should be desired for any reason."
- With suitable legal measures, information may become an appropriable commodity. Then some sort of monopoly power can indeed be exerted.

Hence, there's loss of social welfare and market failure due underinvestment in innovation.
=> two remedies:

<u>Social/ collective financing of innovation:</u>
On firm-level via portfolios or on society-level via government intervention

<u>Introducing intellectual property rights:</u>

- There's a tricky thing about information as a good, in the sense that if I want to sell that, if I want to buy that, then I need intellectual property rights
- It will create another problem in terms of welfare dynamics

So basically, what you need to know:
- market failure
- the 2 solutions for it (fund basic research and intellectual property rights)

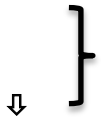
Market failures, always and everywhere?

- It is clear that market failures are only present in research and development activities of an uncertain/more basic nature
- Currently, both firms and governments support R&D activities (e.g. 3% Target EU: +/- 2% BERD & 1% HERD)
- Efforts/policies should focus on creating additional rather than substitutive effects
- To the extent that public money is being invested in R&D, actors performing these R&D activities can/should be hold accountable for results, including efforts geared towards spillovers (valorizing knowledge)

From heroic entrepreneurship to innovation systems: stepping stones

It's very important to know and understand the following principles and links in between:

- Entrepreneurs & Established Firms
- Technology Push & Market Pull



Early days push (entrepreneurs)
Then pull (established firms)

- Life Cycle Dynamics
- Market Failures, especially during the early stages

⇩

- Government as investor and regulator (e.g. creating temporary monopolies by granting patents)
- Universities and Research Centres as sources of scientific inventions' (innovations?)

⇩

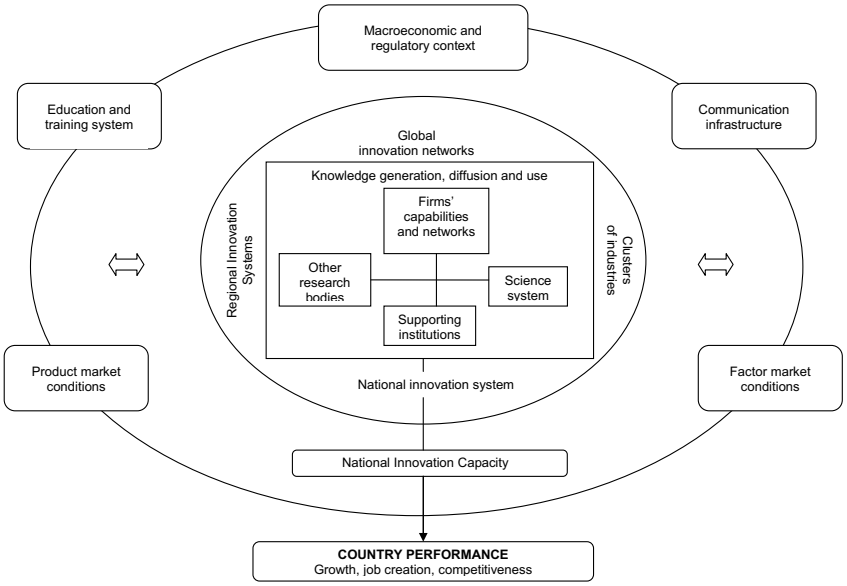
- Towards the concept of Innovation Systems

Go check book chapter 5: Timing of Entry p 67-78
However, it's between brackets in the overview of the professor, so less important

3. INNOVATION SYSTEMS
Slides + chapter 2 book

From book:
Innovation can arise from any different sources. It can originate with individuals, as in the familiar image of the lone inventor or users who design solutions for their own needs. It can also come from the research efforts of universities, government laboratories and incubators, or private nonprofit organizations.
One primary engine of innovation is firms. They have greater resources than individuals and a management system to marshal those resources toward a collective prupose. They face strong incentives to develop differentiating new products and services.
An even more important source of innovation, however, does not arise from any one of these sources, but rather the linkages between them. Networks of innovators that leverage knowledge and other resources from multiple sources are one of the most powerful agents of technological advance.
Therefore, today if we look at innovation, a lot of people talk about **innovation systems.**
The whole idea: if we look at the economic performance of a country, we see that If we have more capacity of innovation then we'll have more wealth.
But then who's responsible for the national innovation capacity?
Companies, science and research institutions, governmenet institutions that permit to be more innovative, science etc.

National Innovation Systems



If you want to understand why Silicon Valley is doing good, we cannnot only focus on companies and entrepreneurs! Maybe universities are very important? Maybe the public money that the US government is investing in new emerging innovations is affecting the wealth and innovation.
When did Silicon Valley start? 1930s they established a company on land that used to be hold by the university and put the first industrial parc.
Paytrank: foundation of Google it's owned by stanford university. It's a patent when he did his PhD at Standford.

So, you see, the government has a lot to do with innovation and should be involved in it in order to create wealth in the country.

National innovative capacity: the ability of a country to produce and commercialize a flow of innovative technology pver the long term, the capacity depends on:

- the strength of nation's common innovation infrastructure
- the environment for innovation in a nation's industrial clusters
- the strenght of linkages between both

Innovation Systems

While the concept of innovation systems in itself turns our attention to interactions, the strength of its components is at least as important. In this respect it is worthwhile to keep the following observations in mind:

- Considerable differences between the US (JP) and EU do exist in terms of total R&D expenditures and the gap increased the last decade
- R&D intensity is considerably higher in the US (2.89%) and Japan (2.69) than in the EU (1.93) (Figures: 2000 - 2001)
- Government spending per capita on R&D is higher in the US than EU
- Scientific performance of US > EU (Dosi et al. 2005 STI Links and the 'European' paradox)

The European paradox: European countries are good in science, but they have an entrepreneurial deficit: they lack the ability to translate the new scientific knowledge into economic activity. European countries perform good in mature industries, f.e. the agriculture industry.

Differences in organizing innovation systems do translate into performance differences.

Innovation intensity of countries as measured by patents (USPTO patents for 17 OECD countries for the period 1973-1996), vary as a result of differences in:

- Innovation input (R&D manpower and spending)
- R&D policy choices such as the extent of IP protection and openness to international trade, the *share* of research performed by the academic sector and funded by the private sector, the degree of technological specialization, and each individual country's knowledge "stock"

Universities and government-funded research

Another important source of innovation comes from public research institutions such as universities, government laboratories, and incubators. A significant share of companies reports that research from public and non-profit instittions enabled thel to develop innovations that they would not have otherwise developed.

Universities

Universities in the US are the second largest performer of R&D after industry. And are the number one performer of basic research in the US. Many universities encourage their faculty to engage in research that may lead to useful innovations. To oncrease the degree to which university research leads to commercial innovation, many universities have established **technology transfer offices.** The creation of these technology transfer offices accelerated rapidely after the **Bayh-Dole Act** was passed in 1980. This allowed universities to collect royalties on inventions funded with taxpaper dollars. Before this, the federal government was entitled all rights from federally funded inventions.

Unoversities also contribute significantly to innovation through the publication of research results that are incorporated into the development efforts of other organizations and individuals.

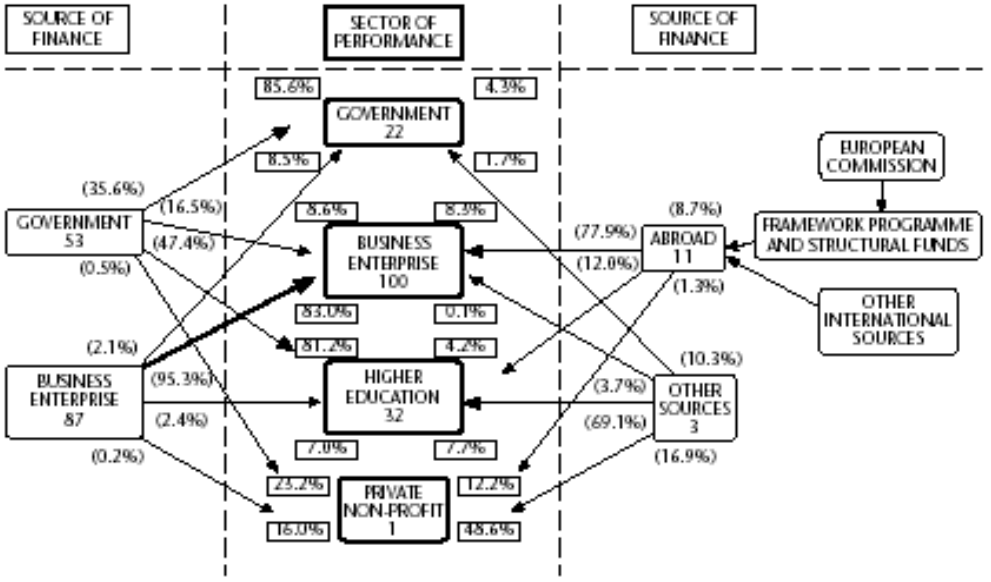
Government-Funded Research

Governments in many countries actively invest in research through their own laboratories, the formation of science parks and incubators, and grants for other public or private research entities.
Science parks: regional districts, typically set by governments, to foster R&D collaboration between government, universities and private firms.
Incubators: Institutions designed to nurture the development of new businesses that might otherwise lack access to adequate funding or advice.
One way governments support the R&D efforts in bot public and private sectors is through the formation of science parks and incubators. Since the 1950s, national governments have actively invested in developing science parks to foster collaboration between national and local government institutions, universities, and private firms. They often include institutions designed to nurture the development of new businesses that might otherwise lack access to adequate funding and technical advice. These parks create fertile hotbeds for new start-ups and a focal point for the collaboration activities of established firms. Their proximity to university laboratories and other research centers ensures ready access to scientific expertise. They help university researchers implement their scientific discoveries in commercial applications. They give rise to technology clusters that have long-lasting and self-reinforcing advantages.

Private Nonprofit Organizations

They are: private research institutes, non-profit hospitals, private foundations, professional and technical societies, academic and industrial consortia, and trade associations. Many perform R&D themselves, others do fund R&D and don't perform themselves while othersdo both together.

Financing and performance structures of R&D in the EU-15 (1)
(€ billion, in current terms), 1999



Source: DG Research
Data: OECD – MSTI database (STI, EAS Division) with DG Research provisional estimates
Notes: (1) L data are not included in EU-15 average; A is not included in the calculations of the % shares.
Totals for source of funding and sector of performance do not correspond exactly due to rounding.

Third European Report on S&T Indicators, 2003

The figure above shows what EU is doing 20 years ago in terms of R&D.
On the right who is doing it, and, on the left, who is funding it.
Middle part: the biggest amount of $ is in-firms (1/3 public, 2/3 private)

Provisional data for 2015 indicates that public R&D budgets in the OECD area continued their downward trend since 2010 after briefly stabilising in 2014. Among countries for which 2015 data are available, more than half have decreased their R&D budgets in real terms and the estimated area total has dropped by 1.3%. In a number of cases, this decline may have been mitigated through growing support through R&D tax incentives, which have been increasing in relative importance over time. On the basis of leading budget data, it is expected that R&D performed in government and higher education institutions in the OECD also declined in 2015.

The most recent data on Gross Domestic Expenditures on R&D (GERD) for the OECD suggest that annual GERD grew in 2014 by 2.3% in real terms, a slower pace compared to the previous year (+3.0%). This recent growth in the OECD has been mainly driven by a steady increase in R&D performed by business (+2.8%). R&D expenditures recovered in government institutions (+1.3%) after a previous fall but stayed constant in higher education (+0.2%). As a percentage of GDP, GERD remained unchanged at 2.4%.

In China, 2014 saw R&D expenditures reaching the milestones 2% of GDP (the target set in the 2006-2010 plan for 2010). While China's GERD continued to grow very rapidly (+9% in real terms) in 2014, this represented China's lowest GERD growth since 1996. Korea has the world's largest R&D intensity (4.3% in 2014) ahead of Israel (4.1%) for the second year in a row.

3% target: from the summit of Lisbon ('99-2002). Says that EU should be more ambitious, and we want to be the leading economy: being n1 in the knowledge economy and in order to be that we advanced a number of ambitious goals and we are going to spend 3% of our GDP on R&D. Do we do that in 2018? Scandinavia: 4-5%, Belgium: almost 3%.

Some facts

- Seven fields in which Europe has the largest share of Triadic Patents: Food, Agriculture & Fisheries: Materials; New Production Technologies; Construction; Green Energy; Environment; Aeronautics.
- Four fields in which North America (USA & Canada) have the largest share of triadic patents: Health; Biotechnology; Space; Security
- Five fields in which Asia has the largest share of triadic patents: ICT: Nanotechnology; Energy; Automobiles; Other transport technologies
- The internet economy: not a lot of EU companies (spotify, SAP)
- Car manufactury: EU has 45%, the rest is Asia and 15% is USA

=> Europe is not doing a good job in emerging activities (hightech, the ones that require entrepreneurial dynamics

Bayh Dole legislation
Legislation that allows universities to take patents on publicly funded research

Entrepreneurial universities

= add patenting activities, spin off activities and contract research to their traditional missions of teaching and research

WHY ?

- Extra university research funding opportunities
- Improving relevance of academic curricula
- Faster/better exploitation of new inventions
- Rejuvenating the economical texture of a region

EXAMPLE
Stanford University: in the 1930s, Frederick Terman (dean); encouraged Bill Hewlett ad David Packard to start their own electronics company. In 1951, Stanford University opened the Stanford Industrial Park (234 ha of university land), the first company was Varian industries, the second Hewlett Packard, today, 150 firms are active in the areas of electronics, software and biotechnology.

CONCERNS

- Secrecy problem: firms may ask universities to keep information (temporarily) confidential, this might reduce the incentive to publish and run counter to the academic norm of public exposure of scientific knowledge
- Skewing problem: Corporations may interfere with the normal pursuit of science and seek to control university research for their own ends, the changes in the university research agenda are most often related to an alleged shift towards the more applied research end.

While entrepreneurial activities show a growing tendency, one should be aware of:

- Large (within/between country) differences: pointing out the relevance of institutional factors fostering/hampering such activities (at different levels)
- Within the broader framework of universities' activities, entrepreneurial activities are 'small' (E.g. Contract Research (with industry): 8,14 % of total research budget US/AUTM – License revenues of University of California: 1.5% of total research budget)
- The field specific nature of these activities (e.g. biomedicine)
- Slow/gradual nature of such activities (e.g. no spin offs < 5 years employ more than 50 people, recent survey EC-Globalstart project)

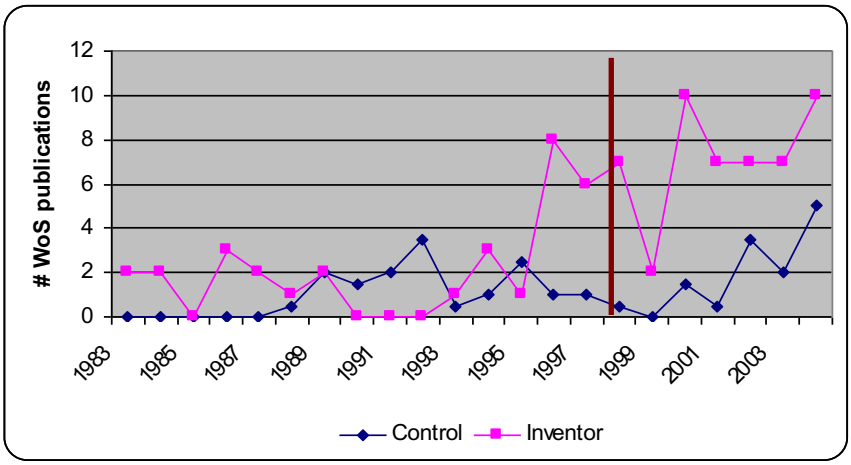
Finally, one notices a 'dual' interaction effect (within university and within region):

- Scientific Capabilities * Entrepreneurial orientation (University)
- Entrepreneurial Universities * Presence and interaction with (local) business texture (Varga, 1999) (Region)

Publication and patent behavior of academic researchers:
Conflicting, reinforcing or merely co-existing?
Research questions:
(1) Do faculty members who are engaged in patenting activity publish less than their colleague non-inventors?
→ inventors publish more than non-inventors, two possible explanations:

- Companies prefer working with the better scientists (selection effect)

- The inventor can increase his scientific footprint using the benefits related to his patents (treatment effect)



(2) Do inventors differ from colleague non-inventors in terms of the nature of their publications (basic/applied)?
→ inventors publish less than expected in technology-oriented journals and more than expected in science-oriented journals (↔ skewing problem!)

(3) To what extent does involvement in contract research with industry influence the co-existence of patent and scientific activities?
→ involvement in contract research further adds to the differential publication outputs

House in Leuven is more expensive than Brussels. Why? pressure of students, technology => the litte Silicon Valley effect

Myths versus Realities (Van Looy/Piccaluga/Debackere)	
Entrepreneurial activities hamper science.	Scientific capabilities (eminence) are the engine of entrepreneurial performance.
TTO's are crucial to arrive at scale/scope of technology transfer activities (TTO's are the 'engine' behind the third mission).	Distributed entrepreneurial efforts (within the university) benefit from the presence of specialized support staff and a strategic vision/commitment at the level of the top (of universities) (our 'internal triple helix').
Entrepreneurial activities generate a substantial share of funding for universities (allowing to decrease over time more traditional types of university funding).	Universities will always require funding for research (market failures) and education (as long as we organize it as a 'public good'). Entrepreneurial activities of universities could/should not be organized for monetary purposes only.
A more entrepreneurial orientation of universities will be beneficial for all kind of industries and all kind of R&D/Innovation challenges.	The specific role of universities within innovation systems is situated in the vicinity of 'market failures'
'Bayh Dole' type of legislations are not relevant (or even harmful).	To the extent IP rights are essential to operate they are best situated at the level of the principal (University/Faculty/Department) while agents (academic staff) should be considered as entrepreneurial (and hence incentivized as such)

PART 2 : INNOVATION AT THE LEVEL OF THE FIRM

Content: Innovation strategy and how to organize/implement such a strategy effectively on the level of the firm (internally + externally) (Innovation Management, Organizational theory, alliances/networks, etc.)
= We're going to focus on strategies of firms to be effective in strategies and innovation.
= the basics of making sure that at the level of the firm you implement a strategy

1. BUILDING BLOCKS

Turning innovation into profit. Creativity VS innovation
Google is not really that effective all the time.
The company that creates a lot of money with a lot of products: Apple.
Message 1: if we label a company as very good in terms of innnovation, it is about making money as well. The whole idea is we want to create new products and turn them into economic value.
If they are creating a lot of innovative products but not creating profit then they are not innovative, but just creative.
Message 2: There are more failures than successes.
If you're afraid of failure, then never go into innovation or R&D.

Some examples of failures

Besos- fire phone
Good example of a heroic entrepreneur that starte w/ amazon and is over 100billion turnover, in hardly 20yrs.
E-3 yrs ago they launched a smartphone that was a tablet as well. The fire phones.
No succes becaue there's too much competition, it's a rat ocean and they don't have sufficient capabilities to do so.
They could make it, expecially with partnerships.
More fundamental question: is this a good idea for a company like amazon?
Strategy of amazon: « they want to be the online e-commerce for everyone, for everything ». If that's your strategy, and you invest a lot in e-commerce, but you also have a huge network, and supply chain, why would youd develop a smartphone?
If you want to be effective as a company, what you do in terms of innovation should reinforce what you try to achieve in your market, to exploit your competititve advantage. So where is this smartphone going?
The phone was the perfect electronic wallet to shop on amazon.
Reason behind: if they do it, they will learn about hardware etc. Don't forget they are involved in the kindle.
The projects that make it to the market: 60% are failures, 10% are ok, but don't make a lot of money and 10% are blockbusters

Segway
When it was launched, it got a lot of money, lot of people were very excited into this project and in the end, it didn't solve our mobility problem.

Conclusion
Innovation = ideas + exploitation of ideas
Innovation = a managerial & entrepreneurial activity,
Involving a variety of activities along the corporate value chain:
- Research & development
- Engineering & manufacturing
- Logistics
- Marketing & sales
R&D = a "SERVICE" function as well as a "BUSINESS" creation function
=> If they are creating a lot of innovative products but not creating profit then they are not innovative, but creative
!! In order to be effective you need to have the whole value chain!!

2. DEFINING THE ORGANIZATION'S STRATEGIC DIRECTION

chapter 6 book

2.1. Assessing the firm's current position

External Analysis
Porter's 5 forces model

- *The degree of existing rivalry*

It is unfluenced by the number and relative size of competitors, the degree to which competitors are differentiated from eachother, the demand conditions and the exit barriers.

- *Threat of potential entrants*

It is influenced by the both the degree to which the industry is likely to attract new entreants and the height of entry barriers.

- *Bargaigning power of suppliers*

The degree to which the firm relies on one or a few suppliers will influence its ability to negotiate good terms. Its influenced by the number of suppliers and their differentiation, the amount the firm purchases from the supplier, if the firm faces switching costs and if the firm can backward vertically integrate.

- *Bargaigning power of buyers*

The degree to which the firm is reliant on a few customers, the level of differentiation of the firm's product, if the buyers face switching costs, if the buyers can threaten to backward vertically integrate.

- *Threat of substitutes*

Substitutes are products or services that are not considered competitors but fulfill a strategically equivalent role for the customer. It is influenced by the number of substitutes, the degree of substitutuin and the relative price. Note: distinguishing between a competitor and a substitute depends on how the industry is defined – f.e. transportation industry versus airline industry

Complements
Complements are products that enhance the usefulness or desirability of a good. For example, software is an important complement for computers, and gasoline is an important complement for automobiles. Its important to consider:

1) How important complements are in the industry
2) Whether complements are differentially available for the products of various rivals
3) Who captures the value offered by the complements

Stakeholder analysis

Involves identifying any entity with an interest in the firm, what it wants from the company and what claims it can make on the company.

- Strategic stakeholder analysis: emphasizes the stakeholder management issues that are likely to impact the firm's financial performance
- Normative stakeholder analysis: emphasizes the stakeholder management issues the firm ought to attend to due to their ethical or moral implications.

Internal Analysis

Value chain

The activities are divided into primary activities and support activities. Each activity can then be considered from the point of view of how it contributes to the overall value produced by the firm and what the firm's strengths and weaknesses are in that activity. Once the key strengths and weaknesses are identified, the firm can assess which strengths have the potential to be a source of sustainable competitive advantage → a sustainable competitive advantage is rare, valuable, durable and inimitable.

2.2. Identifying core competencies and dynamic capabilities

Core competencies

Core competencies = itedgrated combinations of abilities that distinguish the firm in the marketplace. Prahaland and Hamel offer the following tests to identify the firm's core competencies:

- Is it a significant source of competitive differentiation? Does it provide unique signature to the organization? Does it make a significant contribution to the value a customer perceives in the end product? For example, Sony's skills in miniaturization have an immediate impact o the utility customers reap from its portable products.
- Does it transced a single business? Does it cover a range of businesses, both current and new? For example, Honda's core competence in engines enables the company to be successful in businesses as diverse as automobiles, motorcycles, lawn mowers, and generators.
- Is it hard for competitors to imitate? In general, competencies that arise from the complex harmonization of multiple technologies will be difficult to imitate. The competence may have taken years (or decades) to build. This combination of resources and embedded skills will be difficult for other firms to acquire or duplicate.

According to Prahalad and Hamel, few firms are likely to be leaders in more than five or six core competencies.

The risk of core rigidities

Sometimes, the very things that a firm excels at can enslave it, making the firm rigid and overly committed to inappropriate skills and ressources. They can also inhibit the development of new core competencies.

Dynamic capabilities

In fast-changing markets, it can be extremely useful for a firm to develop a core competency in responding to change. Dynmic capabilities enable firms to quickly adapt to emerging market or major technological discontinuities.

2.3. Strategic intent

A long-term goal that is ambitious, builds upon and stretches the firm's existing core competencies and draws from all levels of the organization, f.e. Apple's mission of ensuring that every individual has a personal computer. Once the firm articulates its strategic intent, managers should identify the resources and capabilities the firm must develop or acquire to achieve its strategic intent. Many companies are now pairing the articulation of their strategic intent with a multidimensional performance measurement system such as the balance scorecard.

Red and Blue Ocean Strategy (we'll see it later)

The Balace scorecard

It's a measurement system that encourages the firm to consider its goals from multiple perspectives and establish measures that correspond to each of those perspectives.

- Financial perspective
  goal: meet shareholder's expectations
  measure: net cashflow
- Customer perspective
  goal: improve customer loyalty
  measure: % of repeat purchases
- Internal perspective
  goal: improve inventory management
  measure: inventory costs
- Innovation and learning perspective
  goal: improve employee skills
  compete in existing market-space
  measure: employee training targets

2.4. Summary of Chapter

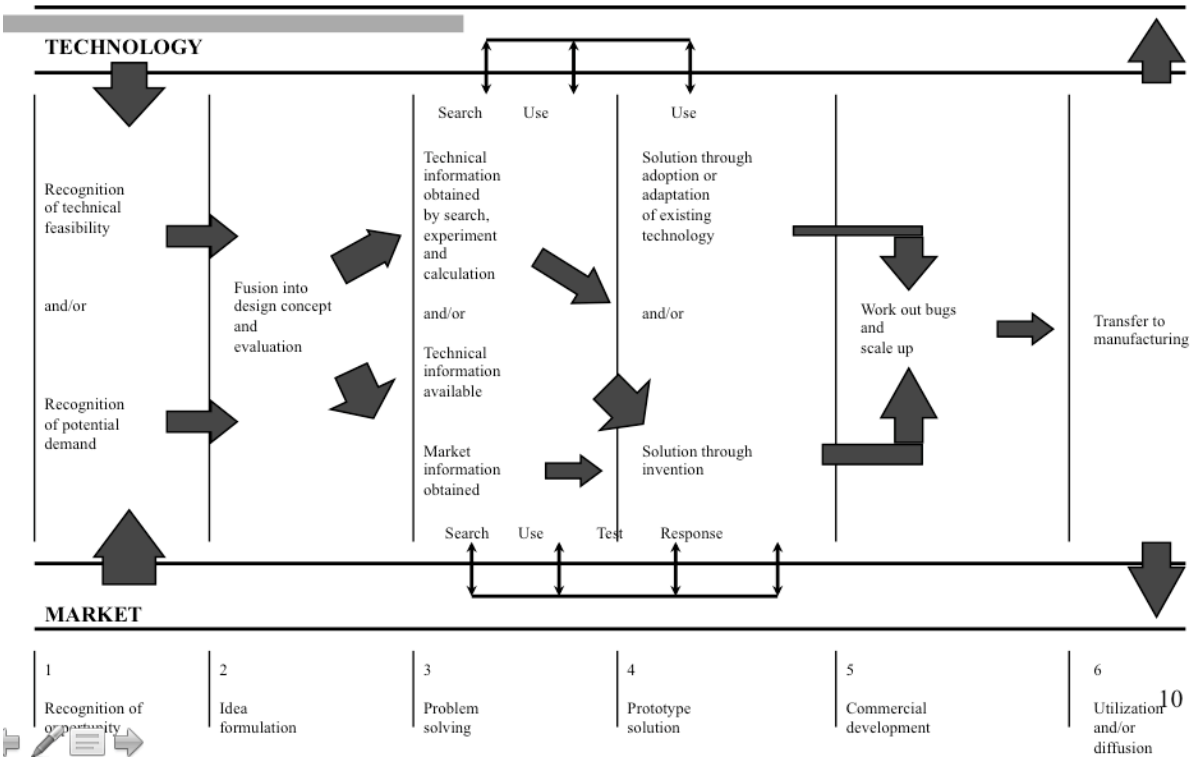
- The first step in establishing a coherent strategy for the firm is assessing the external environment. Two commonly used models of external analysis are Porter's 5 forces model and the stakeholder's analaysis
- Porter's 5 forces model entails assessing the degree of existing rivalry, threat of potential entrants, bargaigning power of suppliers, bargaigning power of customers, and threat of substitutes. He has added a sixth force, the role of complements
- Stakeholder analysis involves identifying any entity with an interest in the firm, what it wants from the company, and what claims it can make on the company
- To analyze the internal environment, firms often begin by identifying the strengths and weaknesses in each activity of the value chain. The firm can then identify which weaknesses in each activity of the value chain. The firm can then identify which strengths have the potential to be a source of sustainable competitive advantage.
- Newt, the firm identifies the ore competencies. Core competencies are integrated combinations of abilities that distinguish the firm in the marketplace. Several competencies may underline each business unit, and several business units may draw upon the same competency.
- Sometimes core competencies can become core rigidities that limit the firm's ability to respond to a changing environment

- Dynamic capabilities are competencies that enable the firm to quickly reconfigurate the firm's organizational structure or routines in response to change in the firm's environment or opportunities.
- A firm's strategic intent is the articulation of an ambitious long-term (10 to 20 years) goal or set of goals. The firm's strageic intent should build upon and stretch its existing core competencies.
- Once the firm articulates its strategic intent, managers should identify the ressources and capabilities that the firm must develop or acquire to achieve its strategic intent.
- The balanced scorecard is a measurement system that enourages the firm to consider its goals from multiple perspectives (financial, customer, business, process and innovation and learning), and establish measures that correspond to each of those perspectives

3. CHOOSING INNOVATION PROJECTS

Slides + chapter 7 book

Innovation as a process



We talked about push and pull.

In the end we need to connect new technologies to the market. Need to make sure the're something novel, that we try to connnect to market needs. How can I create a new technological artefact in such a way that people are interested in it and ready to buy it?

While innovating, you're coping with several problems:

- Coping with uncertainty and ambiguity
- Coping with tensions:
  - Long-term versus short-term
  - Competence disrupting versus competence enhancing
  - Individual/collective creativity versus strategic alignment
  - Effectiveness versus efficiency
  - Slack versus speed

3.1. The development budget

- Firms have to choose which project to fund
- Many firms use a form of *capital rationing* in formulating their new product development units

Capital rationing
- The allocation of a finite quantity of resources over different possible users
- The firm sets a fixed R&D budget and then uses a rank ordering of possible projects to determine which will be funded. Firms might establish this budget on the basis of industry benchmarks or historical benchmarks of the firms' own performance
- If there's no investment return, companies won't do it.

- Some industries (notably drugs, special industry machinery, and semiconductors and electronic components) spend considerably more of their revenue on R&D than other industries on average
- There's also considerable variation within each of the industries in the amount that individual firms spend.

3.2. Quantitative methods for choosing projects

Methods for analyzing new projects unsually entail converting projects onto some estimate of future cash returns from a project.

Discounted cash flow methods

Methods for assessing whether the anticipated future benefits are large enough to justify expenditure, given the risks. They take into account the payback period, risk, and time value of money. Two types od methods: NPV and IRR.

Net present value (NPV)

Given a particular level and rate of cahs inflows, and a discount rate, what is the project worth today?

$$NPV = C * \frac{1 - \frac{1}{(1+r)^t}}{r} \text{ or in case of perpetuity } NPV = C * \frac{1}{r}$$

Actual NPV: includes risk and uncertainties. => $A{-}NPV{=}NPV{*}P\text{t} {*}P\text{o} {*}P\text{m}$

You should take into account your RISK. You have to discount your cashflows with an interest rate with risk.

3 types of risk:

- Technical (Pt): Can we do it?
- Operational (Po): Can we scale it? And in a cost effectiev way?
- Commercial (Pm): Is the customer ready? that's the problem with Google glass and Segway

Internal Rate of Return (IRR)

Given a particular level of expenditure and particular level(s) and rate of cash inflows, what rate of return does this project yield? It's the discount rate that makes the NPV of the investment zero.

Real options

Real Options

When a firm develops new core technologies, it is simultaneously investing in its own learning and in the development of new capabilities. Thus, development projects can create valuable future opportunities for the firm that would otherwise be unavailable.[2] Even development projects that appear unsuccessful (as Intel's DRAM discussed above) may prove to be very valuable when they are considered from the perspective of the options they create for the future of the firm. Some managers and scholars have begun arguing that new product development decisions should be evaluated as "**real options.**"

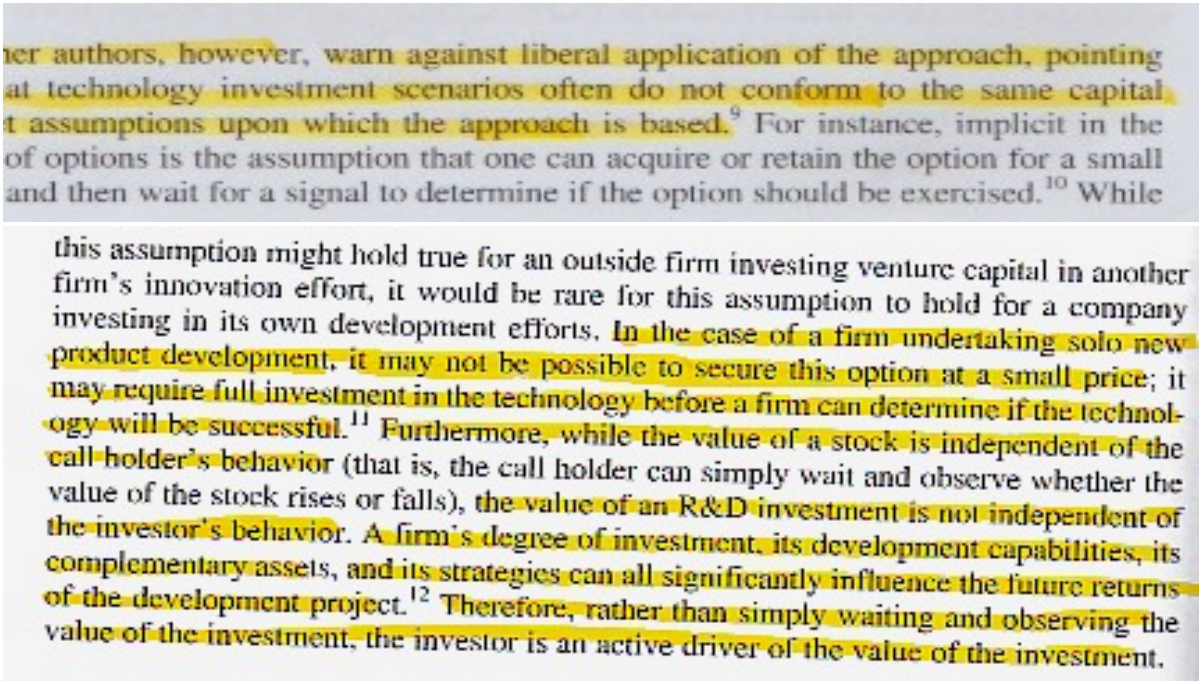
To understand real options, it is first useful to consider the financial model upon which they are based—stock options. A call option on a stock enables an investor to purchase the right to buy the stock at a specified price (the "exercise price") in the future. If, in the future, the stock is worth more than the exercise price, the holder of the option will typically exercise the option by buying the stock. If the stock is worth more than the exercise price plus the price paid for the original option, the option holder makes money on the deal. If the stock is worth less than the exercise price, the option holder will typically choose not to exercise the option, allowing it to expire. In this case, the option holder loses the amount of money paid for the initial option. If, at the time the option is exercised, the stock is worth more than the exercise price but not more than the exercise price plus the amount paid for the original option, the stockholder will typically exercise the option. Even though the stockholder loses money on the deal (some portion of the price paid for the original option), he or she loses less than if he or she allowed the option to expire (the entire price paid for the original option).

In "real options," the assets underlying the value of the option are nonfinancial resources.[3] An investor who makes an initial investment in basic R&D or in breakthrough technologies is, it is argued, buying a real call option to implement that technology later should it prove to be valuable.[4] Figure 7.4 provides examples of investment decisions that can be viewed as real call options. With respect to research and development:

- The cost of the R&D program can be considered the price of a call option.
- The cost of future investment required to capitalize on the R&D program (such as the cost of commercializing a new technology that is developed) can be considered the exercise price.
- The returns to the R&D investment are analogous to the value of a stock purchased with a call option.[5]

As shown in Figure 7.5, the value of a call stock option is zero as long as the price of the stock remains less than the exercise price. If the value of the stock rises above the exercise price, however, the value of the call rises with the value of the stock, dollar for dollar (thus the value of the call rises at a 45-degree angle).[6]

Options are valuable when there is uncertainty, and because technology trajectories are uncertain, an options approach may be useful. Though there has not yet been much empirical work in the area, several authors have developed methodologies and applications of options analysis to valuing technology development investments.[7] Also, some evidence shows that an options approach results in better technology investment decisions than a cash flow analysis approach.[8]



ıer authors, however, warn against liberal application of the approach, pointing at technology investment scenarios often do not conform to the same capital t assumptions upon which the approach is based.[9] For instance, implicit in the of options is the assumption that one can acquire or retain the option for a small and then wait for a signal to determine if the option should be exercised.[10] While this assumption might hold true for an outside firm investing venture capital in another firm's innovation effort, it would be rare for this assumption to hold for a company investing in its own development efforts. In the case of a firm undertaking solo new product development, it may not be possible to secure this option at a small price; it may require full investment in the technology before a firm can determine if the technology will be successful.[11] Furthermore, while the value of a stock is independent of the call holder's behavior (that is, the call holder can simply wait and observe whether the value of the stock rises or falls), the value of an R&D investment is not independent of the investor's behavior. A firm's degree of investment, its development capabilities, its complementary assets, and its strategies can all significantly influence the future returns of the development project.[12] Therefore, rather than simply waiting and observing the value of the investment, the investor is an active driver of the value of the investment.

Disadvantages of quantitative methods

Advantages

- Provide concrete financial estimates that facilitate strategic planning and trade-off decisions
- Explicitely consider the timing ofinvestment and cash flows and the time value of money and risk
- Make the returns of the project seem unambiguous, and managers may find them very reassuring

Disadvantages

- This minimization of ambiguity may be deceptive: the discounted cash flows are only as accurate as the original estimates of the profits from the technology, and it's extremely difficult to anticipate the returns of the technology
- For tryly innovative products it is impossible to reliably produce any numbers (very difficult to compute the size of a market that does not exist)
- Discriminates the projects that are long term oriented or risky, and the methods may fail to capture the strategic importance of the investment decisions

3.3. Qualitative methods for choosing projects

Almost all firms utilize some form of qualitative assessment of potential projects, ranging from informal discussions to highly structured approaches.

As a starting point, a management team is likely to discuss the potential costs and benefits of a project, and the team may create a list of screening questions. They might be organized into categories such as the role of the customer, the role of the firm's capabilities, and the project's timing and cost.

- **Screening questions:** can be used to structure debate about a project or they can create a scoring mechanism.
- **Aggregate project planning framework:** four types of development projects commonly appear on the map:
    - R&D and advanced development projects: precursor to commercial development projects, necessary to develop cutting-edge strategic technologies
    - breakthrough: development of products that incorporate revolutionary new product and process technologies

  - platform: offer fundamental improvements in cost, quality and performance over preceding generations, they introduce improvements across a range of performance dimensions – speed, functionality, size, weight – and are designed to serve a core group of customers
  - derivative projects: introduce changes along only one or two dimensions and are designed to appeal to different niches within the core group.
    → companies can use a project map to assess what their balance of projects is and allocate resources accordingly.
- **Q-Sort** = a simple method for ranking objects or ideas on a number of different dimension. Individuals are each given a stack of cards with a project on each card. Then a series of project selection criteria are presented and for each criterion, the individuals sort their cards in rank order or in categories. Individuals then compare their rank orderings and use these to structure a debate about the projects.

3.4. Combining qualitative and quantitative methods

→ there are also valuation techniques that attempt to translate qualitative assessments into quantitative measures:

  - Conjoint analysis = a method of converting qualitative assessments of a choice into quantitative weights of the different criteria underlying the choice. It is most often used for assessing how customers value different product attributes
  - Data envelopment analysis (DEA) = a method that enables projects that have multiple criteria in different measurements units to be ranked by comparing them to a hypothetical efficiency frontier.

3.5. Summary of chapter

- Firms often usea combination of quantitative and qualitative methods to vealuate which projects should be funded. Though some methods assume that all valuable projects will be funded, resources are typically constrained, and firms must use capital rationing.
- The most commonly used quantitative methods of evaluating projects are discounted cash flow methods such as NPV or IRR. While both methods enable the firm to create concrete estimates of returns of a project and account for the time value of money, the results are only as good as the cash flow estimates used in the analysis (chich are often unreliable). Both methods also tend to be heavily discounted long-term or risky projects and can undervalue projects that have strategic implications that are not well reflected by cash flow estimates.
- Some firms now use real options approach to assessing projects. Real options better account for the long-run strategic implications of a project. Unfortunately, many new product development investment decisions do not conform to the assumptions inherent in an options valuation approach.
- One commonly used qualitative method of assessing development projects is to subject projects to a series of screening questions that consider the project from multiple angles. These questions may be used merely to structure the discussion of a project or to create rating scales that are then utilized in an approach that combines qualitative and quantitative assessment.
- A company's portfolio of projects typically includes projects of different types (e.g., advanced R&D, breakthrough, platform, and derivative projects) that have different resource requirements and different rates of return. Companies can use a project map to assess what their balance of project is (or should be) and allocate resources accordingly.

- Q-sort is a qualitative method of assessing projects whereby individuals rank each project under consideration according to a series of criteria. Q-sort is most commonly used to provide a format for discussion and debate.
- Conjoint analysis is a method of converting qualitative assesments of a choice into quantitative weights of the different criteria underlying the choice. It is most often used for assessing how customers value different product attributes.
- Data envelopment analysis (DEA) is another method that combines qualitative and quantitative measures. DEA enables projects that have multiple criteria in different measurement units to be ranked by comparing them into a hypothetical efficiency frontier.

4. THE PARTNERSHIP MODEL

slides

In the past R&D was in the side of a company. (separate building, aside etc.)
If we want to make money with a company, innovation should be inside the company and in the overal strategy of the firm.

First Generation	***Second Generation***	***Third Generation***
No long-term strategic framework	Partial strategic framework	Holistic strategic framework
No explicit link with the value chain	Some customer-supplier relationships	R&D contributes along the value chain
Cost center approach	Project-based approach	Value creation approach
Professional control of resource allocation	Customer/supplier involvement in resource allocation	Partnership approach to resource allocation
No clear performance indicators	Project performance indicators	Regular performance reviews
No targeting of expected results	Consistency between business / R&D objectives	Combining business & technological objectives

1st generation:
Some companies are still managing R&D in what we define as the first-generation mode → They hire good people, provide them with the best facilities money can buy, have them work in a creative – possibly remote – setting, leave them alone, and hope they produce commercially viable results.

2nd generation
Many companies have adopted second-generation R&D management practices
→ Practices that are distinctly more systematic and more specifically attuned to business needs.
Second-generation R&D management seeks to quantify the cost and benefits of individual projects and to monitor progress against project objectives. But even in the second-generation mode, operations tend to manage R&D on a project-by-project basis, rather than managing the aggregate of all projects.
Although each individual project may have merit, the collection, or portfolio, of projects may or may not be strategically adequate. Managers working in this mode find it difficult to establish priorities among projects within each business, across businesses, and for the corporation as a whole.

3rd generation
Some companies are now moving to a third-generation mode of R&D management that is both purposeful and strategic.
→ General managers and R&D managers work as partners to pool their insights in deciding what to do and why and when to do it, given the needs of each business and of the corporation.
They realistically assess costs, benefits, and risk/reward, and they balance these variables within a portfolio of R&D activity that best fulfils the purposes of the corporation as a whole.

PARC- Xerox case

The **Xerox Alto** was the first computer designed from the start to support an operating system based on a graphical user interface (GUI), later using the desktop metaphor. The first machines were introduced on 1 March 1973, a decade before mass market GUI machines arose.

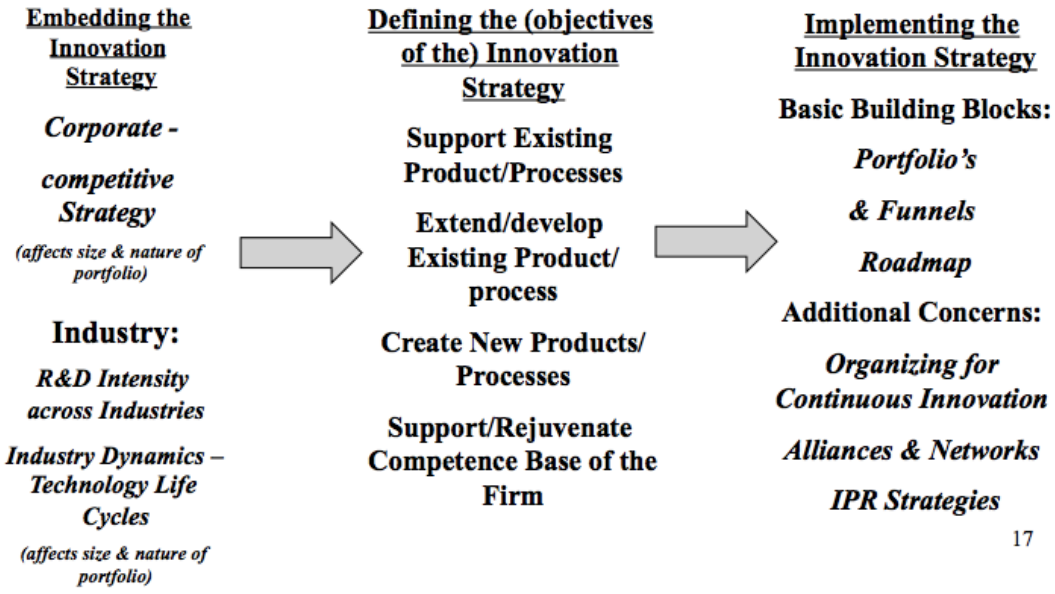
The Alto uses a custom multi-chip central processing unit (CPU) filling a small cabinet, and each machine cost tens of thousands of dollars despite being intended to be used as a personal computer. Only small numbers were built initially, but by the late 1970s about 1,000 were in use at various Xerox labs, and about another 500 in several universities. Total production was about 2,000 systems.

The Alto became well known in Silicon Valley and its GUI was increasingly seen as the future of computing. In 1979, Steve Jobs arranged a deal in which Apple Computer would license the concepts from Xerox in exchange for Xerox being able to purchase stock options in Apple. After two famous visits to see the Alto, Apple engineers used the concepts to introduce the Apple
Lisa and Macintosh systems, sparking the GUI revolution that took hold during the 1980s.

Xerox eventually commercialized a heavily modified version of the Alto concepts as the Xerox Star, first introduced in 1981. A complete office system including several workstations, storage and a laser printer cost as much as $100,000, and like the Alto, the Star had little direct impact on the market

5. INNOVATION STRATEGY AT THE LEVEL OF THE FIRM

Slides



Every strategy cannot limit herself to one simple goal.
You have to think in terms of a portfolio.

Defining the innovation strategy
Ex: Shell they have the V power and that is « support existing product/process » because they don't really have innovation, it's more marketing
BUT: it's very important that you create new products process if you want to be still around with the upcoming electric cars then you have to put medium and LT objectives and be careful because one product will not do!

Innovation: Creating something and making money with it. It is a managerial and entrepreneurial activity, involving a variety of activities along the corporate value chain.

Innovation strategy :

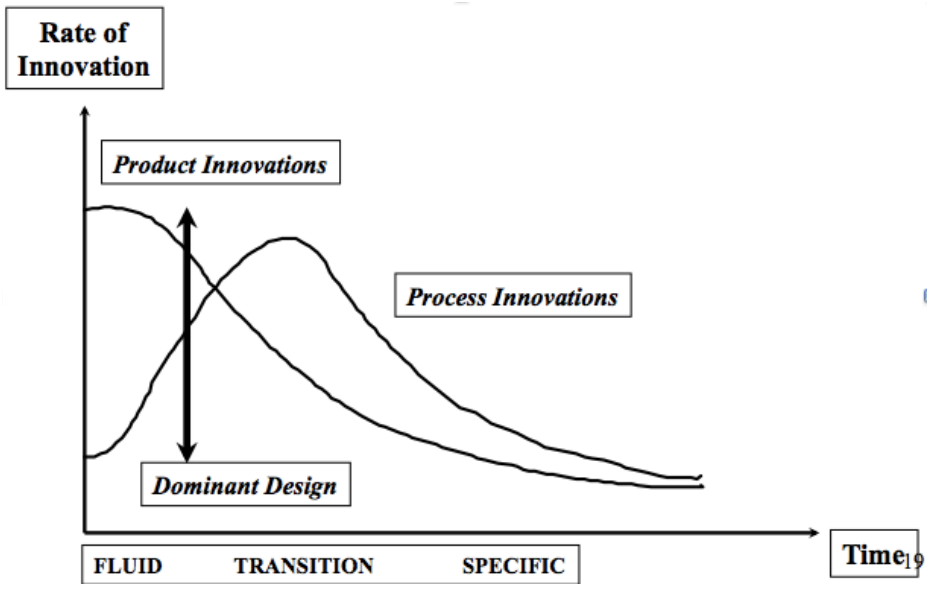
- Embedding the innovation strategy
  Consider the corporate strategy, the competitive strategy, the R&D intensity in the industry, industry dynamics. You have to make sure there's a connection with strategy
- Defining the objectives of the innovation strategy
  Support/extend existing products and/or processes, create new products and/or processes, support/rejuvenate the competence base of the firm
- Implementing the innovation strategy
  Consider portfolio's/funnels/roadmaps/alliances and networks

Open innnovation: It has become very popular: if we organise R&D we should not limit that exercice to the boundares of the firm, we should look outside, connect to broader echo-systems, make partners etc. (we'll look at that)
You also have to look at IP. You need, and we have a value proposition that is superior, we need to assure that we have that investment paid back, so you have to think about the IP strategy.

5.1.R&D intensity across industries

Ex: if you open a bar, you will not need an R&D team on your payroll. If you need high tech, you just buy them
Ex: bio-tech company: you start with 20 people and 15 are in R&D
=> there's a huge difference in the different sectors in terms of R&D expenditures

5.2. Technology and organization: Abernathy – Utterback model



Fluid
Competitive emphasis on:
- Predominant type of innovation
- Product line
- Production processes Equipment
- Organizational form

Transition
- Functional product performance
- Product innovations
- Diverse, often including custom designs flexible and inefficient
- General-purpose, highly-skilled labour
- Informal and entrepreneurial

Specific
- Cost reduction
- Process innovations
- Undifferentiated, standard products, efficient,
- Capital-intensive, rigid special-purpose, automated,
- Emphasis on structure and procedures

3 things in the car industry:
- Fuel efficiency
- Cost effectiveness
- Design (it's only a bit the service nowadays)

=>In a mature industry you make sure you have enough ressources to substain given the lifecycle of your industry.

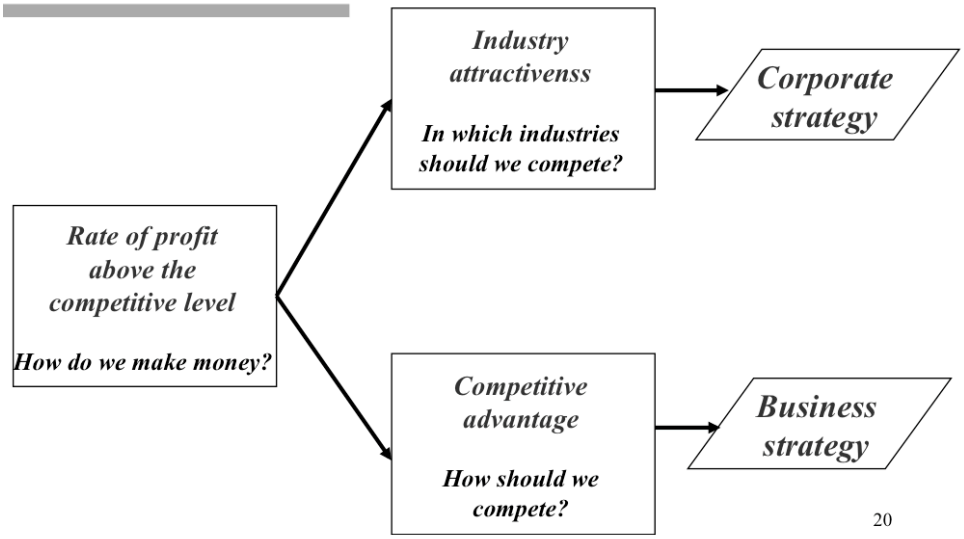
Strategy

- the 3rd generation R&D

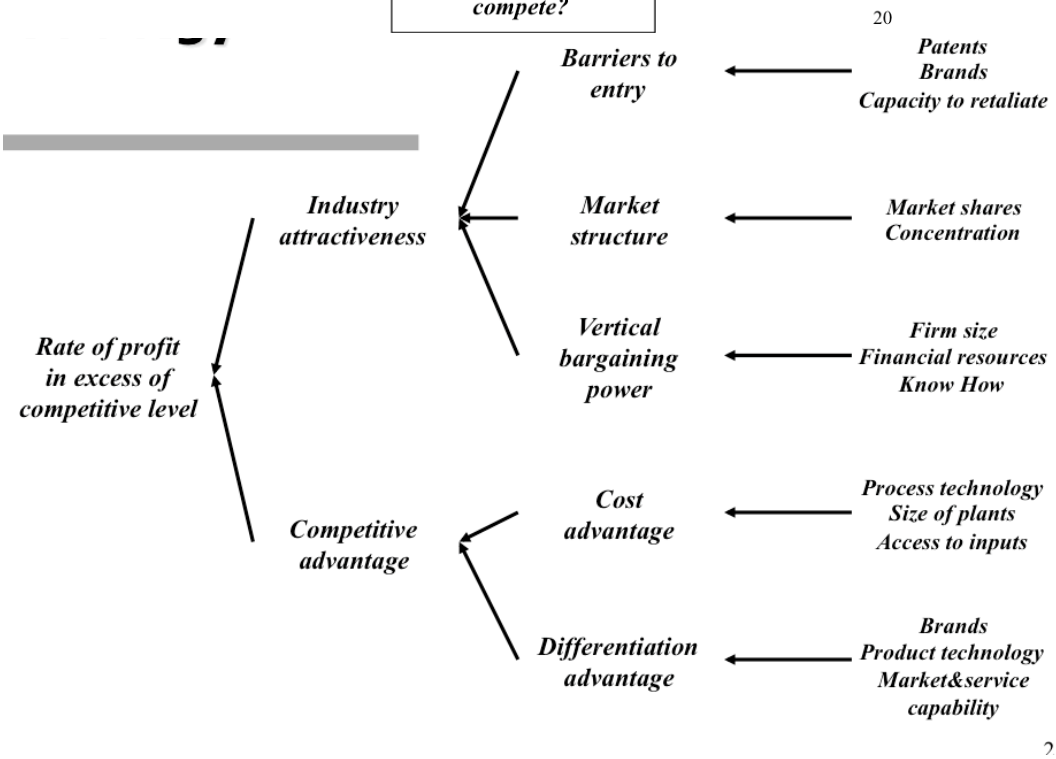
=> Connect what you do in R&D w/ the strategy of the firm

Only 2 real decisions that deserve the label 'strategic'

1. Entry/exit decision - In which industry do we want to make a difference?
2. Comp adavantage - How are we going to create distinctive value for customers?



20



21

→If you look at the pharmaceutical industry: how many companies started the last 5 years ? None.

Illustration: Dolman
Their initial idea was to be nr1 in terms of cost effectiveness and in order to do that they invested a lot in IT. Repackaging machines etc, because there was a direct link to their competitve advantage.
If you want to be cheaper than the others but still make profit, then you integrate backwards.
Look @ Apple: They have less than 1000 patents. They don't have as many as direct competitors in that industry. But apple has a lot of design patents. (example of the lawsuit between Apple and Samsung, because samsung had the same angles than Apple, sot they went on trial)

5.3. Red & Blue ocean strategy

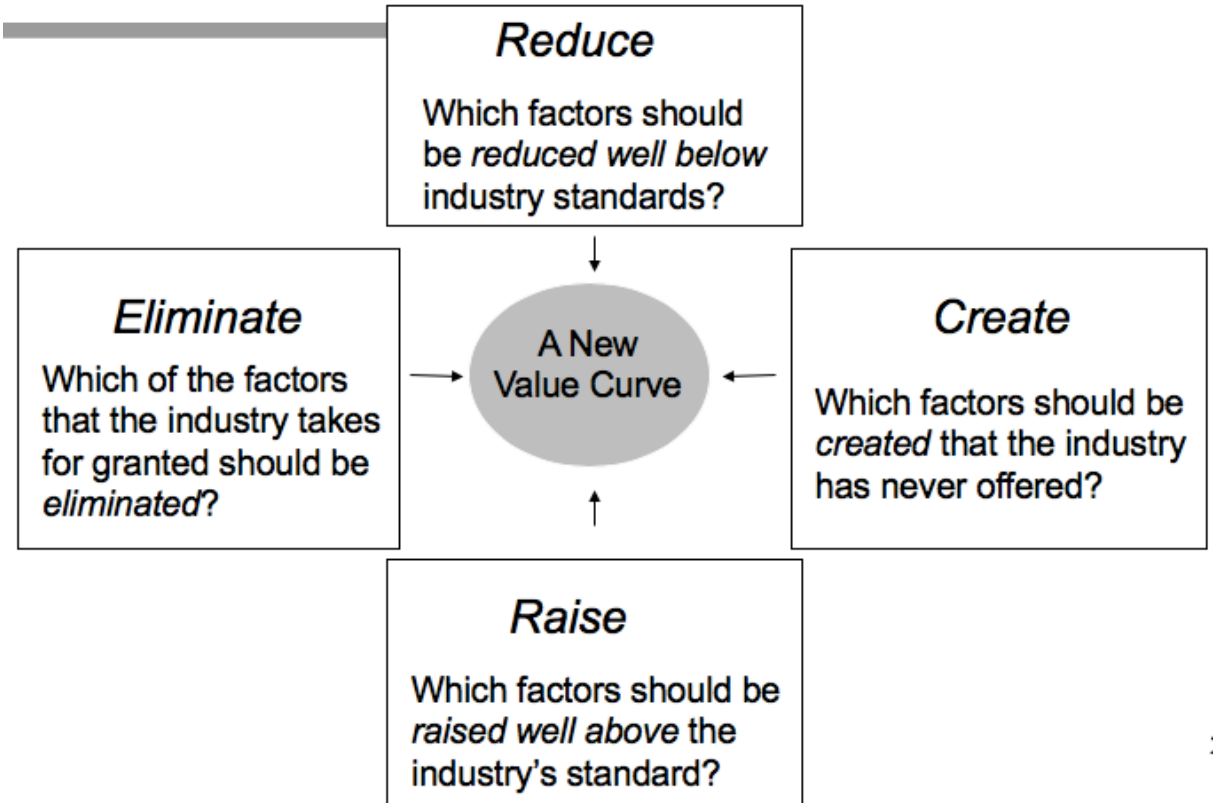
As a company you have to choose between being cost effective or (pas sur) quality effective, basically you choose between a red-ocean strategy or blue-ocean strategy.
Blue Ocean firms are innovating in a way that allowed them to enter untapped market space by redefining the dimensions of competition. Cutthroat competition turns the ocean bloody (as known as "red ocean").

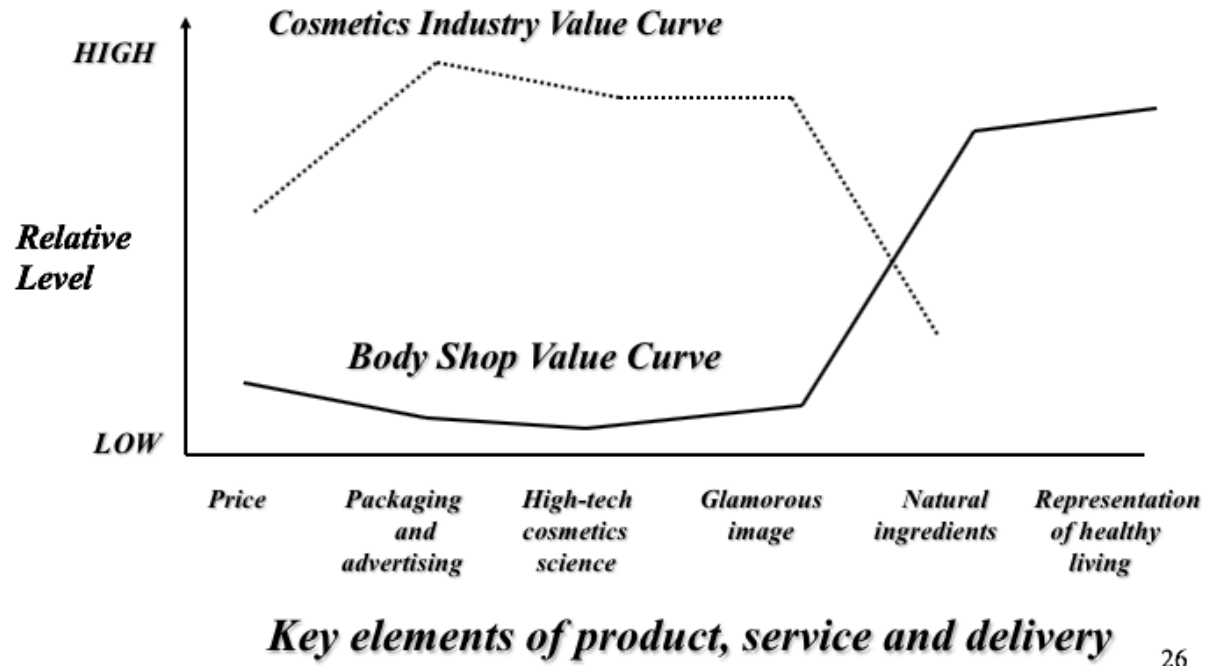
Red Ocean strategy	Blue Ocean strategy
- Compete in existing market space - Beat the competition - Exploit existing demand - Make the value cost trade-off - align the whole system of a firm's activities with its strategic choice (differentiation / low cost)	- Create uncontested market space - Make the competition irrelevant - Create and capture new demand - Break the value-cost trade-off - align the firm's activities in pursuit of differentiation and low cost

Strategy canvas – Mauborgne and Chan: firms can identify BlueOcean strategies by using a visualization tool (the horizontal axis lists the factors that the industry competes on, the vertical axis indicates high/low), managers can plot value curves for different product offerings and can then challenge the industry's strategic logic by asking the following questions:

- Which of the factors that the industry takes for granted should be eliminated?
- Which factors should be reduced well below the industry's standard?
- Which factors should be raised well above the industry's standard?
- Which factors should be created that the industry has never offered?

5.4. The value curve

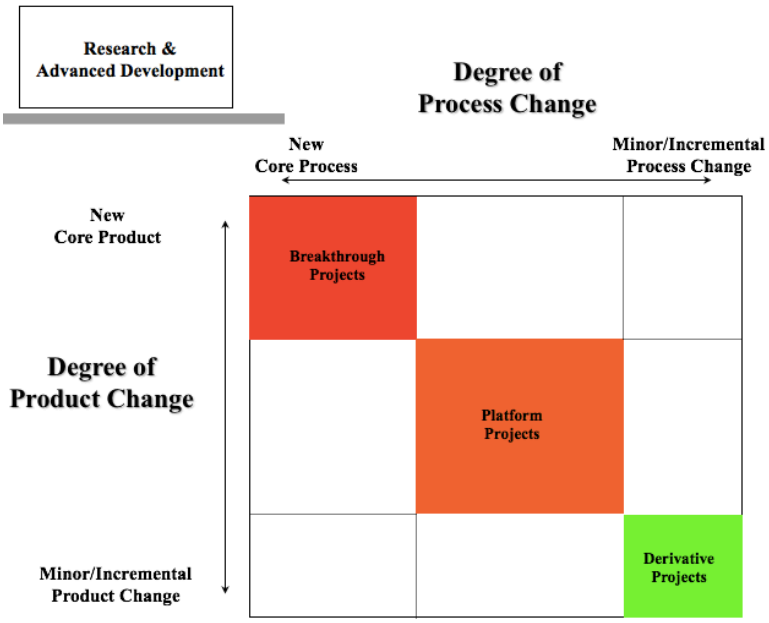




5.5. Implementing an innovation strategy

- Multiple objectives and sustainability (time) lead to:
  - Portfolio
  - Roadmaps
- Resource considerations inspire to install a funnel approach and to complement the (internal) R&D efforts (portfolio) with (a portfolio of) collaborative, inter-organizational, collaborations oriented towards innovation.
- At the same time, when deciding upon priorities, industry attractiveness (expected evolutions) and strategic considerations (competitive advantage) should be taken into account: designing an innovation strategy should 'fit' with the corporate/competitive strategy.

Research and advanced development



90% of the R&D are in the boundaries of this portfolio

Balacing the portfolio

- How should my portfolio look like ? BALANCED
- You have to do things simultaneously. Why? suppose you take the middle one and you only work on improving the existing products, then at the time new products are on the market you'll be too late, this is a consequence of being too close of your existing customers
- you also have to make sure that the balance is alligned w/ your company

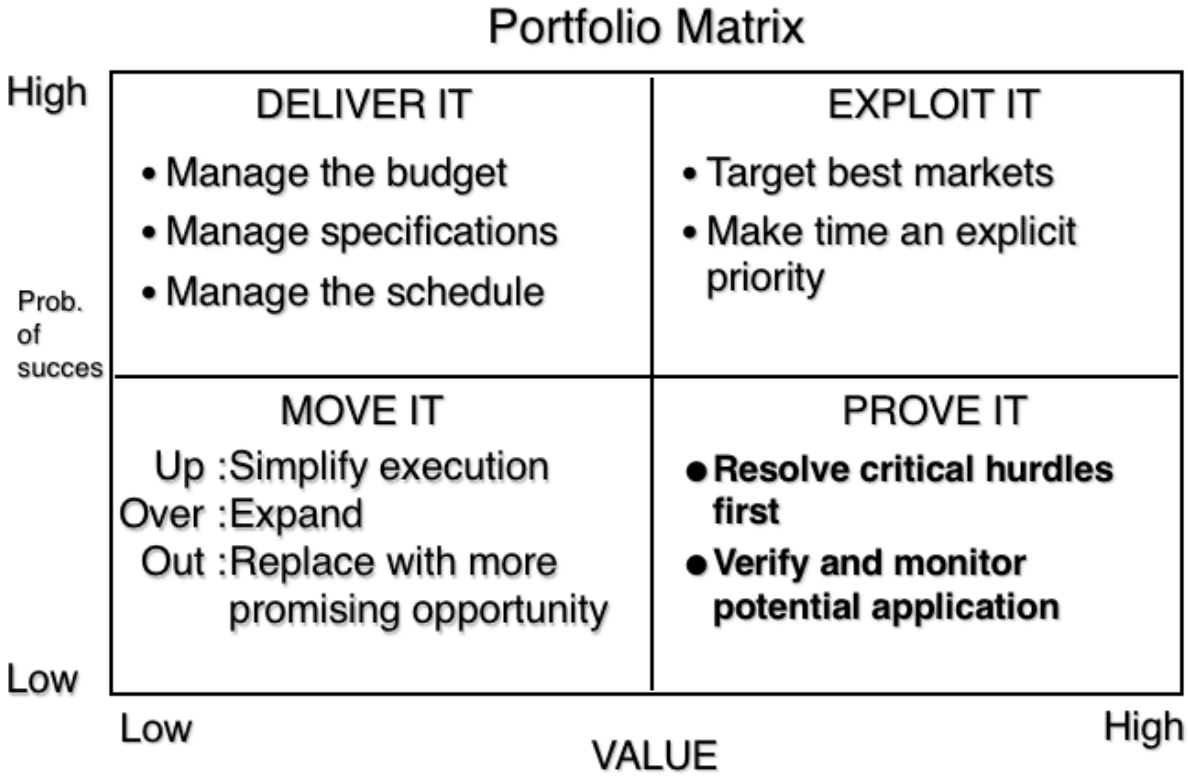
Portfolio clustered left

This portfolio contains a significantly high proportion of projects in the high-risk upper left hand area of the matrix. This does not it well with a strategy for an existing business as it exposes the business to the risk of potential launch failures and, at the same time, fails to support existing brands through less ambitious brad support projects.

Portfolio clustered bottom right
This portfolio could potentially illustrate a scenario in which a business follows rather than leads, the market and/ or does not invest adequately in support of its brand through technology or product innovation.

Balanced portfolio
There is no ideal, but generally a well-balanced portfolio will tend to be distributed along the diagonal top left- bottom right

Portfolio matrix



Objectives and practices of portfolio management

■ ***Objectives:***
- **communication +**
- **interface linkages +**
- **urgency +**
- **transparency +**
- **tolerance for failure +**
- **killing projects +**
- **corporate wide optimization +**

■ ***Practices:***
- **common vocabulary**
- **clear choice processes**
- **priority setting**
- **backlog of projects**
- **shoot approach**
- **resource management**
- **program management**
- **project planning**
- **project team work**

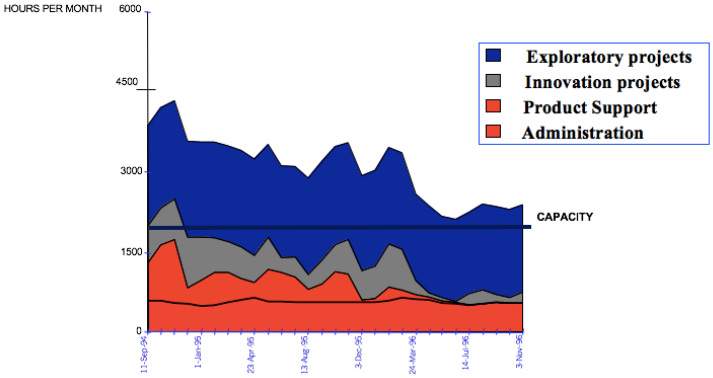
After a while the whole system starts to erode a little bit

Major steps in portfolio management

- Define project types as either breakthrough, platform, derivative, R&D or partnered projects
- Identify existing projects and classify by project type
- Estimate average time and resources needed for each project type based on past experience
- Identify existing resource capacity
- Determine the desired mix of projects
- Estimate the number of projects that existing resources can support
- Decide which specific projects to pursue
- Work to improve development capabilities

People are busy with managing the projects and they lose the big picture sot hey make KPI's to 'determine the desired mix of projects': in the end it's the strategic choice of the company

Issues: demands typically exceed ressources

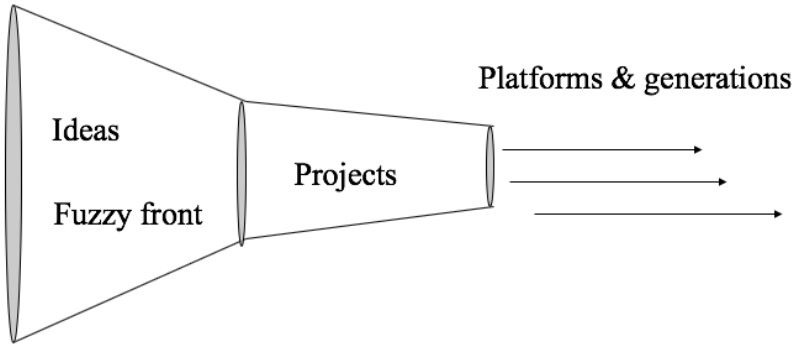


Typical portfolio mapping exercice

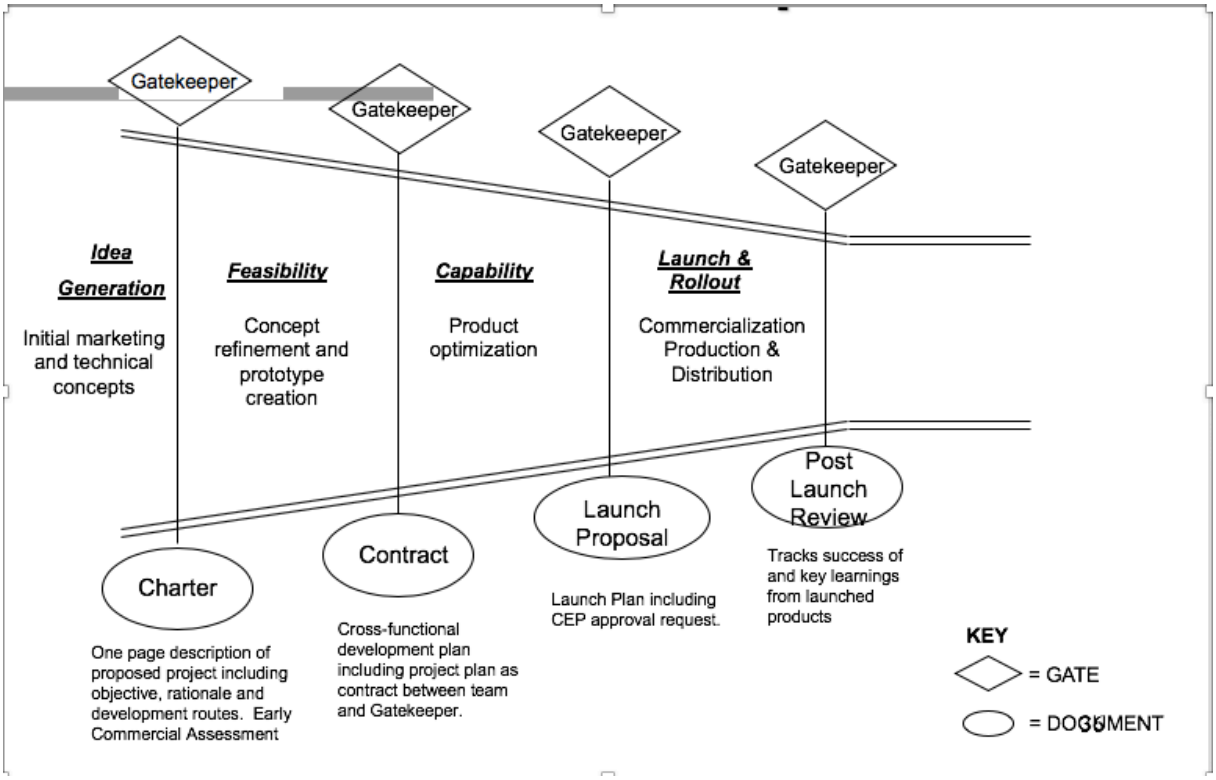
You have about 150people in your R&D department. You have a capacity of these 150 but you have projects that imply double. Is that a problem? Not necesssarily, but it implies all your people are busy for 2 years whithout any new projects coming in, and that's a problem.

If you overload your capacity, you won't have time for novelty. And if you have too much work, what gets priority? short term and so you don't make time for MT and LT

The funnel concept

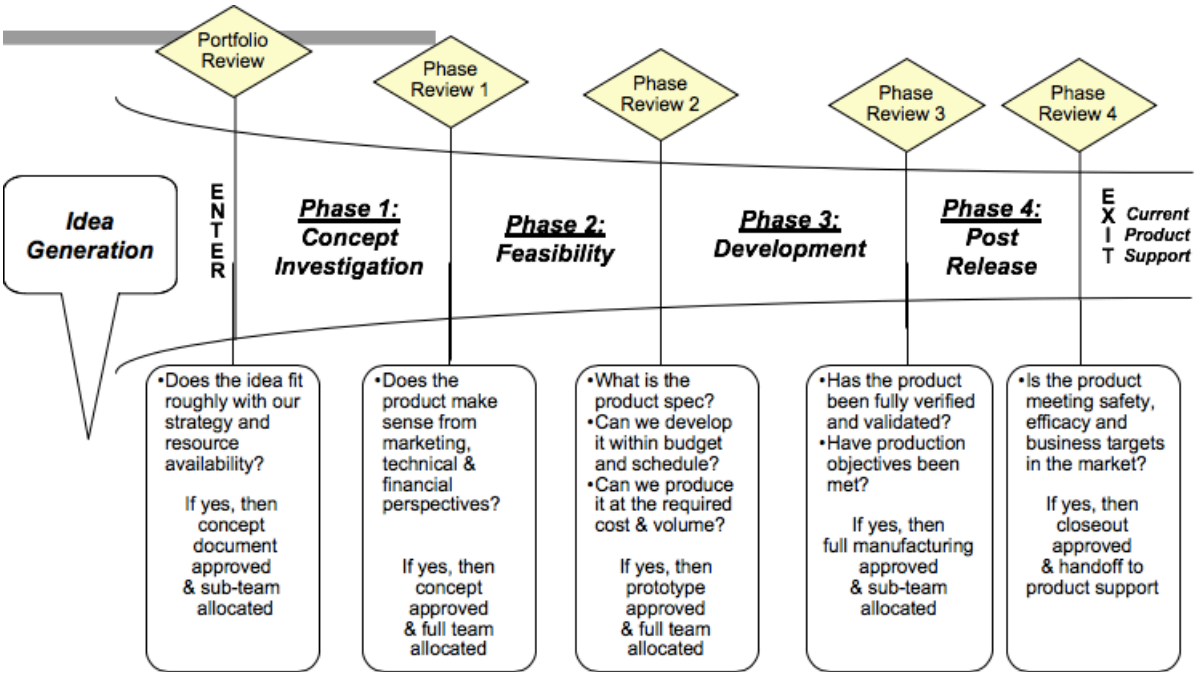


Funnel= combination of filtering and tunneling
Basic process of: 'I have an idea and I develop it', create a value proposition and sell to customers
But you have to make choices. Therefore, we use this funnel concept.
We start with a lot of ideas (not kill them all in the beginning), you look at them in a step wise way and in each step, you get more info, you reduce the unkown and at the end you come up with real novel problems. And that means you need gates.

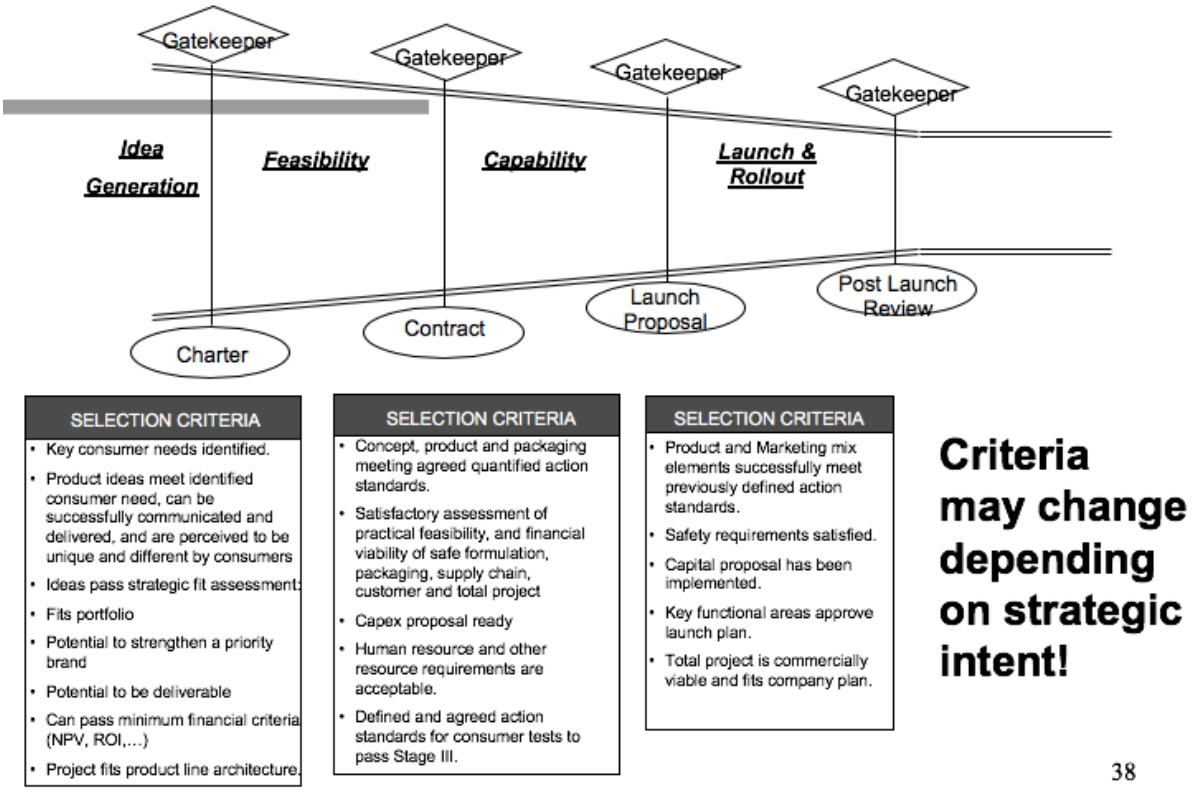


It implies that you have people who say this are the 23 ideas we have, 3 months later : what did we learn and which one do we discard and pursue ?
Ex: pharma

The key questions answered by each phase



Example: gate selection criteria

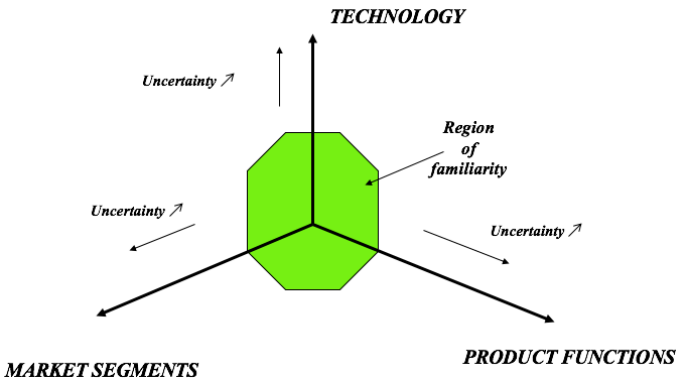


Everything in the left-hand corner should not do that from a business perspective, because they have a return less than 25% and the're a high risk. Let's use all these ressources and put them up in the graph where less risk or (we are not against risk !!) and go on the bottom right where there's 200-300% return. This really is an economical perspective. Because the people in the R&D are engineers and

scientists that want to have fun and want to surpass themselves and they sometimes forget the economic value

Gates are…

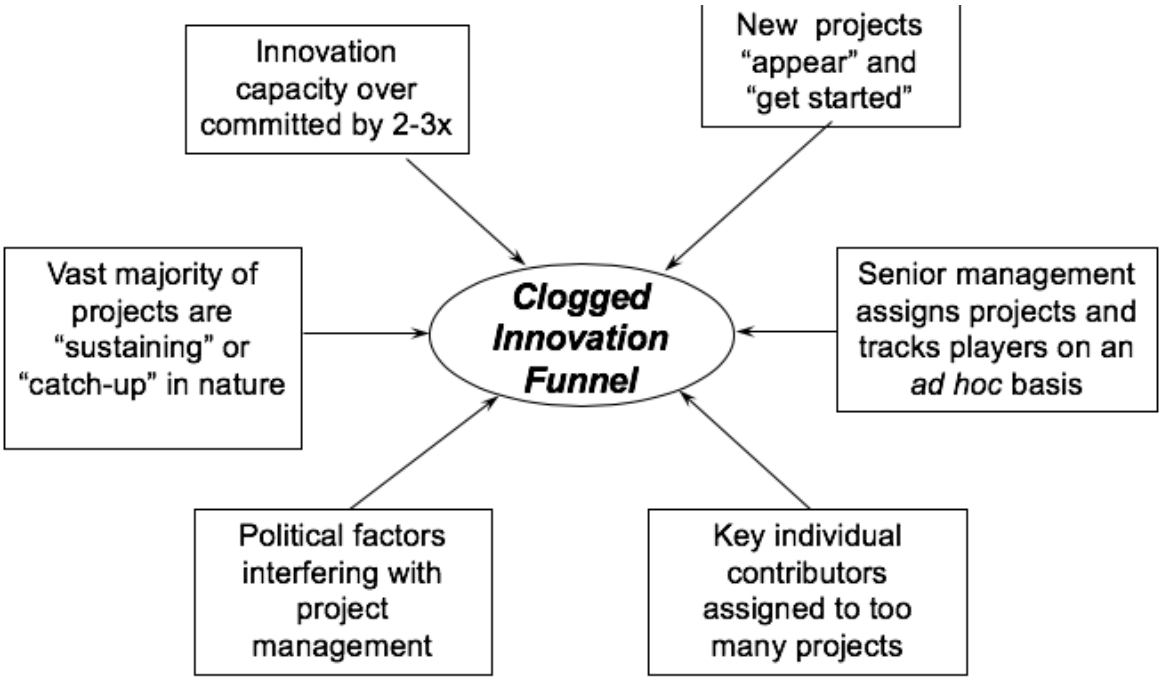
- major milestones
- intended to allow passage of the projects more likely to succeed by sacrificing projects more likely to fail as early as possible
- foci of decision-making. At a gate, a decision is therefore made to either:
  - Continue working on the project, moving it along to the next stage in the funnel
  - Stop working on the project, shelving it or canceling it
  - Get additional information and reconsider the project for passage through the same gate once that information becomes available.
- They require criteria:
  - Any portfolio, funnel exercice will have this as a decision-making criteria



Think about the time management. If you don't believe that look at apple. When are they making more turnover? when the new iPhone is on the market.
Nobody likes these wild fluctuations, that's why you ave to do reverse planning to make sure there's a continuous stream of innovation.

The reality of most technology & product development programs

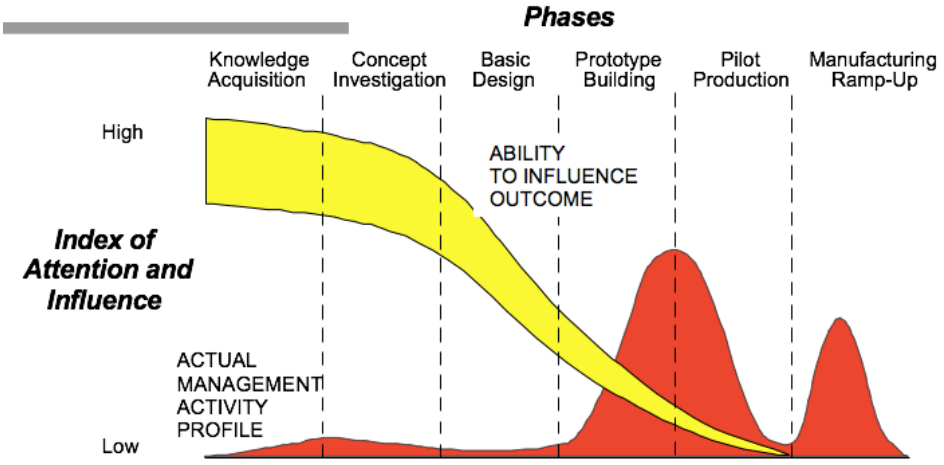
Issues with funnel programs and portfolio practices: the good people are involved in too any projects



The timing and impact of management attention and influence

We tend to make wrong assesment in terms of when should we be involved in a project/ you see the time going by and the yellow line shows how much influence you still could have, and red is how much time you're devoting. Managers are only devoting time on something thsat's near completion. But the problem is that 90% of the gain has been payed

=> you should pay attention in the beginning because the important decisions are taken there.



The dynamic portfolio approaches: the roadmap

Dynamic part

- we have the portfolio
- we have the thunnel
- but we should make it dynamic
- a way to make sure that you manage that uncertain future
- Roadmap = instrument to integrate business unit strategies and corporate technology strategies.
- Roadmaps have a dual function:
    - linking technology to the business unit by improving/diversifying product/process platforms
    - stimulating the creation of new businesses.
- Developing roadmaps is not a top-down exercise "only" but requires active bottom-up participation and cross-functional processes

Requirements

- Cross-functional integration and planning
- An ability to balance (future) vision and present reality
- An ability to combine re-active and pro-active thinking
- Transparency of information and decision processes
- Improvement of interface management at:
    - the organizational level (B.U. versus corporate)
    - the functional level (marketing, R&D, manufacturing)
    - the competence level (fundamental research areas, development, engineering disciplines, …)
- A continuous process of planning, combining FIT as well as STRETCH with respect to platform-definition and technology development

They allow for

- Development of a common language
- Planning and vision building
- Identification of generic technologies
- Establishing a common product-technology strategy
- Timely availability of new technology (internal or via partnerships)
- Detection of inconsistencies
- Supporting the budget cycle
- Benchmarking against 'best in class' as well intra- as inter-company

6. TYPES AND PATTERNS OF INNOVATION

From chapter 3 book – p 43-59

- It evokes the 4 different dimensions of innovation:
  - Product Innovation vs. Process Innovation
  - Radical Innovation vs. Incremental Innovation
  - Competence-Enhancing Innovation vs. Competence-Destroying Innovation
  - Architectural Innovation vs. Component Innovation
- And evokes the Technology S-curves
  - S-curves in technological Improvement
  - S-curves in Technology Diffusion
  - S-curves as a Prescriptive Tool
- Then it covers the technology cycles
  - Def. of creative destruction is important
  - Technology Evolution Model by Utterbck and Abernathy
  - Technology Cycle by Anderson and Tushman

7. DISRUPTIVE AMBIDEXTERITY

slides

If we look at the different strategies of these oil companies:

- Shell: Shell is a global group of oil, gas and petrochemical companies with a broad portfolio of hydrogen, biofuels, wind and solar power interests. Our aim is to meet the energy needs of society, in ways that are economically, socially and environmentally sustainable.
- Lukoil: we are here to make as much money as possible w/ oil and gass and whatever happens we are an oil and gas company
- Estimates: oil and gas to meet human needs untill 2200-2300

The innovation strategy of the firm

- Support to existing operations and products
- Extension and expansion of (existing) product/process range
- Creation of new core products and processes
- Rejuvenation and alignment of the firm's competence base
- (Wheelwright & Clark, 1992)

The multiple objectives such innovation strategies entail, lead to dual, often conflicting, or paradoxical requirements:

- Incremental versus Radical (Wheelwright & Clark)
- Flexibility versus Commitment (Ghemawat, Abernathy)
- Exploitation versus Exploration (March)
- Divergent versus Convergent (Garud; Utterback)
- Path Creation versus Path Dependence (Garud & Karnoe)

Complementing Portfolio's, Funnels & roadmaps: organizing innovation

Can a firm – simultaneously – be effective in improving/extending existing platforms and creating new ones?

- No: Bower & Christensen (1996); Christensen & Bower (1997); Christensen (1997)
- Yes: if one organizes in a proper way: Tushman & Anderson (1986); Tushman & O'Reilly (1997); Benner & Tushman (2003); O'Reilly & Tushman (2004; 2008)
- It depends: only to the extent that 'spill overs' can be enacted (Tripsas, 2000/2005, Van Looy et al. 2006; Leten et al. 2007/2008, Organization Science – Special issue, 2009)

If we are confronted with a technology that is replacing the old existing technology. Can a firm being succesful with the old technology still be successful in this situation?
answer: no (christensen). If that's true, we better invest in Lukoil. We have to adopt the right strategy and also the same management and organisational desire practices.
Yes: ambidexterity

What should kodak have been doing?
Ils se font de la thune avec des chemicals et paper

7.1. Christensen: the innovator's dilemma

= pessimistic view on the fact that a company can do both: improving existing products and creating new ones.

Innovator's dilemma: established firms lose their market leadership over technological changes. How could technologies that were initially inferior and useful only to new markets eventually threaten leading companies in established markets? Once the disruptive architectures became established in their new markets, sustaining innovations raised each architecture's performance along steep trajectories, so steep that the performance available from each architecture soon satisfied the needs of customers in established markets

- Different objectives imply different activities, which seem to be difficult to organize within the same organization especially when 'creative destruction' is entering the stage.
- "Every company that has tried to manage mainstream and disruptive business within a single organization failed" (Bower & Christensen).
- Why?
    - Different Customers
    - Decision making Processes - Size
    - Nature of Activities, …
- See in this respect also the arguments stemming from scholars in the field of organizational design/structure:
    - Burns & Stalker
    - Mintzberg, Miller & Friesen (Configurations imply internal consistency)

You get a greek tragedy in your executive group: if you raise children, if they get succesfull, they will kill you.

« every company that has tried to manage mainstream and disruptive business within an organization failed » (Bower & Christensen)
Example of a company that proved the contrary (a real shift in a company where the market leader stayed the market leader):

Le prof dit aux pharmaceutocal industry that by 20130 they will die. Why? becaseu they still have a chemical ortiented thinking. We are doing this for more than 100 years, but now there's a productivity crisis. We put a lot of money and the number of blockbusters coming out of it is decreasing. Now if you want to treat deseases we shift to biotechnology and personalized medicine (= instead of having 1

treatment for all of us, we look at your profile and what will work for you won't work for someone else)
There's a shift from chemical to biotechnology. But also, the business model is changing. For example, we invest 1 billion in a chemical that will work for all of us, but that also is under threat.

Christensen is not that optimistic, what is his solution? We have to put it outside, we can't do this in the same organization, let's create a venture unit. (the prof is not buying it). We give the money, we let them research, but independent from the company. And that is the solution. You focus on the existing products with the large firm and you invest in a separate thing in venturing. Do you think it's a good idea?

Technology cycles, innovation streams, and ambidextrous organizations

- Technology and resource-rich firms often fail to compete in the very technologically turbulent environments that they helped to create (E.g. SSIH, the Swiss watch concern).
- The sudden demise of SSIH was not due to a lack of knowledge or resources but was rather rooted in organizational 'inertia'.
- Core competencies become core rigidities (see Barton '92)
- It seems that building core competencies and managing through continuous improvement are not sufficient for sustained competitive advantage ("you can't shrink to greatness").
- This success paradox is not deterministic: core competencies need not become core rigidities.
- 'You need 'innovation streams' that simultaneously build on and extend prior knowledge' and destroy those very products that account for a firm's historical success.'
- Companies that are able to sustain competitive advantage over time are able to create and shape technology cycles through creating streams of innovation. Such streams include competence-enhancing, architectural and competence-destroying innovations.

7.2. O'Reilly & Tushman: The ambidextrous organisation

= The positive ones about the fact that a company can do both: improving new products and creating new ones

- Corporate executives must constantly look backward, attending to the products and processes of the past, while also gazing forward, preparing for the innovations that will define the future.
- This mental balancing act is one of the toughest of all managerial challenges- it requires executives to explore new opportunities even as they work diligently to exploit existing capabilities-and it's no surprise that few companies do it well.
- But as every businessperson knows, there are companies that do. What's their secret? The clue to solve the problem is management and organizing:
    - These organizations separate their new, exploratory units from their traditional, exploitative ones, allowing them to have different processes, structures, and cultures; at the same time, they maintain tight links across units at the senior executive level and introduce an 'overarching' strategic vision.
    - Such "ambidextrous organizations," allow executives to pioneer radical or disruptive innovations while also pursuing incremental gains.
    - "Of utmost importance to the ambidextrous organization are ambidextrous managers - executives who have the ability to understand and be sensitive to the needs of very different kinds of businesses. They possess the attributes of rigorous cost cutters and free-thinking entrepreneurs while also maintaining the objectivity required to make difficult trade-offs".

- "Almost every company needs to renew itself through the creation of breakthrough products and processes, but it shouldn't do so at the expense of its traditional business."
- "Building an ambidextrous organization is by no means easy, but the structure itself, combining organizational separation with senior team integration, is not difficult to understand."
- "Given the executive will to make it happen, any company can become ambidextrous."
    - ⇨ that's almost an insult. 'just foloow our recipe and i twill all work out'. But what's wrong with this recipe?

The 5 elements we should pay attention to to resolve the innovator's dilemma with ambidexterity

- *Presence of compelling strategic intent*
- *Articulation of common vision*
- *Consensus among senior management, relentless communication and common fate incentive system:* this is scary, that we have to listen to the senior management, especially since the 2008 crisis
- *Separate exploitation & exploration:* The nature of the activities is pretty different. So, the best idea to handle these differences is to put them in separate divisions (but that's not the same as venturing!). You need to compensate the differentiation with integration: overcharging strategic visions and senior management
- *Senior leadership able to handle tensions & contradictions*: role is to ensure that we will still behave as one company, that's also why we need to redefine our visions. A good senior management is the recipe for succes

Ambidexterity: feasible?

A list was made of the companies that illustrate that this really is the recipe for success.
We can make two observations from this list:

- There are only 23 names, so this suggests that it is a rare phenomenon
- Are these really good examples?
    - Xerox: little story about the Alto. The first personal computer. Perfect example of separation. They were making paper and next to it they developed the first personal computer. But did they make profit? No
    - Mariott: now Hotel chain. Mariott started as a brewing company. What happens if you want to grow in abrewing company? Forward integration, they own pubs, restaurants, hotels etc. So Mariott followed that path. And what happened so many years later? Consolidation in the part of brewery and they continue in the hotel industry. But this is not informing us on the disruption issue.
    - ITT corporation
- The prof asked all his PhD students to make an analysis on every company of the list to see if they were really ambidextrous. They stopped at the 18th company, because none of them were ambidextrous.
- Conclusion: It's incomplete and not inspiring companies to be successful
- So, where's the alternative? Because good to be critical, but you have to be constructive and give a solution.

ITT corporation

- The story of ITT begins with a historic call — for its founders to develop phones.
- The original International Telephone & Telegraph was created in 1920 by two brothers named Sosthenes and Hernand Behn who set out to build the first worldwide system of interconnected telephone lines. This was a case of a business catching up with its aspirational name as the company had a small beginning as the Puerto Rico Telephone Company but grew quickly through strategic acquisitions and the purchase of telephony patents. The result was the creation of a major international provider of telephone switching equipment and telecommunication services.
- The next chapter for ITT can best be described as the conglomerate years. From 1960 to 1977, with Harold Geneen at the helm, ITT acquired more than 350 companies — at one time securing deals at the rate of one acquisition per week. The portfolio included well-known businesses such as Sheraton hotels, Avis Rent-a-Car, Hartford Insurance and Continental Baking, the maker of Wonder Bread. Under Geneen's management, ITT grew from a medium-sized business with $760 million in sales to a global corporation with $17 billion in sales.
- Following the conglomerate years, Rand Araskog, who served as CEO from 1979 to 1995, embarked on a continuous course of restructuring through strategic divestitures and acquisitions to organize the company into more manageable segments. It culminated in 1995 when ITT split into three separate, independent companies: ITT Corporation, which was focused on the hotel and gaming businesses, ITT Hartford which became a stand-alone insurance operation, and ITT Industries, which started as a collection of manufacturing companies.
- One decade later, ITT Corporation had been acquired; ITT Hartford had changed its name; and ITT Industries continued its transformation. Since 1995, under the leadership of Travis Engen, Lou Giuliano and now Steve Loranger, ITT Industries — which changed its name back to ITT Corporation in 2006 — has dedicated itself to creating more livable environments, enabling communications and providing protection and safety.
- Today, the company plays an important role in vital markets including water and fluids management, global defense and security, and motion and flow control. Thanks to its talented workforce of nearly 40,000 people, ITT is known for engineering and operational excellence, strong values and leadership, and is building a reputation for product innovation and superior customer satisfaction in each of the markets it serves.

ITT is a vibrant part of the global economy. We are a high-technology engineering and manufacturing company with approximately 40,000 employees operating in 55 countries. Our portfolio of businesses is aligned with enduring, global growth drivers, and our employees bring extraordinary focus to meeting the needs of the people who buy and use our products and services in all the markets we serve.

Fluid Technology

ITT is a global water leader. Our products touch every part of the water cycle—delivering fresh water to communities and commercial businesses, treating and disinfecting it, transporting the wastewater and returning it to our streams and rivers cleaner than it came in. We are also a leader in supplying pumps and related technologies for handling harsh chemicals, mining slurry and industrial process fluids.

Defense Electronics & Services

ITT is a trusted provider of mission-critical products and services that support the United States military and its allies. Our Defense group also develops space-based technologies that enable Global Positioning Satellite systems to communicate our precise location and allow weather satellites to help

forecasters calculate when and where the next hurricane will hit. In many important ways, we are working to ensure a safer, more secure world.

Motion & Flow Control
ITT is a global powerhouse in the motion and flow control market. We design, manufacture and distribute shock absorbers, flow control devices, friction technologies and other products for use in everything from beverage systems to commercial aircraft. Customers worldwide recognize ITT for our ability to deliver highly engineered, durable components that succeed in the harshest environments where the cost of failure is high.

7.3. Exploring requisites and antecedents of continuous innovation - On the sustainability of Ambidextrous Organizing

Is the concept of ambidextrous organizations really sustainable?

- As ambidextrous organizational designs imply the simultaneous presence of different activities - exhibiting differences in technology and market maturation - financial returns inevitably reflect this diversified resource allocation pattern.
- Compared to organizations that focus on the most lucrative part of the portfolio, hybrid (ambidextrous) organizations may tend to be inferior in terms of financial performance, within a given time period.
- Moreover, tendencies towards internal consistency imply additional resources for ambidextrous organizations as higher levels of organizing complexity are being introduced.

Methodological approach: Defining a formal value creation model

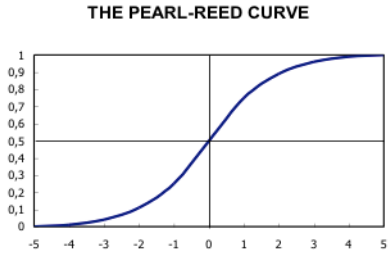
- Within this contribution, we explore under which conditions sustainable performance of ambidextrous organizations can be achieved
- This is done by developing an analytical framework depicting the differential value dynamics, focused and diversified firms can enact.
- Premises relate to:
  1) the technology life cycle affecting the amount of value created in a given time period
  2) the resources needed to organize and manage the diversity e sntailed within ambidextrous organizations
  3) resources needed to enact the diversity present within such ambidextrous organizational forms (if chosen to do so)

Value creation reflecting technology life cycle positions.

- In order to model the value creation of firms, a Pearl-Reed curve is used to reflect differences related to the technological life cycle (Young, 1993, Martino, 1972).
- The formula for the Pearl-Reed curve is:

$$\frac{L}{1+e^{-b(t-a)}}$$

- For L=1, b=1 and a=0, this curve looks as follows:



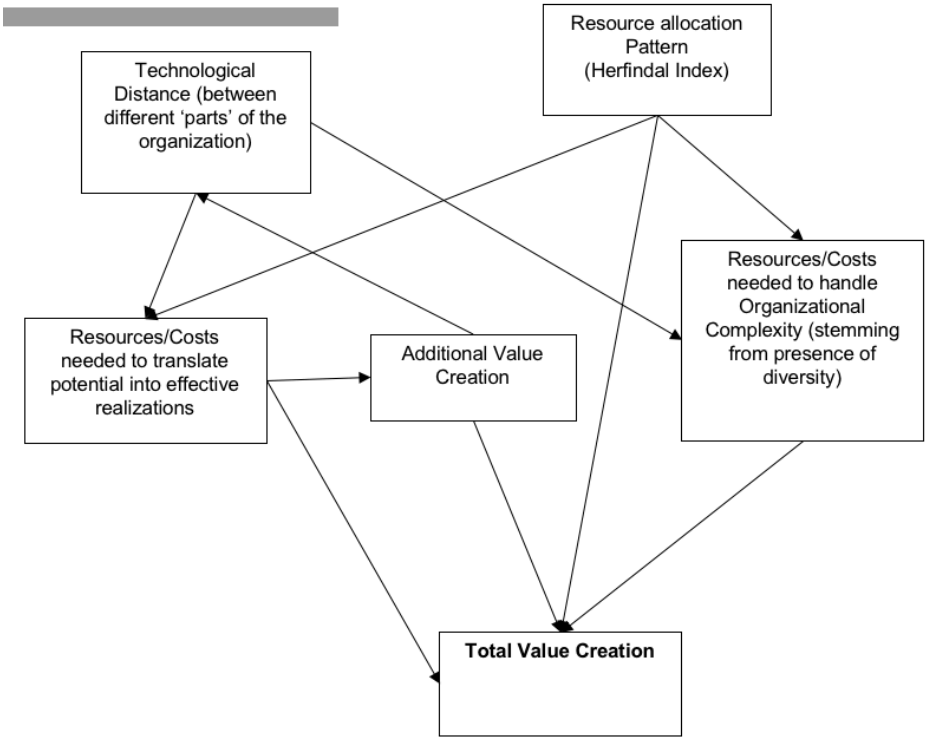
- Introducing Life Cycle Stages (Seed, Growth, Mature, Decline) – Parameter 'a'
- Value is being calculated over 40 time periods:

$$\int_{a}^{a+40} \frac{L}{1+e^{-b(t-a)}}\,dt = \frac{L}{b}\ln\left(\frac{1+e^{-b(40-a)}}{e^{-b40}+e^{-b(40-a)}}\right)$$

- Resource Considerations:

$$c_{div} = f(stages, value\,created) * g(herfindahl) * h_1(techn.dist)$$

Ex.: Coca Cola: what could disrupt Coca Cola? the fact that you can drink and eat everything with only one pill



Conclusions

- Our first, preliminary findings, reveal that – under certain conditions – diversified firms can indeed take on sustainable forms, the latter defined as resulting in overall value creation equal or superior to focused mature firms:
    - adopting longer time frames
    - being able to shift resources across different parts of the portfolio
    - actively pursuing or enacting synergies
- The importance of the synergetic potential (threefold):
    - flexibility in terms of resource allocation across activities
    - technological cross-fertilization affecting the growth/decline rate of the life cycle (b/b')
    - market development as reflected in L
- Implications for managerial practice:
    - Interface management practices oriented towards pursuing synergies becomes crucial (<> loose coupling?)
    - Technological cross-fertilization as a necessary condition – implications for technology portfolio decisions (scenario building)

'A system – any system, economic or other – that at every given point of time fully utilizes its possibilities to the best advantage may yet in the long run be inferior to a system that does so at no given point of time, because the latter's failure to do so may be a condition for the level or speed of long-run performance ' (J. Schumpeter, 1934, The Process of Creative Destruction, p.83).

Shell dumps wind, solar and hydro power in favour of biofuels

- Shell will no longer invest in renewable technologies such as wind, solar and hydro power because they are not economic, the Anglo-Dutch oil company said today. It plans to invest more in biofuels which environmental groups blame for driving up food prices and deforestation.
- Executives at its annual strategy presentation said Shell, already the world's largest buyer and blender of crop-based biofuels, would also invest an unspecified amount in developing a new generation of biofuels which do not use food-based crops and are less harmful to the environment.
- The company said it would concentrate on developing other cleaner ways of using fossil fuels, such as carbon capture and sequestration (CCS) technology. It hoped to use CCS to reduce emissions from Shell's controversial and energy-intensive oil sands projects in northern Canada.
- The company said that many alternative technologies did not offer attractive investment opportunities. Linda Cook, Shell's executive director of gas and power, said: "If there aren't investment opportunities which compete with other projects, we won't put money into it. We are businessmen and women. If there were renewables [which made money] we would put money into it."
- Shell said biofuels fitted its core business of providing fuels, logistics, trading and branding. Cook added: "It's now looking like biofuels is one which is closest to what we do in Shell. Wind and solar are interesting [but] we may continue to struggle with other investment opportunities in the portfolio even with big subsidies in many markets. We do not expect material investment [in wind and solar] going forward. "
- Until recently, Shell's investment in wind power featured prominently in its corporate advertisements. FoE said the company's move heralded a slightly more honest approach. "Shell is at least being a bit more honest about the fact they are a fossil fuel company. It has seen the limitations of the greenwash it was putting out a few years ago."

- Shell has about 550 megawatts of wind farm capacity around the world, enough to power a city the size of Sheffield when the wind blows. Last year, it pulled out of the 1,000MW London Array project, the joint venture to build what would be the world's largest offshore wind farm, in the Thames Estuary. Former project partner E. ON has yet to decide to continue with the £3bn investment needed.
- Outgoing chief executive Jeroen van der Veer admitted that the company had suffered some "technology baths" in the past when it backed unprofitable technologies. "We don't do it [renewables] all."
- The company has predicted that by 2025, 80% of energy will come from fossil fuels and 20% from alternative energy sources. Yet it is spending just over 1% of its budget on alternative technologies. Over the past five years, only $1.7bn of the $150bn it has invested has gone towards alternative energies. Cook pointed out that at one stage the company only invested 1% of its budget on liquefied natural gas, which is now a big part of its business. "You have to start somewhere," she said. Van der Veer also admitted that Shell's overall R&D budget would "fall a bit" as the company focused on the most promising technologies and in the wake of the oil price slump.
- The company said it would raise debt levels to maintain dividend payments and its spending programme. Van der Veer insisted that energy demand in the long term was strong and oil prices would recover. "The problem is you don't know when the long term starts."
- You can only be there in the future if you can leverage your own technology

Ambidexterity : feasible ?

- Tripsas, M. (1997): Unraveling the process of creative destruction; complementary assets and incumbent survival in the typesetter industry, SMJ.
- Different technological platforms:
    - Hot metal typesetters
    - Analog phototypesetters
    - Digital CRT typesetters
    - Laser Imagesetters
    - Incumbents were displaced by new entrants, however, in only one of these three shifts.
- Why?
    - While incumbents invested in developing new, competence destroying technology, the technical performance of the products they developed proved to be significantly inferior to the performance of new entrant products.
    - Although incumbent products were technologically inferior in all three competence-destroying generations of technology, incumbents were only displaced in only one of these three generations.
    - The presence of specialized complementary assets helps explain this disparity.
    - When specialized complementary assets, unavailable to new entrants retained their value despite a technological shift, incumbents maintained their market position in the new generation of technology.
    - These assets appear to have buffered incumbents from the effects of competence destruction, enabling them to sustain a high level of commercial performance despite their technological disadvantage.
- Complementary assets (see also Teece, 1986):
    - Specialized manufacturing/development capabilities
    - Access to distribution channels, service networks and complementary technologies.

- 'Business commentators often remark that many small entrepreneurial firms which generate new, commercially valuable technology fail while large multinational firms, often with a less meritorious record with respect to innovation, survive and prosper. One set of reasons for this phenomenon is now clear. Large firms are more likely to possess the relevant specialized and co-specialized assets within their boundaries at the time of a new product introduction.' (Teece, 1986, p. 301)
- So that's why large pharmaceutical firms will survive the change from a chemical oriented technological platform towards more biotechnology-oriented platforms? (see also the leading role Microsoft has developed while not being a first mover).

8. ORGANIZING FOR INNOVATION

Book chapter 10

The structure of an organization and the degree to which it uses formalized and standardized procedures and controls can significantly influence its likelihood of innovating, the effectiveness of its innovation projects and the speed of its new product development process.

- Small, flexible organizations with a minimum of rules and procedures → encourage creativity and experimentation → more innovative ideas
- Well-developed procedures and standards → organization makes better development investment decisions → implement projects quickly and efficiently

8.1 Size and structural dimensions of the firm

Size: is bigger better?

Advantages of size

Schumpeter challenged supporters of antitrust law by proposing that large firms would be more effective innovators. Because:

1) Capital markets are iperfect, and lare firms are better able to obtain financing for R&D projects
2) Firms wit larger sales volumes over which to spread the fixed costs of R&D would experience higher returns than firms with lower sales volume

- Better developed complementary activities such as marketing and financial planning that enable them to be more effective innovators
- Greater global reach to obtain information or other resources
- Scale and learning effects: if large firms spend more on R&D in an absolute sense, they might also reap economies of scale and learning curve advanatges in R&D.
- In a better position to take on large or risky innovation projects than smaller firms

Disadvantages of size

- As a firm grows, its R&D efficiency might decrease because of a loss of managerial cotrol.
- Less innovative because their size can lake them less nimble and responsive to change.
- High numbers of employees, large fixed-assets bases, and a large base of existing customers or supplier contracts can also be sources of intertia, making it difficult for a firm to change course quickly. Communication and coordination may become more difficult and prone to decision-making delays.

- Small firms are more flexible and entrepreneurial than large firms. They are unencumbered by multiple layers of administration, large fixed-assets bases, or strategic commitments to large numbers of employees, customers and suppliers.

Conclusion

Empirical studies have shown that small firms outperform large firms. Small firms appear to spend their R&D dollars more carefully and are more efficient, receiving a large number of patents per R&D dollar.

While the firm's overall size is not an easy-to-manipulate attribute of the firm, many firms have found ways of making even large firms feel small. One primary method is to break the overall firm into several smaller subunits. Multiple studies have observed that in industries characterized by high-speed technological change, many large and hierarchical firms have been disaggregated into networks of smaller, often more specialized, autonomous divisions or independent firms.

The giant multidivisional firms of the 20th century were replaced by leaner firms that were more focused and flexible, loosely coupled in a network of alliances, supplier relationships, and distribution agreements. This phenomenon lead to the rise of terms such aas *virtual organization, network organization,* and *modular organization.*

8.2. Structural dimensions of the firm

Firms vary on a number of structural dimensions that can influence the amount, type, and effectiveness of their innovation. The key structural dimensions include centralization, formalization, and standardization.

Centralization vs. decentralization

Decentralization

- It is the degree to which decision-making authority is pushed down to lower levels of the firm
- Enables those divisions to develop new products or processes that closely meet their particular division's needs
- The solutions they develop are more likely to fit well within the operating structure of the division
- Enables the firm to take advantage of the diversity of the knowledge and market contacts that exist in different divisions
- When decision making about new projects is pushed down to the lowest levels of the firm, the firm ends up taking on both a greater quantity and variety of projects + the firm makes fewer errors of omission
- However, the're much risk of reinveting the wheel + forgo economies of scale and learning-curve effects

Centralization

- It is the degree to which decision-making authority is kept at top levels of management
- Maximize economies of scale, enabling greater division of labor among the R&D specialists and maximizing the potential for learning-curve effects through the development of multiple projects
- Enables the central R&D department to manage the deployment of new technologies throughout the firm, improving the coherence of the firm's new product development efforts and avoiding the possibility that valuable new technologies are underutilized throughout the organization.
- The use of centralized vs. decentralized varies by type of firm and industry.
    - Research-intensive firms that are highly diversified: centralized
    - Consumer product companies: decentralized
    - Electronics industries: centralized

Conclusion
Highly centralized firm is better tomake a bold change in its overall direction because its tight command-and-control structure enables it to impose such change on lower levels of the firm in a decisive manner.
Decentralized firms may struggle to get the cooperation from all the divisions necessary to undergo a significant change. But decentralized firms may be better able to respond to some types of technological or environmental change because not all decisions need to be passed u the hierarchy to top management; employees at lower levels are empowered to make decisions and changes independently and thus may be able to act more quickly.

Formalization and Standardization
Formalization
- Is the degree to which the firm utilizes rules, procedures, and written documentation to structure the behavior of individuals or groups within the organization
- The rules and procedures employe din formalization can facilitate the standardization of firm activities and help to regulate employee behavior by providing clear expectations of behavior and decision-making criteria
- Formalization can substitute for some degree of managerial oversight, and thereby help large companies run smoothly with fewer managers
- High degrees of formalization can make a firm rigid. If a firm codifies all of its activities with detailed procedures, it may stifle employee reativity. Employees may not feel empowered or motivated to implement new solutions

Standardization
- Is the degree to which activities in a firm are performed in a uniform manner
- Can ensure that ativities ithin the firm run smoothly and yield predictable outcomes
- Can stifle innovation
- May be used to ensure quality levels are met and that customers and suppliers are responded to consistently and equitably
- However, by minimizing variation, standardization can limit the creativity and experimentation that leads to innovative ideas

Mechanistic vs. Organic Structures
Mechansistic
An organization structure characterized by a high degree of formalization and standardization, causing operations to be almost automatic or mechanical.
It is often associated with greater operational efficiency, particularly in large-volume production settings. The careful adherence to policies and procedures combined with standardization of most ativities results in a well-oiled machine that operates with great consistenc and reliability.
While mechanistic structures are often associated with high centralization, it is also possible to have a highly decentralized mechanistic structure by using formalization as a substitute for direct oversight. By establishing detailed rules, procedures, and standards, top management can push decision-making authority to lower levels of the firm while still ensuring that decsios are consistent with top management's objectives.
BUT they stifle creativity due to the rigidity.

Organic

These strcutures are more free flowing, low degree of formalization and standardization. Employees may not have well-defined job responsabilities and operations may be characterized by a high degree of variation. Because much innovation arises from experimentation and improvisation, organic structures are often thought to be better for innovation despite their possible detriment to efficiency.

Size vs. Structure
Large firms often make greater use of formalizationa dn standardization because as the firm grows it becomes more difficult to exercise direct managerial oversight. Formalization and standardization ease coordination costs, at the expense of making the firm more mechanistic. Many large firms attempt to overcome some of this rigidity and inertia by decentralizing authority

The ambidextrous organization: The best of both worlds?
= The ability of an organization to behave almost as two different kinds of companies at once. Different divisions of the firm may have different structures and control systems, enabling them to have different cultures and patterns of operations.

It's a firm with a complex organizational form that is omposed of multiple internally inconsistent architetures that can collectively achieve both short-term efficiency and long-term innovation. Such firms might utilize mechanistic structures in some portions of the fir and organic structures in others. This is one of the rationales for setting up an R&D division that is highly distinct from the rest of the organization; a firm can use the high levels of formalization and standardization in its manufacturing and distribution divisions, while using almost no formalization or standardization in its R&D division.

Whereas traditionally research emphasizes the importance of diffusing information across the firm and ensuring cross-fertilization of ideas across new product development efforts, recent research suggests that some amount of isolation of teams, at least in early development stages, can be valuable. There's a risk that a solution that appears to have an advantage will be too rapidly adopted by other teams. This can cause all the teams to converge on the same ideas.

Skunk works: New product developmet teams that operate nearly autonomously from the parent organization, with considerable decentralization of authority and little bureaucracy.

If big firms can have internal structures with the incentives and behavior of small firms, then much of the logic of the impact of firm size on technological innovation rates becomes moot. Firms can also achieve some of the advantages of mechanistic and organic structures by alternating through different structures over time.

8.3. Modularity and "loosely coupled" organizations

Another method firms use to strike a balance between efficiency and flexibility is to adopt standardized manufacturing platforms or coponents that can then be mixed ad matched in a modular production system. This enables them to achieve standardization advantages at the component level, while achieveing variety and flexibility at the end product level.

Modular Products

Modularity refers to the degree to which a system's components may be separated and recombined. Making products modularcan exponentially increase the number of possible configurations achievable from a given set of inputs.
Modularity is achieved in product design through the specification of standard interfaces. Modular products become more valuable when customers have heterogeneous demands and there are diverse options for meeting them.
When products are made more modular, it enables the entire production system to be made more modular. The standard interfaces reduce the amount coordination that must take place between the developers of different components, freeing them to pursue more flexible arrangements than the typical organizational hierarchy. Such flexible arrangements are referred to as "loosely coupled organizational structures".

Loosely coupled organizational structures
Organzations can also be made modular through the adoption of structures that enable "loose coupling". In a loosely coupled structure, development and production activities are not tightly integrated but rather achieve coordination through their adherence to shared objectives and common standards.

- Pro:
  - less need for integration frees firms to pursue more flexible R&D and production configurations
- Contra
  - if ongoing intensive coordination is required, the development activities might be better carried out through close integration of all parties
  - if the development groups are in separate companies, developing a new product in a collaboration agreement, neither firm may possess the authority to resolve the dispute and enforce a particular outcome

8.4. Managing innovation across borders (Barlett and Ghoshal)

- Center-for-global strategy = when all innovation activities are conducted at a central hub and innovations are then diffused throughout the company
- Local-for-local strategy = when each subsidiary conducts its own R&D activities tailored for the needs of the local market
- Locally leveraged strategy = when each division or subsidiary of the firm conducts its own R&D activities, but the firm attempts to take the most creative resources and innovative developments from divisions and deploy them across the company
- Globally linked strategy = innovation activities are decentralized, but also centrally coordinated for the global needs of the corporation, each division might be charged with a different innovation task that serves the global company's needs, in which the division can exploit some local market resource advantage.
  → Barlet and Ghoshal propose that firms should take a transnational approach (= firms are trying to simultaneously achieve cost reductions and local responsiveness).

9. COLLABORATION STRATEGIES

Slides + Book chapter 8

9.1. iPod

Straight dope on the iPod's birth – Wired Magazine

- One of these myths is that the iPod has a father -- one man who conceived and nurtured the iconic device. Steve Jobs, of course, is one candidate; but engineer Tony Fadell has also been named the father of the iPod, as has Jon Rubinstein, the former head of Apple's hardware division. While they all played key roles in the iPod's development, the iPod was truly a team effort.
- In 2000, Steve Jobs' candy-colored iMac was leading the charge for Apple's comeback, but to further spur sales, the company started asking, "What can we do to make more people buy Macintoshes?"
- Music lovers were trading tunes like crazy on Napster. They were attaching speakers to their computers and ripping CDs. The rush to digital was especially marked in dorm rooms -- a big source of iMac sales -- but Apple had no jukebox software for managing digital music.
- To catch up with this revolution, Apple licensed the SoundJam MP music player from a small company and hired its hotshot programmer, Jeff Robbin. Under the direction of Jobs, Robbin spent several months retooling SoundJam into iTunes (mostly making it simpler). Jobs introduced it at the Macworld Expo in January 2001.
- While Robbin was working on iTunes, Jobs and Co. started looking for gadget opportunities. They found that digital cameras and camcorders were pretty well designed and sold well, but music players were a different matter: "The products stank," Greg Joswiak, Apple's vice president of iPod product marketing, Newsweek.
- Digital music players were either big and clunky or small and useless. Most were based on fairly small memory chips, either 32 or 64 MB, which stored only a few dozen songs -- not much better than a cheap portable CD player.
- But a couple of the players were based on a new 2.5-inch hard drive from Fujitsu. The most popular was the Nomad Jukebox from Singapore-based Creative. About the size of a portable CD player but twice as heavy, the Nomad Jukebox showed the promise of storing thousands of songs on a (smallish) device. But it had some horrible flaws: It used Universal Serial Bus to transfer songs from the computer, which was painfully slow. The interface was an engineer special (unbelievably awful) and it often sucked batteries dry in just 45 minutes.
- Here was Apple's opportunity.
- "I don't know whose idea it was to do a music player, but Steve jumped on it pretty quick and he asked me to look into it," said Jon Rubinstein, the veteran Apple engineer who's been responsible for most of the company's hardware in the last 10 years.
- Apple's team knew it could solve most of the problems plagued by the Nomad. Its FireWire connector could quickly transfer songs from the computer to player -- an entire CD in a few seconds; a huge library of MP3s in minutes. And thanks to the rapidly growing cell phone industry, new batteries and displays were constantly coming to market.
- In February 2001, during the Macworld show in Tokyo, Rubinstein made a visit to Toshiba, Apple's supplier of hard drives, where executives showed him a tiny drive the company had just developed. The drive was 1.8 inches in diameter -- considerably smaller than the 2.5-inch Fujitsu drive used in competing players -- but Toshiba didn't have any idea what it might be used for.
- "They said they didn't know what to do with it. Maybe put it in a small notebook," Rubinstein recalled. "I went back to Steve and I said, 'I know how to do this. I've got all the parts.' He said, 'Go for it.'"

- Rubinstein didn't want to distract any of the engineers working on new Macs, so in February 2001 he hired a consultant -- engineer Fadell -- to hash out the details. Fadell had a lot of experience making handheld devices: He'd developed popular gadgets for General Magic and Philips. A mutual acquaintance gave his number to Rubinstein.
- "Fadell was put in charge of a small team of engineers and designers, who put the device together quickly. The team took as many parts as possible off the shelf: the drive from Toshiba, a battery from Sony, some control chips from Texas Instruments. The basic hardware blueprint was bought from Silicon Valley startup PortalPlayer, which was working on "reference designs" for several different digital players, including a full-size unit for the living room and a portable player about the size of a pack of cigarettes.
- The team also drew heavily on Apple's in-house expertise.
- "We didn't start from scratch," Rubinstein said. "We've got a hardware engineering group at our disposal. We need a power supply, we've got a power supply group. We need a display, we've got a display group. We used the architecture team. This was a highly leveraged product from the technologies we already had in place."
- One of the biggest problems was battery life. If the drive was kept spinning while playing songs, it quickly drained the batteries. The solution was to load several songs into a bank of memory chips, which draw much less power. The drive could be put to sleep until it's called on to load more songs. While other manufacturers used a similar architecture for skip protection, the first iPod had a 32-MB memory buffer, which allowed batteries to stretch 10 hours instead of two or three.
- The iPod's basic software was also brought in -- from Pixo, which was working on an operating system for cell phones. On top of Pixo's low-level system, Apple built the iPod's celebrated user interface.
- The idea for the scroll wheel was suggested by Apple's head of marketing, Phil Schiller, who in an early meeting said quite definitively, "The wheel is the right user interface for this product."
- Schiller also suggested that menus should scroll faster the longer the wheel is turned, a stroke of genius that distinguishes the iPod from the agony of competing players. Schiller's scroll wheel didn't come from the blue, however; scroll wheels are pretty common in electronics, from scrolling mice to Palm thumb wheels. Bang & Olufsen BeoCom phones have an iPod-like dial for navigating lists of phone contacts and calls. Back in 1983, the Hewlett Packard 9836 workstation had a keyboard with a similar wheel for scrolling text.
- The interface was mocked up by Tim Wasko, an interactive designer who came to Apple from NeXT, where he had worked with Jobs. Wasko had previously been responsible for the clean, simple interface in Apple's QuickTime player. Like the hardware designers, Wasko designed mockup after mockup, presenting the variations on large glossy printouts that could be spread over a conference table to be quickly sorted and discussed.
- On Oct. 23, 2001, about five weeks after 9/11, Jobs introduced the finished product at a special event at Apple's HQ.
- "This is a major, major breakthrough," Jobs told the assembled reporters.

9.2. Cooperation

Reasons for going solo

Availability of capabilities

If a firm has all of the necessary capabilities for a project, it may have little need to collaborate with others and may opt to go it alone. Furthermore, if a firm finds that it lacks certain required capabilities

but there are also no potential partners with such capabilities, it may be forced to develop the capabilities on its own.

Protecting proprietary technologies
Firms sometime would avoid collaboration for fear of giving up proprietary technologies. Working closely with a partner might expose the company's existing proprietary technologies to the prying eyes of a would-be competitor. Furthermore, the firm may wish to have exclusive control over any proprietary technologies created during the development project.

Controlling technology development and use
Sometimes firms choose not to collaborate because they desire to have complete control over their development processes and the use of any resulting new technologies. This desire might be for pragmatic reasons (e.g., the new technology is expected to yield high margins and the firm does not wish to share rents with collaborators) or cultural reasons (e.g., a company's culture may emphasize independence and self-reliance).

Building and renewing capabilities
The firm believes the efforts are key to building and renewing their capabilities. Solo development of a tecnological innovation challenges the firm to develop new skills, resources, and market knowledge. As said before, the potential for creating and enhancing the organization's capabilities may be more valuable than the innovation itself.

Advantages of collaborating

Access to complementary assets/knowledge
Ex.: When Apple was developing its LaserWriter, a high-resolution laser printer, it did not possess the technological expertise to produce the printer's engine and developing such capabilities in-house would have taken a long tiùe. They persuaded Canon, the market leader in printing engines, to collaborate on the project. With Canon's help, Apple was able to bring a qualitative printer on the market.

Reduce its asset commitment and enhance its flexibility
When technology is progressing rapidely, firms may seek to avoid committing themselves to fixed assets that may rapidely become obsolete. They may choose to become more narrowly specialized and use linkages with other specialized firms to access resources they do not possess in-house.

Transfer of tacit knowledge
It's an important source of learning for the company. Transfer of knowledge between firms and creation of new knowledge that individual firms could not have created alone. This can be particularly important when a project is very expensive or its outcome highly uncertain.

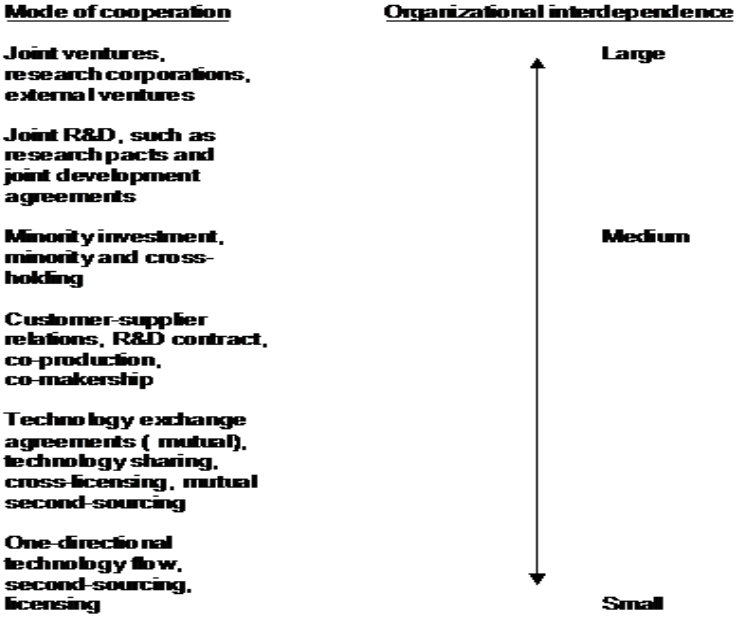
Facilitate the creation of a shared standard
An important way of ensuring cooperation in the commercialization stage of a technology. It's curcial for technologies in which compatibility and complementarity goods are important. Ex: in 1997, Nokia, Motorola and Ericsson formed a nonprofit corporation called WAP Forum to establish a common wireless telecommunication format.

Sharing/Spreading of costs and risks

Combining diverse resources beneficial for creativity/novelty of new products/processes
Technology scouting
Speeding up the development process

Types of collaborative arrangements

There's a wide range of Cooperation Modes (with varying degrees of organizational interdependence).



Strategic Alliances
Any type of formal or informal relationship between two or more firms

Joint Ventures
A partnership between two or more firms involving a significant equity stake by the partners and often resulting in the creation of a new business entity.

Licensing
A contractual arrangement whereby one organization (the licensee) obtains the rights to use the proprietary technology of another organization (the licensor).

Outsourcing
Firms tht develop a new technological innovation do not always possess the competencies, facilities, or scale to perform all the value-chain activities for the new innovation effectively or efficiently. Such firms might outsource activities to other firms. *Contract manufacturing* (common form of outsourcing) = when a firm hires another firm to manufacture its products.

Collective Research Organizations
In some countries, multiple organizations have established cooperative research and development organizations. Many of these organizations are formed through government or industry association.

Choosing a mode of collaboration

	Speed	Cost	Control	Potential for leveraging existing competencies	Potential for developing new competencies	Potential for accessing other firm's competencies
Solo	Low	High	High	Yes	Yes	No
Strategic alliance	Varies	Varies	Low	Yes	Yes	Sometimes
JV	Low	Shared	Shared	Yes	Yes	Yes
Licensing in	High	Medium	Low	Sometimes	Sometimes	Sometimes
Licensing out	High	Low	Medium	Yes	No	Sometimes
Outsourcing	Medium	Medium	Medium	Sometimes	No	Yes
CRV	Low	Varies	Varies	Yes	Yes	Yes

Choosing and monitoring partners

Partner Selection

- Resource fit = the degree to which potential partners have resources that can be effectively integrated into a strategy that creates value
- Strategic fit = the degree to which partners have compatible objectives and styles

Partner Monitoring and Governance

- Alliance contracts = legally binding contractual arrangements to ensure that partners (1) are fully aware of their rights and obligations in the collaboration and (2) have legal remedies available if a partner should violate the agreement
- Equity ownership = each partner contributes capital and owns a share of the equity in the alliance. This helps to align the incentives of the partners and provides a sense of ownership and commitment to the project that can facilitate supervision and monitoring of the alliance
- Relational governance = self-enforcing norms based on goodwill, trust and reputation of the partners. These typically emerge over time through repeated experiences working together.

Effects of Cooperation

- Majority of studies (75%) reveal a positive effect of alliances on innovative performance (technical/financial)
- Positive effects increase when:
    - Cooperation is of a more intensive nature (increasing levels of inter-organizational interdependence)
    - Overlap of knowledge/capabilities is present
    - Managerial 'alliance' skills are present
- Moderating effects of technology/industry:
    - Within new emerging fields alliances of a less intensive nature seem to be equally effective
    - Within mature industries, long-term alliances with considerable levels of interdependence are most effective
- Majority of research focus on bi-lateral alliances – impact of network characteristics less clear

Company perspective

- Cooperation with universities/research labs seems especially beneficial for exploring/creating new technologies and products (compared to improving existing ones)
- Recent research by Belderbos, Carree & Lokshin (2004/2005):
    - Still very little systematic evidence if and how different types of R&D partnerships complement each other. Preliminary evidence (ongoing research) also points out that pursuing multiple innovation objectives simultaneously in various partnerships is complex

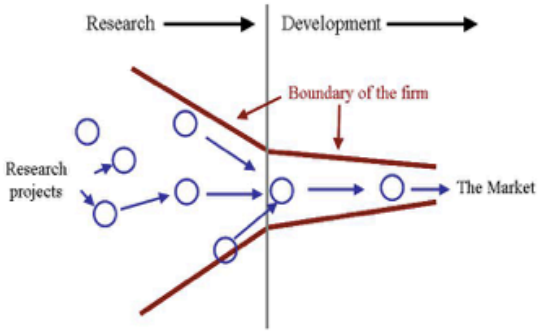
- Benefits or portfolio approach less obvious for smaller firms.

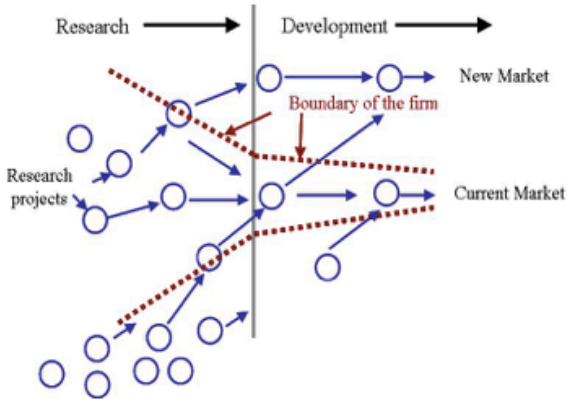
10. CLOSED AND OPEN INNOVATION

Slides

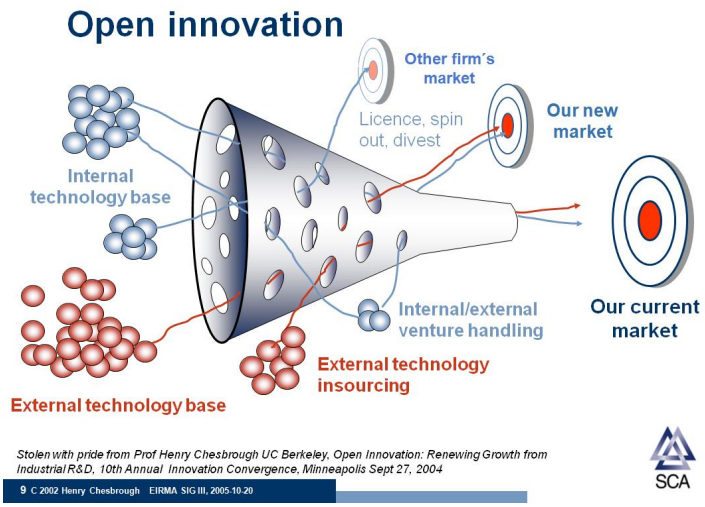
Henry is labeling the closed paradigm and he says it's not a good idea. We should open the windows:
You're not going to develop everything yourself
- to inflows: outside in, you use components that are not from you
- inside out: you start to look for opportunities outside your business
ex: Carta Mundi: they make cars. Play cards. It's a mature industry. But it's cheap and you don't possess a lot of cards. So, they innovated => Pokémon cards. Now they are innovating, and they want to go online, so chips in the cards, put that on TV and you can play worldwide connected. In the meantime, they have developed the production technology with cards that have an ID chip (made en EU project together w/ Imec = open innovation) and they now can make cards with RF-ID chips. But now, where's the money, where's the market now? Metro cards are RF-ID.

Paper Eric von Hippel « the source of innovation »:
talks about supplyers, users and competitors but also research labs, universities etc.
=> If you really try to make novel things, working w/ your customers or supplyers does not really make a difference. Which was 'chocking' because we tend to think we have to involve customers. But then careful if you want to improve what you already do, then you need the customer's feedback.
simple idea that comes from the portfolio model
remember you need exporation and exploration in a company.
If you are working on really novel things: exploration





10.1. Open innovation



From alliances and M&As towards Open Innovation (Chesbrough)

- M&As and alliances are only two modes to source external technology
- External sourcing strategy can only be understood when all modes are taken into account
  - Licensing
  - External corporate ventures
  - Participation in VCFs, etc…
- External technology sourcing is complementary to internal R&D resources
  - building of absorptive capacity
  - how to structure the organisation and how to integrate external technology sourcing into corp. strategy making
  - technological opportunity recognition

Advantages of open innovation

- Definition:
  - "open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively." Chesbrough, Vanhaverbeke & West, 2006
  - you have a bidirectional flow of knowledge (outside – in and inside – out) throughout the whole funnel
- Advantages of open innovation:
  - Higher development speed
  - Access to external technology sources
  - Higher flexibility: you acquire the technology early (high risk / small investment) on or later (lower risk but at a higher price!)
  - The value of technologies can be determined by linking them to your business model
    - Insource technologies that may strengthen your business
    - Sell technologies that are not in line with your technology / product portfolio

Company perspective

- At the same time, organizing alliances is a complex process: 50% of alliances fail.
- What makes it complex?
  - Unintended knowledge spillovers
  - Learning races between the partners
  - Diverging opinions on intended benefits

    - Lack of flexibility and adaptability
    - Lack of managerial skills/expertise/experience
    - Strategic/cultural differences between partners
    - Lack of – at least partially – overlapping capabilities
    - Additional complexity on the level of portfolios
    - How to address the complexities entailed?
    - Relevance/Importance of combining formal (contracts) and relational governance mechanisms (trust)
    - Alliances as processes implying different stages
    - Alliances differ in terms of objectives and interdependencies; hence a portfolio approach – in terms of organizing practices – seems to be as relevant.
- Difference between good and bad collaboration: trust. If you have to rely on a contract, then it's going to fail.

10.2. Managing inter-firms' relationships: towards an enriched understanding of the governance function of R&D alliance contracts

Introduction

- Shift in focus alliance governance literature:
    - From studying choice between equity/non-equity structures to examining governance function of contracts (Ariño & Reuer, 2004)
- Governance function of contracts is twofold:
    - Control function: Mitigating opportunistic action (Deeds & Hill, 1998; Parkhe, 1993)
    - Coordination function: Simplifying decision making and aligning interdependent tasks (Reuer & Ariño, 2003; Mellewigt et al., 2005)
- Existing literature on alliance contracts: Problematic issues
    - Impact contracts on trust building processes: Ambiguous results
        - Complex contracts hamper trust building (Lyons & Mehta, 1997; Malhorta & Murnighan, 2002)
        - Complex contracts facilitate trust building (Luo, 2002; Poppo & Zenger, 2002)
- Possible explanation: Exclusive focus on degree of contractual formalization, neglecting the actual content of the contract (Klein Woolthuis et al., 2005)
    - Scholars paid limited attention to how contracts are actually applied during the alliance
- Purpose of this study:
    - Explore the governance function of contracts by focusing on the content of alliance contracts and its actual application during the collaboration.

Research design

- In-depth case study of two sequential explorative R&D alliances between same pair of partners:
    - JET: High-tech entrepreneurial firm specialized in development of inkjet printheads
    - GRAPH: Established company active in imaging industry

	SSH Alliance (Feb 99 – April 01)	ESH Alliance (June 00 – March 02)
Purpose of alliance	Exploration feasibility of SSH printhead technology	Exploration feasibility of ESH printhead technology
Governance structure	Contractual alliance	Contractual alliance
Degree of success	-Original objectives not achieved -Premature termination of alliance	-Successful completion of original objectives -Partners negotiate new alliance for exploitation of ESH printhead

The Arfa Gevaert case

Arfa Gevaert: during the digital transformation they lost 88% of their value. But they're still there. Here: High-end printers for offices. They have a nice range of products. But there'sa new competitor announcing a new product that has much better performance. So, they're getting nervous, because they could loose market share.

It takes 3-4 years to come up w/ a new product, but by that time you loose 30-40% market share.

So, what they do is they look at novel applications (patents). And they see that in the UK there's a small thing that might offer the solution. For this challenge it makes sence to get to know these people. And they discuss if it makes sense to use this technology for the next generation of products.

Conclusion when back to Antwerp: let's take that option. So now you have to do the contracting.

What's in the contract?

- the scope of the project, timeline (12-18 months)
- task division: we expect from you the print ads
- define the specs: that kind of precision, and speed
- alpha: they have to make the whole printing system work
- discuss IP: if we develop something in that project and put a patent, we have to agree who will get the IP. Easy: IP reflects the task division.
- exclusivity (the Toshiba-apple thing)
- if it fails, then you have to agree when they do stop (after youp ay all the lump sum)

So, we're drafting the contract. They send it to London, but then he company in UK starts having doubts. Why? Because they are only 100 and Arpha is 50.000. So, they're afraid they won't be able to control. Where will the technology go?

So, they say they want a non diclosure clause in which they can never ever be obliged to reveal critical information about their technology, because there's this risk of abuse.

In Antwerp they agree.

So, they can start collaborating.

After a few months, the first printer arrives. The people from Antwerp are very excited and then they put it in the system. But then the quality is not good (48%). As an engineer you want to have 78-88%. They pick up the phone, you say: London we have a problem. The results are below than we expect from the first run. People in London say: this can't be true, you've done something worng. Our printers here are doing much better. It's your fault, not ours.

So, in Antwerp they do it a second time. But still doesn't change. So, they ask to come over, they have a look and see there's a print ad problem.

So then, Antwerp they ask what's going on, how it's possible it doesn't work. But UK says no I'm not going to discuss this with you, we go back to UK and will sort it out here.
What do you do as Arfa Geva? You don't like it, but you have to say yes that's what we agreed.
A while later, you have the management that comes talking and asks what's going on and how you are advancing. You say it's not good. They then ask: are you confident that you're able to solve these issues, should we intervene?
Honest answer for confidence: you can't say yes, you have to say no, or I don't know. Why ? Because you don't know where the problem is. And the supplyer didn't prove they are capable to solve the problem in a timely manner.
First thing I do as the manager I am not confident. So, he looks at this contract (they're not meeting the specs, so I can suspend my milestone payments). He also calls the CEO in London to ask what he can do about it and also say he's not paying them. This creates stress in London. Ceo puts pressure on the engineering team.
In the end they stopped the project.
This happens regularly. What is exceptional is that while this collab unfolds, they start up another project. Because there's a competititve threat and they do the IHS alliance.
Another complementary technology from another company in the UK and they start a collab with them.

Methodology

- Retrospective data collection
- Multiple data collection techniques
- Content analyses of formal contracts
- Multi-level analyses of dynamics of collaboration separating out governance, operational and managerial levels

Explorative R&D Alliance	Interviews	Documents
SSH Alliance	- GRAPH managers : 2 - GRAPH engineers: 4 - JET managers: 1 - JET engineers: 2	- Contract - Reports of steering meetings - Evaluation Document
ESH Alliance	- GRAPH managers: 2 - GRAPH engineers: 5 - JET managers: 2 - JET engineers: 1	- Contracts - Reports of steering meetings - Reports of technological meetings

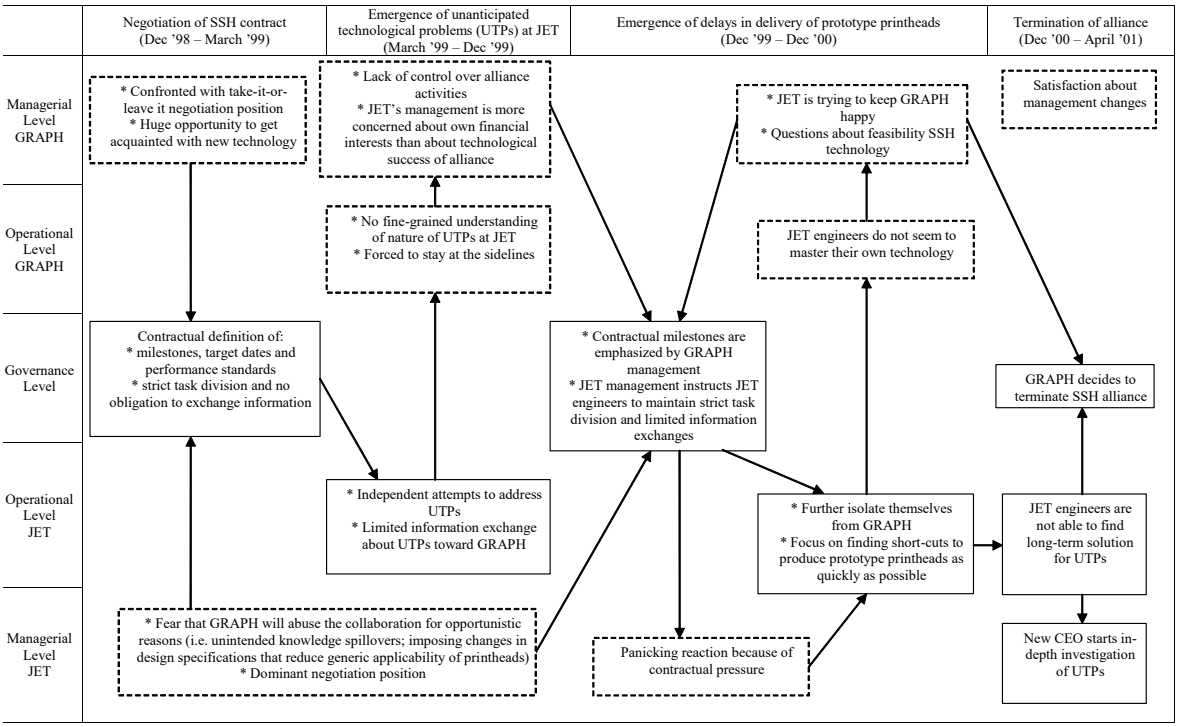
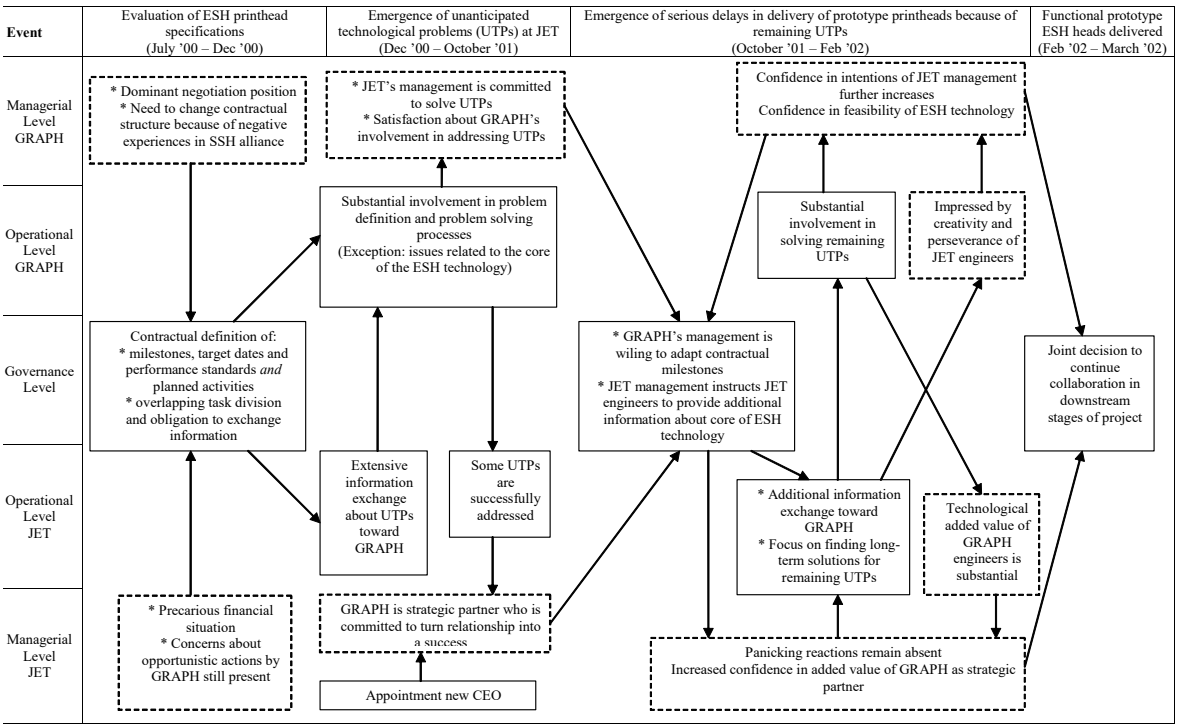


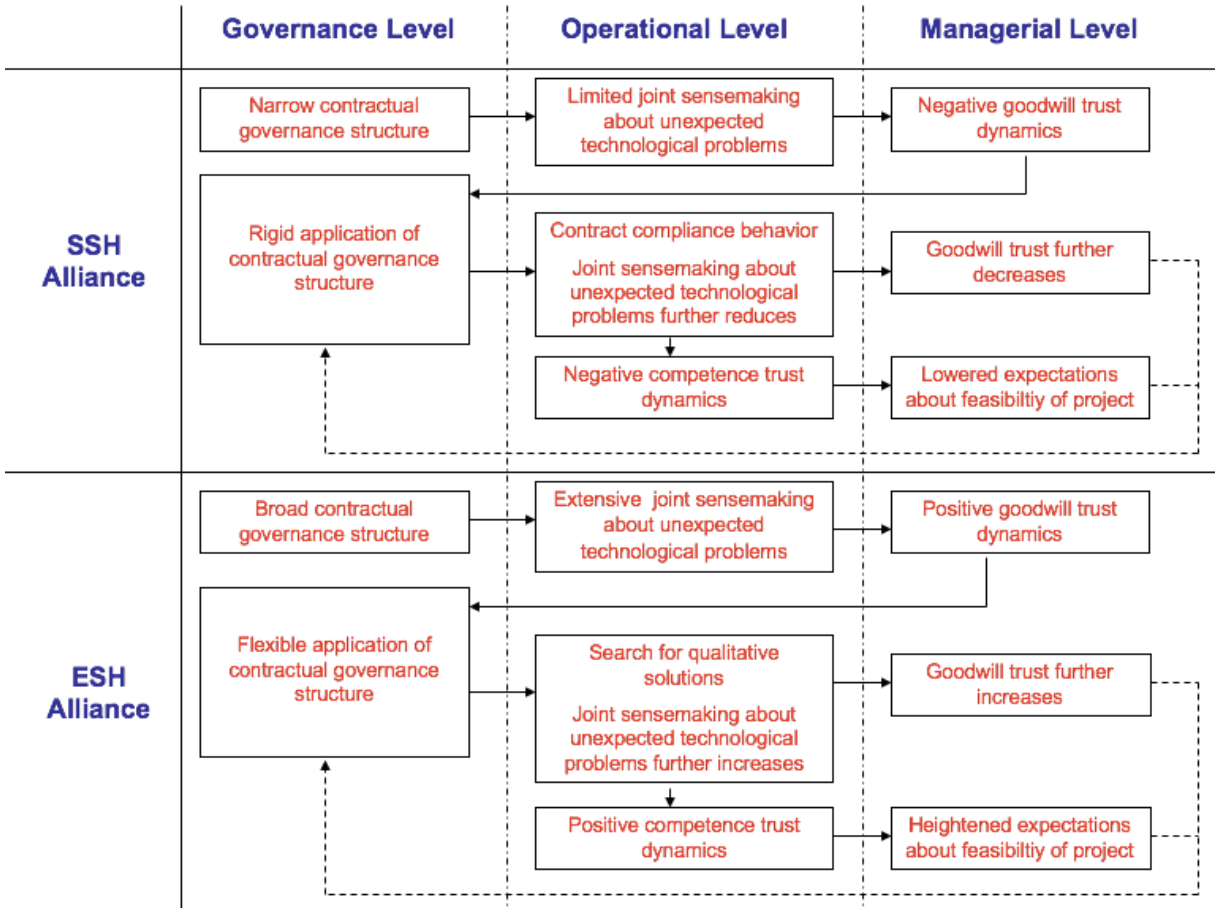
Figure 2: Overview dynamics of collaboration in the ESH alliance



Findings: content of contacts

	Narrow Contractual Governance Structure *SSH Alliance*	**Broad Contractual Governance Structure** *ESH Alliance*
Formalization of control processes (Mintzberg, 1979)	Presence of performance control system *Presence of program milestones, target dates, and performance standards for delivery of SSH printheads* Absence of action control systems	Presence of performance control system *Presence of program milestones, target dates, and performance standards for delivery of ESH printhead* Presence of action control systems *Specification of technological activities that are supposed to be conducted by JET*
Formalization of coordination processes (Landau, 1969; Van de Ven & Fry, 1980)	Mutually exclusive task division *JET is solely responsible for design and development of SSH prototype printheads, while GRAPH is solely responsible for design and development of prototype printing system* Absence of contractual obligation for information flows	Overlapping task division *JET and GRAPH are jointly responsible for establishing the initial design specifications of the ESH prototype printhead. JET and GRAPH are supposed to conduct similar technological tests.* Presence of contractual obligation for information flows *Need for joint review meetings in which results of technological experiments need to be exchanged*

- Why did partners shift from narrow to broad contractual governance structure?
    - Learning experiences triggered need to shift from narrow to broad contractual governance structure (cf. Mayer & Argyres, 2004)
    - Bargaining power provided the ability to shift from narrow to broad contractual governance structure
- Findings: Multi-level model of collaborative dynamics
    - A broad (narrow) contractual governance structure facilitates (hampers) joint sense-making about unanticipated technological problems on the operational level, which in turn positively (negatively) influence goodwill trust dynamics on the managerial level
    - Positive (negative) goodwill trust dynamics on the managerial level increase the probability of flexible (rigid) contract application
    - Reinforcing cycles between governance, operational, and managerial levels that further increase (decrease) goodwill trust and trigger heightened (lowered) expectations about feasibility of the project



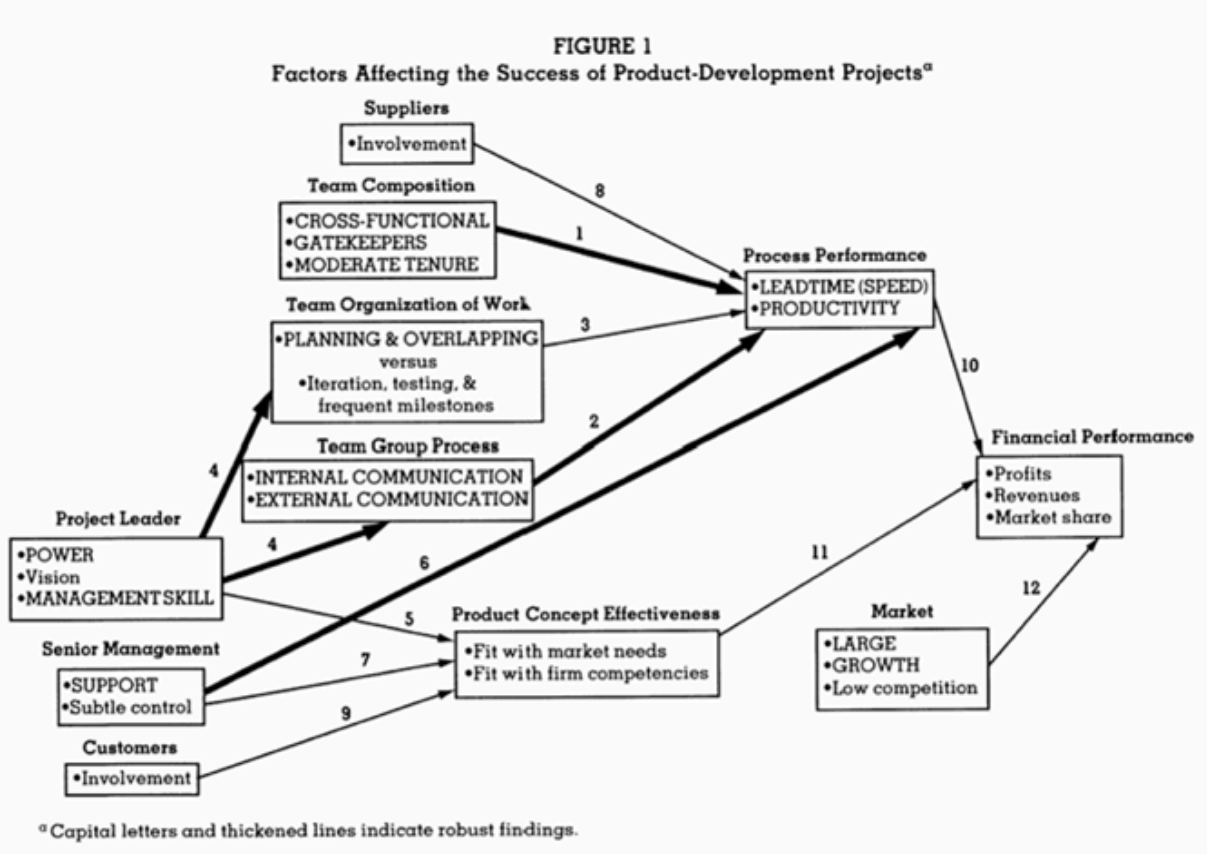
Implications

- Contribution to ongoing discussion about impact of contracts on trust building processes:
  - Complex contracts can both encourage and discourage trust building depending on the nature of the contract (in relation to the nature of technological activities)
- Bridging the transactional and relational view
  - Process of contracting is an incremental learning process that is sensitive to bargaining power dynamics
  - Not goodwill trust, but rather mutual interdependence and competence trust function as necessary conditions to continue interfirm relationships

11. OPERATIONAL ISSUES

Slides + chapter 11 +12 book

We're going to talk about how to organize your projects/R&D



First perspective:

You will have a better result if you do your homework in advance. You have to do a very good planning, with milestones. You will gain a lot, especially in lead time

2nd & 3rd perspective:

- You'll work better if you communicate within and outside the team
- Key ingredients: the notion of champions. If you don't have strong leadership, then troubles might appear. Back to the schumpeter idea of the heroic entrepreneur, you need a micro… that is willing to motivate and make things move.
- Senior management support becomes important at that stage

Tom Ellen's communication study

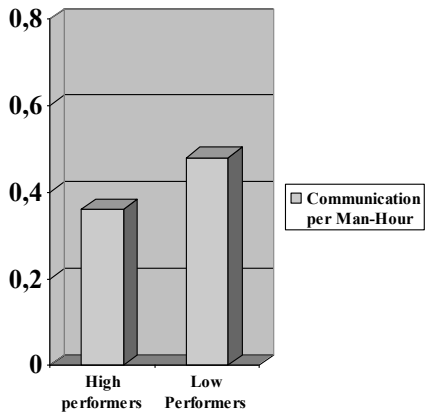
Today in the digital age, where we have so much info available (data, internet), but communication is still very important (face-to-face).

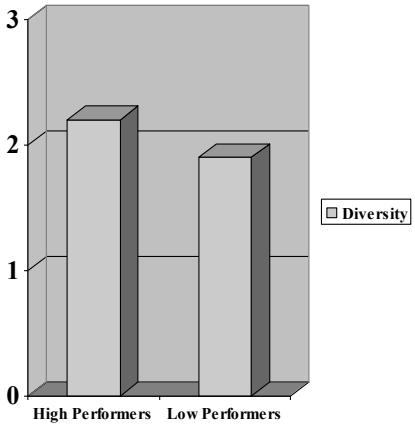
He compares successful with less succesfull projects. And he looked at to what extent are succesfull projects different in communication patterns?

What we see on the graphs are the findings.

Firt-order findings within project communication patterns

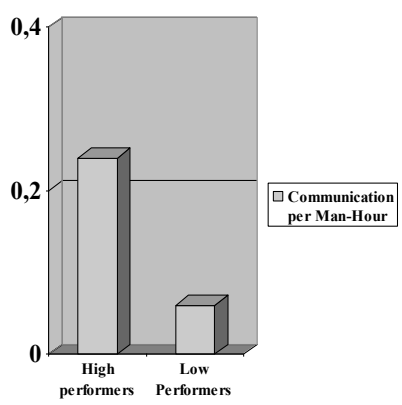
- Technical, problem-solving information versus administrative information
- The significant importance of direct, face-to-face contact
- The significant impact of boundary spanning
- Graph: people that are not doing that good waste time talking. But that's talking within the team.
- A better diversity has a good impact on high performance projects

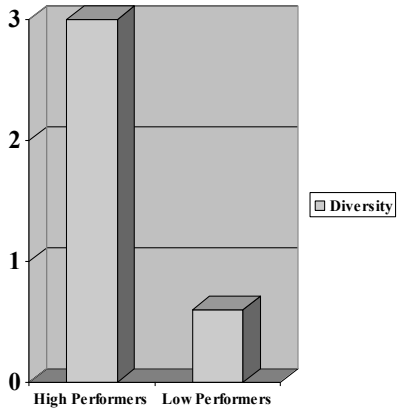




First-order findings: boundary-spanning communication

- Quantity, diversity and quality of technical communication are related to project performance when considered from a boundary-spanning perspective (i.e. inter-project communication)
- If you look at communication outside the team, you see a huge difference.
- High performance projects have more external communication with outside partners. One of the important things that makes a difference is to make sure that you have diversity in the whole project in which the team is embedded
  => diversity
  => You need suffiecient levels of variety to adress the complexity of the project





Not invented-here syndrom
They continued looking at communication patterns
Relationship between team duration between team seniority and performance of the project.
- If a new team starts with the project (and they don't know eachother). Look at graph. First, they improve a lot, and then once they now eachother, the process has improved etc, you think you are a good team. But once you are there it's going down. Why?
1) The more we interract with eachother, the more you become homogeneous
Whom do you select into interracting with? In the beginning, groups are different with different opinions, but after the group becomes more homogeneous. We tend to hook up with people that are similar to us. Therefore, less new, contrastig ideas.
2) The fact that you have succes
One you start having success, you start doing less because you opt for a "we know it" attitude.
3) potential threat from newness

Remedies:
You have to actively manage openness and closure

1) Rejuvenating the team
2) Opening team boundaries

11.1. Managing New Product Development Teams

Constructing New Product Development Teams
The organization must consider how the team's size and composition will affect its mix of skills, its acces to ressources, and its effectiveness in providing communication and coordination across the divisions.

Team Size

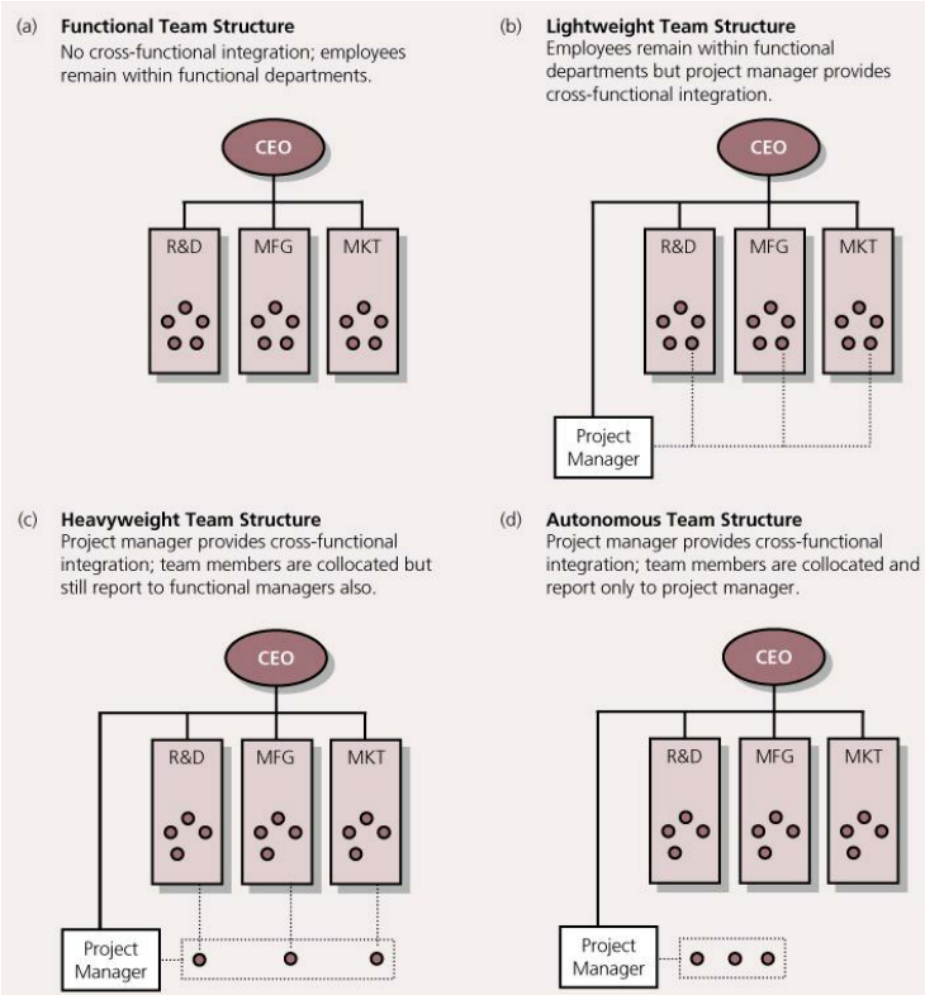
- By combining the efforts and expertise ofmultiple individuals, groups can outperform individuals on many roblem-solving tasks, implying that the size of the development team might be related to its potential for success.
- Bigger is not always better:
  - Administrative costs and communication problems → costly delays
  - Harder to foster a shared sense of identity among team members

- Social loafing: when an individual in a team does not exert the expected amount of effort and relies instead on the work of other team members.

Team composition

- *cross-functional teams:* teams whose members are drawn from multiple functional areas in the firm – advantage: broader knowledge base and cross-fertilization of ideas;
- *homophily:* the tendency for individuals to like other people whom they perceive as being similar to themselves – advantages of heterogeneous teams: they possess more information and can increase the creativity and variance in decision making, leading to more innovative outcomes and higher overall performance; however, to realize these advantages, heterogeneous teams may require long-term contact and incentives to foster communication and cooperation.

The Structure of New Product Development Teams



Functional Team Structure

- members remain in their functional department
- they report to their regular functional manager
- they meet periodically ot discuss the project
- temporary teams, and individuals may spend 10% of their time on team-related activities

- they have no project manager or dedicated liaison personnel
- (+) requires little deviation from the firm's normal operations
- (-) little opportunity for cross-funtional coordination
- (-) team members have little commitment to the development project

Lightweight teams
- Members remain in their functional department
- Functional supervisors retain authority over evaluation and rewards
- Temporary projects
- Members spend most of their time on their normal functional responsabilities
- There's project manager and dedicated liaison personnel
- (-) Managers are juniors and have low influence on team members
- (-) lightweight teams offer a small improvement in team coordination and likelihood of success over functional teams

Heavyweight teams
- Members are removed from their functional departments so that they may be collocated with the project manager
- Project manager = senior manager with significant authority
- The core group of team members is dedicated full time to the project
- (+) Strong cross-functional coordination and communication
- (+) team members are significantly commited to the development project
- Temporary
- For platform projects

Autonomous teams
- Members are remove from their functional departments and dedicated full-time (and often permanently) to the development team
- Team members are collocated with the project manager
- The project manager has full control resources contributed from different functional departments
- The team often does not conform to the operating procedures of the rest of the organization, they are permitted to create their own policies, procedure, and reward systems
- They are held fully accountable for the success of the project
- (+) excel at rapid and efficient new product development, particulary when such development requires breaking away from the organization's existing technologies and routines
- Appropriate for breakthrough projects and some major platform projects
- Birthplace of new business units
- (-) the independence of the autonomous teams can cause them to underutilize the resources of the parent organization
- (-) the people are often hard tp fold back after the project is completed, they thus go in separate divisions or are spun off the firm as a subsidiary

Characteristics	**Functional**	**Lightweight**	**Heavyweight**	**autonomous**
Project Manager	None	Junior or middle	Senior	Senior
Power of PM	NA	Low	High	Very high

Time spent on team activities	Up to 10%	Up to 25%	100%	100%
Location of team members	Functions	Functions	Collocated with project manager	Collocated with project manager
Length of commitment	Temporary	Temporary	LT but ultimately temporary	Permanent
Evaluation of team members	Functional heads	Functional heads	PM and functional heads	PM
Potential for conflict b team and functions	Low	Low	Moderate	High
Degree of fit with existing organizational practices	High	High	Moderate	Moderate-low
Appropriate for:	Some derivative projects	Derivative projects	Platform projects/breakthrough projects	Platfrom projects/breakthrough projects

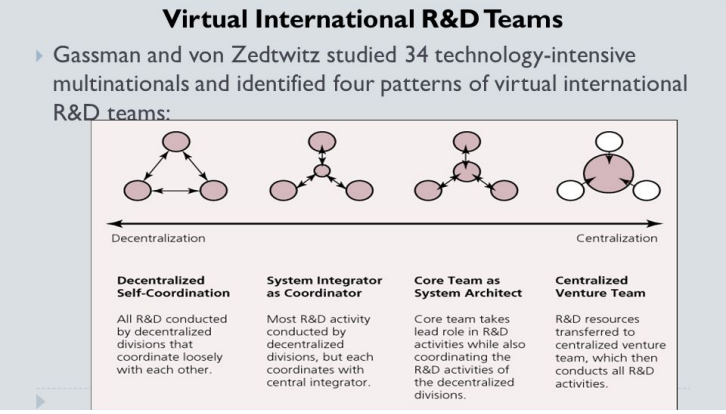
Management of New product Development Teams
For a new product development team to be effective, its leadership and administrative policies should be matched to the team's structure and needs:

Team leadership
Attributes of the team leader must match the team type for teams to be most effective. See above, the different team types and functions of the project manager.

Team Administration
Many firms have teams develop and sign project charter and contract book to ensure that all team members have a common understanding of the project's goal and possess a sense of ownership and commitment to the project's success

Managing virtual teams
When a company wishes to form a team with individuals who have unique skills but live great distances from each other, it ight opt to forl a virtual team, the team uses IT to achieve communication and coordination and faces a distinct set of challenges in promoting participation, cooperation and trust, management must make sure they selet personnel who are both comfortable with the technologies used and who have strong interpersonal skills

Gassman and von Zedtwitz – typology of virtual international R&D teams



- Decentralized self-coordinating teams: all R&D is conducted by decentralized divisions that coordinate loosely with each other.
- System integrator as coordinator: most R&D is conducted by decentralized divisions, but one single individual or office takes
    - responsibility for the coordination.
- Core team as system architect: the core team takes a lead role in R&D, while also coordinating the decentralized divisions.
- Centralized venture team: all R&D resources are transferred to a centralized venture team, which then conducts all R&D

11.2. Managing the New Product Development Process

Objectives of the New Product Development Process

Maximizing fit with customer requirements

→ many fail to achieve this:

- The firm may not have a clear sense of which features customer value most
- The firm may overestimate the customer's willingness to pay for particular features
- The firm may have difficulty resolving heterogeneity in customer demands

Minimizing cycle time

→ a firm that brings a new product to market late:

- May find that customers are already committed to other products
- Will have higher costs because many development costs are directly related to time and is unlikely to be able to fully amortize the fixed costs before the generation becomes obsolete
- May not be able to quickly revise or update its offering as design flaws are revealed or technology advances and may miss out on first-mover and second-mover advantages

Controlling development costs

→ development efforts must not only be effective, but also be efficient!

Methods of achieving these objectives

- To shorten the development process and avoid time-consuming and costly iterations, firms may adopt a partly parallel development processes → partly parallel development process = a development process in which some (or all) of the development activities at least partially overlap.
    - concurrent engineering (type of parallel development process) = a design method in which stages of product development and planning for later stages of the product lifecycle occur simultaneously
- firms may use project champions → project champion = senior executive that has the power and authority to support and fight for a project, note: a manager's role as champion may cloud judgment about the true value of the project
- firms can involve customers and suppliers:
    - beta testing = an early working prototype of a product is released to users for testing and feedback
    - lead users = customers who face the same general needs of the marketplace but are likely to experience them months or years earlier than the rest of the market and stand to benefit disproportionally form solutions to those needs
    - crowdsourcing = a distributed problem-solving model whereby a design problem or production task is presented to a group of people who voluntarily contribute their ideas and effort in exchange for compensation, intrinsic rewards or a combination thereof.

Tools for improving the new product development process

Stage-Gate processes

It's a model that provides a blueprint for moving projects through different stages of development. Go/kill decision points = gates established in the development process where managers must evaluate whether or not to kill the project or allow it to proceed.

Quality function deployment (QFD)

It's a process for improving the communication and coordination among engineering, marketing and manufacturing personnel by taking managers through a problem-solving process in a very structured fashion.

House of quality = a matrix that maps customer requirements against product attributes – 9 steps:

1) identify customer requirements
2) weight the customer requirements in terms of relative customer importance
3) identify the engineering attributes that drive the performance of the product
4) enter the correlations between the engineering attributes to assess the degree to which one characteristic may positively or negatively affect another
5) fill in the body of the central matrix: the number represents the strength of the relationship between a customer requirement and engineering attribute
6) multiply the customer importance rating of a feature by its relationship to an engineering attribute and sum these numbers for each column
7) evaluate the competing products on each of the customer requirements
8) use the relative importance ratings for each engineering attribute and the scores for the competing products to determine target values for each of the design requirements
9) create a product design based on the design targets

Design manufacturing methods (DFM)

It's a simple way of structuring the new product development process, often this involves articulating a series of design rules.

Failure modes and effects analysis (FMEA)

It's a method by which firms identify potential failures in a system, classify them according to their severity and put a plan into place to prevent the failures from happening – several steps:

1) identify potential failure modes

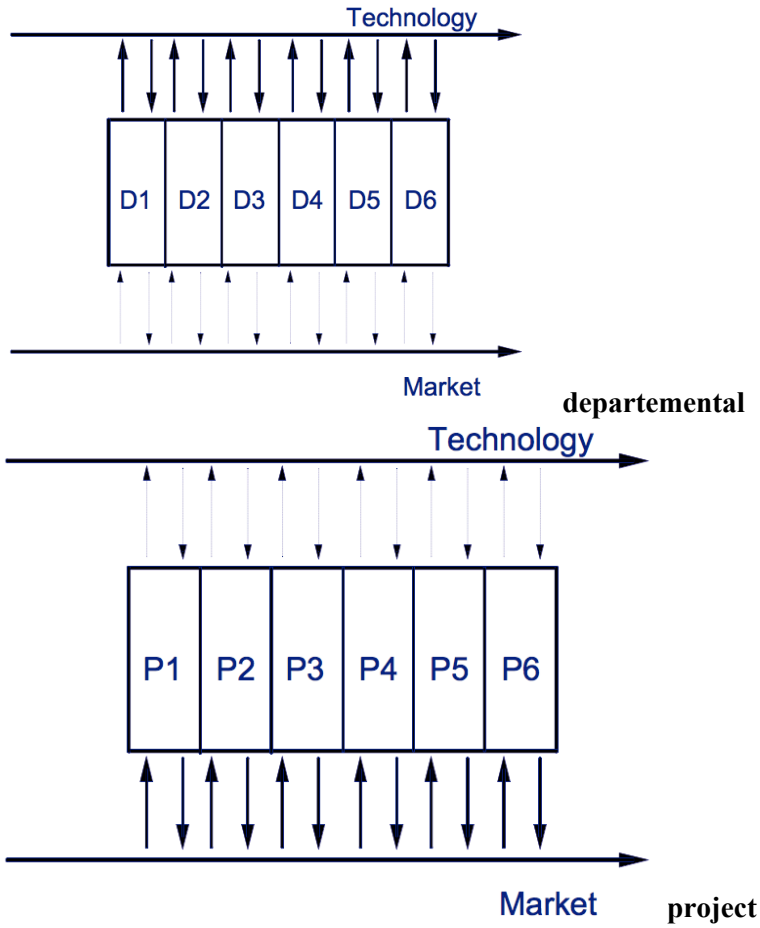
2) evaluate the failure modes based on severity, likelihood of occurrence and the inability of controls to detect it (one for the lowest risk, five for the highest risk)
3) create a composite risk priority number for each failure mode by multiplying the scores
4) prioritize the development efforts to target potential failures modes that pose the most composite risk

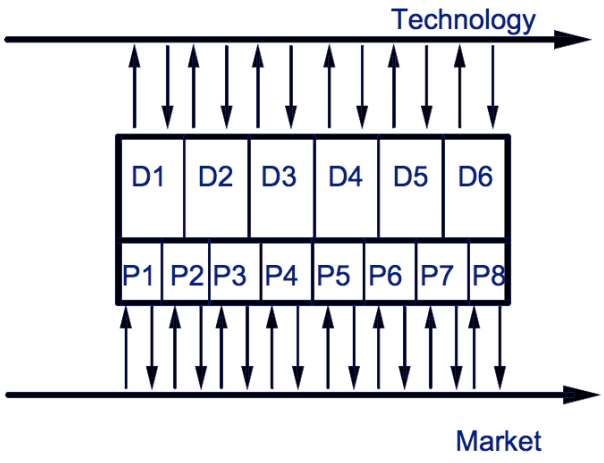
CAD & CAM
CAD (computer aided design) = the use of computers to build and test product designs.
CAM (computer aided manufacturing) = the implementation of machine-controlled processes in manufacturing.
Three-dimensional printing = a method whereby a design developed in a CAD program is printed in three dimensions

Tools for measuring new product development performance

Firms should use a variety of measures of their new product development effectiveness and overall innovation performance to identify opportunities for improving the new product development process and improving the allocation of resources.

Innovation: departmental or project team organization? – Tom Allen





matrix: mix of both

Trade-off

Departemental	Project team organization
• Departmental structure is more closely mapped to the structure of the supporting technologies • It thereby provides a better connection to those technologies and better ongoing technical support to the project effort. • This is, however, accomplished at the cost of much greater difficulty in coordination of the project tasks and less responsiveness to market change.	• Project Team structure groups people from different disciplines together in a single team all reporting to a common manager. • It thereby provides better coordination of the project tasks and increased sensitivity to market dynamics. • This is, however, accomplished at the cost of a separation from the disciplinary knowledge underlying the project effort. When this is carried to an extreme, it will gradually erode the technology base of the organization.

- If we go for scale, then we pay a price for integration and coordination.
- There is no best solution, unless we come to matrix.
- The beauty of the model: they give us guidance and relevant evidence to help you decide.
- There are four variables that are important in determining the organizational structure for product development:

1) the rate of change of knowledge variable

The rate, dynamics in terms of knowledge in certain fields are different. (IT it changes fast, accountancy slow, still the same as 20years ago)
If the developments are not that fast, it means for my organizational form that I choose project. Because you can infirm yourself.
If the velocity is very high, then you go for the department. Because we need critical mass to be able to stay on top of the devlopment, so you have to scale in terms of the field. And that you can only do it of you go for department

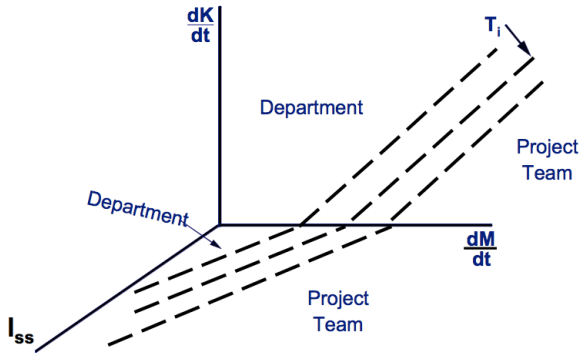
-if the integration is intense and it's going all levels then we should favor the project model.
- if things go fast you go for the department

2) interdependency
→high-project
→low- department (and the only thing that you need to take into acccount is interdependence)

Graph:
Shows in which zone you are and what method you have to use. But what do you do for the ones in the middle? You should maybe then consider the matrix

3) duration of the project
The longer a project takes, the bigger the chance that what you do in terms of technical chouce will be outdated.
- long (3-6 years): department. Because if you put an engineer that is expert in the field now, in 2-3 years, he will be disconnected from his ield and be 3 years behind in terms of technology
- short: project
=> that's why the space on the graphe becomes bigger and you go up.

4)Extent to which markets change rapidly
- rapid: project teams closer to the market
- slow : department



Standard Industrial Practice

- Ignores the rate at which technologies are developing (despite the fact that this can often be measured)
- Usually ignores the interdependencies in project work (seasoned project managers are an exception)
- Focuses only on project duration (and usually makes the wrong decision on this parameter)

Matrix organization

People have been experimenting with the bets of both = the matrix. According to the professor it'snot a good organizational structure.

He refers to: 'The slave of two masters is a free man': if you have multiple people steering you, there will be trouble (either conflict, either neglect, either opportunistic behavior)

Should there be a balance of power between the project side and the departmental side of the product development Matrix?
- Some argue for balance
- Some argue for "Heavyweight Project Managers"
- Does project size and complexity make a difference?

Conclusion

- There are four variables that are important in determining organizational structure for product development.
- Whether balance is necessary in the product development matrix is dependent upon the nature of the project.

Needed roles in the innovation process

Phase	Activities
Pre-Project	Communicate on technical questions, recent developments, engage in problem solving activities, discuss/explore novel ideas
Project Possibilities	Generate new technical idea and/or identify potential use of a new/improved product/process
Project Initiation	Matching a technical idea with a need in the market place: develop the idea into a project to test (commercial) feasibility; provide support for an emerging project group
Project Execution	Managing the project; execute activities, solve technical problems,; track outside technical activities and transfer if needed (gatekeeping); buffer the team from unnecessary constraints
Project Evaluation	Evaluate development's suitability for the intended market
Project Transfer	Transfer the development towards production – problem solving related to scaling up – support in defining procedures, quality standards

Idea Generating	Expert in a limited number of fields – Creative – Strong in problem solving
Entrepreneurship or Championing	Wide range of interests – Energetic and determined – Able to sell ideas and obtain resources - Takes risks
Project Leading	Planning, organizing and coaching – ensures that administrative and organizational requirements are met – takes care of project progress and team members
Gatekeeping	High level of technical competence – can communicate – keeps informed and likes to inform
Sponsoring or Coaching	Support development of people's talents – experience in what is feasible and needed - provides access to a power base within the organization – Buffers when needed

- Different roles imply different personal characters
- Implications for staffing the project
- Implications for career spanning role changes….
- Towards career dynamics for R&D professionals? … The dual ladder "debate".

Speeding up NPD processes (go che

- Speeding up the Development Process (Iansiti, Verganti, McCormack, Thomke…): Developing Products at internet speed, Frontloading, …
- During the nineties, several authors started to stress the idea of speed: high levels of customer involvement, frequent cycles of concept redesign, multiple iterations… supported by integrated design capabilities.
- However, it can be observed that such approaches imply the presence of 'a product architecture which allows the information generated during the process to be easily integrated…' (Verganti et al.) or still…'we view problem solving as an iterative process driven by trial and error experiments that are guided by knowledge of underlying relationships between cause and effect…' (Thomke & Fujimoto).
- Stated otherwise, homogeneity on the level of the problem-solving approach adopted seems necessary… hence addressing uncertainty… exploitation
- When extending such practices to all R&D activities, one risks sacrificing novelty in favor of speed ('one cannot compress what one does not yet understand').

A process view on Managing Quality within R&D

- Arguments in the past, not to introduce QM approaches because of the uncertain/ambiguous nature of the technological activities involved.
- Emphasis within TQM on improving performance, customer needs/value, integrated perspective (value chain), total involvement (all employees/suppliers), 'structured rationality', commitment to change/innovation…
- Spencer (1994) introduces different organizational models in which TQM can become embedded:
    - Mechanistic Model
    - Organic/cultural Model
- If TQM is (exclusively) considered as a set of tools and techniques, it certainly has little in common with the cultural mode of organizing that seems to fit R&D environments.
- From a methodological perspective, TQM has strong functionalistic features as it attempts to streamline individual behavior to the demand of the larger system.
- However, when organizations start seeing and using TQM as a vehicle for change, many comparisons with the cultural model of organization can be made. TQM can become a vehicle to construct and to frame a multiplex dialogue (different partners/different channels) aimed at improving and creating...
- This also means, variability in terms of procedures; acknowledging the implications of the type/nature of the project/task in terms of organizational practice...
- Implies maturity, or 'double loop learning' – see Argyris.
- Hence, main argument: TQM & R&D can co-exist, but this depends on the 'organizational' model in which practices are being embedded.

Quality function deployment

- What versus how:
    - functional parameters versus technical parameters
- Aligning capabilities & expectations
- Cross-functional communication support
- Iterative, priority-setting
    - choice of target values $Y = Sw_i r_i$
- Benchmarking potential

Exploitation, Exploration and Process Management: The Productivity Dilemma Revisited

- Increases in process management processes promote incremental innovation
- Increases in process management practices promote innovation for existing customer sets
- Increases in process management practices decrease architectural/radical innovation (or innovation for new customer sets)
- Solutions (propositions):
    - In the context of an ambidextrous organizational form, increases in process management practices increase exploitative innovation but do not dampen exploratory innovation.
    - Increases in process management practices will improve/decrease performance in eras of incremental technological change/in eras of technological ferment (turmoil)
    - Increases in process management practices will speed/slow organizational responsiveness during eras of incremental technological change/in eras of technological ferment.
    - In the context of an ambidextrous organizational form, increases in process management practices will enhance responsiveness and performance during eras of incremental change

but will have no effect on responsiveness or performance during eras of technological ferment
    - However, to drive streams of innovation, these inconsistent units must be strategically integrated by the senior team. It may be that heterogeneous senior team capabilities coupled with complex organizational architecture are at the root of dynamic organizational capabilities…

He goes back to the first slide
- he already stressed the fact of commnication
- In terms of team composition: Moderate Timing in the scheme (j'ai pas trop compris ça donc faudrait redemander au prof)
- Gate keeper: if you have nerds (people in the technicalities of things) that are always looking at new technologies and improving etc. You need them, they are very benefical. They are gates to the outside world and they bring in relevant knoledge and relevant diversity

12. IP & INNOVATION BEYOND R&D

Slides

12.1. Intellectual property rights

We have to be carfeul about organization and design, networks, open innovations, do we rely on partners or do we do everything inside? Now IP.

What is a patent?

- A modern patent provides the right to exclude others from making, using, selling, offering for sale, or importing the patented invention for the term of the patent. A patent is, in effect, a limited property right that the government offers to inventors in exchange for their agreement to share the details of their inventions with the public.
- In order to obtain a patent, an applicant must provide a written description of his or her invention in sufficient detail for a person skilled in the art to make and use the invention. This written description is provided in what is known as the patent specification, which often is accompanied by figures that show how the invention is made and how it operates.
- In addition, at the end of the specification, the applicant must provide the patent office with one or more claims that distinctly point out what the applicant regards as his or her invention. A claim, unlike the body of the specification, is not a detailed description of the invention, but a succinct series of words designed to provide the public with notice of precisely what the patent owner has a right to exclude others from making, using, or selling.
- It's a right to exlude other, but not an obligation to exploit it yourself
- If you're paying the patent fees, then you have obtained the property rights
- There's a patent time, the time that the patent belongs to you, after that it's public
- If you have a patent, everyone knows what the patent implies after 18 months or 30 if you follow the PCT. You get a monopoly, but then you have to disclose what it implies.

Bringing knowledge into the production function equation

- Patents do not equal inventions
    - You have a lot of innovations where there are no patent and vice versa.
- 3 important patent prerequisites
    - It has to demonstrate novelty

  - There's an inventive step: you have to do something which is non-obvious for people experienced in the field
  - Application: if you can't show that you can apply it, then you won't get the patent
- Certain areas are excluded :
  - European patents shall be granted for any inventions which are susceptible of industrial application, which are new, and which involve an inventive step.
  - The following in particular shall not be regarded as inventions within the meaning of paragraph 1:
    - Discoveries, scientific theories and mathematical methods
    - Aesthetic creations: that does not mean you cannot fine for that, but then you apply for design and esthetic innovations
    - schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers: also includes the software. Nevertheless, there's a lot of software patents, that's a big controverse. That's because software and hardware are connected and that's an innovation (pas sure).
      Ex.: The inventor is Besos (CEO Amazon), this is the 'one-click' shopping patent. When amazon was tsarting and became big, they immediately this oneclick thing. So, if you're a customer that bought for the second time, you have a profile, you only had to push on one click and you were done. They were the first to come up with this. In the end it has been revoked.
    - presentations of information

Evolution of patenting

Despite all the controverses about patents, it's still very popular.

Patents as an Incentive to Innovate (D. Guellec)

- History:
  - Nature is the creation of god(s): Romans, Catholic Church. Inventions are just discoveries by man of existing natural properties. Since then it evolved
  - Locke (1690): a person who labours upon resources that are either unowned or 'held in common' has a natural property right to the fruits of his labour (natural right approach).
  - This view endorsed by some philosophers of the enlightenment inspired the first patent law in France (1791) stating that: 'Every discovery of invention, in every type of industry, is the property of its creator; the law therefore guarantees him its full and entire enjoyment'
  - This view implies that patents are put in the realm of law and seen as a reward fairly deserved by the inventor, rather than an incentive serving society's interest.
  - This argument was put forward by Locke regarding land and agriculture, but is application to intangible assets straightforward?
  - Locke himself noted: '… at least when there is enough, and as good left in common for others.'
  - "Only god creates from scratch"
  - Everyone's invention is based on accumulated knowledge, the sum of past inventions made by others… Granting ownership to the latest discovery implies also ownership of all previous knowledge leading to that invention? See the notion of 'Creative commons' nowadays (L. Lessig, Free Culture).
- "Each man is given a section of the hay to search. The man who finds the needle shows no more genius or no more ability than the others who are searching different portions of the haystack…

To give patents for such routine experimentation on a vast scale is to use the patent law to reward capital investment and create monopolies for corporate organizers instead of men of inventive genius" Court decision by US Judge Arnold, 1941 (see also Schmookler, 1966). → he criticizes the way they looked at patents in the ast, for him it has to be innovative

- "… ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition… (Jefferson, 1813)"
- 'Non-rivalry' character of knowledge.
- The utilitarian perspective:
    - Social institutions should be designed so as to maximize social welfare.
    - The core of the utilitarian argument for patents is that free competition will generate an under-optimal rate of inventions, due to the 'public good' characteristic of knowledge.
    - Hence it is in the interest of society to supplement free competition with special institutions in that field, patents being one of them.
    - From an utilitarian perspective, patents are viewed as incentives for further innovation.
    - Effectiveness of the patent system then depends on whether or not it stimulates future investment in knowledge creation (R&D) (for an example, see the current SW Patent debate).
    - It's strange in innovation that we grand monopolies, because with a monopolist, there's a consumer loss. Nevertheless, we accept that temporary monopoly, if we don't do that nobody will invest money in inventing something, because everyone can copy you. It's an incentive to make sure that people really invest in R&D
- Economy of knowledge:
    - Marginal cost of reproducing knowledge is nearly 0. So investments in invention become sunk costs.
    - Re-inventing an existing piece of knowledge is a 'waste' (from a system perspective)
    - An existing piece of knowledge can be beneficial to others than the inventor without incurring the cost of invention and without depriving the inventor of the use: 'positive' spillover. Social returns > Individual returns.
    - If individual returns < social returns, but inventions depend on individual investments, overall investments will be lower than the desired level for the system as a whole.
    - A competitive market in this situation would make things worse as the inventing party will try to recuperate initial investments, while – free-riding – competitors will not incur these costs: initial investments in (uncertain) R&D will not be undertaken by rational decision makers.
- In fact, the market mechanism would not only lead to under-investment in research in general, but also possibly to excessive investments in particular areas. In the absence of legal protection, companies would keep their inventions secret, making it necessary for others to invest in duplication.
- One solution for government is to sponsor inventors or inventions, and to put them later on in the public domain (scientific model?)
- The alternative solution is to 'privatize' knowledge – to make it an excludable good, hence create intellectual property rights, like patent systems in place in Europe/US/OECD countries/….
- Current patent systems:
    - By granting exclusive rights, society is also generating costs, as these rights hamper the access to existing inventions, at least temporary (reduction of positive spill overs).
    - In addition, by granting temporary monopolies, 'dead weight' losses are being created.
    - So, the utilitarian view has at its core a tradeoff between benefits (incentives to invent) and costs (reduced diffusion, temporary loss of consumer surplus).

- Temporary nature of monopoly and obligation to disclose are from this perspective crucial.

Patent application with no economic value?

More than 1 Million patents are made. As soon as you go into that field, not all the patents are so relevant. Ex.: if you don't have a pet but you still want the experience of walking a dog, here it is

Advantages & disadvantages of patents

If you have patents, it is something that gives you a unique (difficult to immitate) ressource and you can build your competitive advantage on that.

Companies started to use it to build barriers to entry:

(1) Technology protection (resulting in an increase of economic returns of R&D investments)

(2) Retaliatory power – patent arms race

(3) licensing out/cross-licensing/cooperative R&D (including standard setting)

Ex.: If you have patents and there are application that are of no interst to you, then it can just become an additional source of revenue, you license it out. Ex: when Motorola went bankrupt, google bought their patent portfolio for 3 Billion. Why? They're not only doing android, but also developing their own products.

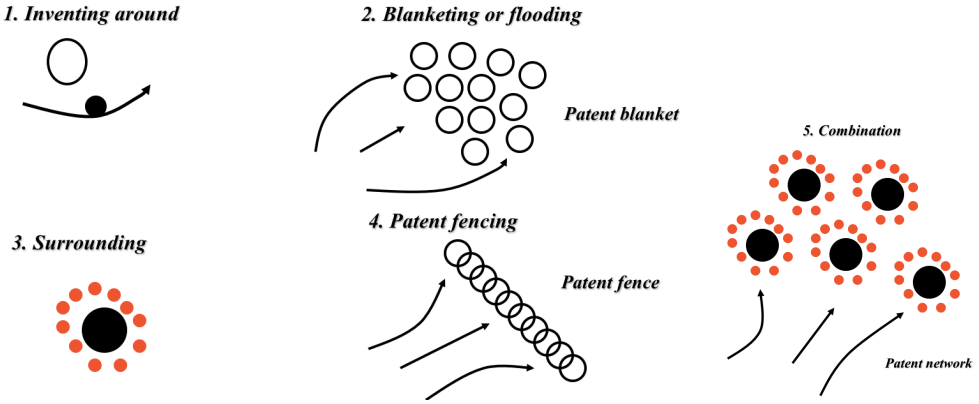
Economic value of a patent

- $Patent\ value = p * {}^{1} * (1 - e^{-r*L}) - discounted\ investment\ r$

  Example:
  - 15% sales margin due to enhanced product performance or cost savings
  - 10-year lifetime of patent
  - discount rate of 7%

  $\rightarrow value = 0{,}15 * (1/0{,}07) * (1 - e^{-0{,}07*10})$
- Other indicators
  - payent of renewal fees
  - times the patent is being cited
  - requested geographic coverage
  - cross-citations to and in scientific literature

Patent strategies



Inveting around

One or a few patents are used in this case to protect innovation in a special application

Blanketing or flooding
Efforts are made to turn an area into a minefield of patents

Surrounding
This is the case when an important central patent of some kind, especially a strategic patent, can be fenced in or surrounded by other patents, which are individually less important but collectively block the effective commercial use of the central patent, even after its expiration

Patent fencing
The situation where a series of patents, ordered in some way, block certain lines or directions of R&D. Putting a whole area, so that everything you're doing on a field, you're stepping on a mine

Combination
Patent network: a patent portfolio in which patents of various kinds ans configurations are consciously used to strengthen overall protection and bargaigning power

Patent pools
- Agreements between two or more patent owners to license one or more of their patents to one another, or to license them as a package to third parties willing to pay the royalties.
- Aim: regularize technology transactions
- In promising new technologies, firms begin to move to form patent pools when patents are blocking …the industry as a whole.

Patenting: still an incentive for innovation?
- There's an ongoing debate about patents. Because the primary purpose is to create incentives to innovate, but when you look at all these strategies, it's more to keep the others away
- The patent system was created to spur innovation. But over recent years it has sparked an arms war between some of the world's leading mobile phone companies. The likes of Apple and Microsoft do not only sue their rivals to protect their own inventions but go on to buy third party patents to build up their weapon stockpile.
- What is more, they appear increasingly willing to litigate.
- The number of handset patent infringement filings to the US courts grew from 24 cases in 2006, to 84 cases in 2010 and to grow to 97 cases this year, reflecting more than a four-fold rise in the space of half a decade.

Examples
Mobile phone makers wage war to protect their patents:
- In December 2010, Microsoft, Oracle, Apple and the data specialist EMC spent $450m on 882 patents, and patent applications, belonging to Novell, an ailing infrastructure software provider. That sum was then dwarfed by the $4.5bn paid in July for a 6,000 strong patent portfolio belonging to bankrupt telecoms manufacturer, Nortel. Microsoft and Apple shared the library with Blackberry maker, Research in Motion, and three others.
- Then, in September, Google revealed plans to buy Motorola Mobility, and its 24,500 patent library, for $12.5bn. Notably, the deal was secured one month after Google's Chief Legal

Officer, David Drummond, wrote a blog titled "When patents attack". "Our competitors are waging a patent war on Android," he said.

- "We're in a situation now of patent poker where the deck has been redealt and everyone has a new hand, and all the patent lawyers are saying we need to review our positions," says Ben Wood, chief of research at mobile analysts CCS Insight.
- "I would like to think this might result in renewed sanity and a realisation that trying to kill each other in court isn't to the greater good of the industry." However others are less optimistic.
- "As long as major companies feel they need to shore up their patent portfolios, we'll continue to see patents valued as defensive assets in a total war, rather than based on their potential for value creation," says Professor Werbach. "While in the short run Nortel's creditors and Motorola's shareholders may have benefitted from patent price inflation, the overall impact will be significant market distortion."

HTC Sues Apple with Google Patent Help

- Today, HTC sued Apple's iPhone using new Google patents in federal court in Delaware, Bloomberg reports:
- The nine patents originated with Palm Inc., Motorola Inc. and Openwave Systems Inc., with Google taking ownership within the past year, according to U.S. Patent and Trademark Office records. Mountain View, California-based Google recorded transfer of the patents to HTC on Sept. 1, according to the agency's website.
- Google knows that HTC is under tremendous legal pressure from Apple and clearly on the losing track. HTC is the first Android device maker sued by Apple, so that dispute is at the most advanced stage, and since HTC's own patent portfolio is weak, it has so far lacked the leverage to force Apple into a cross-license agreement. The possibility of HTC being defeated must have scared Google… This intervention on Google's part increases the likelihood of direct litigation by Apple against Google. Apple may hold patents that could affect Google beyond Android.

Patent trolls

(NPE= Non-practicing entity): an organization that's not doing R&D themselves. They look at opportunities (bankruptcies) and buy IPs and attack companies that are active with it.

Alteratives for patents

- Alternatives
  - Sercecy
  - Lead-time advantages
  - Complexity
  - Trademarks, designs, copyrights
- Practice: smart combinations (over time, for one and the same product)

Empirical findings

Filing for patents is not the most common thing.
Lead time and secrecy is 60%
Patent is 1-15%
=> it heaviliy depends on your industry.
Ex: pharmaceutical industry, it's very important to have patents

One Product can have different patents on the same one.
Ex.: Coca Cola: closing system (patent), recipe (secrecy), name (trade mark), model of the bottle (design), picture (copyright)

10.2. Innovation beyond R&D

Beyond R&D- design driven innovation
If we talk about innovation, it's much mire than just technology
The first of a series of tractors, which suddenly are not straight, they have a curve. But how fast is this machine driving? 20-30km/h. How important are irodynamics for this machine? Nevertheless, when they launched this series, farmers love dit. And a lot of them try to get musch faster rid of their old vehicles and the lifecycle became 6-7 years. And that is design. Even if you are in a B2B market, he's very much attracted by the look and feel of that product. That's what's called design-drive innovation. You also look at the look and feel and the emotional component that it evokes to your customers.

Innovating Through Design

- Alessi, the lighting manufacturers Flos and Artemide, the furniture maker Kartell, and many other northern Italian firms make up the Lombardy design discourse, a loose collection of home-furnishings companies that create highly marketable products with distinctive design profiles.
- These companies do not follow either of the design industry's norms: "tech push," whereby an improvement in performance and functionality dictates a modification in design, or "market pull," whereby the design accommodates consumers' demand for new features or an up-to-date look.
- Nor do they resort to the open-innovation techniques for which IBM, Procter & Gamble, and Eli Lilly, for example, have become known.
- That is, they don't rely on an anonymous horde of code writers or the equivalent to perfect an existing product; they don't in-license the patented discoveries of unaffiliated businesses or inventors; and they don't out-license their own discoveries to generate revenues with minimal effort, or to elicit a third party's better-informed reading of the discoveries' marketability so as to spur their own development efforts.

Ingredients

- In a study conducted for the government of Lombardy, 26 international design experts agreed that the components of the design system – schools, studios, manufacturers, and so forth – were not significantly better in Lombardy than elsewhere.
- What did distinguish the region was the number and strength of the links between these components and the quality of the interactions among them.
- According to the Israeli designer Ron Arad, "Northern Italy is the center of the design world, above all because of its manufacturing culture. There is no other place in the world where you can find such a vast array of manufacturers who know the value of design."
- Earlier kettles came in various shapes and sizes, but their purpose was, almost without exception, utilitarian. Consequently, their form followed their function (to boil water)–the first precept of modern design.
- Sensing from his interactions with the Lombardy research community a new spirit of playfulness that reflected a growing disillusionment with modernism's severity, Alessi's CEO and managing director, Alberto Alessi, contacted Graves, a professor of architecture at Princeton, who at that point had never worked on a consumer product but had designed a few notoriously postmodern

buildings in the United States (their surfaces were decorative and referred to earlier architectural idioms– modernist taboos).

- Although undeniably clever in its synthesis of pop art and art deco references, model 9093 showed its greatest originality in broadening people's expectations of what a kettle was and did and, indeed, the nature of the breakfast experience.
- This broadening reflected years of discussion and generations of design concepts preceding Graves's realization of model 9093.
- Far from being an annoyance or merely a signal, the birdlike whistle the kettle emits draws its owners to the breakfast table as powerfully as the aroma of freshly brewed coffee. The little plastic bird visually confirms that beckoning sound, and the delightfulness of the kettle's shape is its own reward.
- According to an interview he gave BusinessWeek.com, Graves once received a postcard from a French poet, who wrote, "I'm always very grumpy when I get up in the morning. But when I get up now, I put the teakettle on, and when it starts to sing it makes me smile – goddamn you!"

Phase 1: absorb

- Move – as an entrepreneur - at the frontiers of art/avant garde/fashion. E.g. Alessi being involved in the Memphis collective (founded by E. Sottsas) realized that a sharply new design language was needed for his company's kitchenware
- He believed that foreign architects who had never designed consumer goods were the ones to invent its vocabulary and grammar. He called his project the 'Tea and Coffee Piazza' and invited Mendini (architect) to select 10 other architects (including Hollein (AT), Venturi (US) and Graves).
- Architects were asked to concentrate on communicativeness and evocativeness and to neglect issues of cost and functionality (the four-dimensional framework used by Alessi to assess designs).
- Aim/ulterior motive: to discover the next wave of talent in product design
- "It is easy to make a list of the top ten designers of the past ten years. But I'm virtually certain that fewer than half of them will be among the top ten designers of the next 10 years."

Phase 2: Interpret

- Before ground-breaking products could be presented to the public, the ground had to be prepared:
    - The 11 coffee and tea service prototype the architects produced were exhibited at the San Francisco Museum of Modern Art and the Smithsonian and in other cultural settings.
    - They were produced in limited editions of 99 pieces and sold to museums and influential collectors for $25,000 each.
    - Alessi prepared a book about the prototypes and distributed it to the extended design community.
    - A traveling exhibit of the prototypes was shown in high-end department stores around the world.
    - The press in Italy and abroad was invited to write about the exhibits and the project.
- Alessi closely followed the reactions of design aficionados to the prototypes. An incidental benefit of publicizing them and the concepts behind them before an actual product existed was to ensure that the public would forever associate them with the Alessi brand and would view any related development by others as an imitation.
- Among the 11 architects, Graves was one of only two who were invited to turn their concepts into cost-effective and functional commercial products.

- Model 9093 was then rated on Alessi's four dimensions. Its broad base, which facilitated rapid heating; its visible rivets, which recalled a kind of vintage artisanship; its superimposed plastic handle in cool blue, which was decorative as well as heat-resistant; and its little bird, which flew in the face of modernism's insistence on abstract form, earned it the highest rating in Alessi's history.
- Because of the company's success with Sapper's model 9091 kettle, which emits two low, harmonizing whistles evoking ships passing in the night, a whistle was one specification imposed on Graves.
- Alessi also wanted the bird to be removable, so that the kettle could feature a spout instead of a hole, and he wanted a lower cost of fabrication and a faster boil.

Phase 3: Address

- Shortly before and then after model 9093 was launched, Alessi organized another round of exhibitions and publicity.
- Because advertising is not the ideal explanatory medium, little of it was done.
- The members of the design discourse, by continuing to talk and write about the kettle's role and meaning, disseminated knowledge of the product to a wider audience. In the end, they acted as amplifiers of a message they had helped to construct.
- Nowadays, many of the Lombardy companies maintain their own retail outlets as a way of controlling presentation and underlining the traits their products have in common.
- When third-party retailers carry them, often items of the same brand will be found grouped together in their own showcase, for the same reasons. And, unlike an Armani jacket or a Gucci handbag, these products come with literature elaborating on how they came into existence and the qualities that make them special.

Innovation at the level of business models

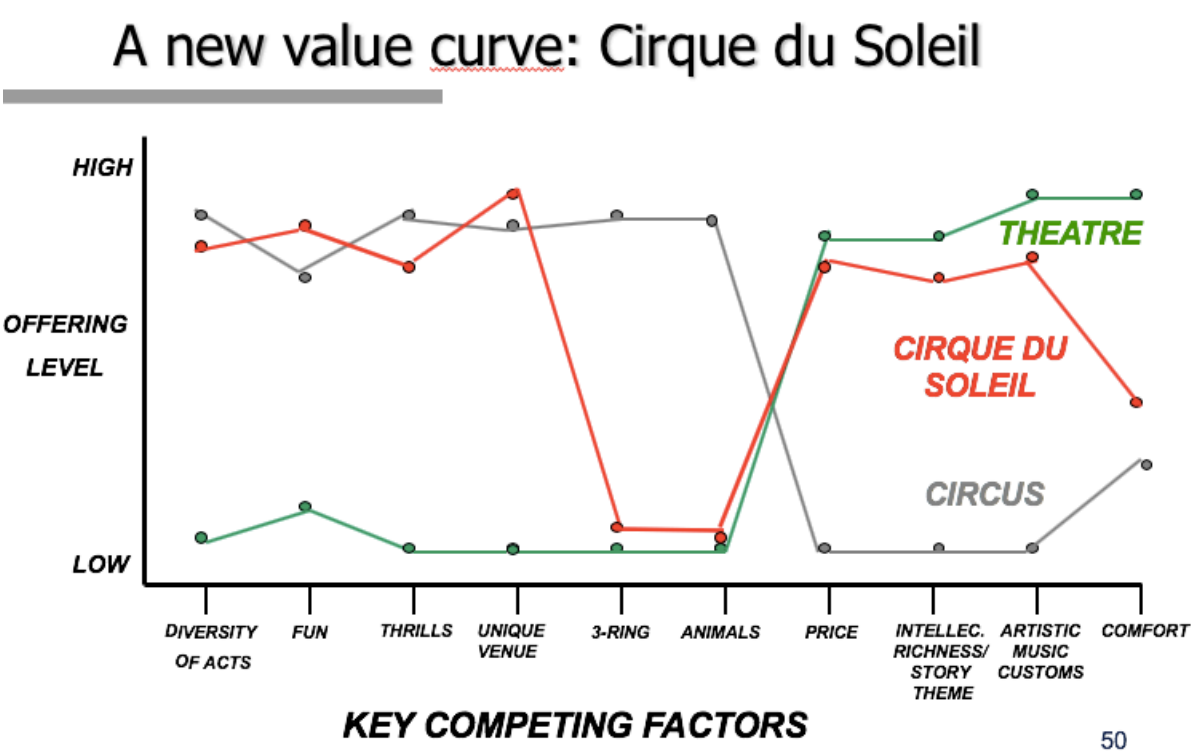
- Defining new value curves: Red/Blue ocean strategies
- Include services in your value proposition: Servitisation.

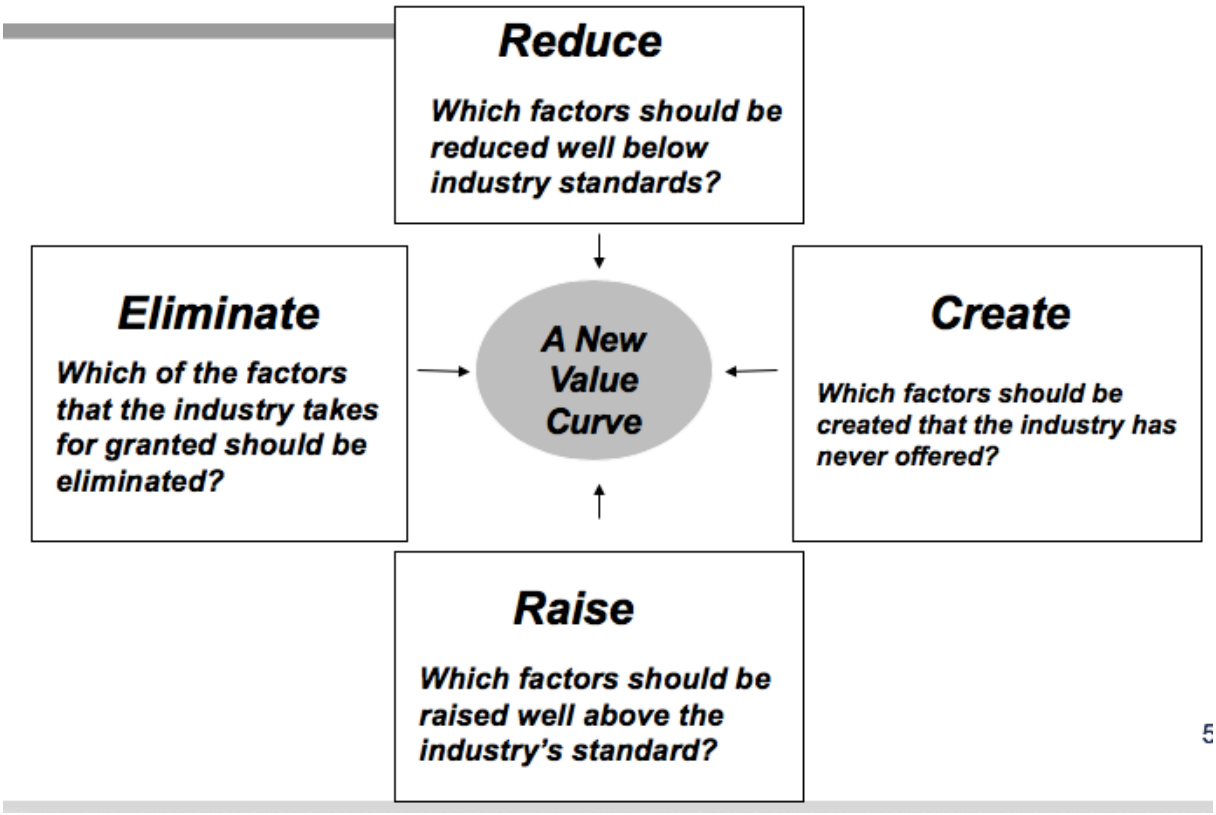
Red & Blue Ocean Strategy

Red Ocean Strategy	Blue Ocean Strategy
Compete in existing market space.	Create uncontested market space.
Beat the competition.	Make the competition irrelevant.
Exploit existing demand.	Create and capture new demand.
Make the value-cost trade-off.	Break the value-cost trade-off.
Align the whole system of a firm's activities with its strategic choice of differentiation *or* low cost.	Align the whole system of a firm's activities in pursuit of differentiation *and* low cost.

A new value curves

Process flows and how you involve different kinds of people : il a ete tres vite (avec les phases)





To be added:
- Melexis report
- 4 papers at the end of the book

EXAM
We have to read once or twice the chapters of the book.
Exam :
- questions of the class
- questions on what's written in the book

He pays more attention to the foundations (innovation systems, schumpeter etc) : lecture 1-4 there's more in the lecture than in the book. (chapter 1-2-3 and a little 5)

Firm level
Chapter 6-7.

!!!!! At the end of the book, 4 papers to read !!!!! the AMG pape ris on toledo

the book : chapter 1 is page 89

the nature of the questions :
They're not going for neety gritty details

Sl 54
Part 1 : 40%

Question 1 :
Expliquer Sch I + Sch II.
How to reconcile both views ?
The more radical things can come from entrepreneurs whie the more incremental come from big firms. (you don't get the full points)
It not only depends on the type of innovation, but also the fase, the lifecycle phase of where the innovtaion is in.
Abernathy : small new entrepreneurs setting the scene, but when we neter into that dominiant design, then we move into the phase of scaling and then the bigger firms start to rule. And either as an entrepneur you become big or you disappear.
=> you have to show that you can combine different models
if not, elaborate which parts/constituements are missing
scinece universities, governements that make sure there's additional investment (3%, 2% coming from companies, 1% coming from the tech sphere) which spillovers into the economy and innovation dynamics.

Question 2 :
What can a firm do ? put it outside
Tushman : you can put it in, but you have to use the same organizational form
Other : it depends on synergies and wether or not you can make spinnofs between the technologies.

You have to be able to connect dots