ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Τεχνολογική Στρατηγική

Dr Γλυκερία Καραγκούνη

karagg@uth.gr

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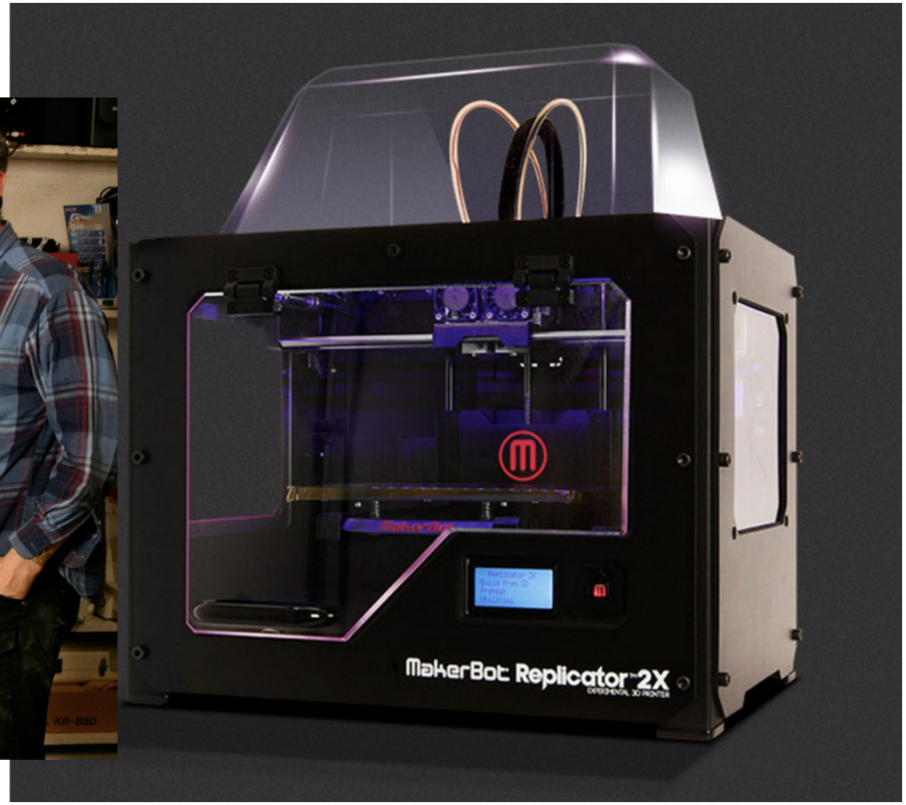
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Watch *Print the Legend* (2014 Netflix Original)
Fascinating documentary of 3D printing industry and Makerbot, among others.

RepRap founded c2009 – becomes Makerbot



Technology forecasting - Sources of information

Technology forecasting is conducted using various internal and external sources of knowledge and information available to SM/FMs.
Forecasting information can be obtained from the SM/FMs' networks, including suppliers and customers.

Sources of information can include:

- Predictions or estimations
- Research and development, qualified researchers
- Adapting new technology, internal experimentation, interactive learning
- Experiential learning, cross-training, new personnel
- Knowledge consultants, technical consultants
- Collaborations with other businesses, cooperative agreements
- Trade shows, overseas visits
- Subject journals, internet, subject magazines
- Informal networks of customers, suppliers, social groups

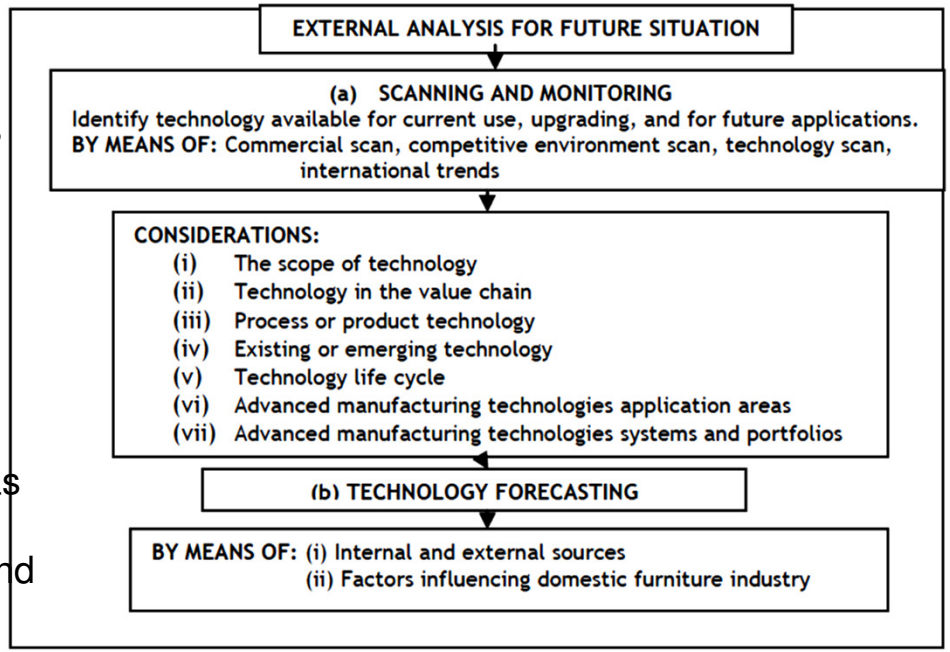
Delphi-Scenario Writing (DSW) Approach to Technology Road-Mapping
an integrated method that provides a systematic approach to developing a strategic scenario for promoting the innovation process. It is a well-known intuitive method. The advantage of the Delphi forecast resides in its simplicity and convenience to use.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Technology scanning and forecasting are major activities that will recognise and prioritize leading technology
The aim is to observe the development of technologies that are new or new to the business.

Advanced manufacturing technologies (AMTs):
technology relating to product design: software such as CAD); the engineering process (software such as CAE, and hardware such as RP); manufacturing (hardware such as CNC, FMS, AGV, and AMHS); and materials handling and management (hardware such as FMS and AS/RS).

Technology applications for
control (such as software for SPC), planning (such as software for MRP, MRPII, and ERP),
office systems (such as software for OA and EDI), and financial systems (such as software for ABC)



ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Προϋπόθεση για τη διαδικασία

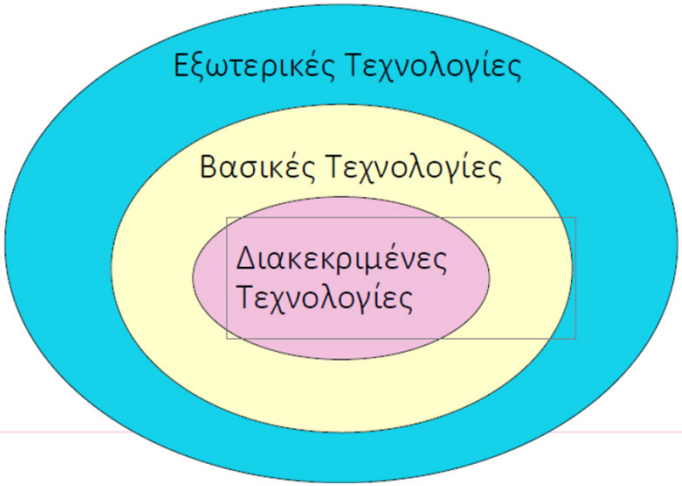
Μια εταιρία πρέπει να είναι ικανή:

1. Να **αναγνωρίζει τις διακεκριμένες τεχνολογίες** της
2. Να διατηρεί την **κατοχή αυτών των τεχνολογικών περιοχών** ***(ποδήλατα Schwinn)***
3. Να αποφασίσει για το **επίπεδο ολοκλήρωσης**
4. Να είναι ενημερωμένη για **αναδυόμενες τεχνολογίες**
5. Να **τροποποιεί** την **επιχειρηματική στρατηγική**

Διακεκριμένες τεχνολογίες: **μοναδικό πλεονέκτημα**

Βασικές τεχνολογίες: τεχνολογίες **επιβίωσης**, χωρίς τις οποίες η εταιρεία θα μπορούσε να αποκλειστεί από τις αγορές της

Εξωτερικές τεχνολογίες: παρέχονται από **άλλες εταιρείες**



ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Σενάρια: οράματα των μελλοντικών δυνατοτήτων-και ιδιαίτερα, οράματα
(α) που έχουν προκύψει και παρουσιάζονται με αρκετά συστηματικό τρόπο και
(β) που επιδιώκουν κάποια ολιστική αντίληψη των υπό διερεύνηση περιστάσεων

Scenario planning has origins in military strategy and the work of the Rand Institute (from the 1960s). Wack (1985) describes how scenarios were first used within **Royal Dutch/Shell** in the 1970s, enabling that firm to be better prepared for oil price shocks and major geopolitical events than its rivals.

The essence of scenario planning and its application has been summarized as:

- analysis of multiple views and different perspectives on the future (Wack, 1985a);
- organizational learning and systems thinking (Senge, 1990);
- a comprehensive and open approach to understanding competition and the business environment
- consideration of multiple stakeholders and their interests (Van Der Heijden, 1996);
- critical and creative approaches to strategic thinking (Schoemaker, 1995); and
- use of storytelling and strategic conversation (Van Der Heijden, 1996).

Benefits of scenario planning in technology management:
promoting enhanced vision, flexibility, and environmental monitoring;
encouraging learning;
a means of testing assumptions; and
supporting sophisticated treatments and analysis of a company and its environment.

The drawbacks of scenario planning in technology management :

- the need to involve busy line managers who may not see it as relevant to pressing concerns;
- occasionally too little focus on the decision context;
- too much reliance on soft data; and
- the time and resources needed for research and analysis

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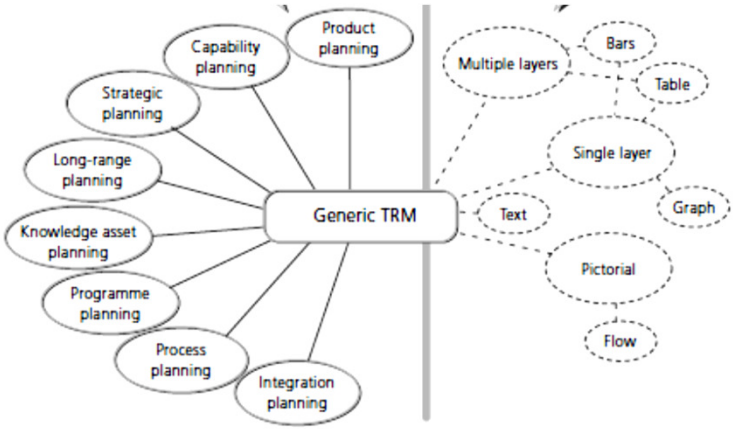
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Σενάρια

There are a number of questions that are considered in scenarios building:
What are the driving forces? What is uncertain? What is inevitable?

Around these questions, **a number of steps** can be defined:
(1) identify the focal issue or decision;
(2) identify the key forces and trends in the environment;
(3) rank the driving forces and trends by importance and uncertainty;
(4) select the scenario logics;
(5) flesh out the scenarios;
(6) assess the implications;
(7) for monitoring purposes, select the leading indicators and signposts.



The ways of producing scenarios vary immensely:

- the outputs of simulation models,
- the work of small expert teams,
- workshops
- the delineation of different views in wider samples of expertise.

ource: Phaal (2003)

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Σενάρια

Scenario workshops

Scenario workshops typically have ***periods of extensive exchange of ideas and debate about them***, and ***periods where ideas are being written down and listed***, where different lists are combined, and so on.

The process usually involves much **dialogue, and use of such instruments** as whiteboards and flip charts, though now mostly computer-based ("groupware") tools.

TIME: at least one day,
NUMBER OF PARTICIPANTS: several dozen participants (with "break-out groups" of 6-12 people exploring different scenarios in detail).

Inputs from at least one facilitator (with experience / training)

Outputs: published report

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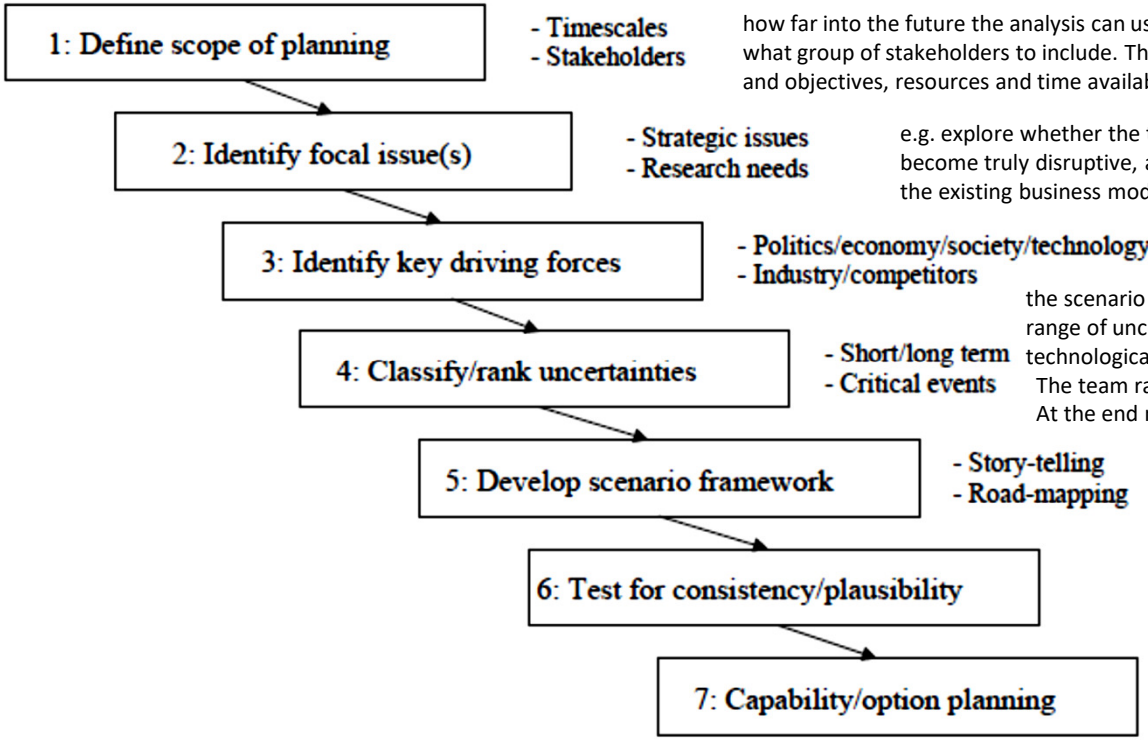
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Σενάρια



Stephen A.W. Drew, (2006)

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Σενάρια

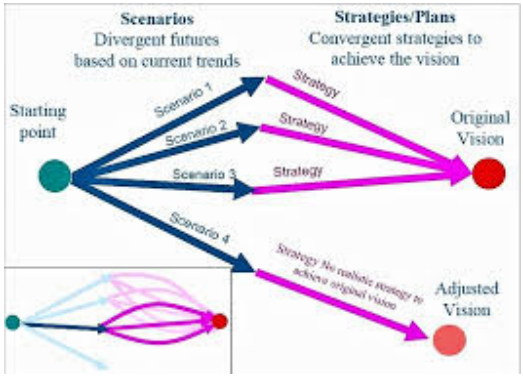
A scenario is a rich description of a possible future, built to explore how an innovation might develop, given particular assumptions. **A scenario framework offers a range of scenarios designed to help guide strategic decision making**

Typically a max of 3-4 scenarios is suggested
one may be a **base case extrapolation of existing trends.**

Broad themes are usually identified for each scenario, and the scenario written by a team as a story of events from the present day to an envisaged future situation. Supporting quantitative data, models, and forecasts might be developed for each scenario.

Initially, scenarios can be written as short stories of no more than 1-2 pages

The scenario stories can be elaborated into more road maps that describe how technologies, market, products, and processes unfold in each scenario



Stephen A.W. Drew, (2006)

1: Define scope of planning — - Timescales - Stakeholders

2: Identify focal issue(s) — - Strategic issues - Research needs

3: Identify key driving forces — - Politics/economy/society/technology - Industry/competitors

4: Classify/rank uncertainties — - Short/long term - Critical events

5: Develop scenario framework — - Story-telling - Road-mapping

6: Test for consistency/plausibility

7: Capability/option planning

The trends and events described in each scenario should be compatible with the chosen timescale.

Managers can use the scenarios to prepare capability and option plans that not only position their firm well for one set of assumptions, but that also give flexibility in the face of uncertain events.

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Σενάρια - Παράδειγμα

Exploring the future of space technology

OECD -organization's International Futures Program: A scenario planning investigation of the space sector and space applications

The aims of this project were to investigate:
(1) the potential contribution the space sector and space applications can make in addressing major economic, social and technological challenges of the future, and
(2) how OECD governments can help the space applications develop their potential, and play a fuller role in meeting challenges.

Key project objectives included:

- assessment of the long-term prospects of the space sector,
- identification of promising applications,
- implications for legal/regulatory/policy framework
- reform, and strengthening of international collaboration.

A time horizon of 30 years was chosen.

Key driving forces identified were
geo-political, socio-economic, and energy and the environment.

Methodology: identification and investigation of key trends, core assumptions, and major uncertainties.

Space 2004 **Space 2005**

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Σενάρια – Παράδειγμα (cont…)

Exploring the future of space technology

Three "synthesis" scenarios were developed: "Smooth sailing," "Back to the future," and "stormy weather".

These scenarios envisaged **different possible worlds** that could arise from combinations of ***geo-political, socio-economic, and energy and environment/technology trends.***

"Smooth sailing" corresponded to high levels of progress in technology, international cooperation, global prosperity, and a sufficiency of energy resources.

"Back to the future" envisaged moderate technological progress, geo-political confrontations between East and West, moderate growth, and tension over resources.

"Stormy weather" described low levels of technological progress, crises in international relations and economics, and tension over resources.

The implications of these scenarios were explored for: military, civil, and commercial space sectors, over the medium- and long-term.

Application categories identified were: information, transport, space production and related activities.
T
echnological opportunities were explored in IT, communications, nanotechnology, new materials, launch systems, and satellite systems.

Promising applications identified for space technologies were: distance education and telemedicine, e-commerce via satellite, entertainment via satellite, location-based consumer services, location-based traffic management, land use – precision farming, land use – urban planning, land use – exploration, disaster prevention and management, environment and meteorology, and monitoring the application of treaties.

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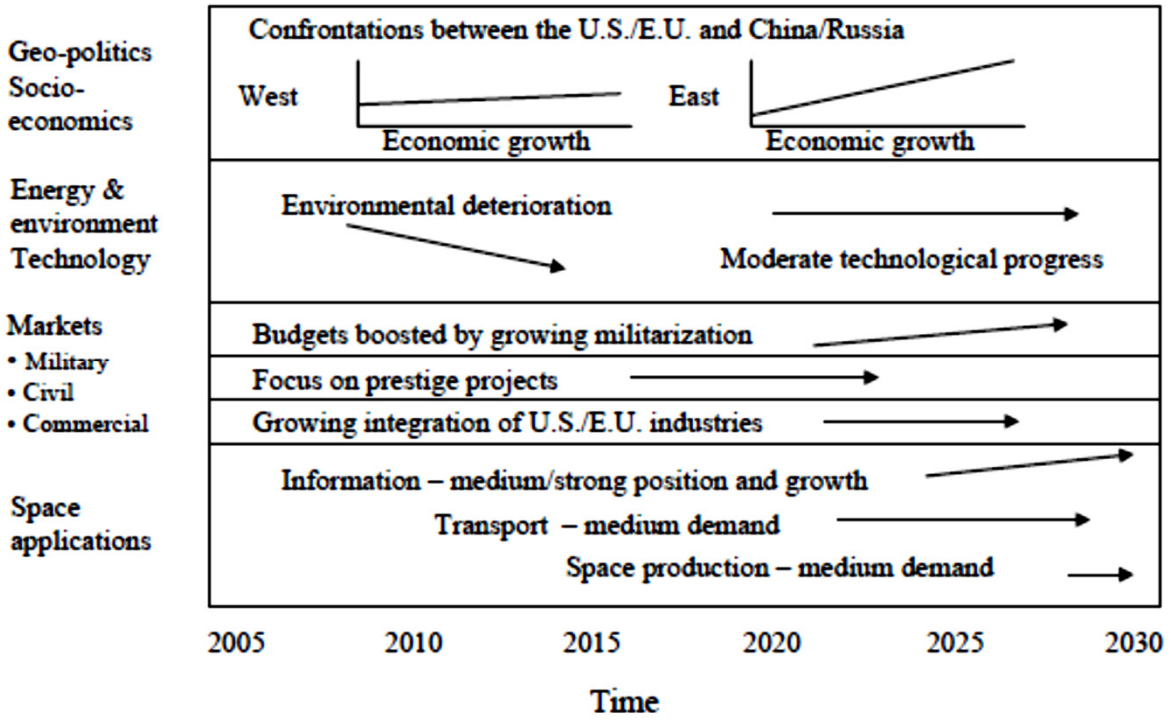
Σενάρια – Παράδειγμα (cont…)

Exploring the future of space technology

A high-level road map of the scenario "Back to the future"



For further information see: Space 2030 (OECD, 2004)..

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Σενάρια - Task of developing a success scenario

What would constitute "success"?

Indicators

- ❏ Key products and applications.
- ❏ Impact of products on end-user performance.
- ❏ Local and global end-user markets—size and company share.
- ❏ Industry structure—large firms, SMEs, spin-outs.
- ❏ Business model (e.g. high value added).
- ❏ Where are the company units in the supply chain?
- ❏ Effect on GDP/employment? And impact on inward investment?
- ❏ Our competitors, and how we compare.
- ❏ Where is the leading-edge research? Where does the company stand?
- ❏ Other features.

How much change by 2026?

What enables change?

- ❏ Quality of research.
- ❏ Ownership of research.
- ❏ Availability of skilled people.
- ❏ Sources of finance.
- ❏ Instrumentation, standards.
- ❏ Infrastructure and manufacturing capabilities (e.g. fabrication facilities).
- ❏ Structure and organization of industry and markets.
- ❏ Regulatory environment.
- ❏ Policies for health services and other public sector markets.
- ❏ Intellectual property regimes.
- ❏ Other issues (please add your own).

How do we know we are beating the competition?

- ❏ Relative performance with other companies.
- ❏ research recognized by global firms as leading edge.
- ❏ high value added patent portfolios.
- ❏ International collaborations.
- ❏ End users seeking/recognizing value of products (market share).
- ❏ Availability/size of facilities
- ❏ Number of graduates and post-graduates in relevant disciplines.
- ❏ Other issues (please add your own).

Technology Road-Mapping

A powerful integrated instrument for technology strategy formulation.

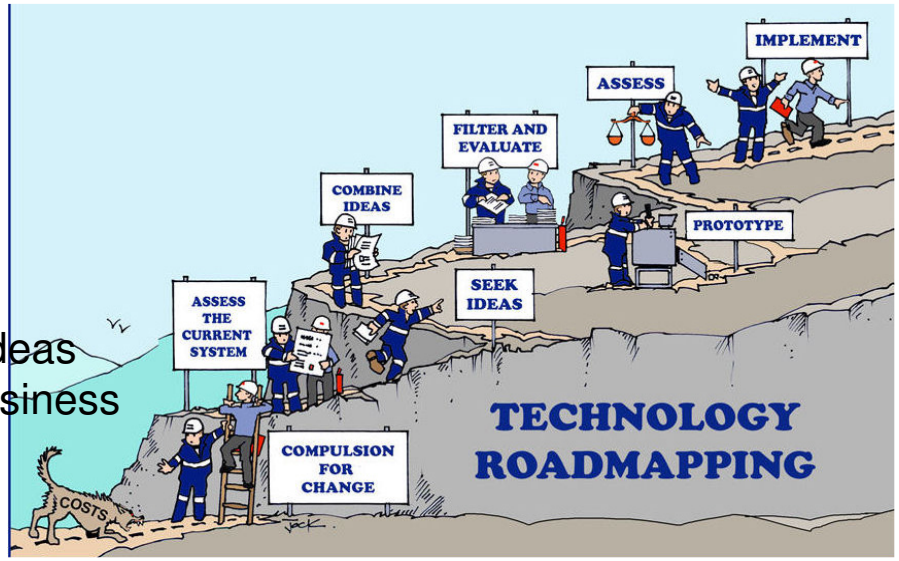
A technology roadmap will explore and communicate the **dynamic linkages between** technology resources, organisational objectives, and the changing environment.

Integrates:

- Technology forecasting,
- technology assessment and
- product planning

Helps us to

- identify new business opportunities,
- validate internal knowledge and communicate ideas
- assess the impact of certain technologies on business plans and systems
- improve our technology portfolio decisions, and
- develop effective technology strategy.



"The best companies maintain roadmaps that define the next technologies they will pursue and the requisite timing of each. These technology roadmaps are **matched to** their product roadmaps to ensure that the two are synchronized; at least two generations of technologies, products, and services are always tracked. The technology roadmaps not only identify technologies but define a **migration** from one to another, as well as within the company."

"Strategy Development by an Integrated Roadmapping Approach", Akio Kameoka

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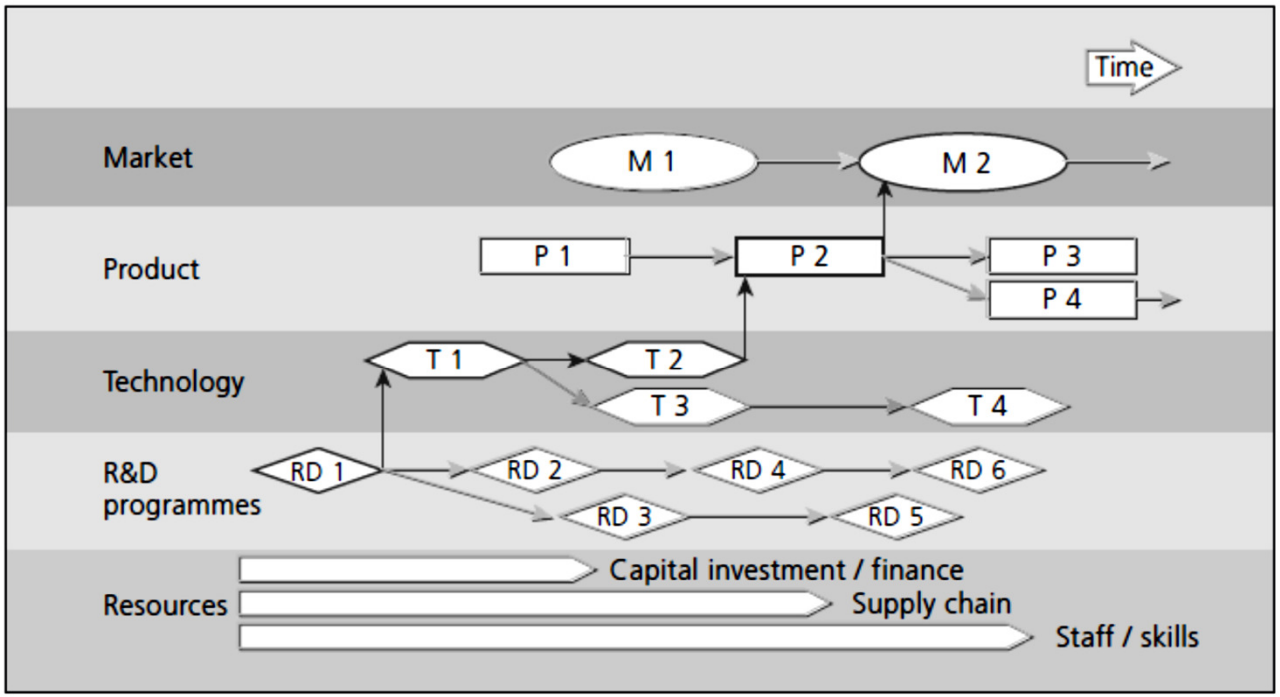
TECHNOLOGY ROADMAPPING

Η μέθοδος technology roadmapping (χαρτογράφησης της πορείας της τεχνολογίας) χρησιμοποιείται ευρέως στη βιομηχανία για την υποστήριξη της τεχνολογίας στρατηγικής και σχεδιασμού. Η προσέγγιση αναπτύχθηκε αρχικά από τη Motorola πριν από 25 χρόνια, για την υποστήριξη του σχεδιασμού ολοκληρωμένων προϊόντων τεχνολογίας. – **είναι πολύ ευέλικτη μέθοδος**
Οι χάρτες πορείας της τεχνολογίας μπορούν να λάβουν διάφορες μορφές,
Η πιο κοινή προσέγγιση = το γενικό έντυπο EIRMA (1997) δείχνει τον τρόπο με τον οποίο η τεχνολογία μπορεί να ευθυγραμμιστεί με τις εξελίξεις προϊόντων και υπηρεσιών, την επιχειρηματική στρατηγική και τις ευκαιρίες



Source: Phaal, (2003).

The generic roadmap is a time-based chart, comprising a number of layers that typically include both commercial and technological perspectives.

The roadmap enables the evolution of markets, products and technologies to be explored, together with the linkages between the various perspectives.

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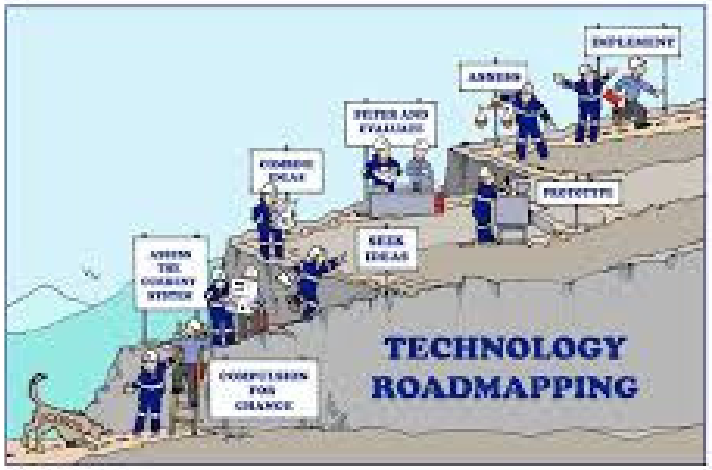
TECHNOLOGY ROADMAPPING

Technology Roadmapping: δημιουργική αναλυτική διαδικασία για την πρόβλεψη, ανάλυση και απεικόνιση της πιθανής μελλοντικής πορείας των προϊόντων, των υπηρεσιών και των τεχνολογιών

Three generations of technology roadmaps can be classified:

- first generation technology roadmaps: mainly a method of technology forecasting, operated by researchers or scientists and with little linkage into company's operational business.
- second generation technology roadmaps: used as a tool for corporate strategic technology planning with a strong focus on the integration of market, product and technology aspects.
- third generation of technology roadmaps: applied through all primary management functions from intelligence to implementation control



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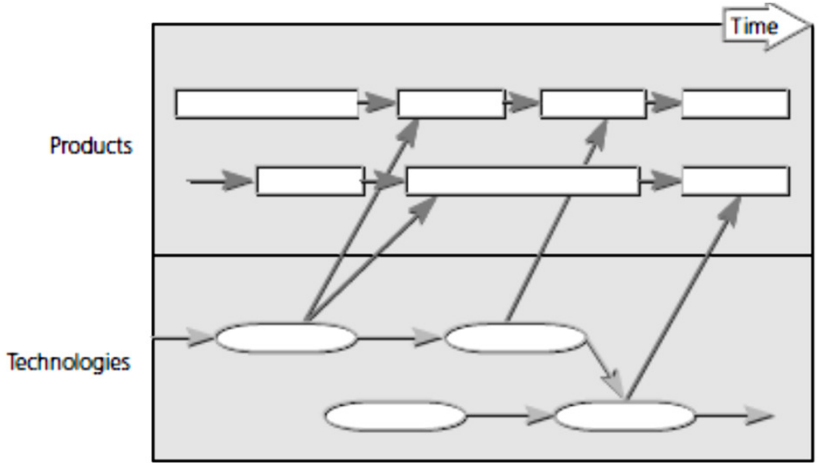
TECHNOLOGY ROADMAPPING

Product planning

Description: This is by far the most common type of technology roadmap, relating to the insertion of technology into manufactured products, often including more than one generation of product.

Example: A Philips roadmap, where the approach has been widely adopted (Groenveld,1997). The example shows how roadmaps are used to link planned technology and product developments



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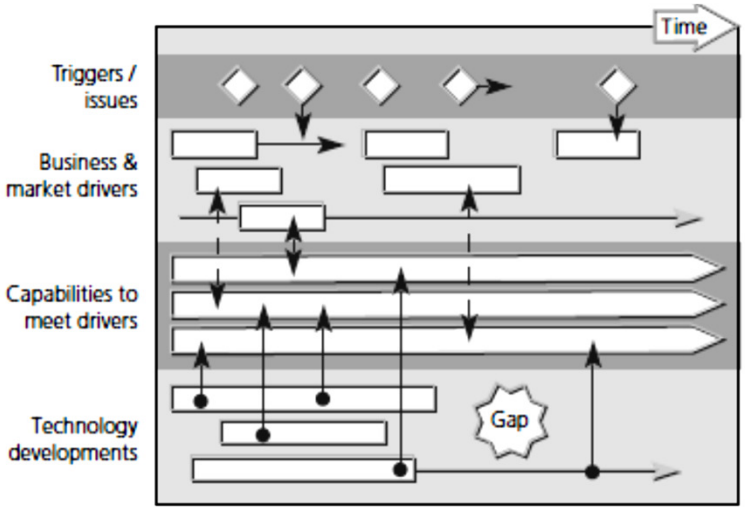
TECHNOLOGY ROADMAPPING

Service/capability planning

Description: Similar to type 1 (product planning), but more suited to service-based enterprises, focusing on how technology supports organizational capabilities.

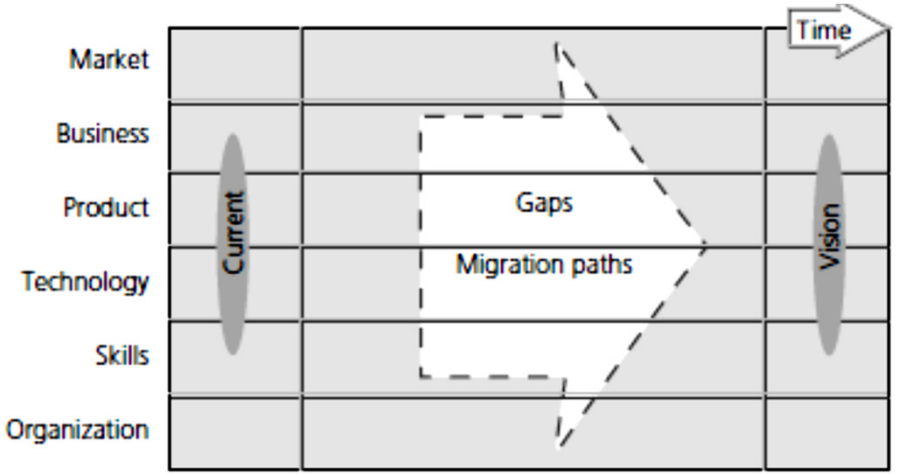
Example: A Post Office roadmap/T-Plan7 application (Brown, 2001), used to investigate the impact of technology developments on the business. This roadmap focuses on organizational capabilities as the bridge between technology and the business, rather than products.



Strategic planning

Description: Includes a strategic dimension, in terms of supporting the evaluation of different opportunities or threats, typically at the business level.

Example: A roadmap format developed using T-plan to support strategic business planning. The roadmap focuses on the development of a vision of the future business, in terms of markets, business, products, technologies, skills, culture, etc. Gaps are identified, by comparing the future vision with the current position, and strategic options explored to bridge the gaps.



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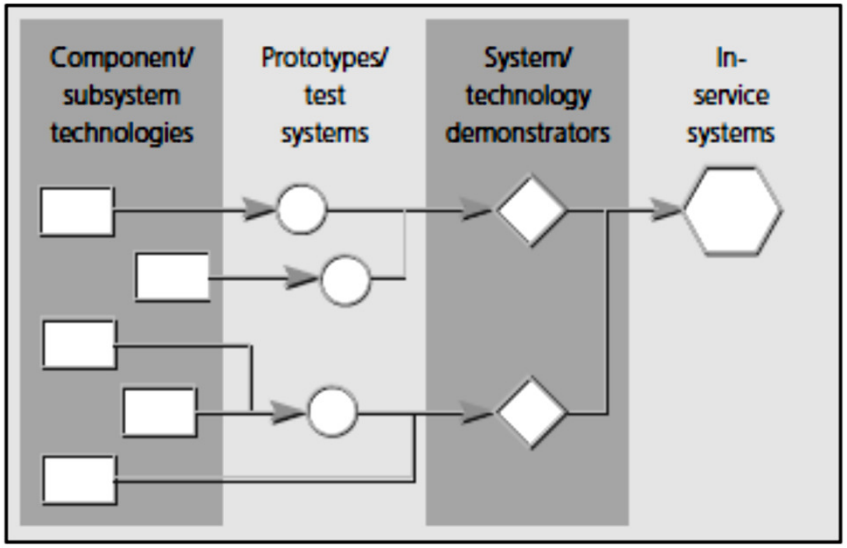
TECHNOLOGY ROADMAPPING

Integration planning

Description: Integration and/or evolution of technology, in terms of how different technologies combine within products and systems, or to form new technologies (often without showing the time dimension explicitly).

Example: A NASA roadmap (Origins programme—see No. 6), relating to the management of the development programme for the NGST, focusing on "technology flow", showing how technology feeds into test and demonstration systems, to support scientific missions (NASA, 1997), Origins technology roadmap, http://origins.jpl.nasa.gov/library/techroadmap/roadmapidx.htm



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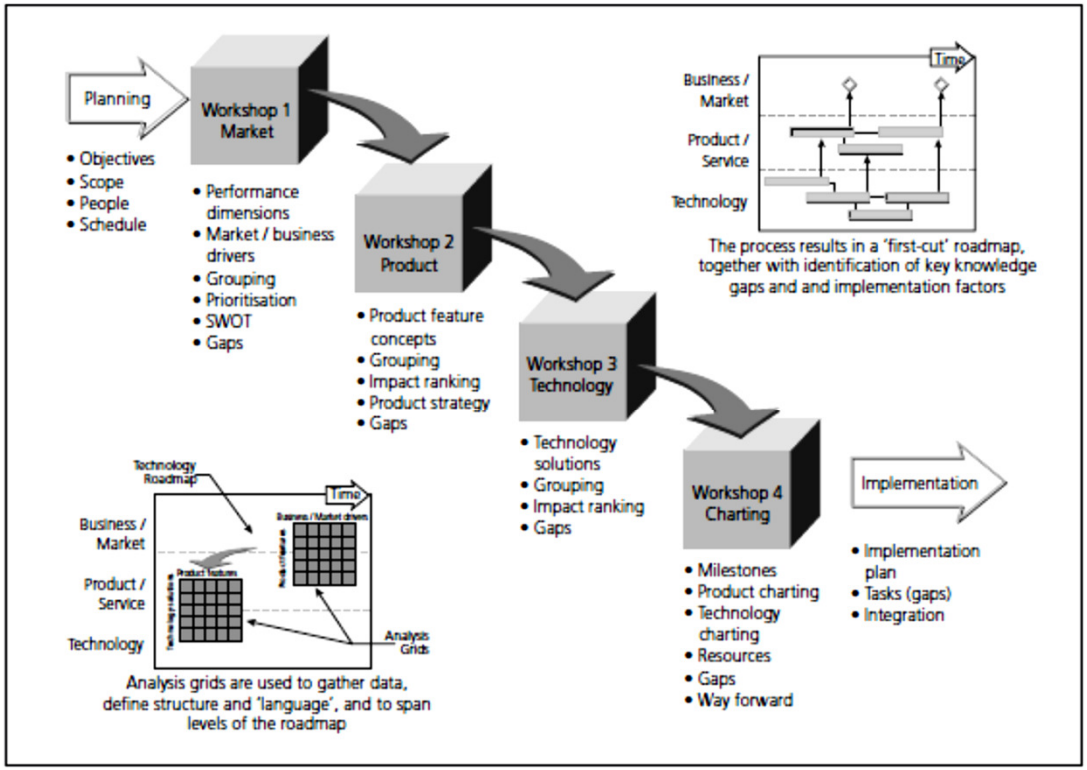
TECHNOLOGY ROADMAPPING process

Standard process (integrated product-technology planning)

The standard T-plan process comprises four facilitated workshops—the first three focusing on the three key layers of the roadmap (market/business, product/service, and technology), with the final workshop bringing the layers together on a time-basis to construct the chart



Source: Phaal, (2003).

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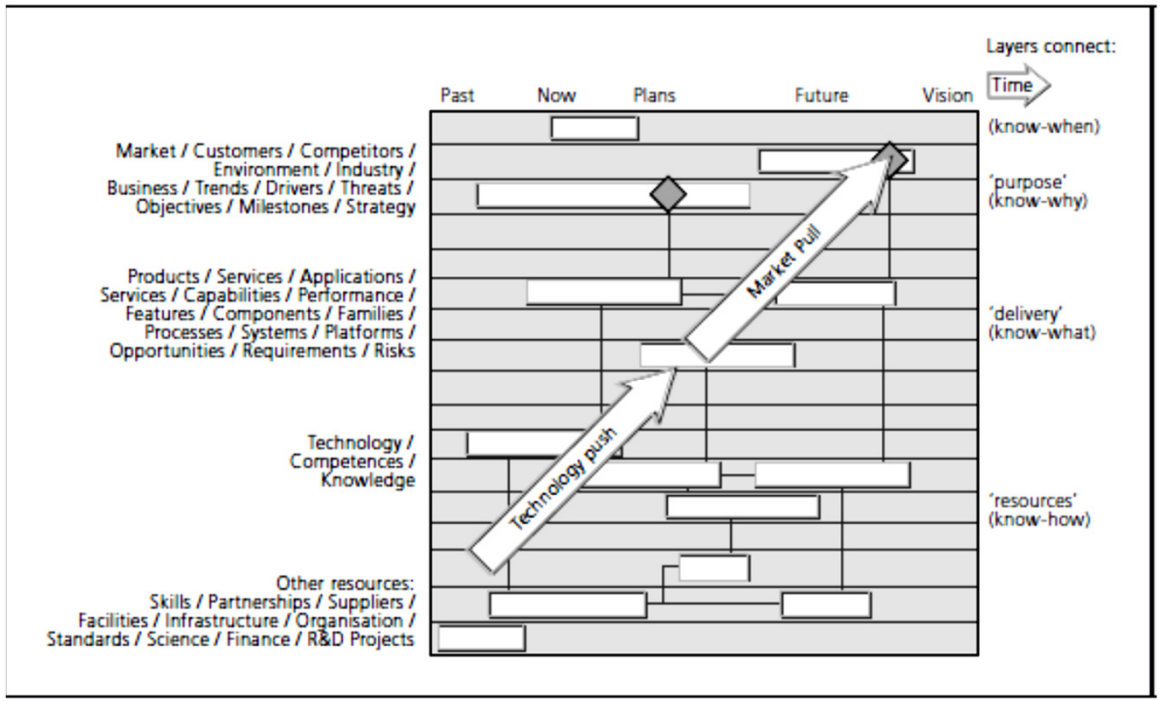
TECHNOLOGY ROADMAPPING

Generalized technology roadmap architecture



Source: Phaal, (2003).

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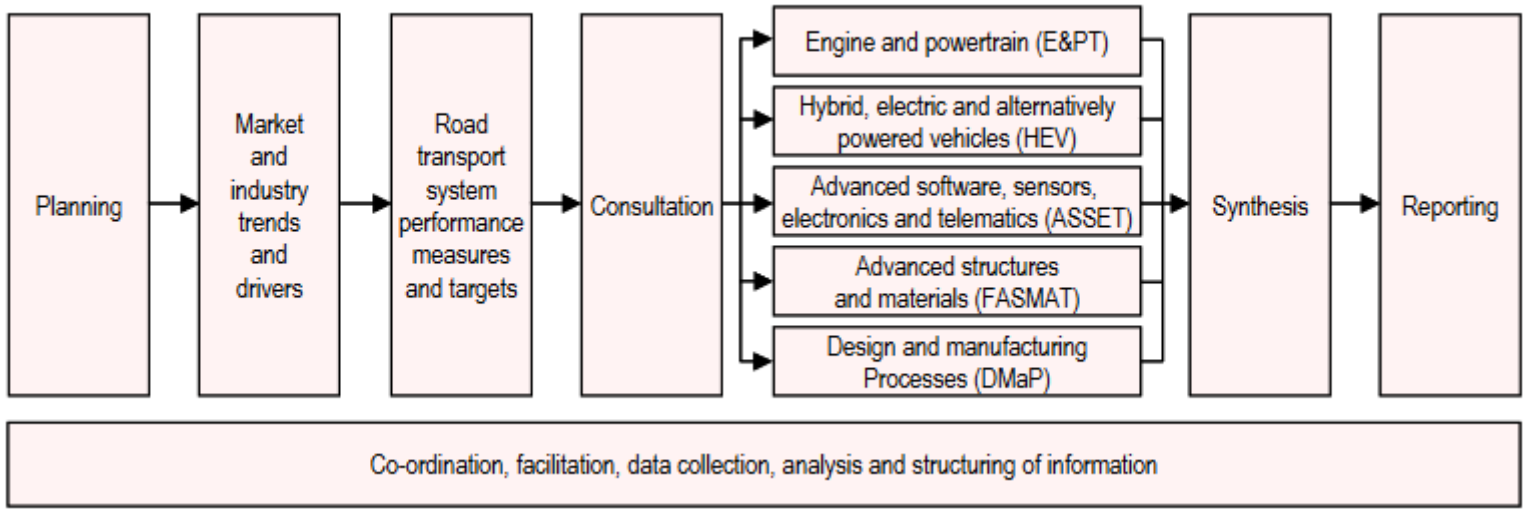
Case example—Foresight Vehicle technology roadmap

http://www.foresightvehicle.org.uk/

The foresight Vehicle consortium has been active since 1997, involving more than 400 organizations and sponsoring collaborative research worth more than £80 million.

The goal is to stimulate applied research that will contribute to the economic, social and environmental goals of industry and government in the UK, focused on the automotive sector (and road vehicles in particular).

The process



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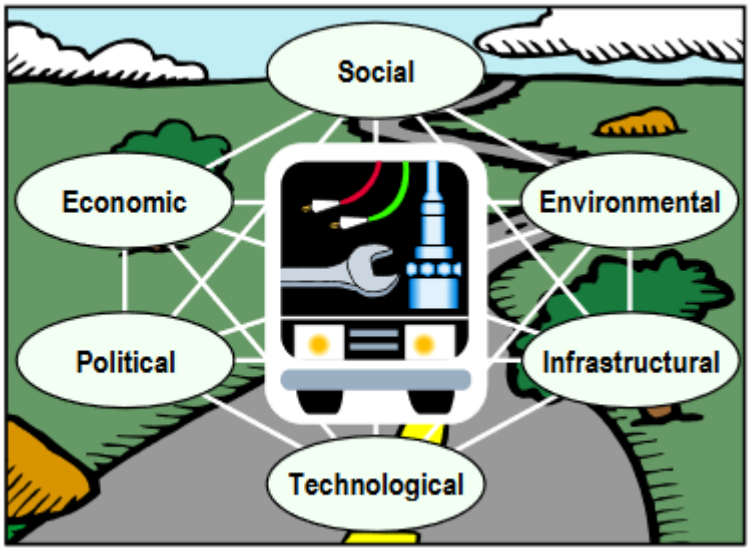
Case example—Foresight Vehicle technology roadmap

Trends and drivers that influence road transport system



Society, economy and the environment

Social, economic and environmental drivers reflect the three cornerstones of sustainable development.

The overall goal must be to meet social aspirations while ensuring that the environmental burden of production and consumption is managed. Economic goals are crucial, as wealth enables social and environmental goals to be achieved.

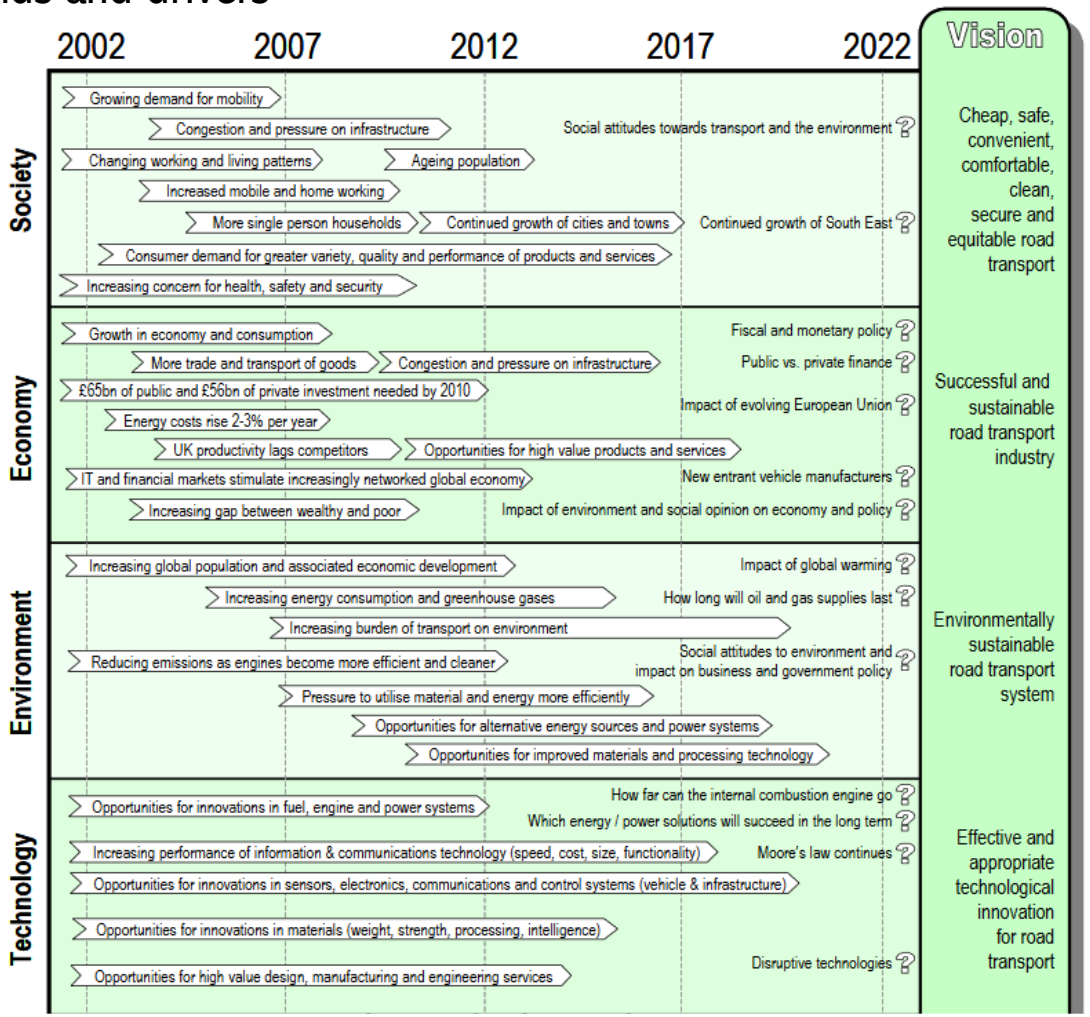
Technology, policy and infrastructure

Technology, policy and infrastructure are different from the above three themes, in that activities here can either enable or constrain progress towards the primary social, economic and environmental goals

Τεχνολογική Προοπτική Διερεύνηση (Technology Foresight) Η διαδικασία - TECHNOLOGY FORESIGHT METHODS

Case example—Foresight Vehicle technology roadmap

Industry and market trends and drivers

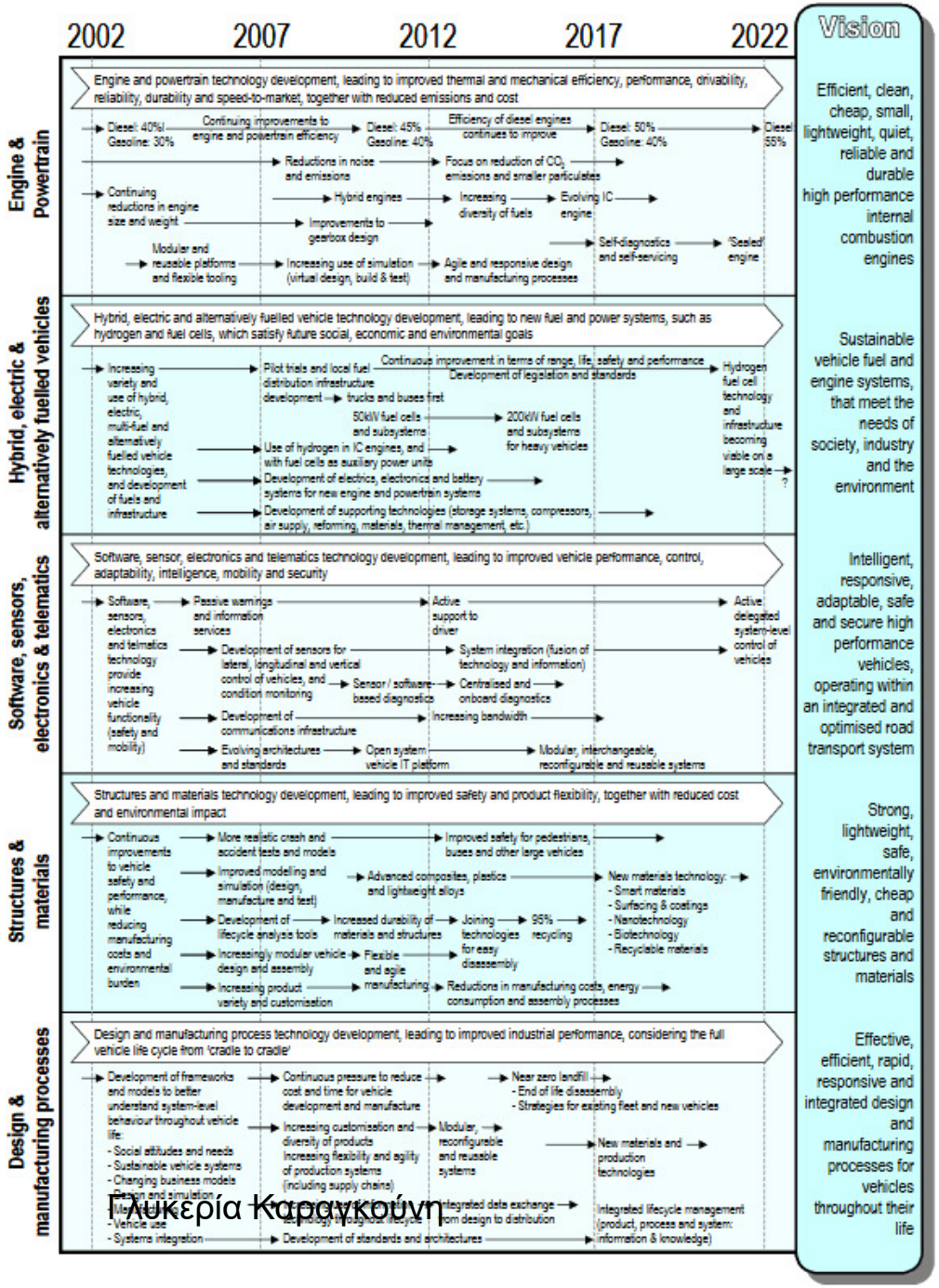


Τεχνολογική Προοπτική Διερεύνηση (Technology Foresight)

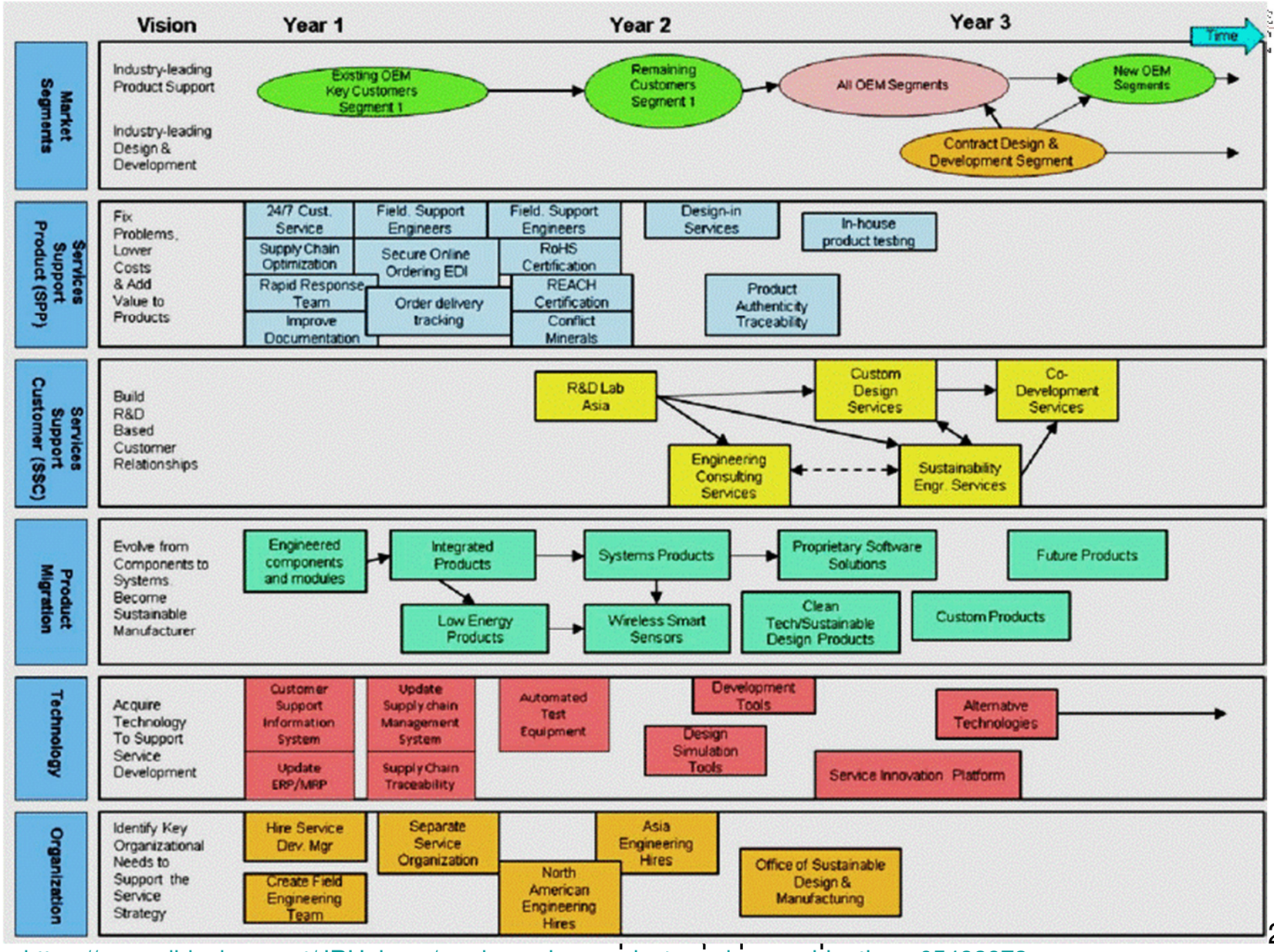
Η διαδικασία - TECHNOLOGY FORESIGHT METHODS

Case example—
Foresight Vehicle technology roadmap

Technology evolution



Technology Road-Mapping



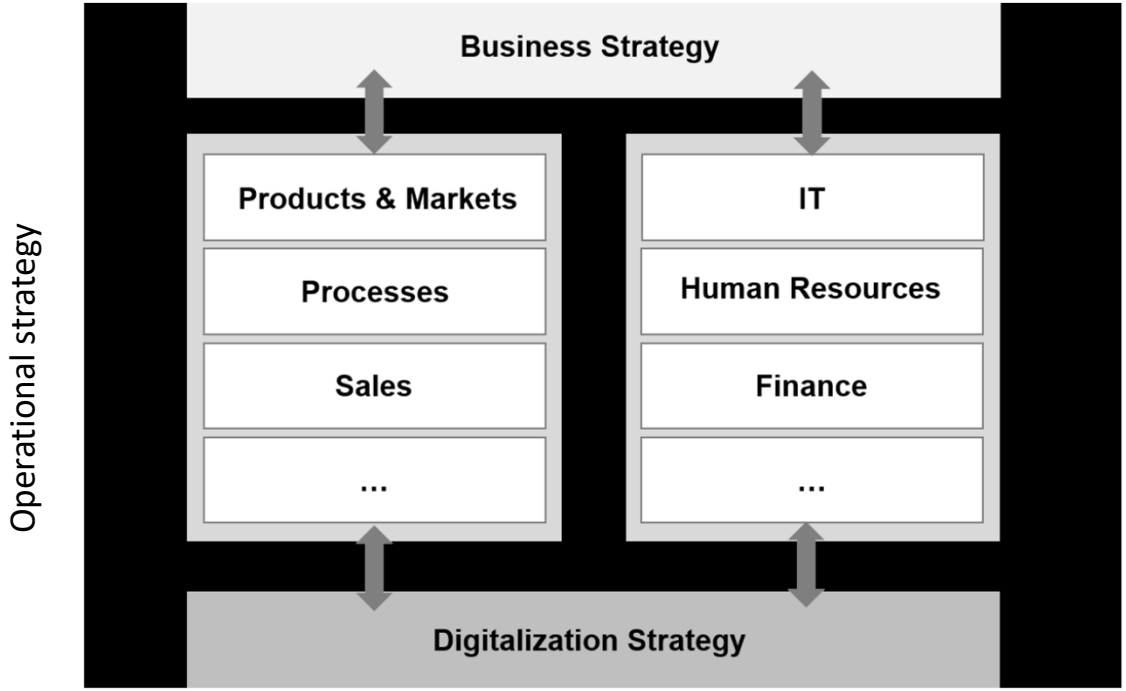
https://www.slideshare.net/JRHelmus/roadmapping-product-service-combinations-65482973

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy or Digital transformation strategy

"Digitalization strategy constitutes a holistic intention of a company to streamline all activities regarding the digital transformation process to generate competitive advantages through new technologies and methods to optimize products, processes and business models. In fact, digitalization influences the overall strategy of the company and goes far beyond the mere technology trend"

(Pfenning & Eigner, 2020)



(based on Matt et al., 2015)

A digitalization strategy sets digital objectives for a defined planning period and formulates measures for medium to long-term implementation (Bitkom Research and Tata Consultancy Services, 2018).

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy or Digital transformation strategy

A digitalization strategy sets digital objectives for a defined planning period and formulates measures for medium to long-term implementation (Bitkom Research and Tata Consultancy Services, 2018).

Customer experiences • Customer journey • Touchpoint analysis • Digital Communication • Integration • Digitized marketing	**Product and Service Innovation** • Digitization of existing products and service • New digital products and Services • Digitization of value networks
Corporate 4.0 • Automation, IoT, Blockchain • Network economics, ecosystems and platform • Collaboration agility and flexibility (structure and process)	**Employees Culture Leadership** • Digitized work system • New profiles and skills • Agile and Adaptive Organization • Attitude and beliefs • Digital guidance

Field of actions in the context of digitalization (based on Kreutzer and Land, 2015)

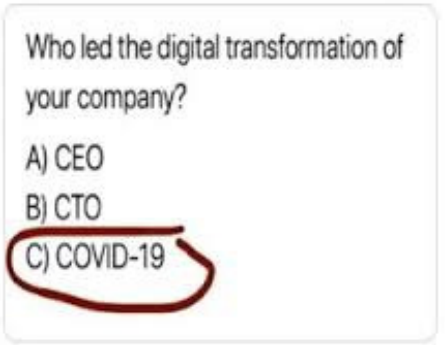
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy or Digital transformation strategy

Therefore,
DS is the foundation and shows a company the business models that could spell success in the future.

Coming from a business-centric perspective, DSs focus on the transformation of products, processes, and organizational aspects owing to new technologies.
Their scope is more broadly designed and explicitly includes digital activities at the interface with or fully on the side of customers, such as digital technologies as part of end-user products. This constitutes a clear difference to process automation and optimization, since digital transformation strategies go beyond the process paradigm, and include changes to and implications for products, services, and business models as a whole.
it is critical to obtain a close fit between digital transformation strategies, IT strategies, and all other organizational and functional strategies.

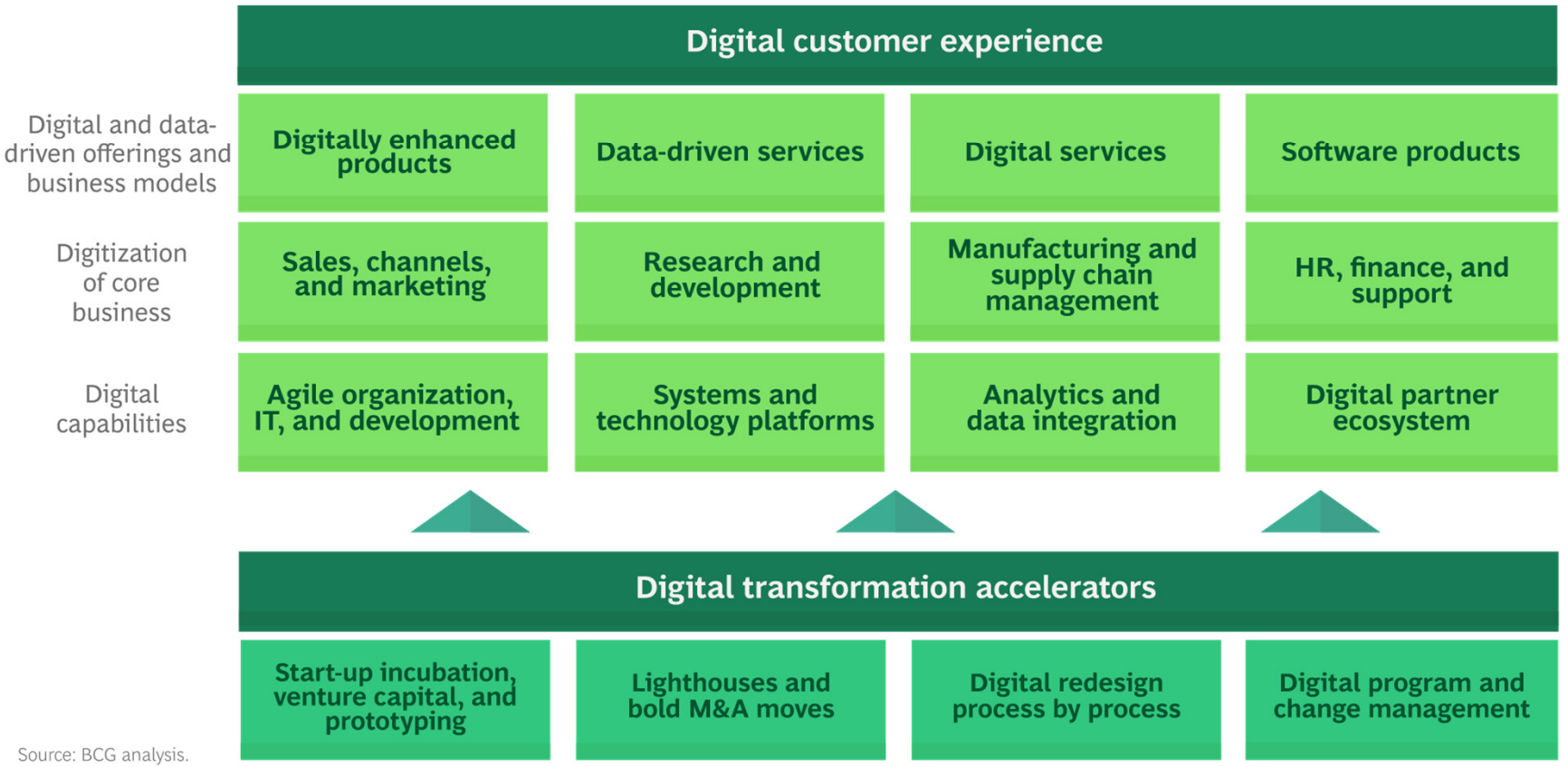
Every company needs its own digitalization strategy to advance its digital transformation.



ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy or Digital transformation strategy

The Strategic Building Blocks of Digital Transformation



Source: BCG analysis.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy or Digital transformation strategy

The 4 Dimensions of DS

- use of technologies,
- changes in value creation, structural changes,
- financial aspects.

Digitalisation strategy

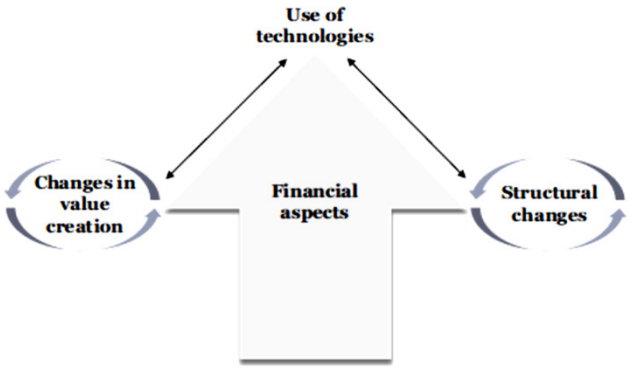
The 4 Dimensions of DS

The use of technologies: addresses a company's attitude towards new technologies as well as its ability to exploit these technologies. It therefore contains *the strategic role of IT* for a company and its future technological ambition.
Decisions to be made: become a market leader in terms of technology usage with the ability to create own technological standards, or resort to already established standards and see technologies as means to fulfill business operations.

Changes in value creation due to digital transformation strategies, i.e. how far the new digital activities deviate from the classical – often still analog – core business.

Structural changes are often needed to provide an adequate basis for the new operations: i.e. variations in a firm's organizational setup, especially concerning the placement of the new digital activities within the corporate structures.

Financial aspects: are both a driver and a bounding force for the transformation.



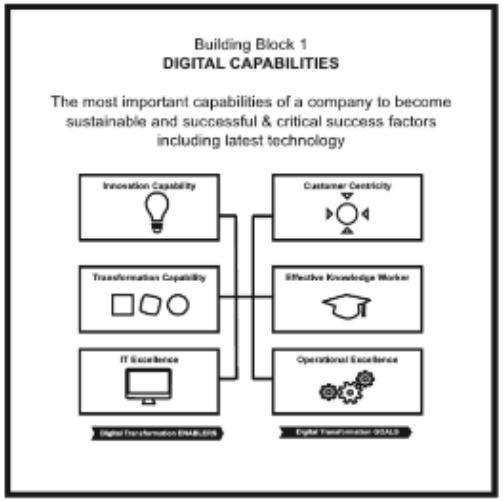
C. Matt et al.(2015)

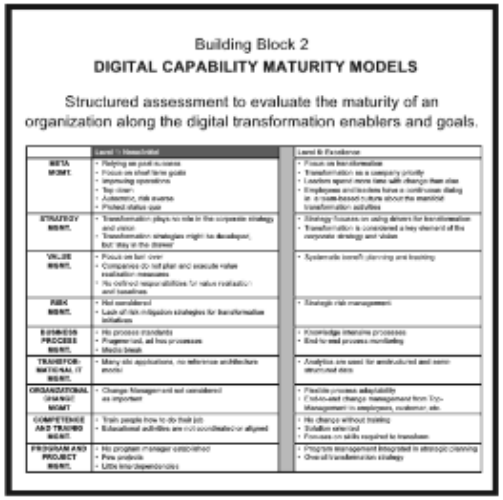
Digitalisation strategy

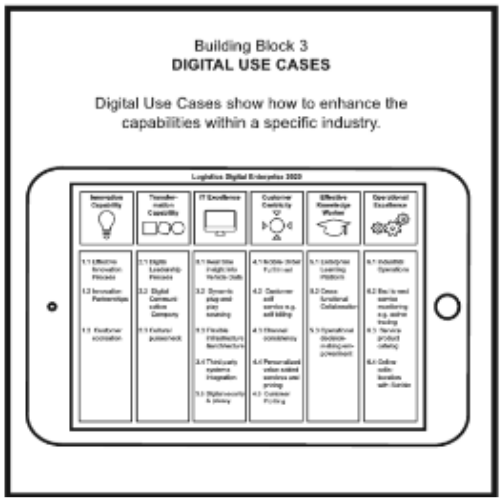
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

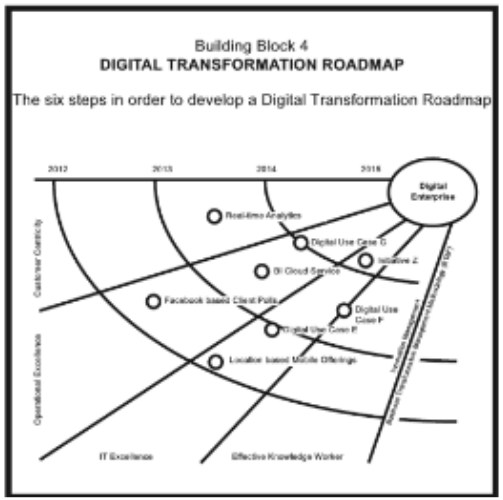
4 existing approaches for the development of an individualized digitalization:

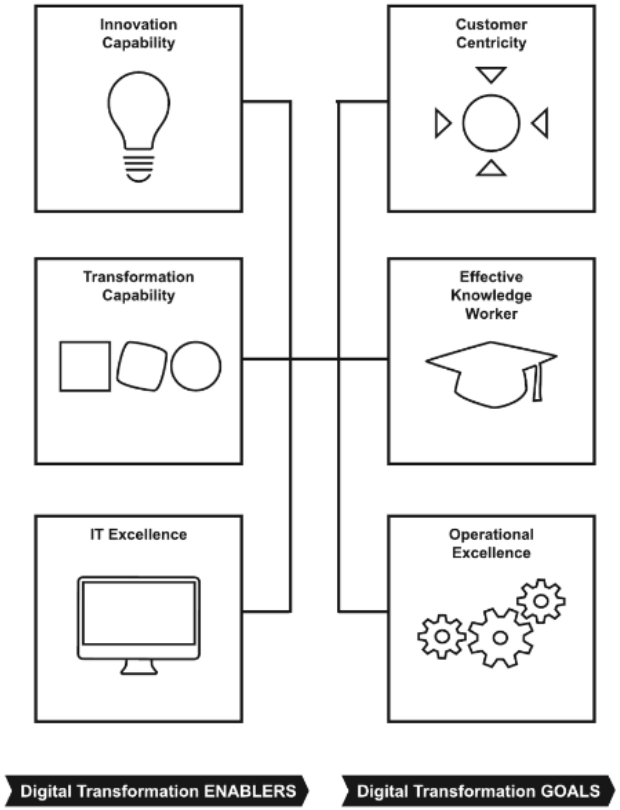
1- **The Digital Capability Framework** consists of four building blocks: Digital capabilities, digital capability maturity, digital use cases and digital transformation roadmap (Uhl et al., 2016).











Digitalisation strategy

4 existing approaches for the development of an individualized digitalization:

2- The Roadmap approach, a five-phase procedure model, focuses on the digital transformation of business models (Schallmo and Rusnjak, 2017). It analyzes the current status of the business model, identifies and details possible future opportunities with new products and services and the deployment of the intended ideas.

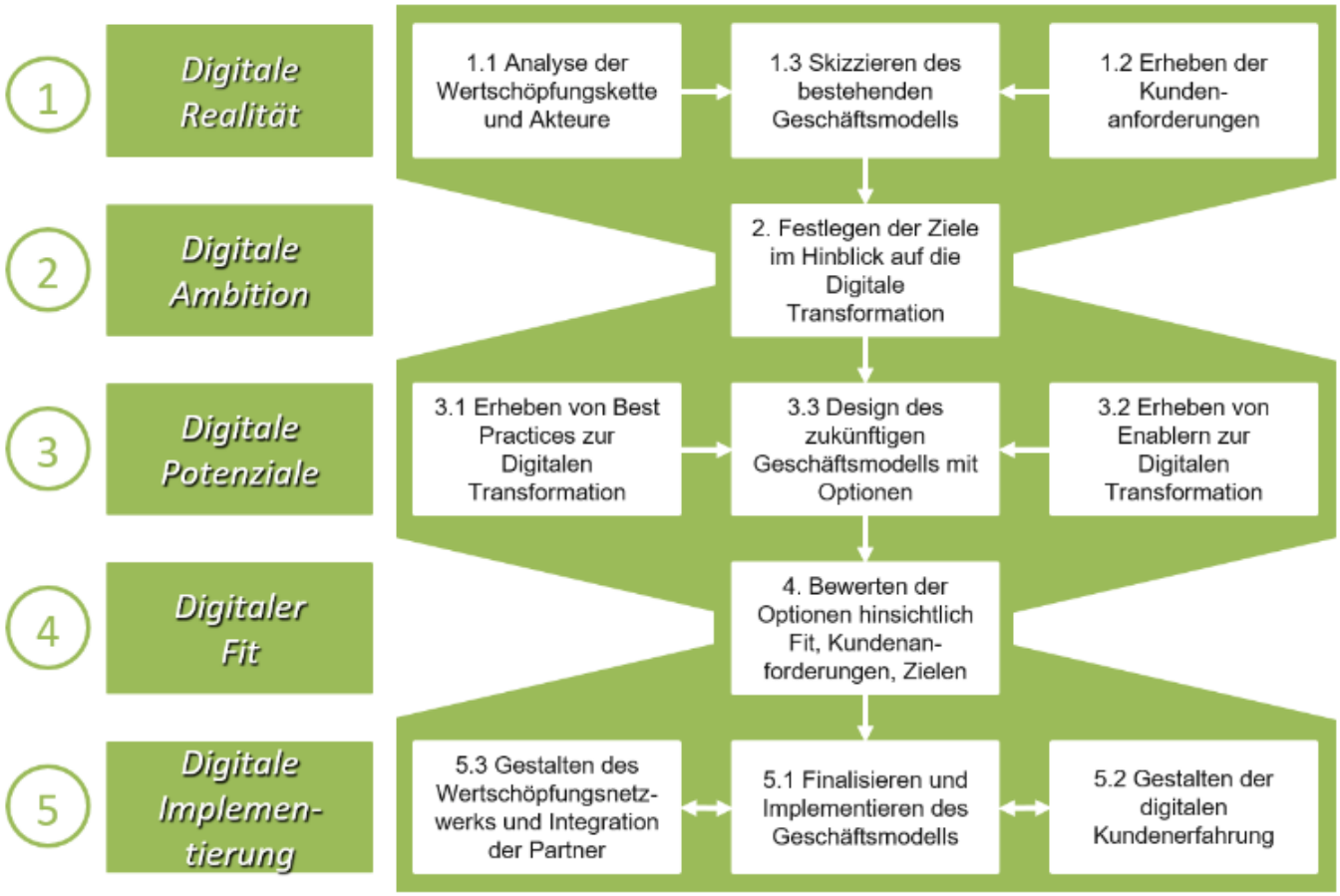


Abbildung 2: Roadmap Digitale Transformation.[5]

Digitalisation strategy

4 existing approaches for the development of an individualized digitalization:

3- The Industry 4.0 business model focuses on the definition of new business models via maturity models, business model patterns, design thinking techniques and economic evaluation methods (Kaufmann, 2015).

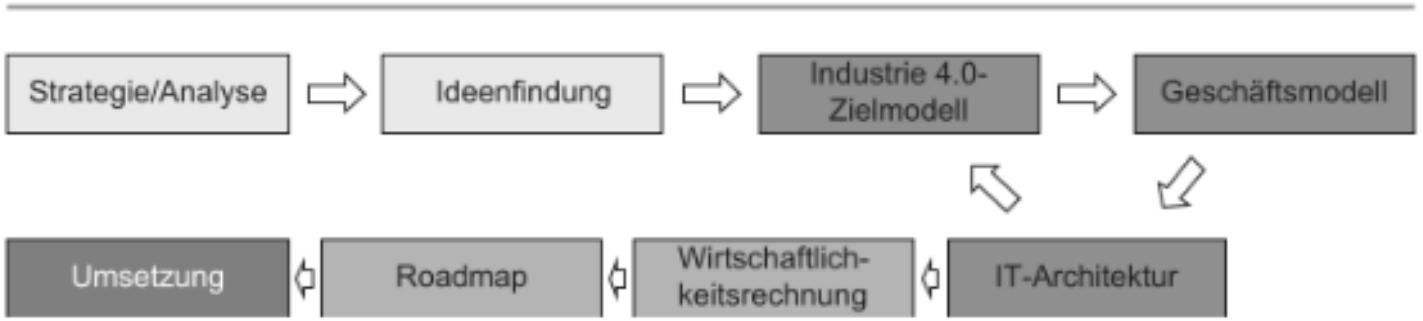


Abb. 3.1 Industrie 4.0-Vorgehensmodell

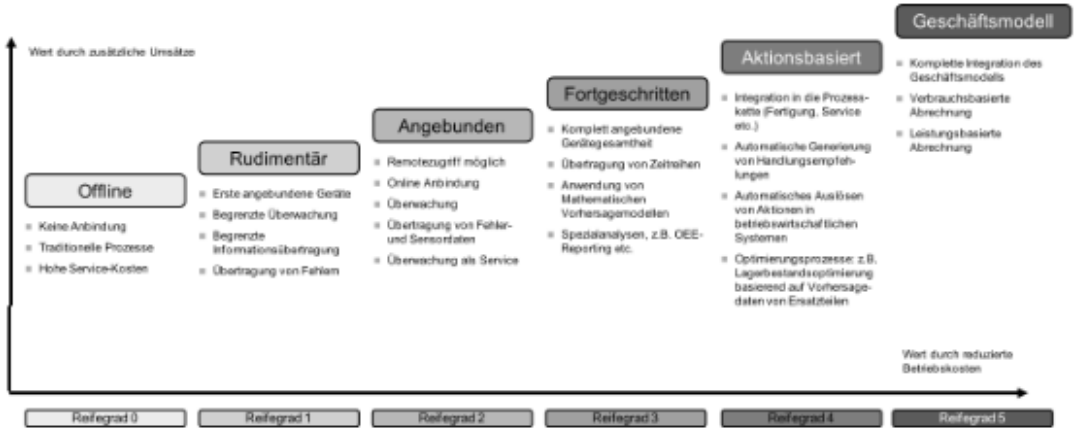
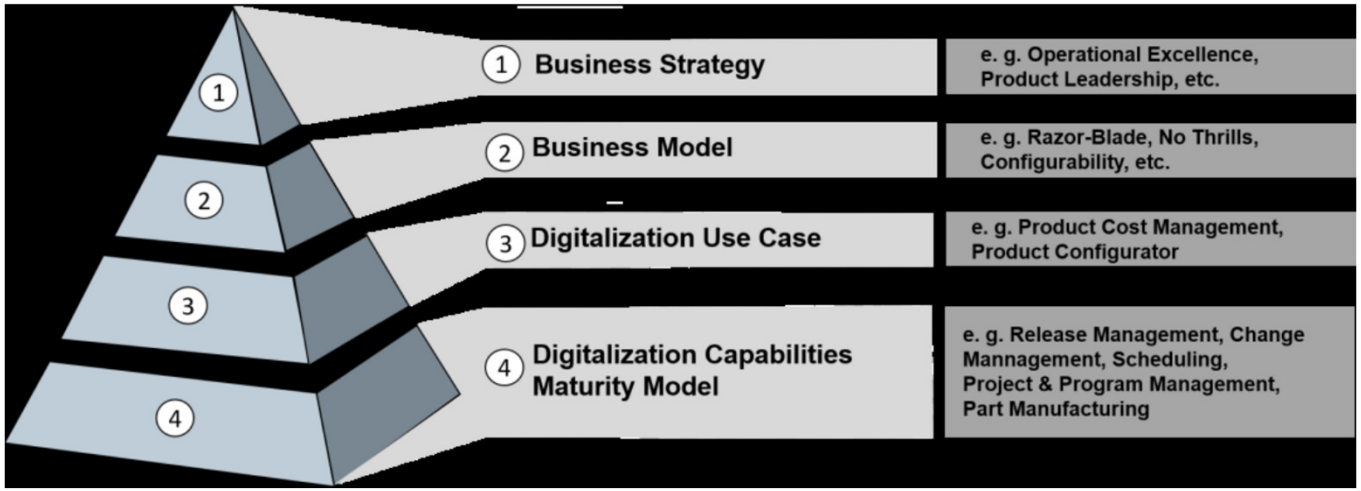


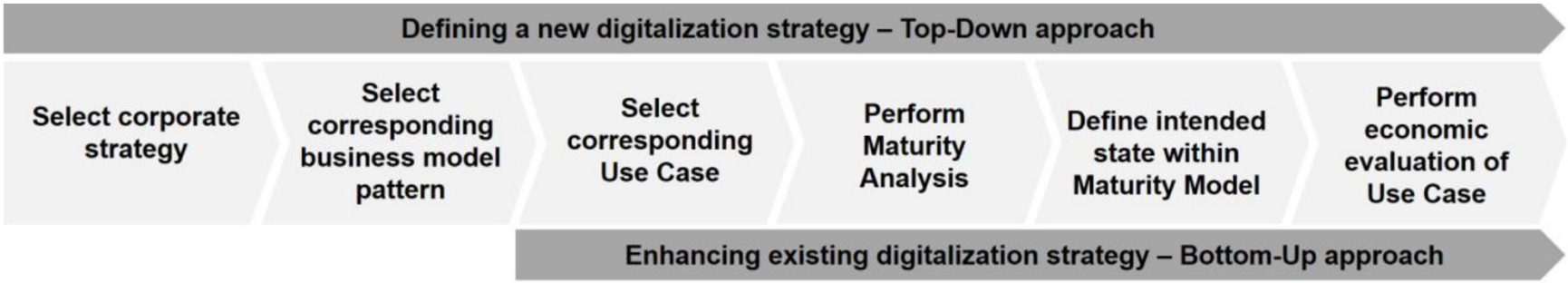
Abb. 3.2 Reifegradmodell Industrie 4.0 (abgewandelt nach Axeda)

Digitalisation strategy

4 existing approaches for the development of an individualized digitalization:

4- **The Totally Integrated Potential Analysis Framework (TIPAF)** provides guidance throughout the definition process (Pfenning & Eigner, 2020)





TIPAF - Procedure Model Process

Digitalisation strategy……

Enabled by one open source digital platform

The Philips HealthSuite Digital Platform

Philips' digital platform for personalized healthcare information

https://www.youtube.com/watch?v=tb2YkBvjUt4

LEGO is developing an engagement platform to supplement its enterprise systems with the ability to interact with customers and innovate rapidly.5

…. and old companies

GE's "industrial internet"

Digitalisation strategy……

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

…. and old companies

"born digital" pioneers (Amazon, Facebook and Google) have grown into powerful behemoths, while companies that had long dominated their industries found their traditional value propositions under threat.

A business strategy, inspired by the capabilities of powerful, readily accessible technologies (like SMACIT), intent on delivering unique, integrated business capabilities in ways that are responsive to constantly changing market conditions. A digital strategy guides leaders' efforts to create new value propositions by combining their companies' existing capabilities with capabilities enabled by SMACIT and other digital technologies. *(Sebastian ET AL., 2017)*

Customer Engagement Strategy

Digitized Solutions Strategy

Digitalisation strategy……

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

…. and old companies

A company pursuing a **customer engagement digital strategy**

- seeks to build customer loyalty and trust **by providing superior, innovative, personalized and integrated customer experiences.**
- typically aims to create a seamless, omnichannel experience that makes it easy for customers to order, inquire, pay and receive support in a consistent way from any channel at any time.
- relies on analytics applied to a growing repository of customer data, to better understand and anticipate varying customer demands.
- facilitates ongoing communications between a company and its customers and, where appropriate, with a larger community

LEGO pursuing a customer engagement strategy achieved greater customer satisfaction and loyalty.

A digitized solutions strategy

- aims to reformulate a company's value proposition by integrating a combination of products, services and data.
- is driven by R&D efforts that seek to anticipate—rather than respond to— customer needs. Just as Steve Jobs trusted his
- instincts (rather than customer input) to guide product innovation at Apple, a company pursuing a digitized solutions strategy tries to imagine what it could do for customers by combining existing competencies with the capabilities offered by
- digital technologies.
- involves collecting and using additional data—often gathered through sensors.

Schneider Electric that were pursuing a digitized solutions strategy gained new sources of revenue

Digitalisation strategy……

…. and old companies

Two Technology-enabled Assets are Essential to Executing a Digital Strategy

a strong and scalable operational backbone -**a digitized process platform**: *the technology and business capabilities that ensure the efficiency, scalability, reliability, quality and predictability of core operations*. Each company's operational backbone is focused on its own unique strategic requirements, but the most common elements include:

- A "single source of truth" for critical data (e.g., customer, order and product data)
- Seamless and transparent transaction processing
- Standardized back office shared services

Indicative operational backbones: ERP , customer relationship management (CRM)

LEGO's Operational Backbone. In 2004, LEGO (renowned for construction kits using the iconic LEGO brick) could not reliably and cost-effectively deliver its products to retailers. Its supply chain problems were so severe at the time that LEGO was facing bankruptcy. Jørgen Vig Knudstorp, LEGO's CEO, recognized that fixing the supply chain was essential to business success:

"One of the things that dawned on me when I arrived at the LEGO Group was that basically you have an allocation problem. You are producing 100,000 components every minute, 24 hours a day, 365 days a year. And you have to allocate them in optimal quantities at different sites, so that you can deliver a set of finished products at Walmart in Arkansas on Tuesday at 5:00 p.m. (and not 5:00 a.m.) in optimal order quantity, optimal transportation quantity, optimal manufacturing batches and so on."

LEGO addressed its crisis by leveraging an under-used ERP system to get its supply chain processes under control. That effort was sufficient to turn the company around, but leadership recognized that other processes were still creating costly inefficiencies. To address these problems, LEGO followed its supply chain management initiative with programs that standardized processes related to HR management, manufacturing and product lifecycle management. By 2012, these efforts had provided efficient, reliable core processes and transparent master data, and had improved customer satisfaction.

With the operational backbone in place, management could now focus on defining and pursuing a digital strategy—one that focused on developing the builders of tomorrow.

(Sebastian et al., 2017)

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy……

…. and old companies

Two Technology-enabled Assets are Essential to Executing a Digital Strategy

A digital services platform: *the technology and business capabilities that facilitate rapid development and implementation of digital innovations*. The architecture of a digital services platform must facilitate experimentation and provide reusable technology and digital services. Common characteristics of digital services platforms include:

- Digital components that enable a variety of technical and business services (e.g., biometric authentication, customer alerts)
- Platform as a service —a cloud-based hosting environment for storing and accessing loosely connected services
- Repositories for massive amounts of data, whether from public sources (e.g., from social media), purchased or derived from sensors
- Analytics engines for converting data into meaningful insights
- Connections to data and processes that reside in the company's operational backbone

LEGO's Digital Services Platform.

LEGO is building an "engagement platform" that supports experimentation and rapid introduction (and, as necessary, elimination) of functionality. The engagement platform will allow the company to continuously adapt its digital interface according to the preferences of individual customers, thus providing a personalized digital experience. For LEGO toys with digital capabilities, the platform will facilitate rapid software updates, so that even older kits will provide new experiences. Finally, the platform will provide an environment for working with digital partners on joint product development and for giving approved partners access to LEGO functionality.

(Sebastian et al., 2017)

Attention 2!!!

	TECHNOLOGY STRATEGY	DIGITAL STRATEGY
GOAL	**We have the right technology for our business to succeed**	**Our business will succeed in a digital world**
SCOPE	• Technology performance/ gaps • Technology solutions, options and architecture • Compliance & risk • Technology policy & governance	• Business performance/ gaps • Business transformation (people, process, technology) • Digital capability requirements
OUTPUT	**Strategic roadmap for technology enhancement:** Hardware, software, systems, integrations, enterprise architecture, security, storage, processes, IT, privacy, risk & business continuity governance & management	**Strategic roadmap for a digital business:** Sales & customer experience design & optimisation, product & service innovation, channel & marketing strategies, data architecture & analytics, digital literacy enhancement, technology capability delivery

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digitalisation strategy

Digital complementary assets as general purpose assets

***Digital private good*:** is a DCA that provides a commercial, digital service as a solution to Corporations, typically centered on the value proposition.
There are very limited network effects between the customers of a digitalprivate good, i.e. the quality of the service provided does not correlate with the number of users of this service. The actual service consumption might require substantial user training as the service will often be a complex solution.

Examples for digital private goods are Salesforce (CRM as a service), SAP's Business by Design (ERP as a service) and Amazon Web Services (aws.com) (infrastructure as a service).

***Digital public goods**:* are easily accessible, in most cases do not even charge for their use, the service consumption is intuitive and does not require any training and the more users the digital public good has, the higher will be the benefits to the user community.

The primary aim of a digital public good is to provide services to the public as opposed to providers of digital private goods targeting corporations.

Some digital public goods were able to attract a very high number of users, in some instances exceeding 100 million (e.g., Facebook, Twitter, LinkedIn), and are also an attractive platform for corporations

Digitalisation strategy

Digital complementary assets

Table 1: Popular DPGs and their services	
DPG	***...as a Service***
Google, Yahoo, Bing	Search
Photobucket, Flickr, Picassa	Picture
YouTube, Hulu, Vevo	Video
Groupon, LivingSocial	Coupon
Facebook, MySpace, Orkut	Social Network
LinkedIn, Google+	Professional Network
Wikipedia, Hudong.com	Dictionary
ITunes/Ping, Spotify, Simfy	Music

Digitalisation strategy
Types of Digital complementary assets

Non-Rivalry
DPG provides a service that is *non-rival*, i.e. consumers of the service do not compete with each other as the available resources are practically unlimited. For example, a consumer can download a digital picture from a DPG such as Flickr without any impact on any other user.

In some cases, a DPG is derived from the digitalization of private goods. A famous example is the Google Book Search initiative (books.google.com) and the attempt to provide unlimited access to previously constrained (rival) books.

Versatility
the users' attitude towards DPG use, their behavioral intention to use DPGs, and ultimately their consumption of a DPG can be explained by their perception of usefulness and ease of use of a DPG.

Positive Network Effects
The quality of the digital service correlates positively with the number of users of the digital service.

Popular videos on YouTube or pictures on Flickr will be ranked higher if they are watched by a higher number of DPG users. In this role, consumers of a DPG provide feedback in terms of crowd voting and contribute to the overall quality of the service provided.

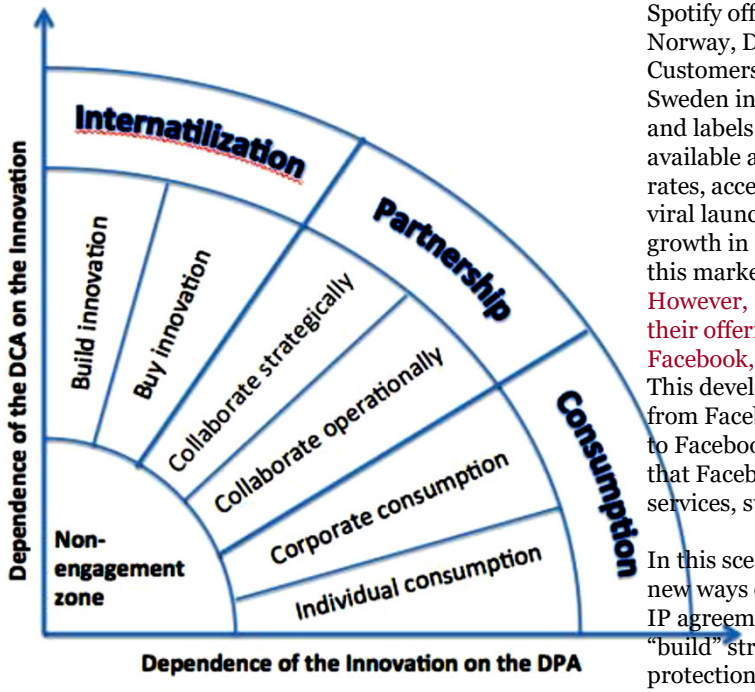
Digital Public Assets
reflect the special status of those DPGs that have reached a very high number of users. The value of a core innovation of most DPAs is much harder to get at through imitation since it is embedded in a very large number of users. Providers of a digital public asset then start to explore the opportunities that the existing large user network provides in its own right.

A good example for this is the current attempt of Facebook to explore ways of commercializing its user base (e.g., via the commercial offer of video downloading services).

Digitalisation strategy

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Digital complementary assets



Modes of Engagement for Digital Public Assets (inspired by Teece (1986), p. 289)

Facebook and Spotify – the Importance of Legal Mechanisms

Spotify offered some 15 million songs to 7 million users (about 800 000 paying) available in Sweden, Norway, Denmark, Finland, France, Spain, The Netherlands, the UK, and launching in the US. Customers can personalize their access by compiling favorite tracks into lists for later use. Launched in Sweden in 2007, Spotify was able to gain access to copyrighted content from major music labels. Artists and labels get paid a small amount of money each time a Spotify user plays one of their songs. Spotify is available as a limited free service with commercials, while paying premium customers get better bit rates, access to mobile device platform apps, and do not have to listen to commercials. Spotify chose a viral launch strategy. Users could give a limited number of friends an invitation to Spotify. In this way, growth in demand was matched with increase in capacity. Social media was an important enabler of this marketing strategy, but it was engaged in a non-specific way by users spreading the word. However, Spotify quickly realized the value of social media as a means of expanding their offering as well as increase their visibility and soon engaged a more active partnership with Facebook, allowing users to share playlists via their Facebook profiles. This development has greatly added to Spotify's visibility. In 2011, there are signals (see e.g. Parr 2011) from Facebook that they are going to enter a new stage of social music and tie Spotify even more closely to Facebook by adding a permanent feature on the Facebook page. However, persistent rumors indicate that Facebook is considering a "Music Dashboard" that could host integrations with multiple streaming services, such as Pandora, Mog, Rdio, Last.fm, Grooveshark and more.

In this scenario, there are clear affordances attractive to both Facebook and Spotify. Facebook desires new ways of promoting Facebook use, while Spotify desires Facebook's massive user base. However, the IP agreements with the major labels, at the core of Spotify, seem to prevent Facebook from employing a "build" strategy to compete directly with Spotify, thus resonating with Teece's (1986) emphasis on legal protection as an important determinant of engagement mode. Consequently, Facebook and Spotify engage in a partnership. Interestingly, Facebook is considering becoming a social hub of music streaming itself. Multiple streaming services will be invited to compete for the Facebook user base. Users could then port their listening to Facebook regardless of which service they use. As a DPA, Facebook is looking to secure and expand its user base, this mode is more desirable than an exclusive partnership with just Spotify

Rosemann et al., 2011

Rosemann et al., 2011

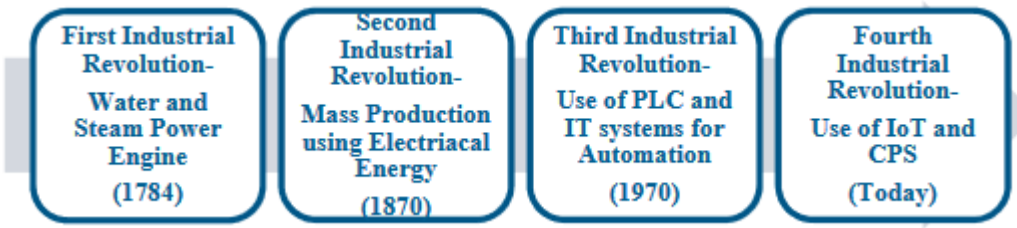
ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Industry 4.0 – an introduction

The term Industry 4.0

- stands for the fourth industrial revolution
- is defined as a new level of organization and control over the entire value chain of the life cycle of products,
- is geared towards increasingly individualized customer requirements and needs which affects areas like order management, research and development, manufacturing commissioning, delivery up to the utilization and recycling of products

The Industry 4.0 paradigm promotes the connection of physical items such as sensors, devices and enterprise assets, both to each other and to the Internet.
The production process is divided into small value oriented units which shares information of the consecutive process steps only which helps in increasing flexibility and probably results in reduction of complexity of coordination.



Industrie 4.0 was initially introduced during the Hannover Fair in 2011; it was officially announced in2013 as a German strategic initiative to take a pioneering role in industries which are currently revolutionising the manufacturing sector

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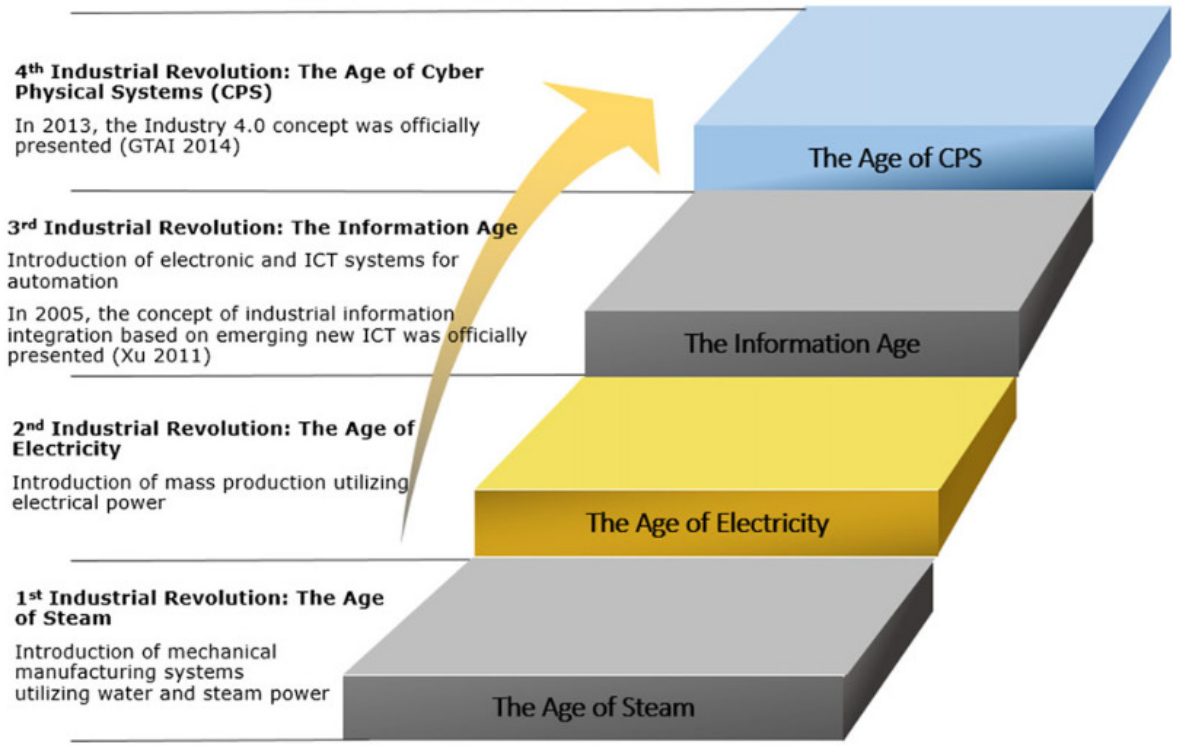
Industry 4.0 – an introduction



ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

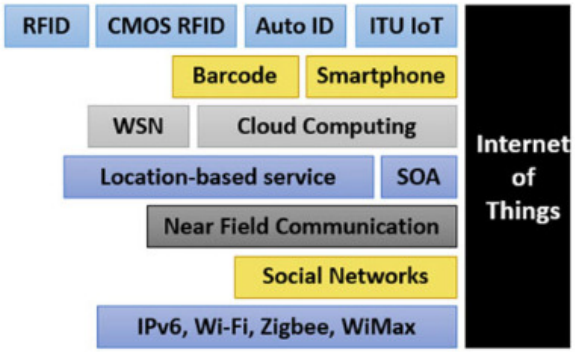
Industry 4.0 – an introduction

The four main drivers of Industry 4.0 are

- Internet of Things (IoT),
- Industrial Internet of Things (IIoT),
- Cloud based manufacturing and
- smart manufacturing which helps in transforming the manufacturing process into fully digitized and intelligent one- the cyber-physical systems (CPS)

CPS is the core foundation of Industry 4.0. CPS
are the systems of collaborating computational entities that are in intensive connection with the surrounding physical world and its on-going processes
provide and use data-accessing and data-processing services available on the Internet to achieve the aforementioned ends.

In CPS, physical and software components are deeply intertwined, each operating on different spatial and temporal scales, and interacting with each other

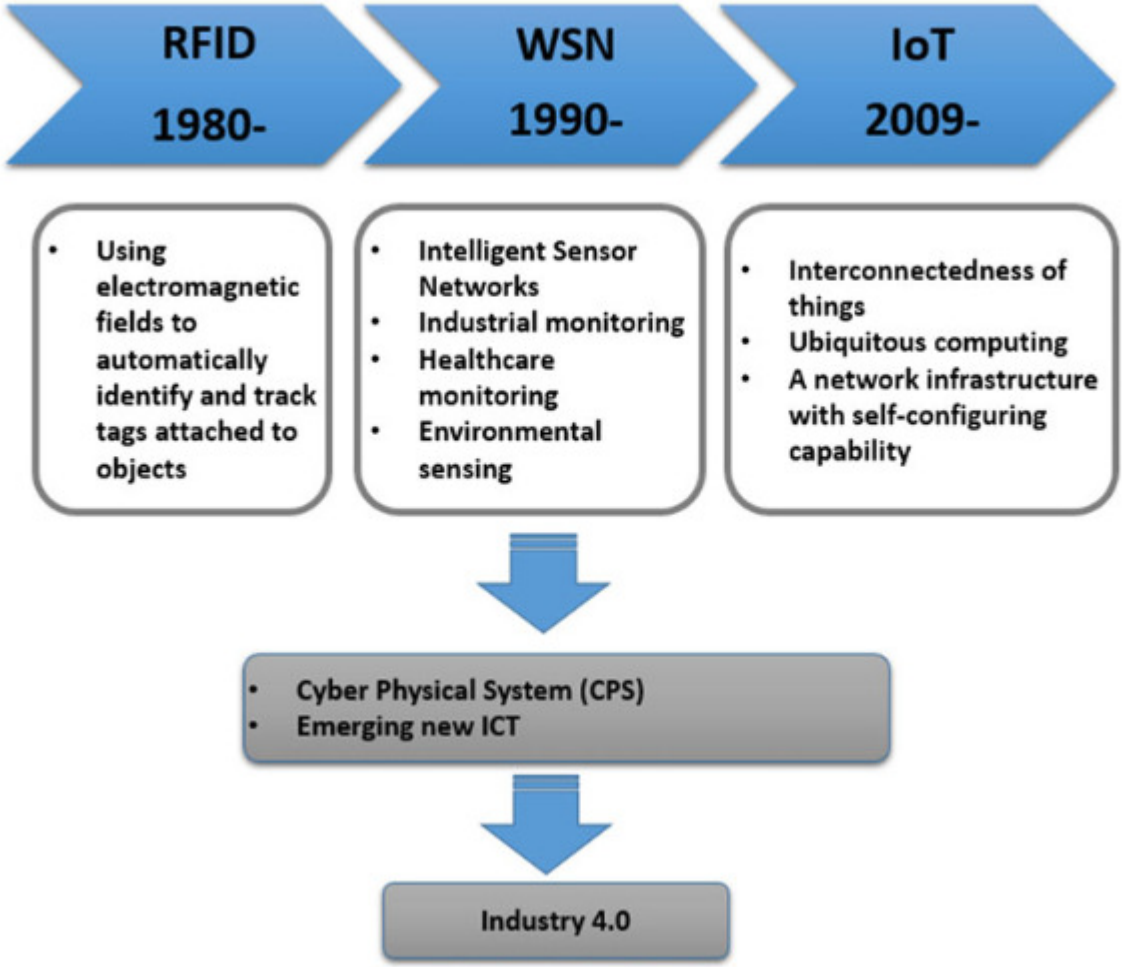


Technologies and devices used to form an extensive network for supporting IoT (Xu, He, and Li 2014).

Cloud manufacturing, similar to cloud computing, uses a network of resources in a highly distributed way. Manufacturing-as-a-Service has been gaining attraction in the manufacturing industry.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Industry 4.0 – an introduction



IoT related technologies made a significant impact on new ICT and paved the way for the realisation of Industry 4.0.

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

Technology audit

will indicate

- the technology status quo
- the position in the industry relative to competitors
- whether it regularly outsources (possibly implying a shortage of skills and technology) and
- whether it is in possession of certain skills and technologies required by other agents in the industry.

Δραστηριότητες

1. Αναγνώριση/χαρακτηρισμός (τεχνολογίας-ων)
2. Επιλογή
3. Απόκτηση (επιπλέον) τεχνολογικών ικανοτήτων
4. Εκμετάλλευση
5. Προστασία
6. Μάθηση (πίσω στο 1)

ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΙΑΣ

A first Technology Audit should include the following questions (cont):

*What is the **life cycle position of the technologies** on which we depend?*

For example,

- are we dependent on a small number of ageing technologies which are increasingly vulnerable to technological obsolescence?
- Alternatively, are we attempting to maintain a position in a wide range of disparate technologies, which is beyond our R&D resources to sustain?
- Are we trying to keep up in-house R & D for all our technologies instead of a more rational balance between internally and externally acquired technology?

What are the emerging or developing technologies both inside and outside our company which could affect our current or prospective markets?

This question cannot be answered by technology people alone.

A first Technology Audit should include the following questions (cont):

Does the company achieve the optimum exploitation of the technologies we have ?
Does the company have technological assets, which are no longer of use to us, but which may be of value to other companies?

Are the company's strengths in product or production technologies or both ? Do our technologies support the maximum productivity?
Is our *forte* in the design of products or in the processes by which they are made?

The U.K. company Kelvin Hughes faced a crisis of profitability in the manufacture of marine radar.
Analysis of the technologies on which the business was based led it to **concentrate on its distinctive technologies**.
It identified these as product design and applications engineering.
It also **retained its basic technologies** which were in equipment assembly and after-market servicing, but **it withdrew from** most **component design** and **manufacture**. These activities accounted for most of the company's labour costs and overheads.
Overall, this approach led to a dramatic profit turn-around.

Kelvin Hughes is a British company specialising in the design and manufacture of navigation and surveillance systems and a supplier of navigational data to both the commercial marine and government marketplace.

A first Technology Audit should include the following questions :

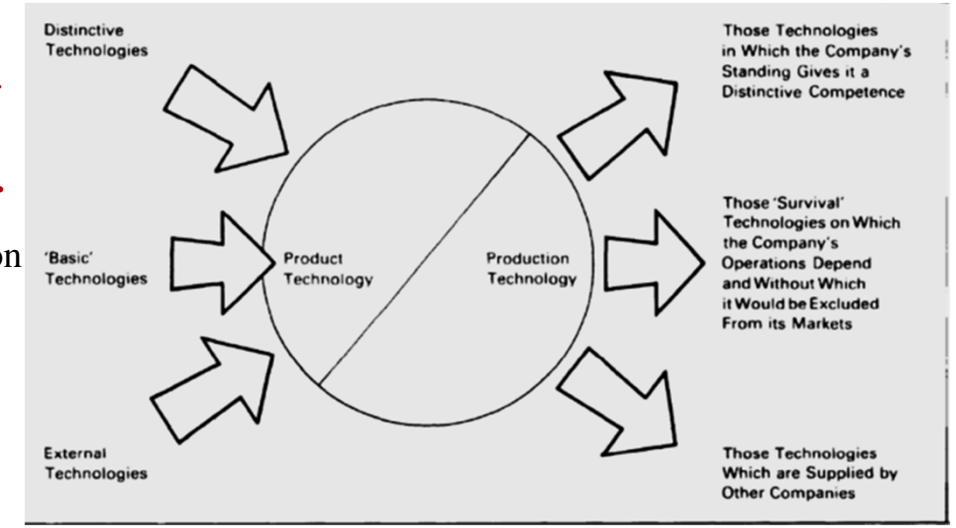
What are the technologies and know-how on which our business competitiveness depends?

For example, one U.S. chemical giant acknowledges 'Half our current technology either started with or is still under license'.

In the manufacture of fractional horsepower electric motors for USC in those hand tools, Black & Decker would regard itself as probably
the most sophisticated manufacturer in the world.

Black & Decker company would include production technologies in the assembly of small hand tools.

plastic parts or some of its painting



Do we have a poor record in bringing 'home-grown' technologies to market ?

How does our technology position compare to that of our customers?

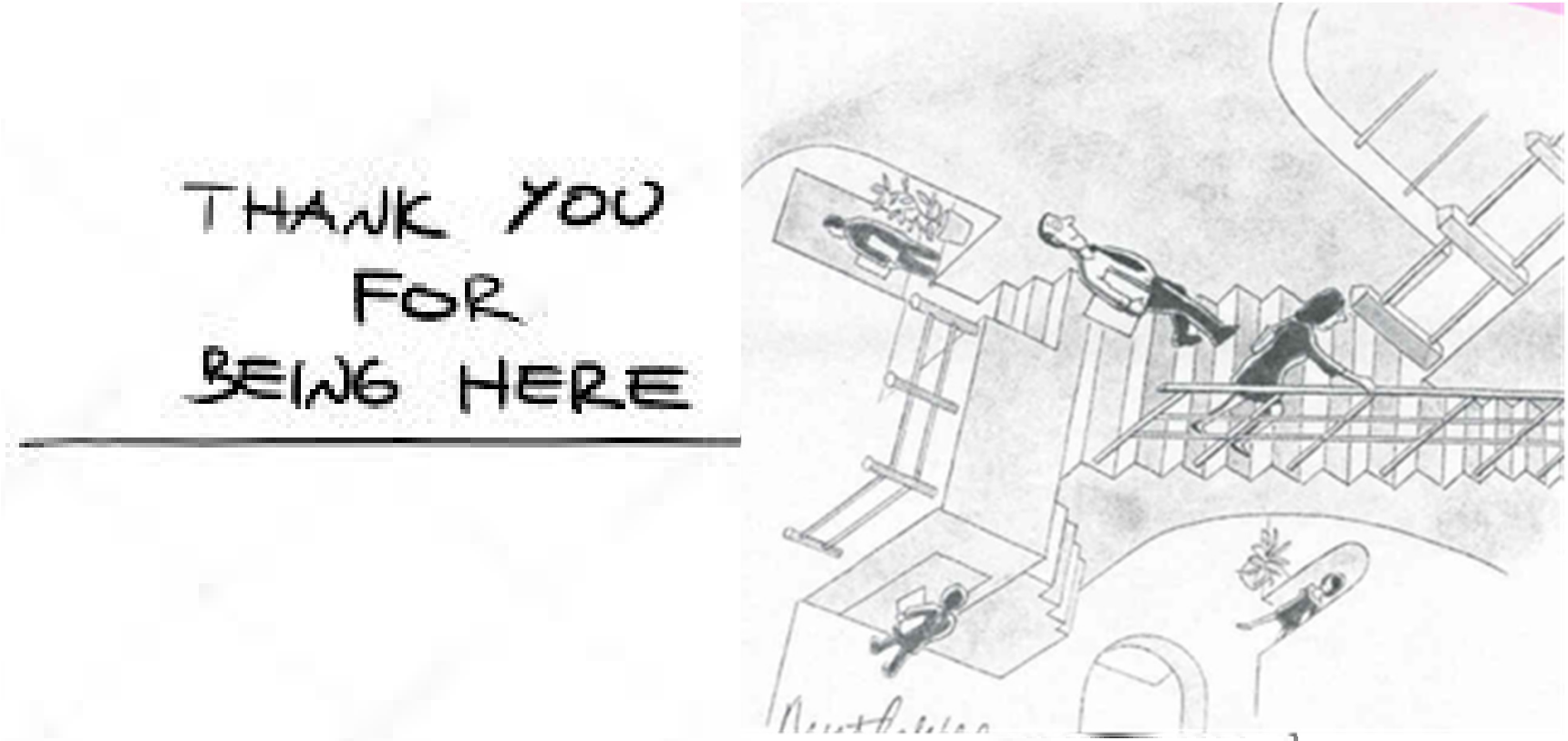
Our home-technology or not?

Make or buy?

Attention 1!!!

The 'high-tech syndrome'

a) it leads managers to believe that technology is synonymous with high technology
b) A coherent view of the technological base of a company is only necessary for high-tech companies.



"Returning home after a Technology Strategy class, (your name) immediately started viewing things from a different perspective"!