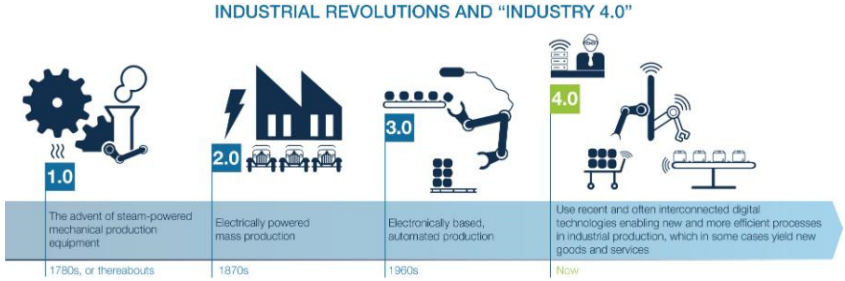
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ



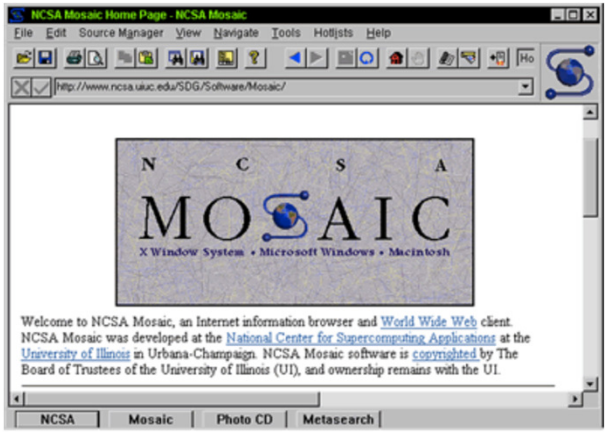
ΔΠΜΣ «Επιχειρηματικότητα»
Τεχνολογική Στρατηγική

Γλυκερία Καραγκούνη
karagg@uth.gr
2020

Questions set when forming a Technology Strategy

Do we **lead or follow** in our adoption and development of new technologies?
If and when we follow, do we **acquire or imitate** the pioneers?
What are the **boundaries** of our innovation frontier (the maximum level of risk and uncertainty we take in our innovation projects)?
What comprises our **technology platform(s)**-- the technologies shared across our products, services, and processes?
Do we "make" or "buy" our technologies?
What methods do we use to appropriate technologies?
What aggregate level of investment do we make in developing and appropriating new technologies, patents, trade secrets, standards, speed?
To what extent do we open our innovation process to the outside world?
To what extent and in what ways do we engage partners and suppliers in technology development?
What role do we play in our technological ecosystem?

The former setting of Technology Strategy



"Seamless Mobility" (απρόσκοπτη Κινητικότητα)

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

"Brings simplicity to complexity" by tying everything to mobile handsets

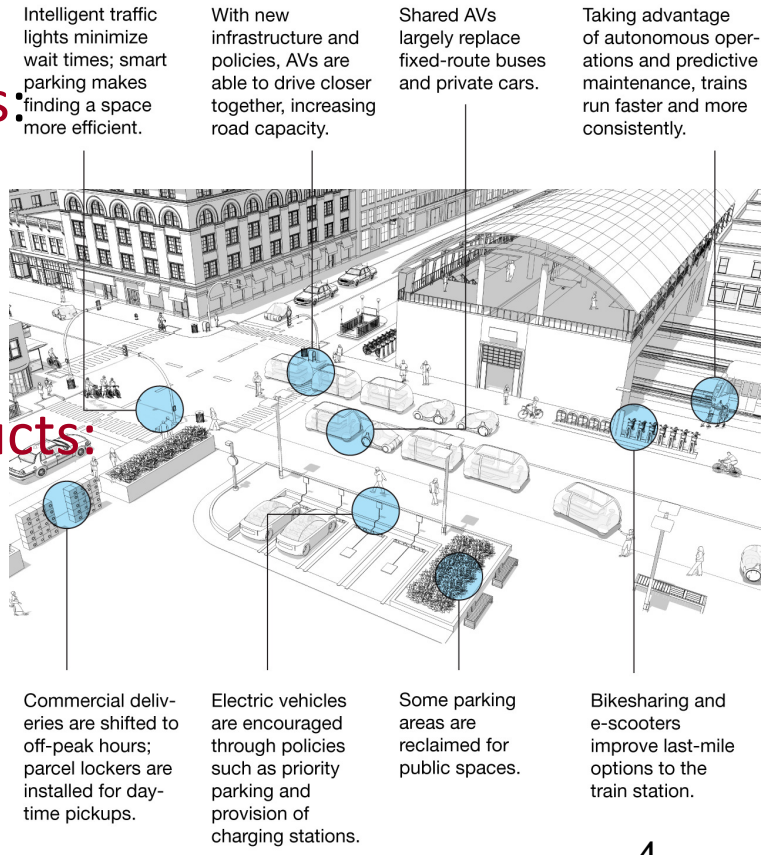
Focuses on "ease of use"

Now

From the TS point!

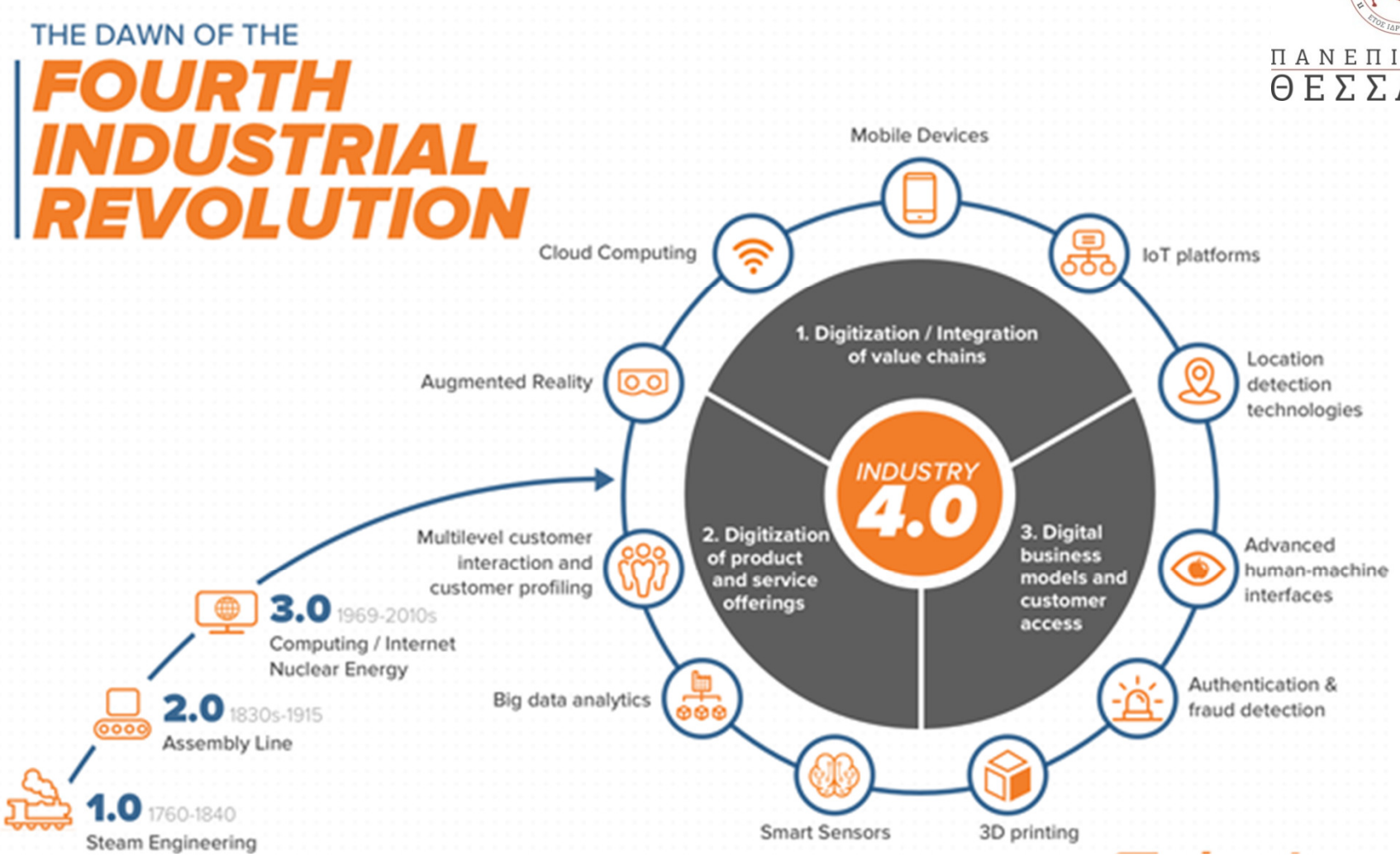
- A rationale for staying in many markets:
  - automotive electronics
  - home-theatres
  - emergency-radios
  - base-stations
- A way to justify new "transition" products:
  - high-speed internet access on trains
  - email in cars
  - Videophones
  - Cellular plane-coverage

https://www.mckinsey.com/business-functions/sustainability/our-insights/the-road-to-seamless-urban-mobility



https://www.youtube.com/watch?v=KTQLulPUow

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ



https://www.youtube.com/watch?v=v9rZOa3CUC8

First Industrial Revolution 1780s–1870s Steam Power & Mechanisation
Second Industrial Revolution 1880s–1930s Mass Production & Electricity
Third Industrial Revolution 1950s–1990s Digitisation, Computing & the Internet
Fourth Industrial Revolution 2000–2030s Artificial Intelligence &Internet-of-Things

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Future waves of innovation – Key technologies and key Developments (Walton: 2017)

Future Waves	
Key Technologies	
• 3D printing • Virtual & augmented reality • Cyber security • Semantic search • Block Chain • Robotics • Deep learning/machine learning • Internet drones, balloons & satellites • Sensors	• 5G • Autonomous vehicles • Quantum computing • Quantum internet and teleportation • Advanced robotics • Smart homes • Virtual currency • Wearable technologies • Cognitive systems
Key Developments	
• Global internet availability • Growth of new cyber security industry • Increased industry disruption in transport, financial services and health • Internet-of-Things (IOT)	• Computing is a utility like water and electricity • Sharing economy • Smart cities • Artificial intelligence

Megatrends and technological trajectories

Megatrends are global, sustained and macro-environmental forces of development that impact business, economy, society, cultures and people's personal lives thereby defining the future world and its increasing pace of change (Schwab: 2018).

Πορεία μαθημάτων

4η ΔΙΑΛΕΞΗ 13/11/2020 (κα Καραγκούνη)

Εκμετάλλευση της Τεχνολογίας για ανταγωνιστικό πλεονέκτημα

Συμπληρωματικοί πόροι (complementary assets)

Τεχνολογικά πρότυπα (Standards)

Το κυρίαρχο σχέδιο (Dominant design)

Τι είναι η αρθρωτή σχεδίαση – τμηματοποίηση (Modularity);

Πλατφόρμες προϊόντων

Τεχνολογικές πλατφόρμες και στρατηγικές οικοσυστημάτων

ΑΝΑΘΕΣΗ 1ης ΕΡΓΑΣΙΑΣ: ΜΕΛΕΤΗ ΑΡΘΡΩΝ - ΟΜΑΔΕΣ 2 ΑΤΟΜΩΝ. ΑΝΑΡΤΗΣΗ ΑΡΘΡΩΝ 13/11/2020

5η ΔΙΑΛΕΞΗ 27/11/2020 (κα Καραγκούνη)

Τεχνολογική Προοπτική Διερεύνηση (Technology Foresight)

Τεχνολογική Παρακολούθηση

Δημιουργία και ανάλυση σεναρίων

Τεχνολογικός χάρτης ανάπτυξης (Technology Road-Mapping (TRM)

Παρουσίαση εργασιών Α' ΜΕΡΟΣ

ΑΝΑΘΕΣΗ 2ης ΕΡΓΑΣΙΑΣ: 5 ΘΕΜΑΤΑ ΠΡΟΣ ΔΙΕΡΕΥΝΗΣΗ - ΟΜΑΔΕΣ 3 ΑΤΟΜΩΝ - ΑΝΑΡΤΗΣΗ 13/11/2020

6η ΔΙΑΛΕΞΗ 11/12/2020 (κα Καραγκούνη)

Digitalisation strategy

Industry 4.0

Ανακεφαλαίωση

ΠΑΡΟΥΣΙΑΣΗ ΕΡΓΑΣΙΩΝ Β' ΜΕΡΟΣ

4η ΔΙΑΛΕΞΗ 13/11/2020 (κα Καραγκούνη)

Εκμετάλλευση της Τεχνολογίας για ανταγωνιστικό πλεονέκτημα

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Τεχνολογικά πρότυπα (Standards)
Το κυρίαρχο σχέδιο (Dominant design)

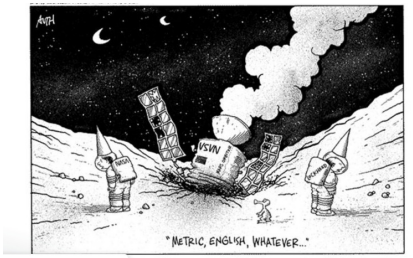
Standards

Η ζωή μας είναι γεμάτη από αυτά!!!

Standards;

The Mars Climate Orbiter, built at a cost of $125 million, was a 338-kilogram robotic space probe launched by NASA on December 11, 1998 to study the Martian climate, Martian atmosphere, and surface changes.
In addition, its function was to act as the communications relay in the Mars Surveyor ‘98 program for the Mars Polar Lander.
The navigation team at the Jet Propulsion Laboratory (JPL) used **the metric system of millimeters and meters** in its calculations, while
Lockheed Martin Astronautics in Denver, Colorado, which designed and built the spacecraft, provided crucial acceleration data in the **English system of inches, feet, and pounds.**
JPL engineers **did not take into consideration** that the units had been converted, i.e., the acceleration readings measured in English units of pound-seconds^2 for a metric measure of force called newton-seconds^2.

In a sense, the spacecraft was lost in translation.



Mars Climate Orbiter incident from 1999?

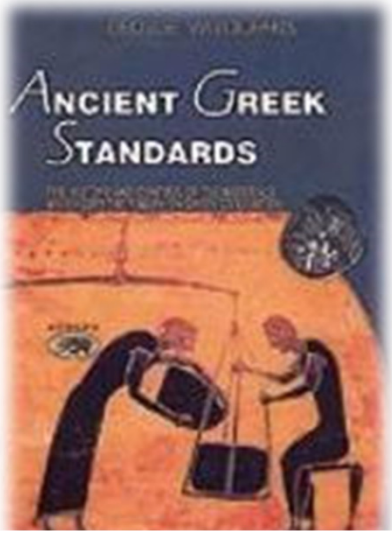
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Πώς δημιουργείται ένα Standard;

Μια προδιαγραφή επιτρέπει την διαλειτουργικότητα μεταξύ προϊόντων, υπηρεσιών, και τμημάτων αυτών

Ποιοι τα δημιουργούν;
- Εταιρείες (e.g. Microsoft, McDonald's)
- Βιομηχανικά κονσόρτια /τραστ
- Σύνδεσμοι και κοινότητες e.g. IATA, Internet

Μπορεί να είναι:
Σε ανοιχτό περιβάλλον (e.g. Linux, Firefox)
Ή
Επίσημη οργανισμοί τυποποίησης (ISO)



- Introduce a great "product"
- Come to market ahead of competition
- Build expectations
- Develop, or encourage the development of, complementary products and services
- Give it away: put the stand in the public sector

- Sounds great, but this is expensive!
- …and – these days – your competitor is trying to do the same thing!

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

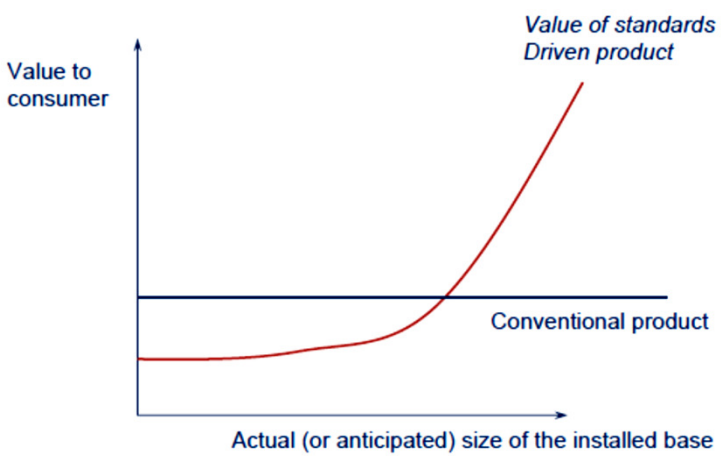
Πώς τα standards δημιουργούν αξία για τον καταναλωτή;

Κόστος εκμάθησης
Οι καταναλωτές επενδύουν MIA φορά για να μάθουν να χρησιμοποιούν την τεχνολογία: π.χ. το πληκτρολόγιο, τα φύλλα στο EXCEL , το κινητό κοκ

Δυνατότητες δικτύωσης
Η αξία αυξάνει με τον αριθμό άλλων ατόμων που χρησιμοποιούν το ίδιο προϊόν π.χ. το skype

Συμπληρωματικά προϊόντα
Αύξηση της διαθεσιμότητας και των επιλογών

Κόστος και Ποιότητα ως αποτέλεσμα από την καμπύλη μάθησης



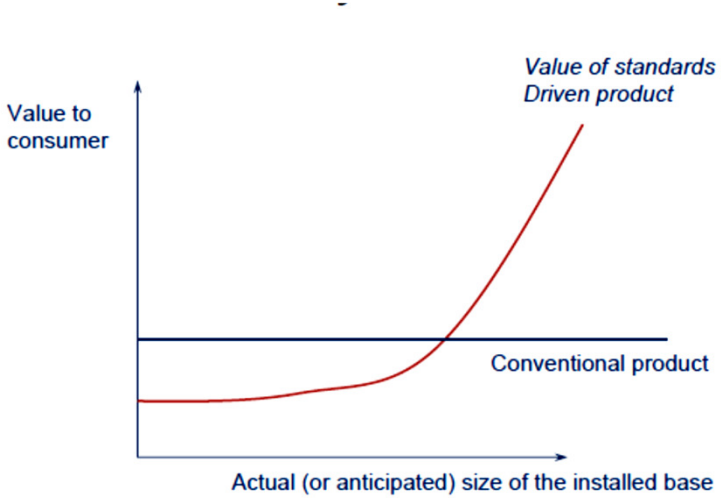
Πώς τα standards μπορεί να δυσαρεστούν τον καταναλωτή;

Αίσθηση εξαναγκασμού
Microsoft Office – νέες εκδόσεις χωρίς ουσιαστικό λόγο

Απομόνωση

Συμπληρωματικά προϊόντα
Ανάγκη αγοράς τους

Ανάγκη προσωπικής καμπύλης μάθησης



ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

The QWERTY standard

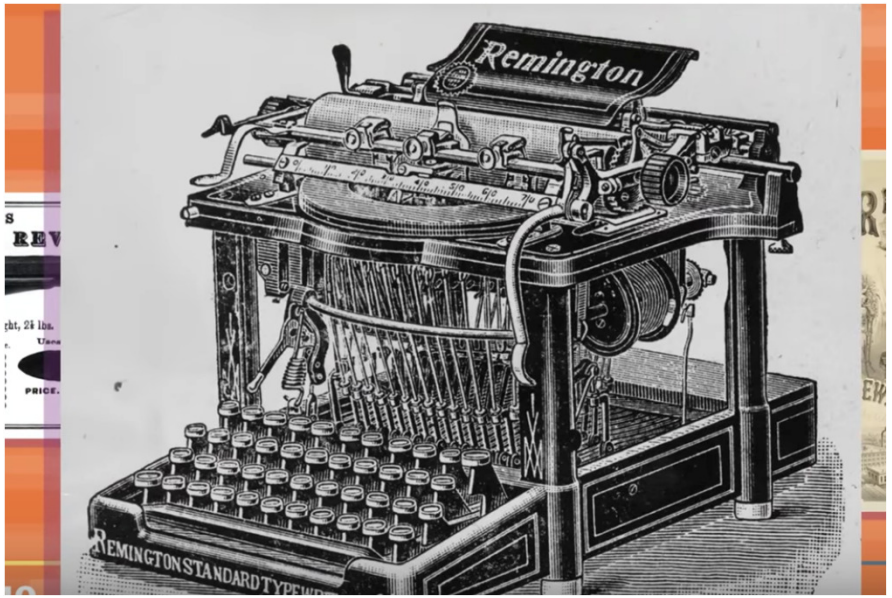
1873

The original 1873 Sholes and Glidden typewriter

father of the qwerty *keyboard*
Christopher Latham Sholes

QWERTY wasn't always the standard.

In fact, there was a **50 year** period of indecision.
In the 1840s, Hues Printing Press tried arranging the letters like piano keys, and
in 1865, there was Hansen's Writing Ball.
It wasn't until 1868 that we start to see the **beginnings** of what would come to be the standard typewriter.



1890s
Union Typewriter Company

Christopher Latham Sholes -1870s

Some of the biggest names in typewriting came together to form **Union Typewriter Company**.

with enough sway in the market, and classes full of secretaries who learned the QWERTY keyboard,

we have the modern-day design that is here to stay.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Standards

Formal definition of a standard: a "document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context".
Think of them as a formula that describes the best way of doing something.

Standards cover a huge range of activities SO there are **several different types of standards:** They can be about making a product, managing a process, delivering a service or supplying materials.
Standards can also be a way to describe a measurement or test method or to establish a common terminology within a specific sector.
Standards are the distilled wisdom of people with expertise in their subject matter and who know the needs of the organizations they represent – people such as manufacturers, sellers, buyers, customers, trade associations, users or regulators.

There are myriads of standards…

- Quality management standards to help work more efficiently and reduce product failures.
- Environmental management standards to help reduce environmental impacts, reduce waste and be more sustainable.
- Health and safety standards to help reduce accidents in the workplace.
- Energy management standards to help cut energy consumption.
- Food safety standards to help prevent food from being contaminated.
- IT security standards to help keep sensitive information secure.

different types of standards:

- Basic standards.
- Normal standards.
- Current standards.
- Attainable (expected) standards.
- Ideal (theoretical) standards.

Most popular Standards

European Standards (ENs) are documents that have been ratified by one of the three European Standardization Organizations (ESOs), CEN, CENELEC or ETSI; recognized as competent in the area of voluntary technical standardization as for the EU Regulation 1025/2012.

ISO: a worldwide federation of national standards bodies from 140 countries. It promotes the development of standardization to aid the international exchange of goods and services. ISO's work results in international agreements, which are published as international standards. An example is ISO 9000 – the family of standards for quality management. It can also be expressed as BS EN ISO 9000.

IEC - The International Electrotechnical Commission: IEC is the global organization that prepares and publishes international standards for all electrical, electronic and related technologies.

BSI :The UK's national member of the international standards organizations ISO and IEC, and their European counterparts CEN and CENELEC. It is also a member of a third European Standardization Organization, ETSI, alongside industry bodies and companies.

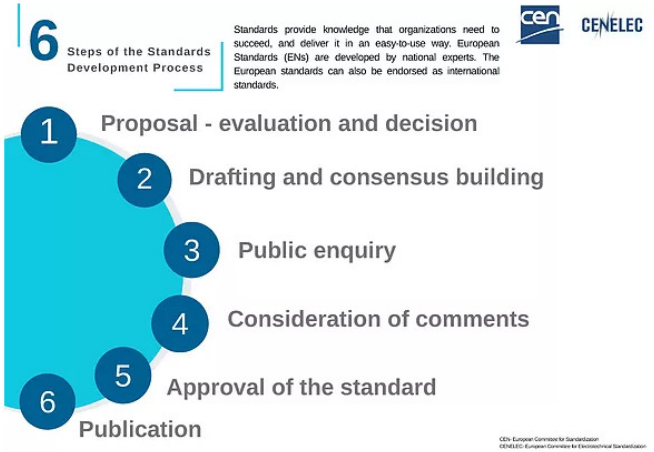
DIN coordinates the entire standardization process at Germanl level and
are responsible for organizing German participation in standards work at European and international level.

Most popular Standards

Most standards concern the inter-operability, quality or safety of products, processes or systems, but, increasingly, standards are also used in service sectors. "Standards battles" can have an enormous impact on the competitive position of (groups of) companies or countries

A hundred years ago, international electrotechnical standardization started because scientific and technical developments enabled the emergence of products and systems for which quality, safety and compatibility issues applied that surpassed not only the company level but also the national level. Since then, many organizations from all over the world have invested time and money in the development of IEC's huge standards collection.

International Organization for Standardization (ISO)
International Electrotechnical Commission (IEC)
International Telecommunication Union (ITU)
European Committee for Standardization (CEN)
European Committee for Electrotechnical Standardization (CENELEC
European Telecommunications Standards (ETSI)



Standards and Technology Strategy

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Προκλήσεις:

- **Πώς υποστηρίζουμε τη μετάβαση από τα προηγούμενα standards?**
- Πώς διατηρούμε την ευελιξία και στηρίζουμε την καινοτομία, αποφεύγοντας μια γρήγορη επιλογή;
- Πώς ορίζουμε το εύρος εφαρμογής του standard?
- ΤΙ στηρίζει το προσδοκώμενο standard, με τι είναι σχετικό?
- Ποιος θα πρέπει να συμμετέχει στην ανάπτυξη του standard?

Αρχικά ερωτήματα:

- Ποιες θα είναι οι στρατηγικές συνέπειες επιλογής / συμμετοχής στην ανάπτυξη κάποιων standards?
- Ποιος θα είναι ο υπεύθυνος? Πώς θα γίνει η προετοιμασία? Πώς οι σχετικές δράσεις σχετίζονται με τις υπόλοιπες οργανωσιακές λειτουργίες?
- Ποιες είναι οι επιπτώσεις του σημείου του κύκλου ζωής της στοχευμένης τεχνολογίας για την ανάπτυξη των standards?

"Companies that fail to participate in the development of standards (including working to block adverse developments) that are critical to their operations and planning **are forced to live by what is determined by competitors"**.

Participation also can be an invaluable means of testing new ideas, and assessing needs of stakeholders, industry and technology trends and strengths and vulnerabilities relative to competitors represented in the development process».

For further reading:

4 CASES ON Standards issues: https://www.iec.ch/about/globalreach/academia/pdf/vries-1.pdf
https://globalizationandhealth.biomedcentral.com/track/pdf/10.1186/1744-8603-9-49

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

The Dominant Design

Dominant design is a technology management concept introduced by Utterback and Abernathy in 1975, identifying key technological features that become a *de facto* standard.

Κυρίαρχο σχέδιο είναι:

- Αυτό που κερδίζει την πίστη της αγοράς(> 50% των νέων εφαρμογών)
- Αυτό που πρέπει να τηρούν ανταγωνιστές και καινοτόμοι αν επιθυμούν την κυριαρχία της αναδυόμενης αγοράς

A dominant design is a single architecture that establishes dominance in a product class *(Abernathy, 1978; Sahal, 1981).*

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Examples of *Dominant Designs*

Automobiles
Model T Ford, Piston IC engine, steel unibody, integrated engine/transmission, **4 wheels**

PC
IBM 360, Windows GUI, pointer, keyboard, desktop display

Mobile phone
finger-based touch screen, icon-based GUI, app store

Bicycle
diamond-frame, chain drive, pneumatic tire, hand brake

Airplanes
Douglas DC-3, pressurized aluminum cylinder, fuel in wings, wing-mounted high-bypass turbofan

Four function calculator and the iPod and iPhone.
AC power and direct current electricity in the late 1800s.
The videotape format war between Betamax and VHS, when VHS became the *de facto* video tape standard.
The desktop metaphor introduced by Xerox's Alto became the dominant design in PC operating systems.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

The Dominant Design

What?

• Consensus of industry (producers and consumers) on configuration and features of product.
• The “mass market” solution.
• Not always the “best” solution in terms of product performance (e.g., Qwerty)

Drivers

• Learning and incremental innovation to discover best match between solution and need
• Benefits of *de facto* standards.
• Scale economies in supply network and infrastructure.
• Network externalities.

May Not Apply When…

• Highly heterogeneous markets with associated diversity in needs.
• Minimal benefits of standardization (e.g., no scale economies in complementary assets

The Dominant Design

MODEL T – Architectural innovations

stand out as creative acts of adapting and applying latent technologies to previously unarticularted user needs. It is the insight and conception about fresh roles for existing inventions and technologies that mark this kind of innovation.

Though there were some disruptive elements in its technology, its genius lay more in
a creative synthesis of technology innovated by its diverse predecessors.

Model A -niche creation innovation

The Model A -late 1927 and a great success.
Its appeal stemmed from the combination of features, the refinements and improvements in existing design concepts, and major advances in performance and styling.
In its basic design, the Model A was a synthesis and refinement of concepts that had been introduced by other manufacturers

Model A gave definition to an emerging market segment (the moderately priced family car - good performance, modern styling, comfortable, convenient) through incremental innovation.

Κυρίαρχο Design: όχι πάντα η καλύτερη λύση

Σύμφωνα με τους Anderson and Tushman, (1990):

The emergence of dominant designs, *unlike technological discontinuities*, **is not a function of technological determinism**; they do not appear because ***there is one best way to implement a product or process***. Rival designs are often technologically superior on one or more key performance dimensions.

For example,

- the IBM PC was not the fastest personal computer,
- JVC's VHS format did not offer the sharpest videocassette reproduction, and
- Westinghouse's AC power systems were not the most efficient.

Dominant designs may not even be particularly innovative;

they often incorporate features pioneered elsewhere (Millera nd Sawers, 1968).

The Dominant Design

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Οδηγεί στη δημιουργία:

- Τεχνολογικών Προτύπων (Standards)

Once a design becomes an industry standard, it is difficult to dislodge. Volume production of the dominant design creates economies due to learning by doing (Arrow, 1962; Rosenberg, 1982).

- τύπων πλατφόρμας τεχνολογίας (Hashimoto, K. (2003). Αρχή προγραμματισμού, σχεδιασμού και παραγωγικής βάσης σε μια τεχνολογική πλατφόρμα (Kim, 2003).

Ο κύκλος ζωής της τεχνολογίας ταξινομείται ομοίως με τον κύκλο ζωής του προϊόντος (Rhyne, 1996).

The Dominant Design

Αναδύεται από ριζικές καινοτομίες: κατασκευαστές, προμηθευτές, πελάτες και ρυθμιστικοί οργανισμοί επιθυμούν τη μείωση της αβεβαιότητας κατά την περίοδο της «ζύμωσης».

Συνδέεται άμεσα με την διάδοση μιας νέας γενιάς τεχνολογίας.

Αναδύεται από τη ζήτηση της αγοράς που επηρεάζεται από ένα συνδυασμό τεχνολογικών ικανοτήτων και ατομικών – οργανωσιακών-κυβερνητικών παραγόντων (π.χ. αγώνας επικράτησης AC vs DC).

Όταν καθιερωθεί αλλάζει ο ανταγωνισμός. -ο ανταγωνισμός περνά αρχικά σε στρατηγικές ηγεσίας κόστους ή εστίασης κόστους και διαφοροποίησης με παραλλαγές στο design (οικονομίες κλίμακας και οικονομίες μάθησης). Κι αυτό σταματάει όταν έρχεται μια νέα τεχνολογική επανάσταση.

Μεταθέτει την εστίαση από την τεχνολογική καινοτομία προϊόντος σε τεχνολογίες διαδικασιών: η καθιέρωση μιας κυρίαρχης αρχιτεκτονικής προϊόντος επιτρέπει την μετάβαση από την καινοτομία προϊόντος σε καινοτομία διαδικασίας.

Δημιουργία νέων εξειδικευμένων αγορών –

*After emergency: The dominant design is continuously improved by incremental innovations, which maintain the basic product architecture***.**

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

The Dominant Design

Τα κυρίαρχα σχέδια μπορούν να προκύψουν και με άλλους τρόπους…

- Η ισχύς του κυρίαρχου παίκτη: π.χ. IBM PC
- Ένας ισχυρός παίκτης: π.χ. U.S. Air Force imposed numerical control on the programmable machine-tool industry (Noble, 1984).
- Ένας βιομηχανικός σύνδεσμος: π.χ. computer communications protocols (Farrell and Saloner, 1988)
- Η δημιουργία μιας συμμαχίας γύρω από ένα πρότυπο: π.χ. shared bank-card systems (Phillips,1 987).
- Νομοθεσία: π.χ. τα πρότυπα της τηλεόρασης (Pelkmans and Beuter, 1987)

Technological discontinuity and Dominant Design

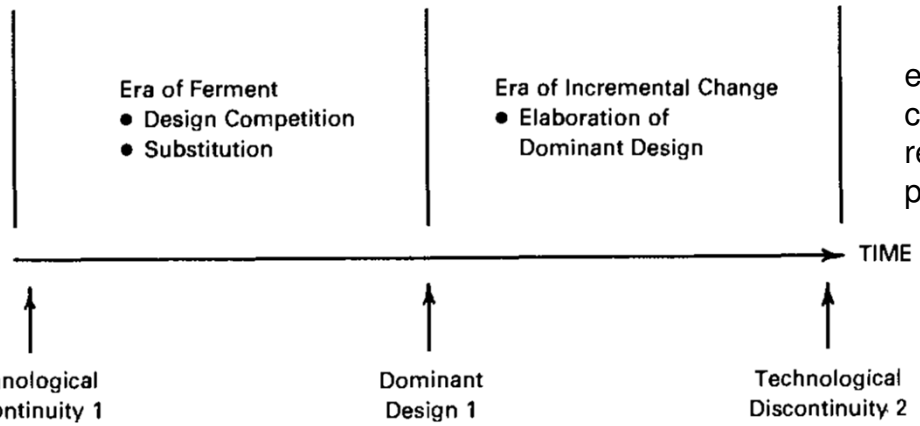
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Anderson Philip and M. L. Tushman, 1990, ***Technological Discontinuities and Dominant Designs***

Τεχνολογική ασυνέχεια είναι όταν μια καινοτομία:
α) ωθεί μπροστά τη απόδοση μιας παραμέτρου ιδιαίτερης αλλά πολύ σημαντικά και
β) το κάνει αλλάζοντας εντελώς ο σχέδιο του προϊόντος ή της διαδικασίας και όχι απλά διευρύνοντας την υπάρχουσα κλίμακα σχεδίων (Anderson and Tushman, 1990)

Figure 1. The technology cycle.

Product discontinuities:
jet (vs. piston) engines,
diesel (vs. steam) locomotives,
electronic (vs. mechanical) typing,
quartz (vs. mechanical) movements in watches,
CT scanners (vs. x-rays),
tran-sistors)



Process discontinuities

electronic imaging (vs. light-lens copying), genetic engineering using restriction enzymes, and dry gelatin photographic processes

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

The Dominant Design

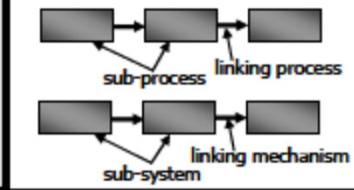
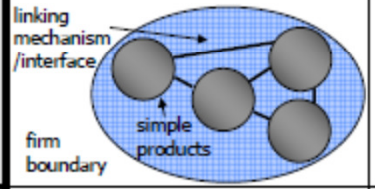
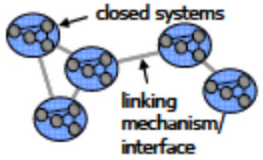
Table 5-4: Technology first-mover advantages and disadvantages (Porter M.E. 1985: 186ff).

First-Mover Advantages	First-Mover Disadvantages
o Reputation for innovation o Preempting a position o Switching costs of customers o Selection of distribution channels o Learning curve effects o Access to resources o Definition of standards o Institutional barriers o Initial profits	o Pioneering costs o Uncertainty of demand o Changing customer demands o Specificity of early investments o Technological discontinuities o Low-cost imitation

first versions **will not become dominant designs**, despite first-mover advantages that may accrue to their sponsors and cost reductions from moving along an experience curve ahead of rivals.

The Dominant Design

4-6: Technology configuration and dominant designs (adapted from Tushman M.L., Rosenkopf L. 1992)

	Technology Configuration	Driver of Progress	Basis of Dominant Design	Arbiter of Dominant Design
Non- & simple assembled products		• Sub-process elimination • Material substitution • Component substitution	Technical superiority	Single or focused practitioner community
Closed assembled system		• Subsystem substitution • New subsystem dominant design • Subsystem elimination • New linking technology	Competition among alternative designs with diverse dimensions of merit	Professional, organizational communities
Open systems		• Subsystem substitution • New subsystem dominant design • Subsystem elimination • New linking technology	Competition among alternative interfaces and designs with diverse dimensions of merit	Multiple, diverse organizational, professional, government communities

The authors argue that scope and form of a dominant design, which emerges in an industry, depends on the complexity of its technology configuration.
Tushman and Rosenkopf identified three basic categories of industries. In all three industry types, product, process or material technologies and technological innovations are potential sources of competitive advantage
Depending on the technology configuration of the industry, a dominant design **is constituted by bundle of product and process technologies** and its progress is driven by different factors.
.

Ασυνέχειες και κυρίαρχο Design

1832, the British Crown Glass Company (later Chance Brothers) became the first company to adopt **the cylinder method** to produce sheet glass (window / plate glass)

When glass manufacture began in America, the dominant process was **hand cylinder blowing**.

In 1857, the first U.S. plate glass factory was established, bringing to this country the European process of rolling a glass sheet on a table.

In 1903, J. H. Lubbers of American Window Glass perfected a machine that could blow glass cylinders rapidly and inexpensively. kept its process proprietary.

In 1917, the Colburn process for drawing a continuous ribbon from a tank of molten glass was introduced commercially

Pilkington, British glassmaker 1950

Figure 2a. Technological progress of machines in the U.S. flat-glass industry, in square feet per hour.

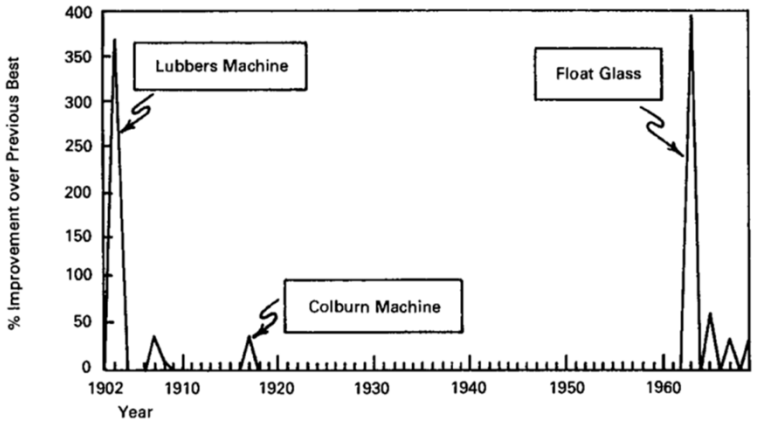
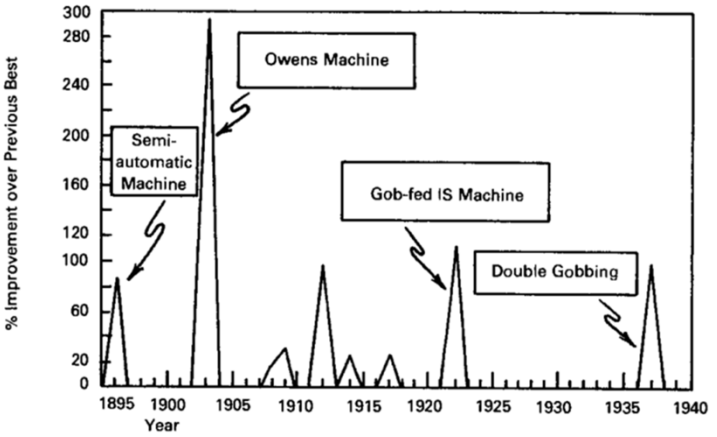
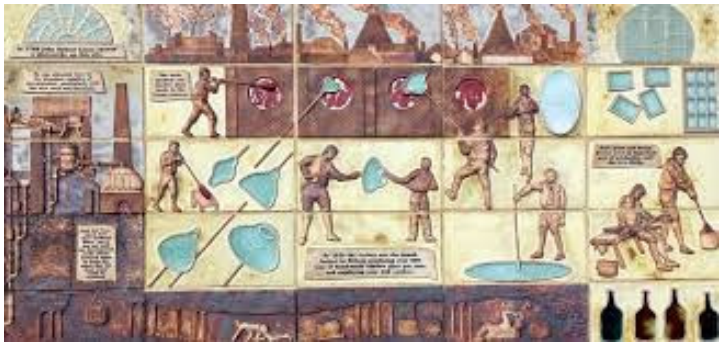


Figure 2b. Technological progress of machines in the U.S. container-glass industry, in bottles per minute.

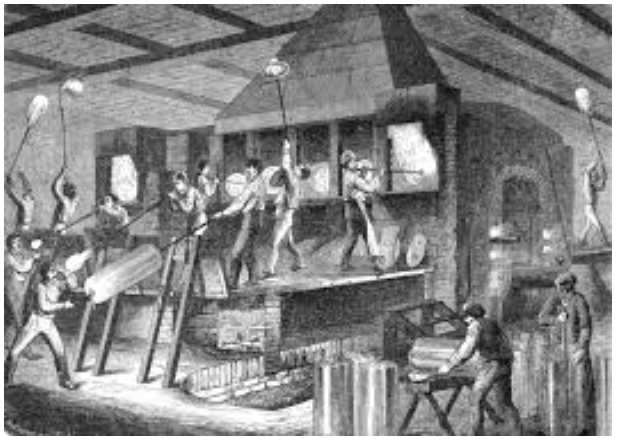


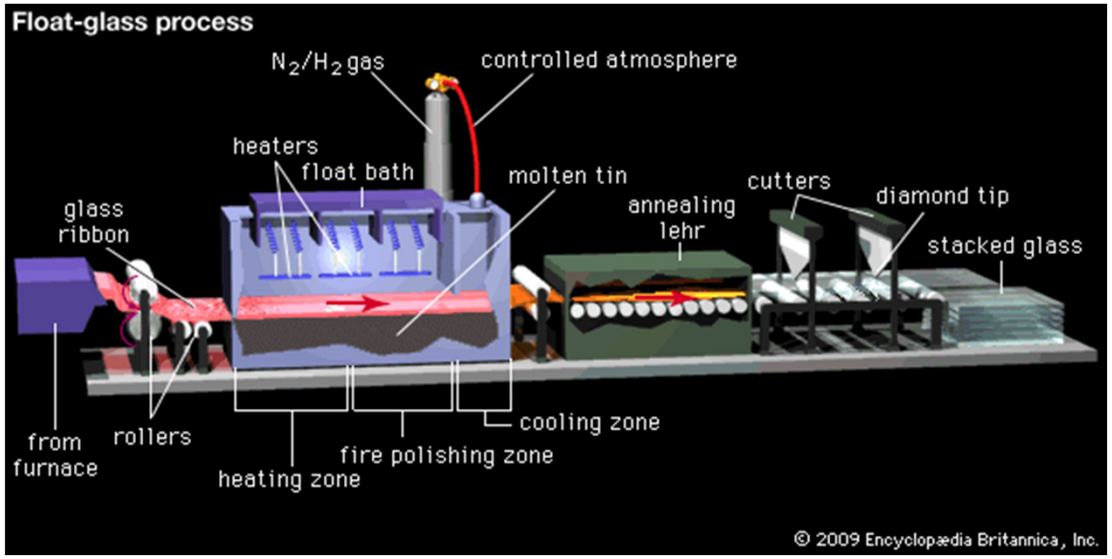
The Dominant Design

Processes for making flat glass include:



- Broad sheet method (13th century)
- Window crown glass technique (14th century)
- Blown plate method (17th century)
- Plate polishing (17th century)
- Cylinder blown sheet method
- Rolling (rolled plate glass, figure rolled glass) (19th century)
- Machine drawn cylinder sheet method (early 20th century)
- Fourcault process (1900s)
- Overflow downdraw method (1960s)





The Dominant Design

(1) Discontinuity	(2) Year introduced	(3) Effect on competence	(4) Industry standard
Container glass			
Semiautomatic machinery	1893	Destroying	United Machine
Owens machine	1903	Destroying	AN/AR Series
Gob-fed machinery	1915	Enhancing	IS Model C
Double gobbing	1937	Enhancing	5-section Model E
Flat glass			
Machine cylinder	1903	Enhancing	Improved Lubbers
Drawing machines	1917	Destroying	Fourcault machine
Continuous forming	1923	Destroying	None
Float glass	1963	Destroying	None

(5) Year standard achieves 50%	(6) Time to standard	(7) Year new sales peak	(8) Performance of dominant design	(9) Performance frontier*
Container glass				
1908	15 years	1910	6.5	15
1915	12 years	1917	40	50
1927	12 years	1930	125	135
1948	11 years	1956	250	270
Flat glass				
1911	8 years	1915	800	800
1937	20 years	1940	1000	1160
–	–	–	–	–
–	–	–	–	–

Εκμετάλλευση της Τεχνολογίας για ανταγωνιστικό πλεονέκτημα

Συμπληρωματικοί πόροι (complementary assets)

Some principles

Profiting from innovation is **a theory** that accounts for marketplace outcomes between innovators and follow-on rivals.

Τα **βασικά δομικά στοιχεία απόδοσης μιας καινοτομίας**:

- Appropriability
- Dominant design
- Complementary assets

Almost all innovations require complementary investments.

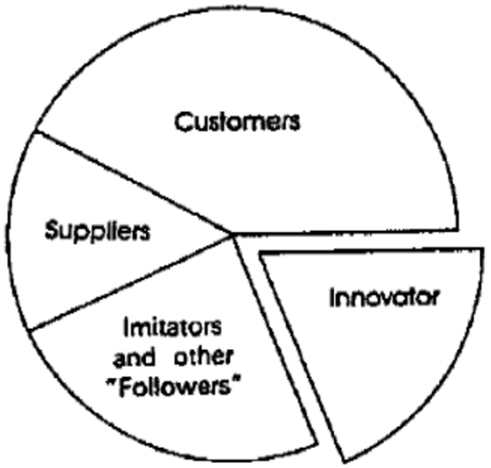
The *weaker the appropriability* regime applicable to an innovation, and the *weaker the market position of the innovator* with respect to providers of complements, **the harder** it will be for the innovator to build a long-term advantage without pursuing corrective measures such as vertical integration.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Εκμετάλλευση της Τεχνολογίας για ανταγωνιστικό πλεονέκτημα

Συμπληρωματικοί πόροι (complementary assets)

Δεν πειράζει αν είστε
ο «γρήγορος δεύτερος»
Ή ακόμη και ο
«αργοπορημένος τρίτος»!!!



What determines the share of profits captured by the innovator?

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Τα βασικά δομικά στοιχεία μιας καινοτομίας

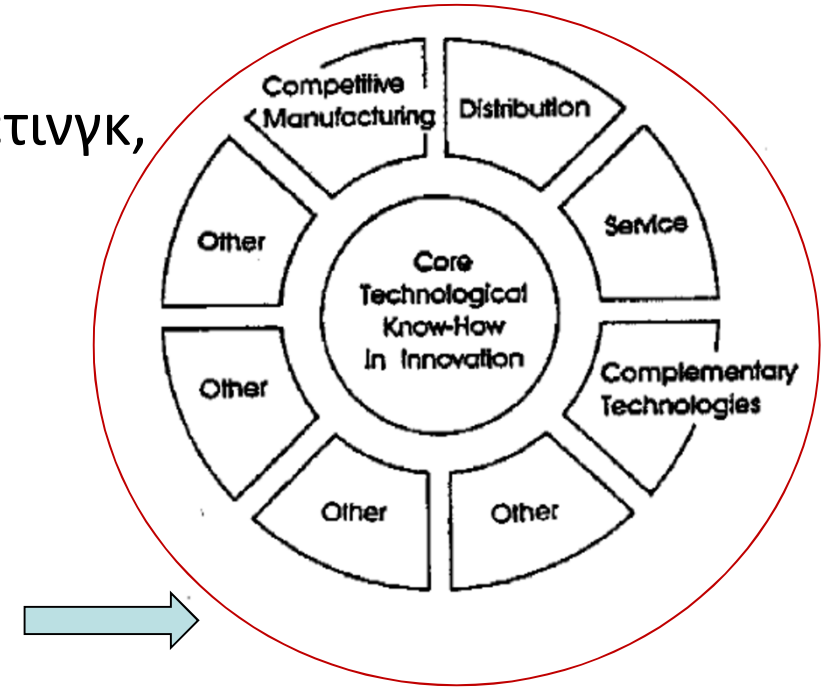
Τεχνική γνώση – εν μέρει κωδικοποιημένη και εν μέρει άρρητη

Επιτυχημένη εμπορευματοποίηση = χρήση της τεχνογνωσίας σε συνδυασμό με άλλες ικανότητες / πόρους (π.χ. πάντα μάρκετινγκ, υπηρεσίες μετά την πώληση κ.ο.)

Άλλες συμπληρωματικότητες

Π.χ.

το PC hardware απαιτεί software



ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Συμπληρωματικοί πόροι μιας καινοτομίας

Αποτελούν ζωτικά **δομικά στοιχεία** για την επιτυχή εμπορευματοποίηση μιας καινοτομίας

Γενικοί πόροι: Ανεξάρτητοι από την καινοτομία

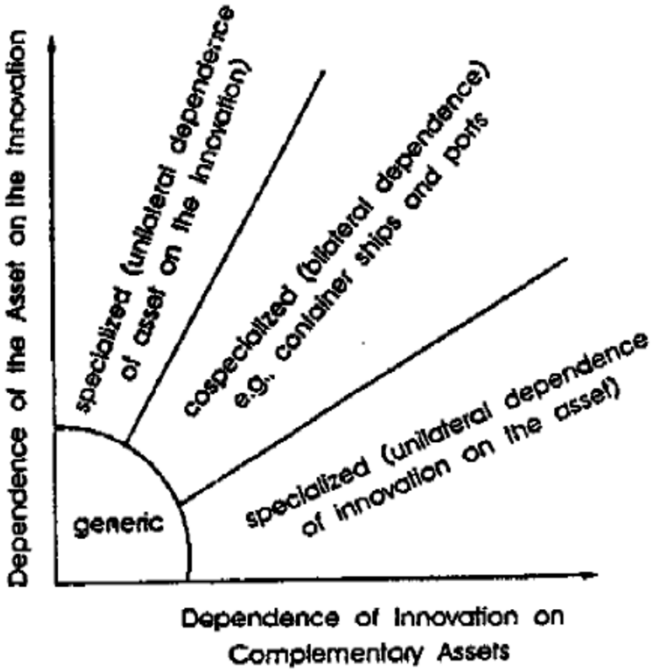
Π.χ. ο εξοπλισμός κατασκευής των αθλητικών παπουτσιών

Εξειδικευμένοι πόροι: μονομερής εξάρτηση

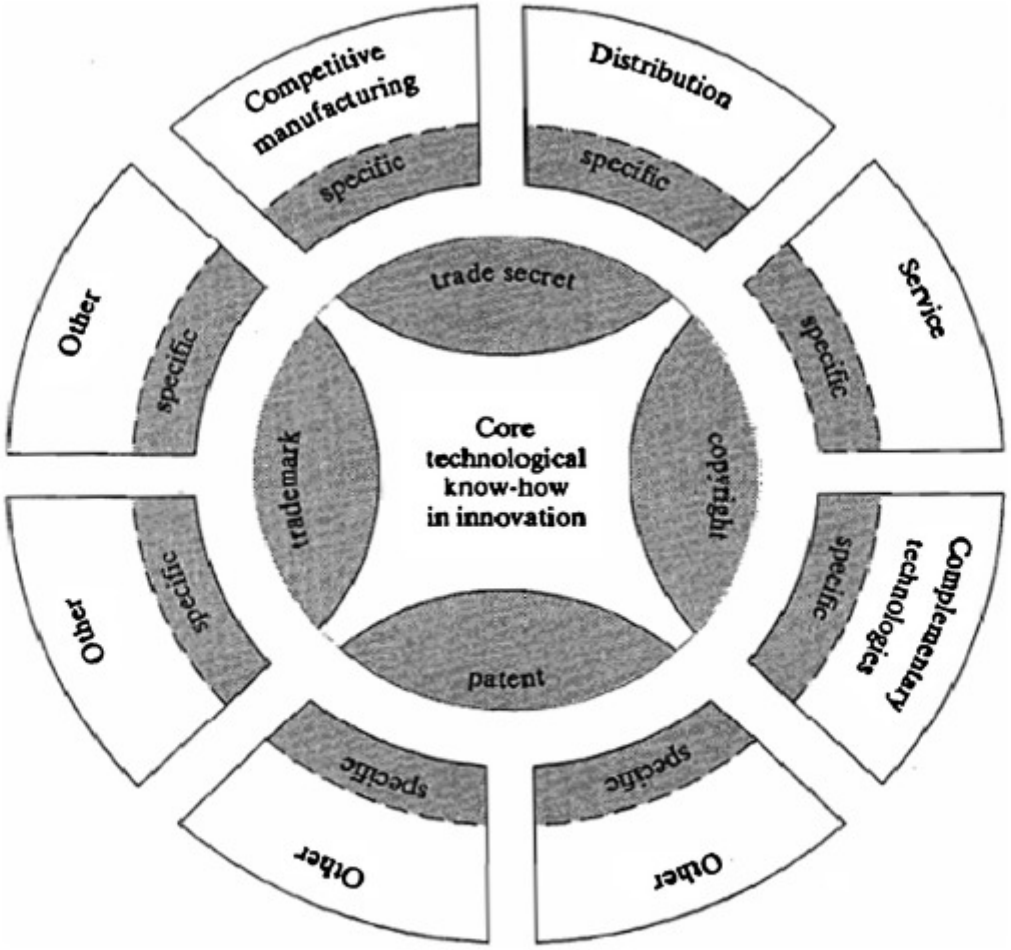
Π.χ. οι πωλητές μιας φαρμακευτικής εταιρείας / συνήθως εκπαιδεύονται εκτεταμένα ίσως και σε μια μόνο κατηγορία φαρμάκων

Συνεξειδικευμένοι πόροι: διμερής εξάρτηση

Π.χ. περιστροφικός κινητήρας Mazda - συντήρηση



Main complementary assets: manufacturing and channels (marketing)



ig. 1. Representative complementary assets needed to commercialize an innovation-shaded area represents the less imitable portion of the value hain. Outer segments represent complementary assets; inner circle segments represent know-how (Fig. 7.1 in Teece (1992b). This is adapted from ig. 5 in Teece (1986)).

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Συμπληρωματικοί πόροι (complementary assets)

	Innovator	Follower-Imitator
Win	1 • Pilkington (Float Glass) • G.D. Searle (NutraSweet) • Dupont (Teflon)	2 • IBM (Personal Computer) • Matsushita (VHS video recorders) • Seiko (quartz watch)
Lose	4 • RC Cola (diet cola) • EMI (scanner) • Bowmar (pocket calculator) • Xerox (office computer) • DeHavilland (Comet)	3 • Kodak (instant photography) • Northrup (F20) • DEC (personal computer)

Πιθανό αποτέλεσμα καινοτομίας

Η ιστορία….

EMI CAT SCANNER

EMI MUSIC PUBLISHING

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

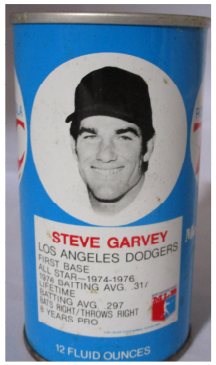
Τι δεν πήγε καλά στην περίπτωση της ΕΜΙ;;;

https://www.youtube.com/watch?v=svdRL2WNiCY

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

EMI CAT SCANNER
(limited IPRs)

- Υψηλή τεχνολογία – απαιτούσε εκπαίδευση, υποστήριξη, συντήρηση
- Η EMI δεν είχε συνειδητοποιήσει την αναγκαιότητα των άνω (να αποκτήσει / να συνεργαστεί (π.χ. με τη Siemens)
- GE / Technicare – ανταγωνιστές με τις ζητούμενες ικανότητες / έμπειροι σε ιατρικό εξοπλισμό με φήμη για ποιότητα, αξιοπιστία και service



RC cola

κομπιουτεράκι τσέπης Bowmar
//Texas Instruments, Hewlett Packard

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

brand names number one and number two were Marlboro and coca-cola it's kind of nteresting number three was Schwinn

Αν υπάρχουν καινοτόμοι που αποτυγχάνουν, θα υπάρχουν οι μιμητές που επιτυγχάνουν!!!

IBM PC (1981)

G.D. Searle's NutraSweet (aspartame) **(1982)**

$74 million (1982) --- $700 million (1985) / 50% of US sugar substitute market

IBM PC

Αποδεικνύει πώς ένα νέο προϊόν με μέτρια τεχνολογική ανάπτυξη φέρνει σημαντικά έσοδα στον δημιουργό του

1981: 1 έτος NPD
What's new? Intel 8088 (new 16-bit microprocessor)
DOS (new disk operating system) ***Adapted for IBM by Microsoft***.

Πέραν αυτών των μικρο-καινοτομιών:
Υιοθέτηση υπαρχόντων μικρο – προτύπων (standards)

??? Συμπληρωματικοί πόροι (υπάρχοντες ή ταχέως δημιουργούμενοι) γύρω από τον Η/Υ.

- Υιοθέτηση αρχιτεκτονικής ανοιχτού συστήματος
- Διαθέσιμη σε όλους η πληροφορία του λειτουργικού της συστήματος (Στα μέσα του 1983, υπήρχαν 3000 προϊόντα hardware & software για το PC)

Υπήρχε ρίσκο για τους δημιουργούς Software?
Το όνομα της εταιρείας και η δέσμευση στο έργο:
ο πλέον σημαντικός συνεξειδικευμένος πόρος είναι η φήμη της IBM και η παράδοση που είχε στον χώρο της.
Εξασφάλιση του ότι το PC-DOS θα γινόταν βιομηχανικό πρότυπο (industry standard) / άρα η δημιουργία software **ΘΑ ΗΤΑΝ ΑΝΕΞΑΡΤΗΤΗ** από την IBM

Apple Inc., which has come to dominate the tablet computer market, **did not succeed by being the first to market**

Apple's technology strategy for the iPad was to **imitate and improve** the original tablet technology.

Apple achieved a competitive advantage in this market by controlling **key specialized assets:**

- a strong brand;
- several complementary technologies which successfully transferred from its digital music player, the iPod;
- in-house digital rights management software;
- tacit technical capabilities that deliver a product with proverbial design and an interface that is easy to use.

Apple also controls **key co-specialized assets** such as the Apps and iTunes Stores: huge marketplaces owned by Apple that enhance the user experience through the online purchase of functional applications and music.
Their use in conjunction with the innovation is value-enhancing.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Apple Inc., which has come to dominate the tablet computer market,
did not succeed by being the first to market

Further complementarities:
On the one hand, Apple benefits from the virtual stores since they encourage its consumers to remain loyal and enhance its bargaining position

on the other hand, the iPad benefits the virtual stores, since it provides developers and artists with a large installed base of Apple customers.

Apple **outsources** production and assembly associated with the iPad, since these are
generic complementary assets that are available in competitive market

G.D. Searle's NutraSweet

Strong IPRs
Patent in 1970 (USA, Japan, Canada, Australia, UK, Frnce, Germany etc) for 17 years
Approval for human consumption in 1982
Special legislation (Searle pushes law for that) – 5 more years of the patent in USA and U.K.

Swirl – logo on all products that use it
Develops tradename ("Equal") for a table top version of the product (trademark law provides protection against "unfair" competition as long as the owner of the mark continues to use it).
Searle builds a position in complementary assets
Searle συνεργάζεται με παραγωγό (Ajinomoto) βιοχημικών με πολύχρονη εμπειρία και άρρητη γνώση (πέραν της κωδικοποιημένης).
Ως να λήξει η πατέντα – μακροχρόνια εμπειρία, ηγεσία κόστους και εμπορικά μυστικά (που σε αντίθεση με τις πατέντες δεν έχουν ημερομηνία λήξης).
Όχι υπεργολαβίες =κράτησε την παραγωγή / δημιούργησε αξιόλογο tradename /

The Comparative Success of Leaders and Followers

PRODUCT	INNOVATOR	FOLLOWER	WINNER
Jet Airliners	De Havilland (Comet)	Boeing (707)	Follower
Float glass	Pilkington	Corning	Leader
X - Ray Scanner	EMI	General Electric	Follower
Office P.C.	Xerox	IBM	Follower
Diet Cola	R.C. Cola	Coca Cola	Follower
Instant Cameras	Polaroid	Kodak	Leader
Pocket Calculator	Bowmar	Texas Instruments	Follower
Microwave Oven	Raytheon	Samsung	Follower
Photo Copiers	Xerox	Canon	Follower
Fiber Optic Cable	Corning	many companies	Leader
Video Games Players	Atari	Nintendo/Sega	Followers
Disposable Diapers	Proctor & Gamble	Kimberly-Clark	Leader
Internet Browser	Netscape	Microsoft	Follower
Teflon	DuPont	many companies	Leader

Adapted from Grant, 1998; Teece, 1986

Δύσκολο για μικρές επιχειρήσεις και start-ups

A common situation, however, involves start-ups lacking downstream complementary assets: when these are specialized and the invention is easy to imitate, these companies tend to lose the competitive battle in the marketplace, as owners of complementary assets imitate and exploit their inventions.

In this case, vertical integration in the product market is deemed to be a failure.

A combination of a strong appropriability regime and lack of specialized complementary assets leads small companies to contract for access to the complementary assets.

Contracting can be accomplished through a variety of cooperative strategies that allow the innovator to share the profits from innovation with the complementary assets holders, such as licensing, joint ventures or the sale of the company

Technology strategy decisions!

A “make component sourcing” decision yields better performance for firms before the emergence of a dominant design (in the pre-dominant design era),
while
a “buy component sourcing decision” yields better performance after the dominant design’s emergence (in the post-dominant design era)

Alternative Strategies for Exploiting Innovation

	Licensing	Outsourcing certain functions	Strategic Alliance	Joint Venture	Internal Commercialization
Risk & Return	**Very small investment risk, but returns also limited** (unless patent position very strong) Some legal risks	**Limits capital investment**, but may create **dependence** on supplies/partners	Benefits of **flexibility**, risks of **informal structure**	**Shares investment and risk.** Risk of partner disagreement and culture clash	**Biggest investment requirement and corresponding risks. Benefits of control**
Competing Resources	**Few**	Permits **accessing of outside resources and capabilities**	Permits **pooling of the resources and capabilities** of more than one firm		**Substantial requirements** in terms of finance, production capability, marketing capability, distribution, etc.
Examples	Konica licensing its digital camera to Hewlett Packard	Pixar's computer animated movies (e.g. "Toy Story") marketed and distributed by Disney Co.	Apple and Sharp build the "Newton" PDA	Microsoft and NBC formed MSNBC	TI divestment of its Digital Signal Processing Chips

Source: Grant, 1998

Key: Strategies / Outcomes		Complementary assets (CA)		
		Generic	Specialized/co-specialized	
			Innovator owns CA*	Innovator does not own CA*
Imitation	Easy+	Contract to access CA† / Consumers will capture largest share of value from innovation	Integrate / Innovator will capture largest share of PFI	Contract to access CA† / CA holders will capture largest share of PFI
	Difficult+	Contract to access CA / Innovator will capture largest share of PFI	Integrate / Innovator will capture largest share of PFI (best case scenario for innovator)	Contract to access CA / Innovator will share rents with CA holders

*: Ownership (or lack of it) may reflect cases whereby the innovator is in a better (or worse) position relative to potential rivals for the acquistion of CA.
†: In this case it may be hard for the innovator to recover the investment required to create the innovation.
+: Ease of imitation is mainly determined by the efficacy of intellectual property rights protection and the replicability of the innovation.

Complementary Asset, Fig. 1 Profits from innovation (*PFI*): Teece's model (Adapted from Teece (1986))

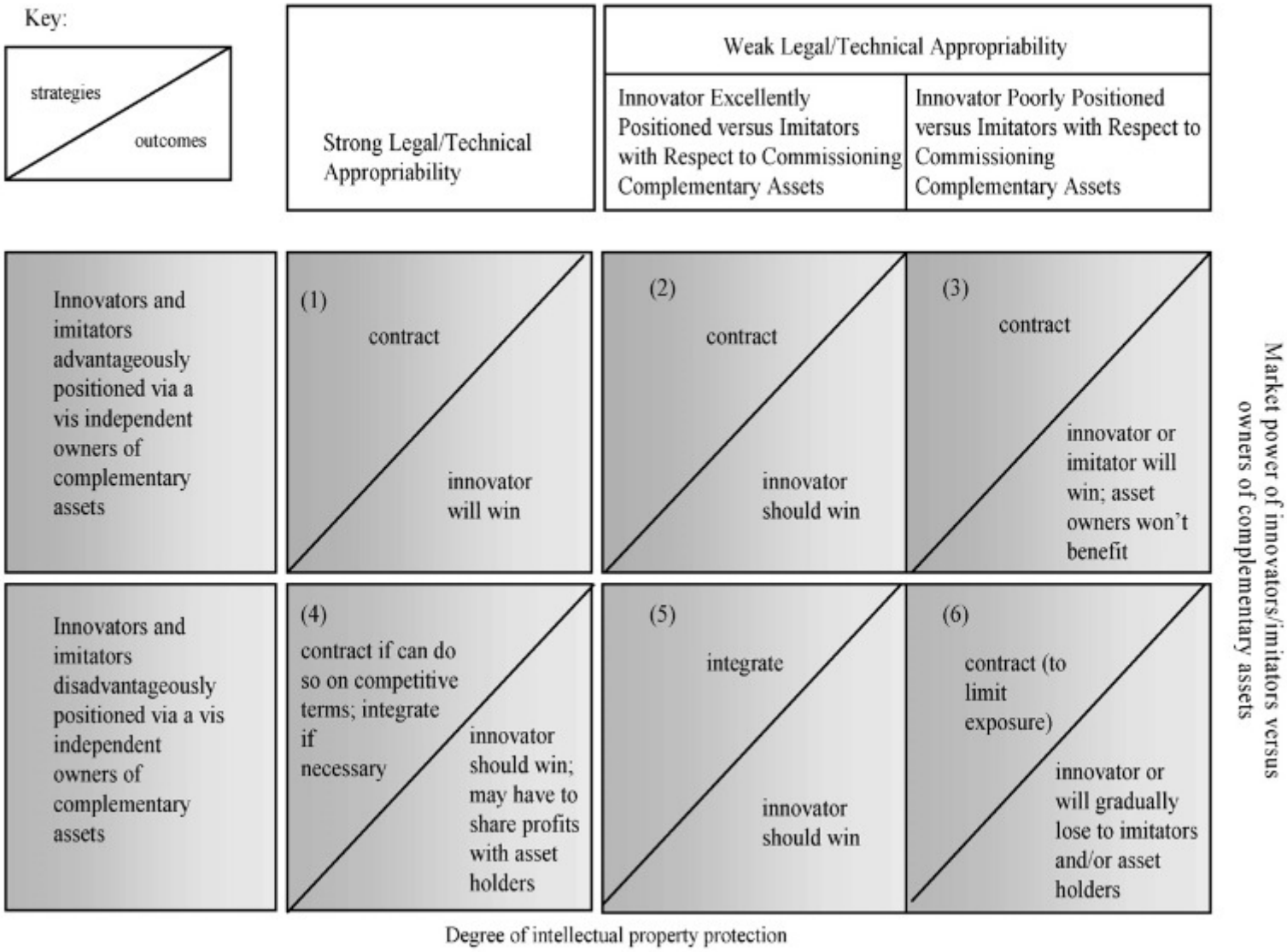


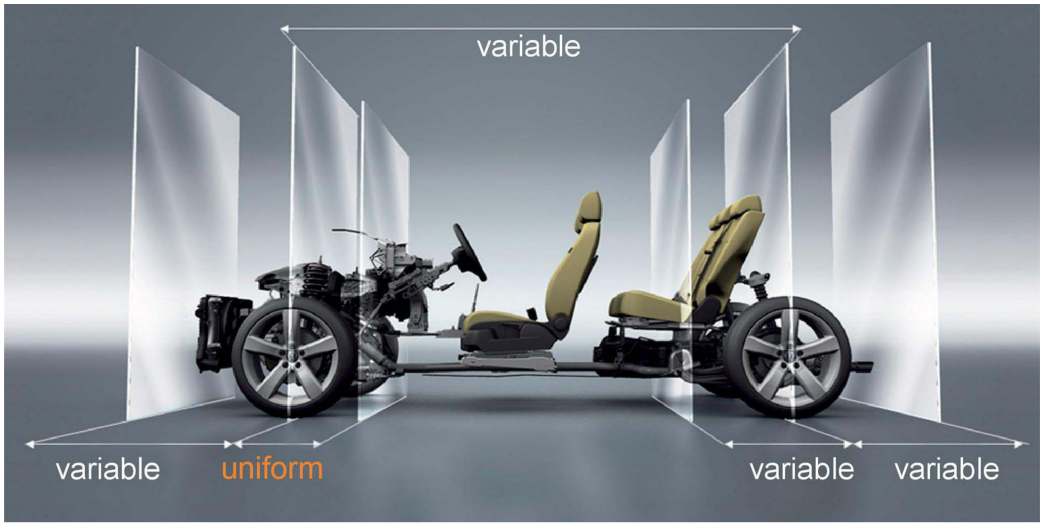
Fig. 2. Contract and integration strategies and outcomes for innovators: specialized asset case (Fig. 11 in Teece (1986)).

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Αρθρωτή σχεδίαση – τμηματοποίηση (Modularity)

Πλατφόρμες

Τεχνολογικές πλατφόρμες και στρατηγικές οικοσυστημάτων



Αρθρωτή σχεδίαση – τμηματοποίηση (Modularity)

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Module: a unit which serves identifiable functions, while its structural elements are strongly interconnected, and weakly connected to elements in other units/modules. A module may also be changed and replaced easily and produced independently for subsequent assembly

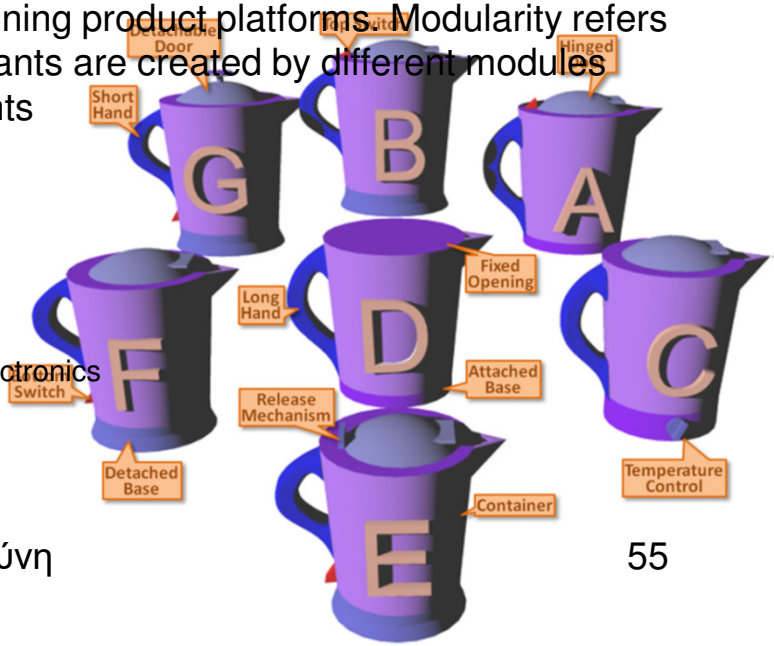
Modular systems are composed of elements, or "modules," that independently perform distinctive Functions

Modularity: the technological architecture consists of components as building blocks that can be separated and combined (modules) AND intentionally creates a high degree of independence or "loose coupling" between components, ***enabling modular innovation.***

Modularity in Design (MID)
Modularity in product variants design is a prerequisite for designing product platforms. Modularity refers to the product design architecture where alternate product variants are created by different modules combinations that to differentiating the main product into variants

Modularity in Production (MIP)
Components are pre-combined off-line into sub-assemblies for simpler final assembly tasks

MODULAR DESIGN EXAMPLES Memory cards for cameras and consumer electronics Users can replace them to increase their devices' performance.



Modularity: αρθρωτή σχεδίαση – τμηματοποίηση

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

IBM System/360 (second generation computer) : first appearance of the dominating computing platform of the mainframe segment

- substantial cost over-runs in the development phase
- upgrading of components relatively cheap and easy due to modularity.
- offering operating system **compatibility** across computers of different processor speeds and disk sizes. Application software and databases on one system could be easily moved to another within the platform.
- IBM developed **technical standards** for product interoperability and embedded these standards in new versions of all its mainframe products.

The nexus of compatibility standards between hardware and software is the hallmark of a platform; the System/360 was a platform sponsored by IBM. A customer-written program adhering to the platform standard would function on any machine drawn from a wide variety of system configurations. ***WHAT IS A PLATFROM???***

Other Modularity examples: Boeing 777; Volkswagen trucks and buses; Black and Decker power tools

industries with international standards: automobile, computer hardware/software industry

CASE STUDY*: the rise of Sun Microsystems and the fall of Apollo - difficulties associated with proprietary products and open architecture products.*

Αρθρωτή σχεδίαση – τμηματοποίηση (Modularity) και πλατφόρμες προϊόντων

Platforms: complex architectures of standardized components ((Bresnahan & Greenstein, 1999; Eisenmann, 2007), bundles of standard components around which buyers and sellers coordinate efforts (Bresnahan and Greenstein, 1999)
Product platform : a set of common elements (parts, components, processes, sequences, etc.) sharing the underlying core technology based on which a stream of derivative products can be efficiently developed and launched (Simpson,2004).

Industry platforms: technological building blocks (e.g. technologies, products, services) acting as foundation on top of which an array of firms, organized in a set of interdependent firms (*sometimes called "ecosystem*"), can develop their own complementary products, technologies and services(Gawer, 2009).

***PP vs IP**: a product is largely proprietary and under one company's control, // an industry platform is a foundation technology or service that is essential for a broader, interdependent ecosystem of businesses.*

Especially for computing platforms: success is courting and maintaining a vibrant supply of third party complements ("software") that makes a product ("hardware") more valuable

Keys to platform success: 1) a technical architecture of standards that a) both facilitates complementary assets and allows re-use between vendors and product generations and b) allows modular innovation by both the platform sponsor and by third party complementors; 2) complementary innovations

Ecosystem: The interdependence of the sponsor with its complementors

Products Platforms

- Greater ability to tailor products to the needs of different market segments or customers.
- Reduced costs of addressing the specific needs of a market segment or of an individual customer. (e.g. When producing larger volumes of common parts, companies achieve economies of scale, common machinery, equipment, and tooling, and the engineering time needed to create them, can be shared across higher production volumes).
- Companies can simplify systemic complexity. Cutting the number of parts and processes lowers costs in materials management, logistics, distribution, inventory management, sales and service, and purchasing.
- lower risk.
- improved service.

Figure 1
Trade-off between Distinctiveness and Commonality

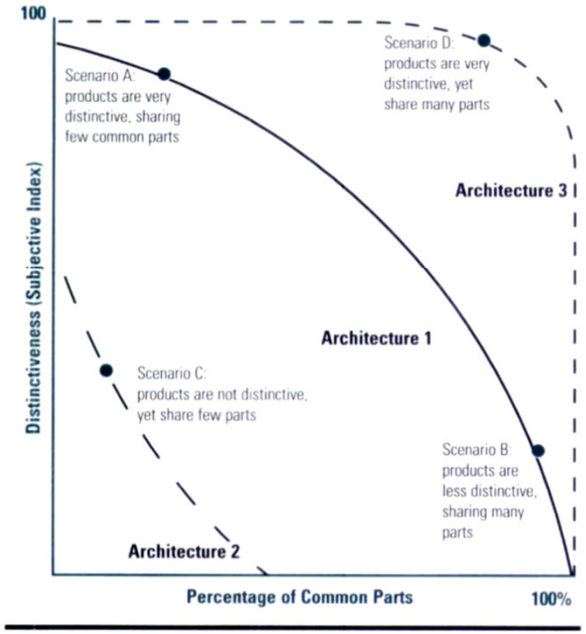
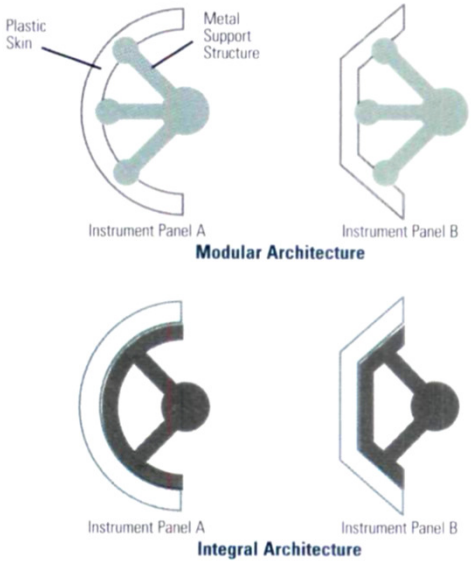


Figure 2
Modular and Integral Architectures for an Instrument Panel



The modular architecture allows the same support structure to be used in two different instrument panel designs. (Illustrative instrument panel designs shown in cross-section.)

Industry Platforms and platform leaders

Platform "owners" : firms that own a core element of the technological system that defines their forward evolution. Π.χ.

Microsoft Corp. benefits from competition among personal PC manufacturers that use its operating system, BUT they, *in contrast*, benefit when customers perceive their products as unique and therefore do not want cutthroat competition at the product or system level where they compete

'Platform leaders'' (Gawer & Cusumano,2002, 2004, 2008)- organizations that:

- manage to successfully establish their product, service, or technology, as an industry platform;
- orchestrate firms whose combined products, technologies, or services add value to the ecosystem as well as end-users
- Aim to create innovation in complementary products and services, which in turn increase the value of their own product or service,
- wish to maintain or increase competition among complementors, there by maintaining their bargaining power over complementors.

Therefore, key principles of platform leadership :

- technology design,
- strong relations with complementors,
- internal organization,
- firm scope (*Is it preferable to create product complements internally or let the `market' produce them?)*

Industry Platforms and platform leaders

Platforms and platform leaders

- exist in various industries, (of course in all high- tech industries!): Google, Microsoft Windows, cell phone operating systems, fuel cell automotive engines
- Provide an essential, or "core," function to an encompassing system of use. They are subject to "network effects,' to dynamically reinforce early-gained advantages e.g. the existence of complementary products or a user base. E.g. hydrogen fuel cells, platforms for micropayments (for banks, credit card companies, internet services)
- embedded within industrial ecosystems, have redesigned our industrial landscapes, upset the balance of power between firms, fostered innovation

What if I overlook the platform potential of my products? Apple Inc.'s Macintosh PC was the leading PC when introduced but didn't become the dominant personal computing platform,
Apple did not open the Mac's architecture and software to third-party complementors and licensees.

Industry Platforms and platform leaders

NOT every market has to have a platform leader.

In some large markets, (e.g. video game consoles or Web portals), several platform companies can persist **without one clear winner**.

PREREQUISITE: enough room for differentiation in user needs -specific niches or segments, low switch barriers for users

NOT every product can become a platform.

A product - a technology - service must satisfy 2 prerequisite conditions:

1) It should perform at least one essential function within a *"system of use"* or solve an essential technological problem within an industry, (e.g. Microsoft's Windows operating system and Intel's microprocessor were both essential platform components of the original IBM and IBM-compatible personal computers)

and

2) It should be easy to connect to or to build upon to *expand the system of use* AND allow new and even unintended end-uses. (e.g. external companies have succeeded in developing complementary and interoperable products)

Industry Platforms and platform leaders

Platform leadership: The story of Intel
from a simple component maker, supplying microprocessors for system architectures to a major source of influence in the evolution of PC architecture and the platform leader

initial years major problems:

- computer end-users bought PCs—not microprocessors.
- Intel had to ensure demand for its ever-evolving microprocessors in accordance with the Moore's law. This law would not become a reality if there were no demand for more computing power; as a result all computer manufacturers and software producers would not make PCs that would take advantage of the latest Intel technology.

In order to overcome these problems, Intel devised a new strategy—to build a platform, which was everything that was around the microprocessor. The company believed in `keeping pace and improving and scaling, so that the microprocessor can deliver its potential'.

Intel established its own Intel Architecture Lab (IAL) in 1991.

- The goal of IAL was to move the PC platform forward by expanding its scope to more than simply trying to redefine the technical architecture of the PC.
- IAL got involved in three key areas—driving architectural progress on the PCs, motivating and facilitating innovation on its complementary products, and coordinating innovation outside of Intel in an effort to drive the development of new system
- capabilities.
- Intel, through IAL was successful in driving innovation activities at other firms that manufactured complementary products to its microprocessors.
- IAL also tried to create new uses for PCs and in turn generate demand for new computers, most of
- which would use Intel's microprocessors.

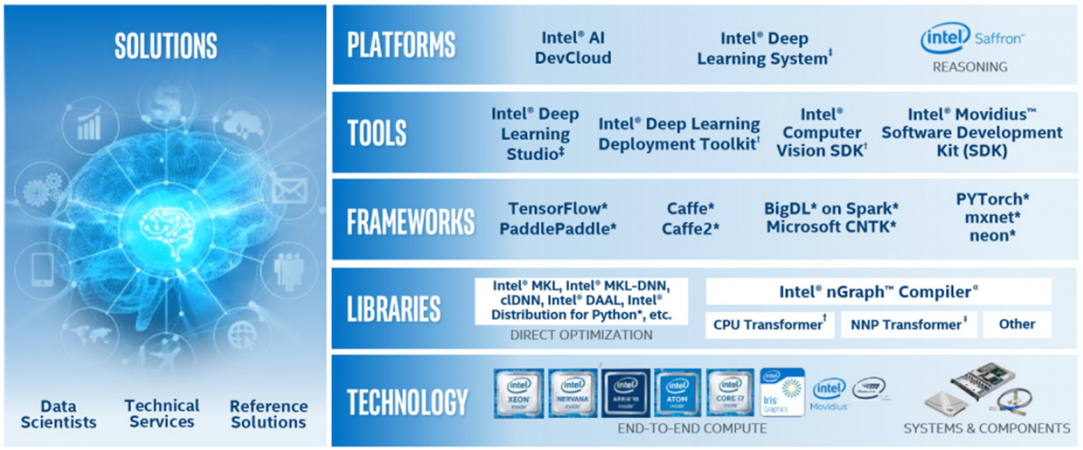
IAL developed a new connector called `bus' technology that linked many pieces of the PC system. This soon became a standard for many firms in the industry

Industry Platforms and platform leaders

Intel's strategic principles for platform leadership

three major rules
Sponsoring innovations in PC architecture,
stimulating external innovations on complements,
coordinating industrial innovation.

YET, STRONG OBSTACLE; the limited bandwidth between PCs and peripherals like scanners, printers and digital cameras, which ultimately slowed down the overall performance.
INTEL innovation: the Universal Serial Bus (USB) in the mid-1990s, a new interface linking the PC to external devices such as the keyboard, scanner and the printer.
Intel needs to convince PC manufacturers to build USB compatible systems:. Ait stimulates innovation on products that could connect to this interface (USB) and created business possibilities for external companies.
As a result, many companies became complementors of the PC platform by adopting to the new USB interface.



° Alpha available
† Beta available
‡ Future
* Other names and brands may be claimed as the property of others.
All products, computer systems, dates, and figures are preliminary based on current expectations, and are subject to change without notice.

Platforms and platform leaders
IBM vs APPLE II (The 8-bit to 16-bit era)

1977, 3 personal computers sold as a complete system: the Apple II,the Commodore PET and theTandy TRS80. **Apple** was able to create a large and growing network of carefully selected partners by providing complementary products such as printers and software. It controlled the network to safeguard the integration of components and the technical quality of the entire system.
1984: Apple Macintosh

1981 IBM benefitted from a solid reputation as world leader in mainframe computers The **IBM PC** was rather quickly developed as an architecture with interchangeable components. This created **an open platform t**o which producers from all over the World could supply components
eventually, Microsoft(withDOS)a nd Intel prevailed.
Software developers were invited to develop compatible software. As a result, IBM announced the availability of a variety of
Software programs: word processing, accounting, games, and Lotus 1-2-3, a spreadsheet that took advantage of the IBM PC architecture, and outperformed the Apple platform's VisiCalc.

In 1986, the IBM platform Reached market dominance (55% market share of IBM-compatible PC's) and won the battle from Apple and from the other competing platforms, such as Commodore

Platforms and platform leaders
IBM vs APPLE

2. Network		
Network size	Comparatively large in the beginning, comparatively smaller later on	Comparatively small in the beginning, comparatively larger later on
Size of platform leaders	Single platform leader that was still relatively small	Large
Network diversity	Few groups; strong in specific niches	Many varied groups of complementary partners
Network governance structure	Star-shaped, central governance	Core–periphery, distributed governance
3. Strategy		
Entry timing	1977: first	1981: second
Product range	Limited, integrated range of products	Large range of products due to possible recombination of modules
Operational supremacy: production	Few	Many
Operational supremacy: distribution	Few	Many
Pricing	High prices, skimming	Range of prices from high to low
Provision of complementary products	Limited, strong in niches, partly provided by Apple	Extensive and specialized, mainly provided by the many network partners
Installed base	None	IBM: office equipment
Reputation	Innovative runner-up	IBM: very reputable; Microsoft: initially unknown, later known as smart copier; Intel: reputation on DRAM business, switched to microprocessors
Financial support	Low	High
Appropriability	High	Low
Dominance		
Dominance	1981: around 15% 1986: less than 10%	1981: around 2% 1986: around 55%

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Platforms and platform leaders: IBM vs APPLE)

Apple was the first supplier of a professional personal computer platform with superior technical Quality and an advanced yet intuitively understandable user interface. The Macintosh is a sponsored platform with a closed hardware architecture, meaning that Apple maintains exclusive control over its interfaces.

IBM's open platform allowed for a much higher growth.
It began as the IBM PC; IBM sponsored the technology and chose a vertically disintegrated structure for the invention and production of components. Later, the platform became simply an `industry standard architecture,' an unsponsored structure. Still later, after its original operating system was succeeded by the backward-compatible Microsoft-sponsored Windows on Intel-sponsored microprocessor designs, it became the `Wintel' (Windows/Intel) standard. Despite all this change, the forces of backward compatibility led to platform persistence.

WINTEL - The PC platform of Microsoft Windows and Intel processors

perhaps the most often cited example of platform success

INTEL: a) As the provider of an essential element of the personal computer, Intel's approach **to complementary markets** strongly affected its relationship with external providers of complementary products.
b) as the largest global producer of microprocessors between 1990 and 2004, Intel was clearly **a platform owner,** and plausibly had considerable market power.

Microsoft and Intel aggressively courted and developed competitors to their initial customer IBM, which gave them new customers, grew the market, and provided incomparable economies of scale. Microsoft and Intel as Wintel platform ''owners,'' they focus on their cooperative rather than competitive platform efforts

The power of the Wintel platform, is that it has given rise to a virtually infinite variety of application and service niches that add value for end users while insulating most participants from direct competition with one another

Technology strategy - Coring: How to create a new industry platform

"Coring" : the set of activities a company can use to identify or design an element (a technology, a product or a service) and make this element fundamental to a technological system as well as to a market.

"Core" element or component of a system: when it resolves technical problems affecting a large proportion of other parts of the system.

The main question

- **Who** will develop these new uses?
- **How** can platform-leader wannabes successfully encourage other companies to join their ecosystems and develop essential complementary applications?

A **balancing technology – business** act as the greatest challenge to platform leadership !
protecting one's sources of profit **while enabling complementors to make an adequate profit** and protect their own proprietary knowledge

Google: Coring in Internet Search

Founded in 1998, as a simple search engine company and went on to establish its proprietary search technology as a foundation for navigating the Internet.
First, technical problem solution: how to find anything in the maze of the Internet, - Google's improved search function became an essential technology for fully using the Internet.
Second, Google distributed its technology to Web site developers and users as an embedded toolbar, making it easy to connect to and to develop Upon, with different uses, such as combining a search with different kinds of information or graphics.
the business side. Google indicated how companies could make money from using the Internet. (linking focused advertising to user searches.
In effect, Google revolutionized the advertising business by rearchitecting the relationships between advertisers and Internet users.

Competition. In the mid-1990s, Digital Equipment Corp. created a powerful search engine tool for the Internet, AltaVista; Yahoo! and Inktomi, MSN

Technology strategy- Tipping: how to win platform wars

Many platform battles involve competition among technical standards and incompatible technologies.

Toshiba Corp.'s HD DVD against Sony Corp.'s Blu-ray Disc for high-definition media storage.
JVC's Video Home System versus Sony's Betamax for videocassette recording and
Microsoft's Windows versus Apple'sMacintosh for personal computer operating systems.

"Tipping" : the set of activities or strategic moves that companies can use to shape market dynamics and win a platform war *when at least two platform candidates compete*.
Tipping activities: sales, marketing, product development and coalition building.
successful tipping requires actions taken from both the technology and the business sides of the platform.

Tipping across markets or "platform envelopment." when a company crosses over the boundary of its existing market to absorb technical features from an adjacent market and bundle them to extend the company's platform *(e.g. in the context of technological convergence, among computers, telecommunications equipment and digital appliances – see mobiles).*

Tipping in the Internet Browser Market

Netscape Communications Corp. introduced the first mass-market browser in 1994 and dominated the segment for several years.
Microsoft designed its own browser, Microsoft Internet Explorer, and bundled this "for free" with Windows from 1995 on.
As hundreds of millions of new PCs shipped with Internet Explorer over the next several years, and as Microsoft steadily improved its browser technology, Netscape's browser dropped from around an 80% market share to a negligible presence.

Is the browser a separate product from the operating system? How should a company with a monopoly in one market t behave when bundling across markets?
By bundling a product for free that competitors often offered for sale, Microsoft violated antitrust law because it engaged in several anti-competitive practices while it had a monopolistic share in operating systems. For example, Microsoft **pressured** PC manufacturers and service providers **not to bundle** the Netscape Navigator Web browser.
Apart from the antitrust story, One dominant platform can be a powerful distribution mechanism for a company that wants to enter other platform markets — if there are ways to bundle the technologies **legally**, use the same distribution channels or create unique complementarities between the different products.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

When battling to become a platform in a standards war…

- try to gain control over an installed base,
- Broadly license your intellectual property
- facilitate partner investments in complementary innovation.
- invest in building brand equity as well as manufacturing, distribution or service capabilities to signal support of the platform.

  Matsushita Electrical Industrial Co. publicized its large investment in mass-production facilities as an argument to convince developers of videotapes to adopt the VHS standard, which had been developed at its much smaller Victor Company of Japan Ltd. subsidiary.
  Intel Corp., when trying to convince motherboard makers in the early 1990s to adopt its new interface for connecting peripheral devices, committed to developing it themselves in large quantities.

- Pricing (to complicated) - Subsidize one side of the market (for example, software application developers) in order to bring on the other, paying side (for example, software end-users).

Is size an issue???

size can sometimes be an advantage for companies seeking to tip a market, BUT!
coring is a possible option for any company because technology and architectural leadership do not directly depend on the size of the company.
JVC, Microsoft and Intel were small companies when they first became platform leaders.
Linux was the product, at least initially, of a lone graduate student working in a remote corner of Europe.
Of course today: smaller companies are likely to have a harder time negotiating with large enterprise customers. They may also find it difficult to tip markets on their own and generally will need to establish ecosystem partnerships or coalitions of providers and users — as JVC, Microsoft, Intel and Linux have done.

Strategic Options for Platform-Leader Wannabes

Two principal strategies for becoming a platform leader are (1) coring (creating a new platform) and (2) tipping a market toward your company's platform. To become a platform leader, companies need to address both the business and technology aspects of platform strategy.

Strategic Option	Technology Actions to Consider	Business Actions to Consider
Coring How to create a new platform where none existed before	• Solve an essential "system" problem • Facilitate external companies' provision of add-ons • Keep intellectual property closed on the innards of your technology • Maintain strong interdependencies between platform and complements	• Solve an essential business problem for many industry players • Create and preserve complementors' incentives to contribute and innovate • Protect your main source of revenue and profit • Maintain high switching costs to competing platforms
Tipping How to win platform wars by building market momentum	• Try to develop unique, compelling features that are hard to imitate and that attract users • Tip across markets: absorb and bundle technical features from an adjacent market	• Provide more incentives for complementors than your competitors do • Rally competitors to form a coalition • Consider pricing or subsidy mechanisms that attract users to the platform

Gawer, A., & Cusumano, M. (2008) How companies become platform leaders. *MIT Sloan management review*.

Therefore,

Platforms share interchangeable components, so many sellers and buyers can share the benefits of the same technical advance. Interchangeable components also permit buyers to use the same platform over time, avoiding losses on long-lived software or training investments. The sharing is a social scale economy: accordingly, there tend to be few platforms in any segment.

Different platforms have been organized and controlled by sellers in different ways. Sometimes, as in the case of mainframe computers, we see a single platform, offered by a single firm with a high level of vertical integration (IBM).
In personal computers, the IBM PC platform was controlled at first by a single firm, but later decentralization led to the `Wintel' platform controlled by Microsoft and Intel

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