

Technology Roadmaps

Τεχνολογική Στρατηγική

▷ **ΔΠΜΣ «Επιχειρηματικότητα»**

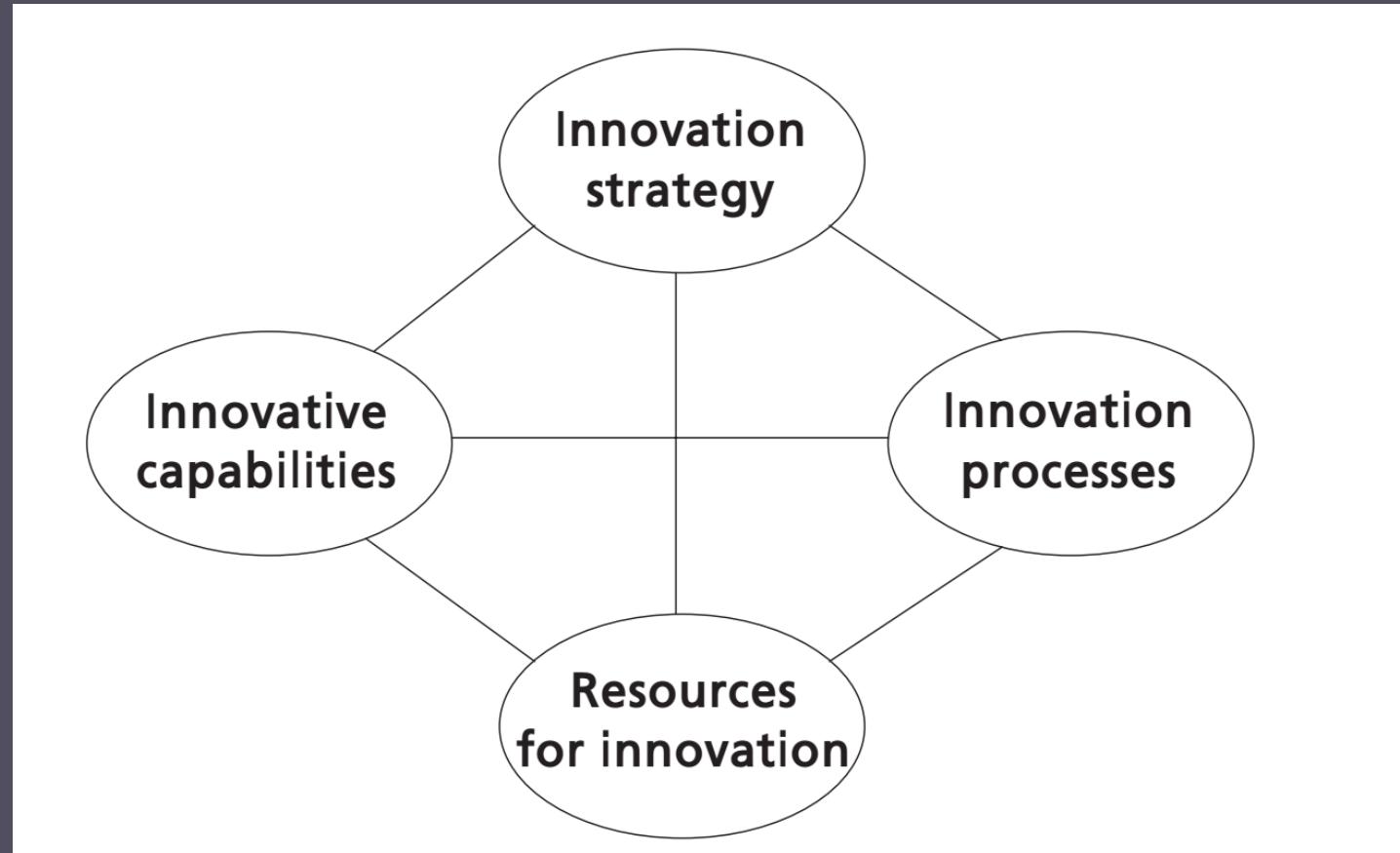
Γεώργιος Σταμπούλης

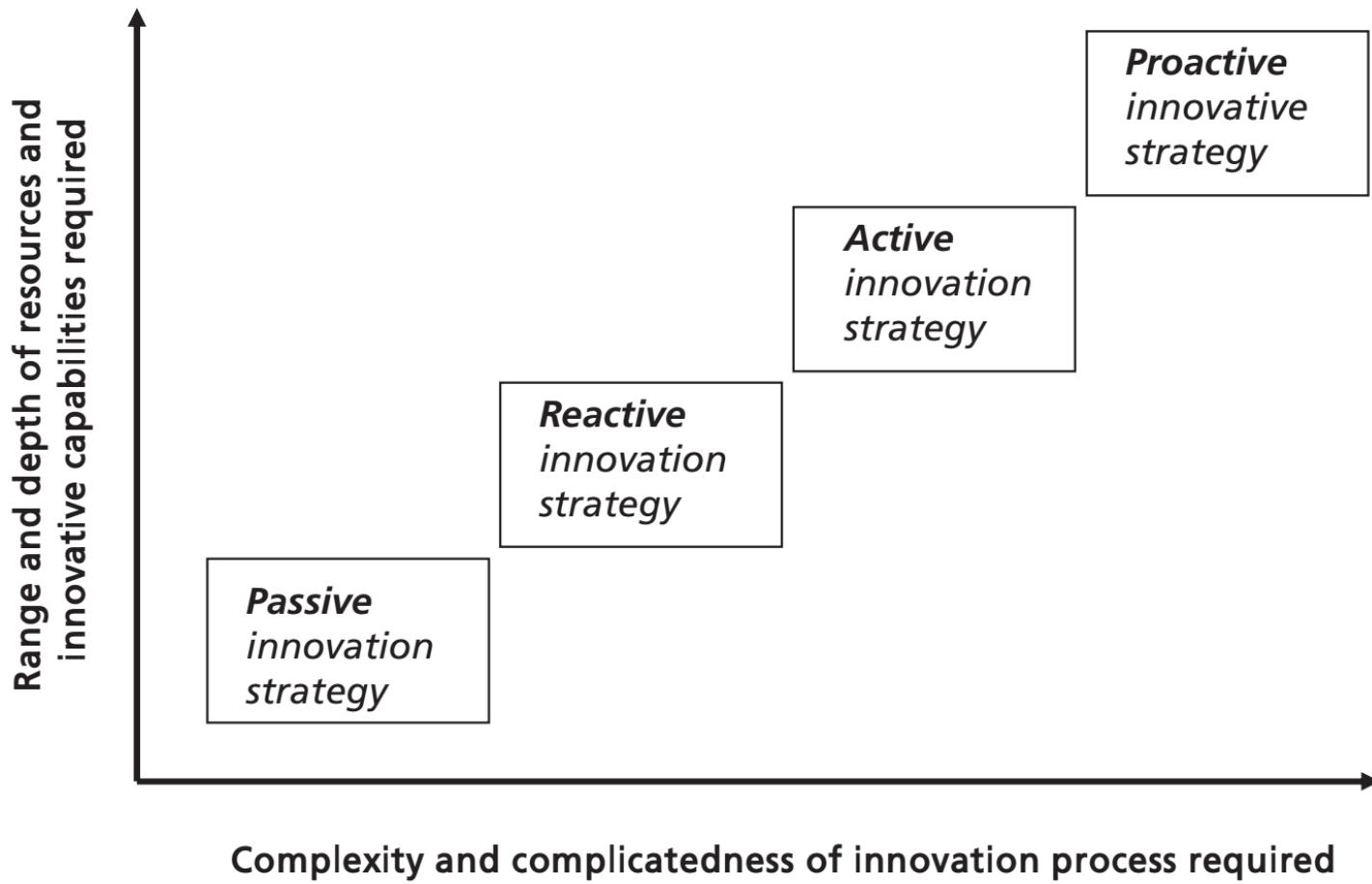
Τμήμα Οικονομικών Επιστημών



ΠΑΝΕΠΙΣΤΗΜΙΟ
ΘΕΣΣΑΛΙΑΣ

A simple model of innovation strategy





Επίπεδα
ανάπτυξης
τεχνολογικής
στρατηγικής

Πηγή: Dodgson et al (2008)

Καινοτομικές ικανότητες, αναλυτικά πλαίσια, εργαλεία και μέθοδοι

Innovative Capability	Key objectives	Analytical frameworks/concepts (some examples)	Tools & techniques (some examples)
Searching	Seeking and assessing market and technology opportunities and threats	Technological trajectories, Sustaining or disruptive innovation, Radical-incremental innovation, Lead customers/suppliers	Forecasting/Foresight, Delphi, Bibliometrics, Technology road maps
Selecting	Choosing amongst future options, based on evaluation of available resources and results of search activities	Life cycle analysis, Core competencies/technologies, Platform technologies, First-mover/fast-follower advantage	Technology and Innovation Audits, Social network analysis, Portfolio analysis, Peer Assist, Gamechanger, Multi-criteria assessment
Configuring	Ensuring the coordination and integration of innovation efforts	Lean Thinking, Integrated Solutions, Innovation brokerage, Balanced teams, Agile manufacturing	Technology Plans, R & D alignment tools, Quality Function Deployment, User tool kits
Deploying	Delivering internally generated and acquired innovations. Protecting and delivering value from innovation	Complementary assets, Dominant designs, Market for ideas or products, Appropriability regimes	IPR portfolio management, Standards setting, Real options
Learning	Improving the performance of innovation processes	Learning curves, High-level learning	Post-project evaluations, Strategic learning, Balanced

Τεχνολογική Προοπτική Διερεύνηση (Technology Foresight)

- Τεχνολογική Παρακολούθηση
- Μέθοδοι Τεχνολογικής Προοπτικής Διερεύνησης
- Δημιουργία και ανάλυση σεναρίων
- Technology scanning and forecasting
- Τεχνολογικός χάρτης ανάπτυξης (Technology Road-Mapping -TRM)

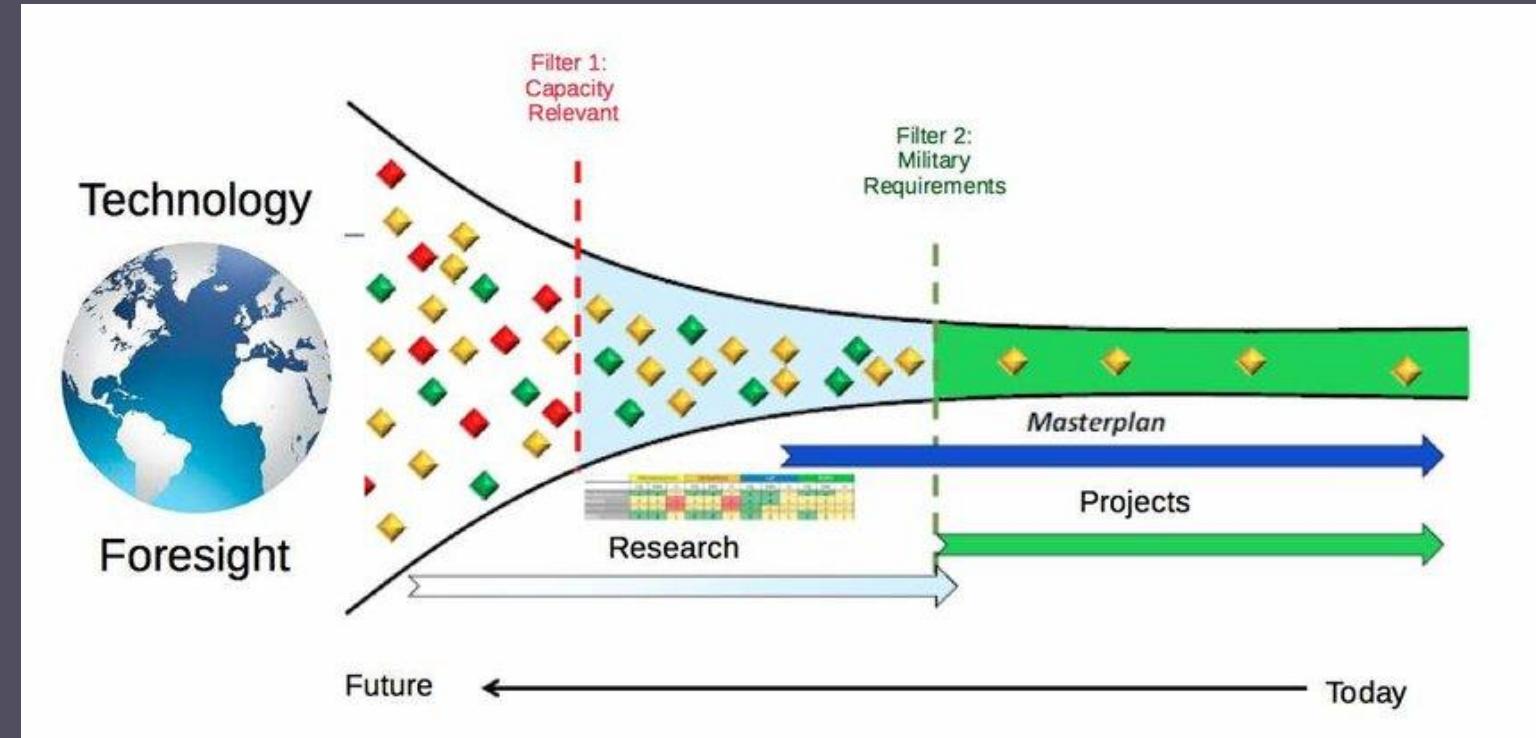
Τεχνολογική Προοπτική Διερεύνηση (Technology Foresight - TF)

The broad aim of technology foresight is to identify emerging generic technologies likely to yield the greatest economic and social benefits

TF involves three main tasks:

- Gathering background information (literature reviews through books, journals, reports, and web sites).
- Eliciting views and advice through private bilateral discussions with key stakeholders, scoping workshops, open conferences. The aim is to gather ideas, obtain commitment of future support and participation, and to begin the process of securing buy-in to the results of the exercise.
- Articulating and presenting options

Technology Foresight: η διαδικασία



Technology Foresight Methods

Group	Method
Identifying Issues	Environmental Scanning, SWOT Analysis, Issue Surveys
Extrapolative Approaches	Trend Extrapolation, Simulation Modelling, Genius Forecasting, Delphi
Creative Approaches	Brainstorming, Expert Panels, Cross-Impact Analysis, Scenarios
Prioritization	Critical (and Key) Technologies, Technology Roadmapping

Source: Miles and Keenan, (2003).

Technology Foresight: 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

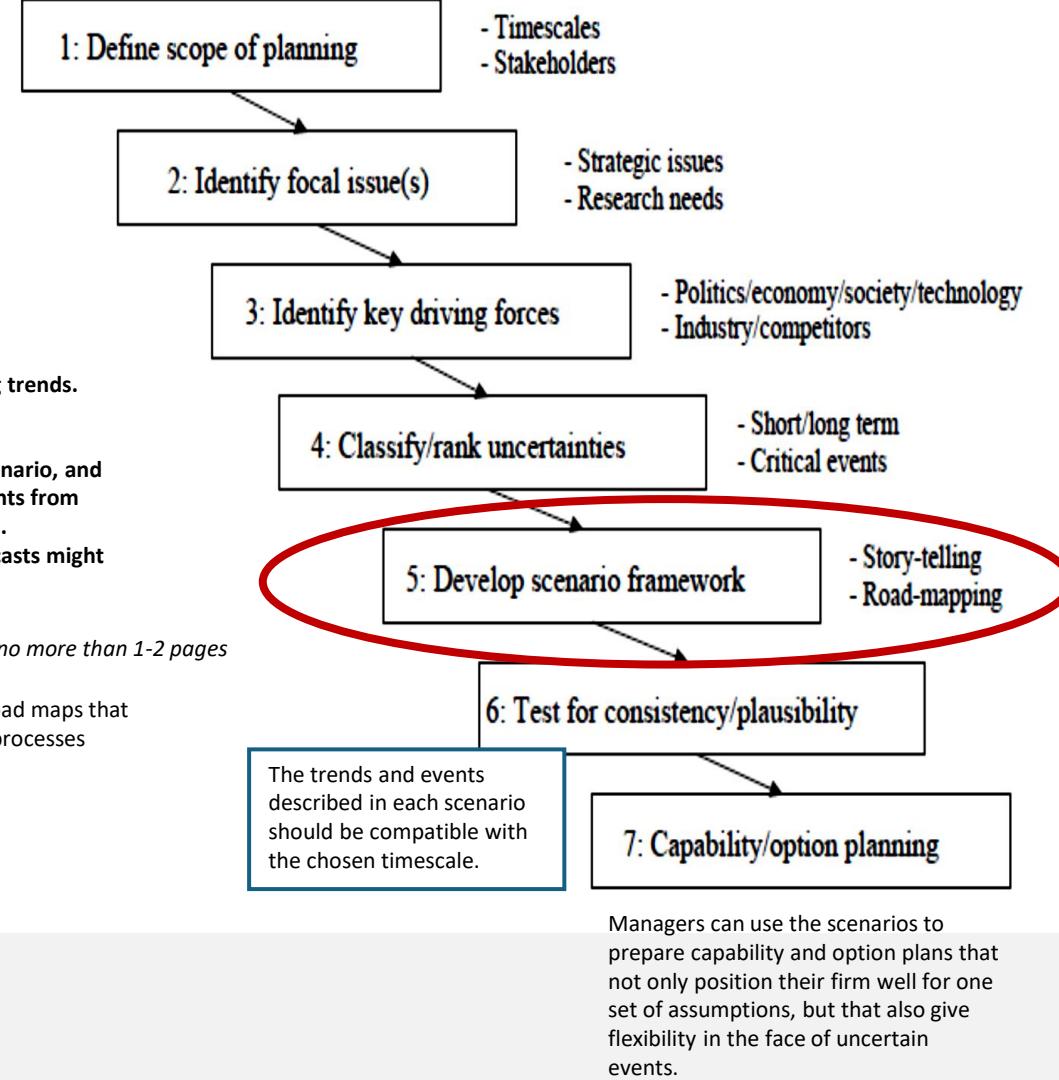
one may be a **base case extrapolation of existing trends.**

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

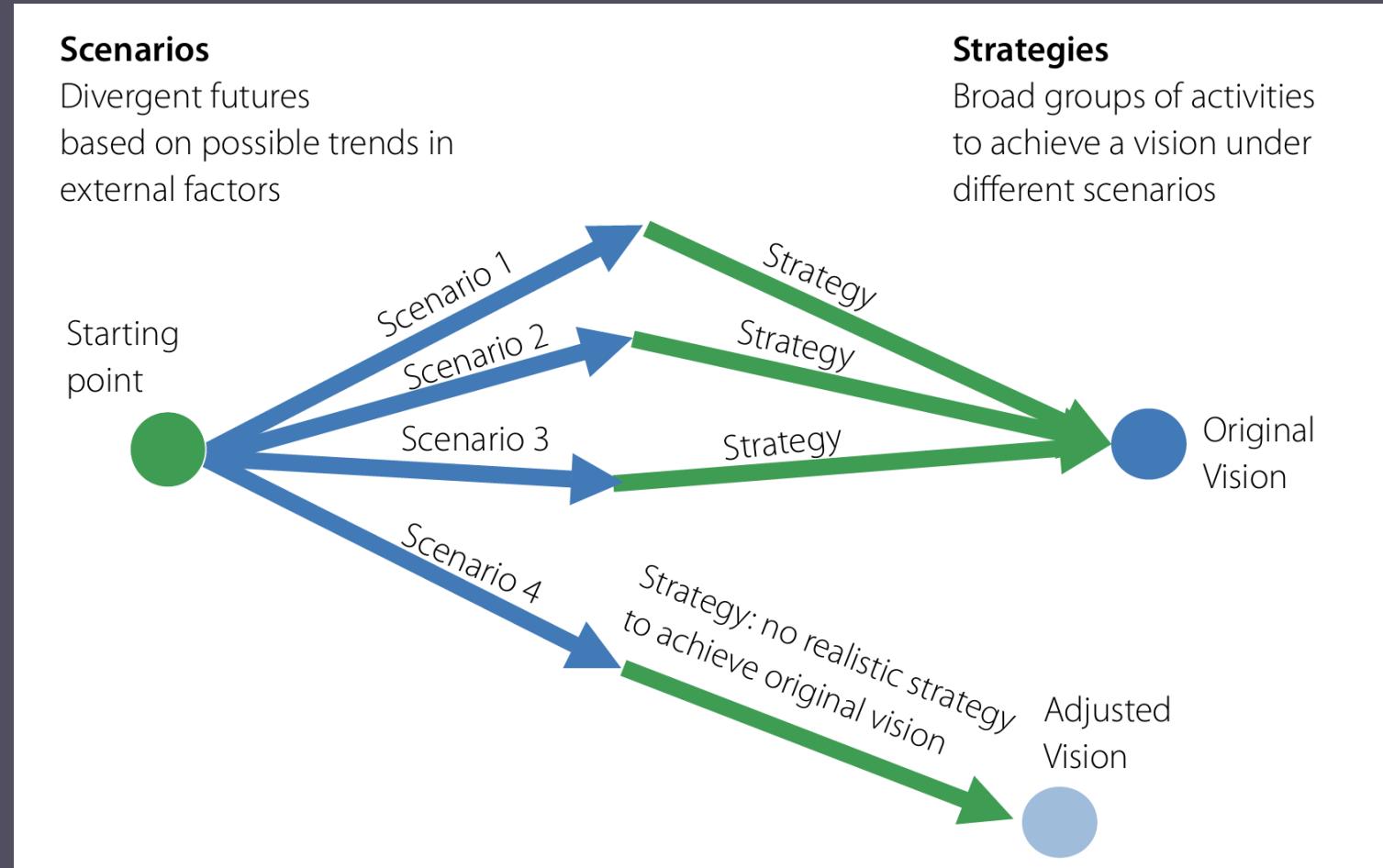
The scenario stories can be elaborated into more road maps that describe how technologies, market, products, and processes unfold in each scenario

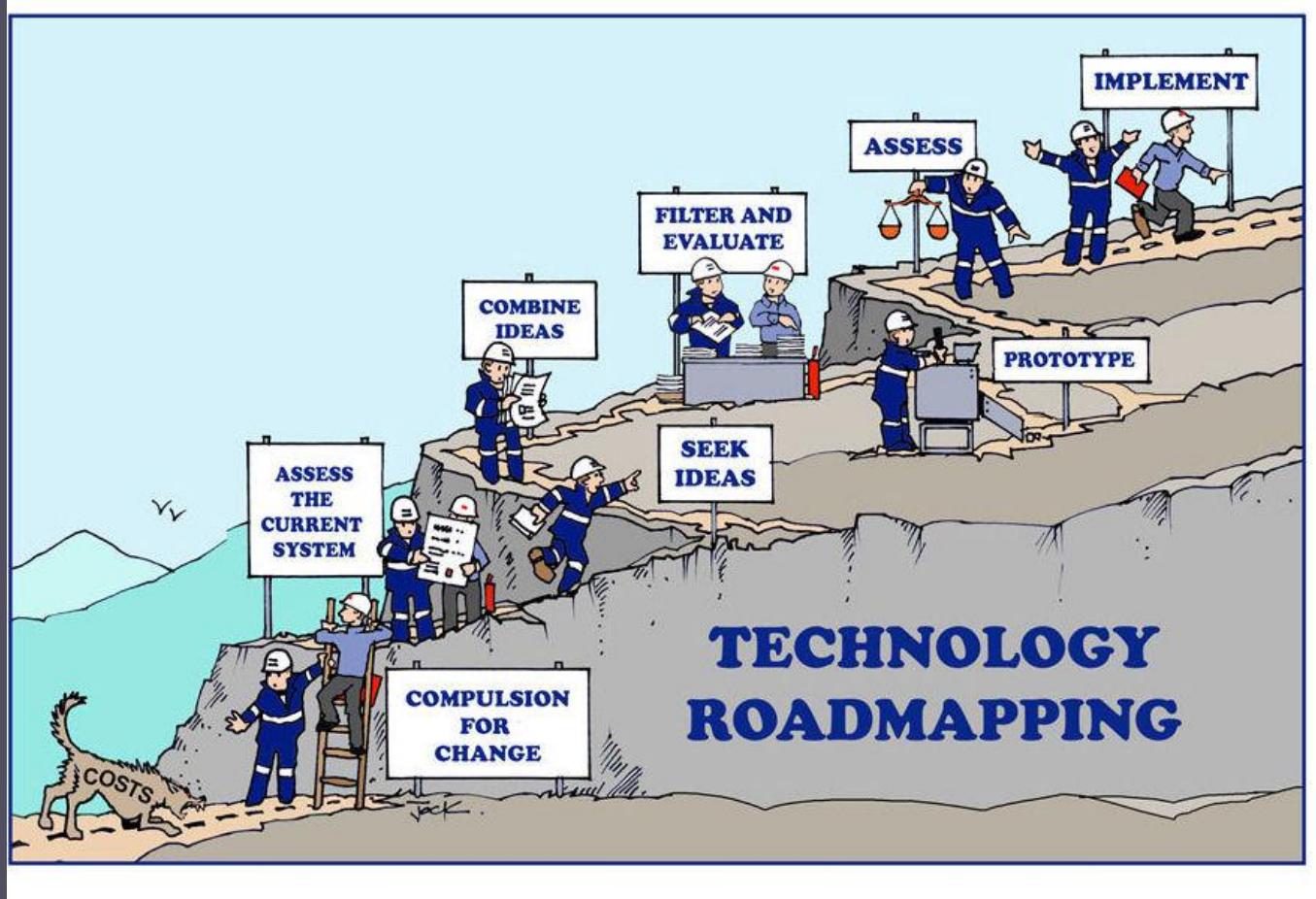
Stephen A.W. Drew, (2006)



“Ο ρόλος της ανάπτυξης σεναρίων στη χάραξη στρατηγικών για την επίτευξη ενός οράματος. Οι πιο ισχυρές στρατηγικές επιτυγχάνουν το όραμα στα περισσότερα σενάρια. Ωστόσο, σε ορισμένα σενάρια δεν υπάρχει ρεαλιστική στρατηγική και το όραμα πρέπει να προσαρμοστεί.”

MORIARTY, P et al. (2007) INWRDAM The EMPOWERS Approach to Water Governance. Guidelines, Methods and Tools. Inter-Islamic Network on Water Resources Development and Management





Integrates:

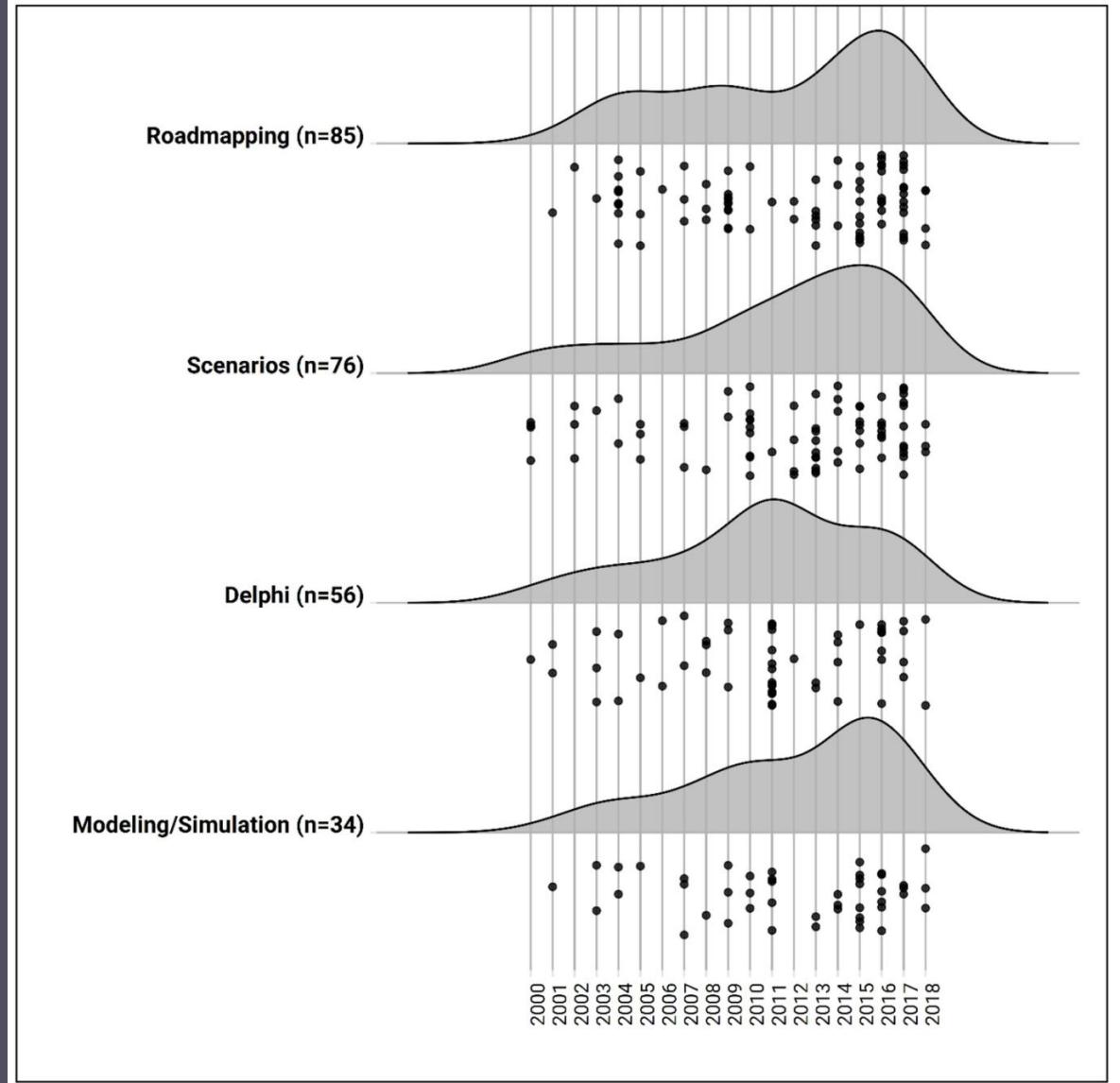
- Technology forecasting,
- technology assessment and
- product planning

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.

Research trends related to forecasting tools during the 2000–18 period

Park, et al. (2020)





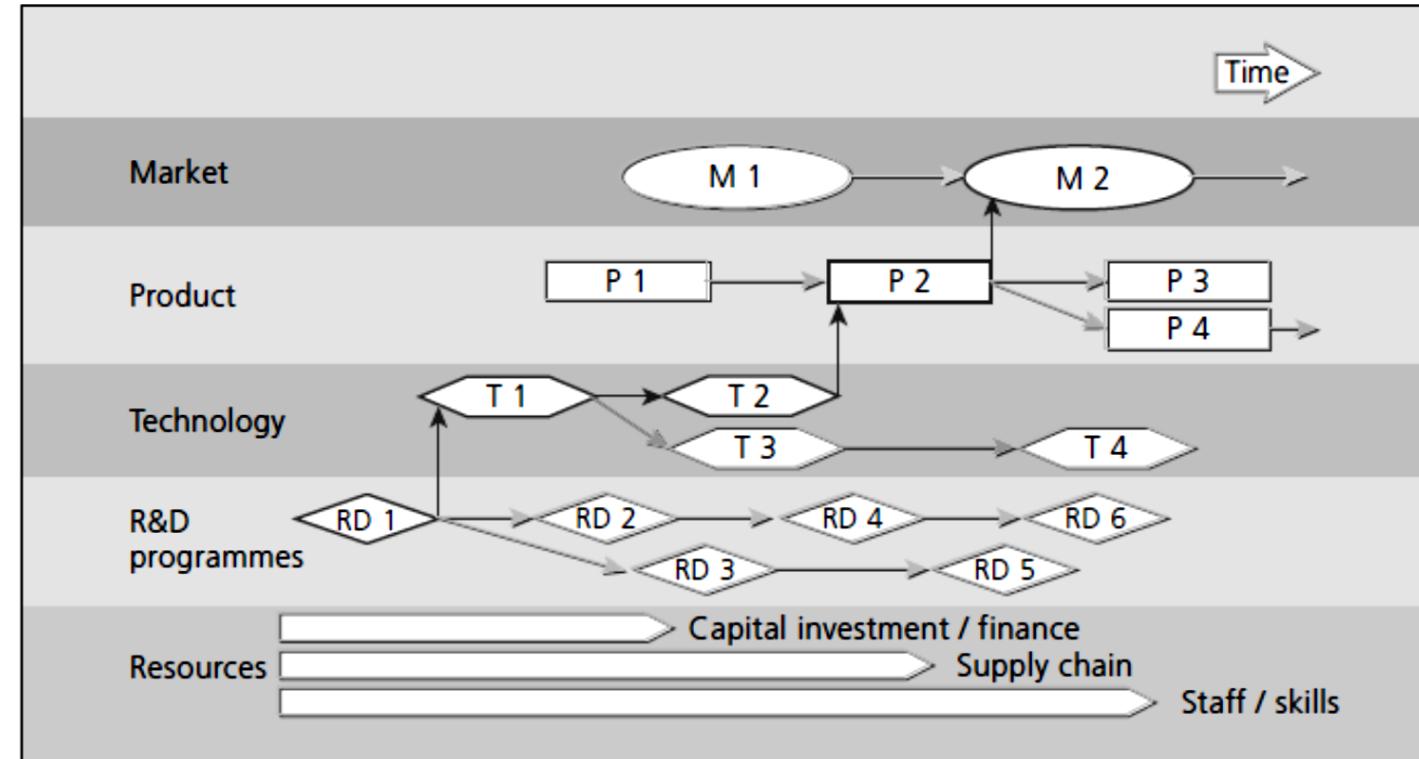
Technology Road-Mapping: A powerful integrated instrument for technology strategy formulation.

"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

Generic Roadmap

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



Source: Phaal, (2003).

Time-based chart

Enables the exploration of:

- the co-evolution of markets, products and technologies, together with
- the linkages between the various perspectives-layers that include both commercial and technological perspectives.

Three generations of technology roadmaps

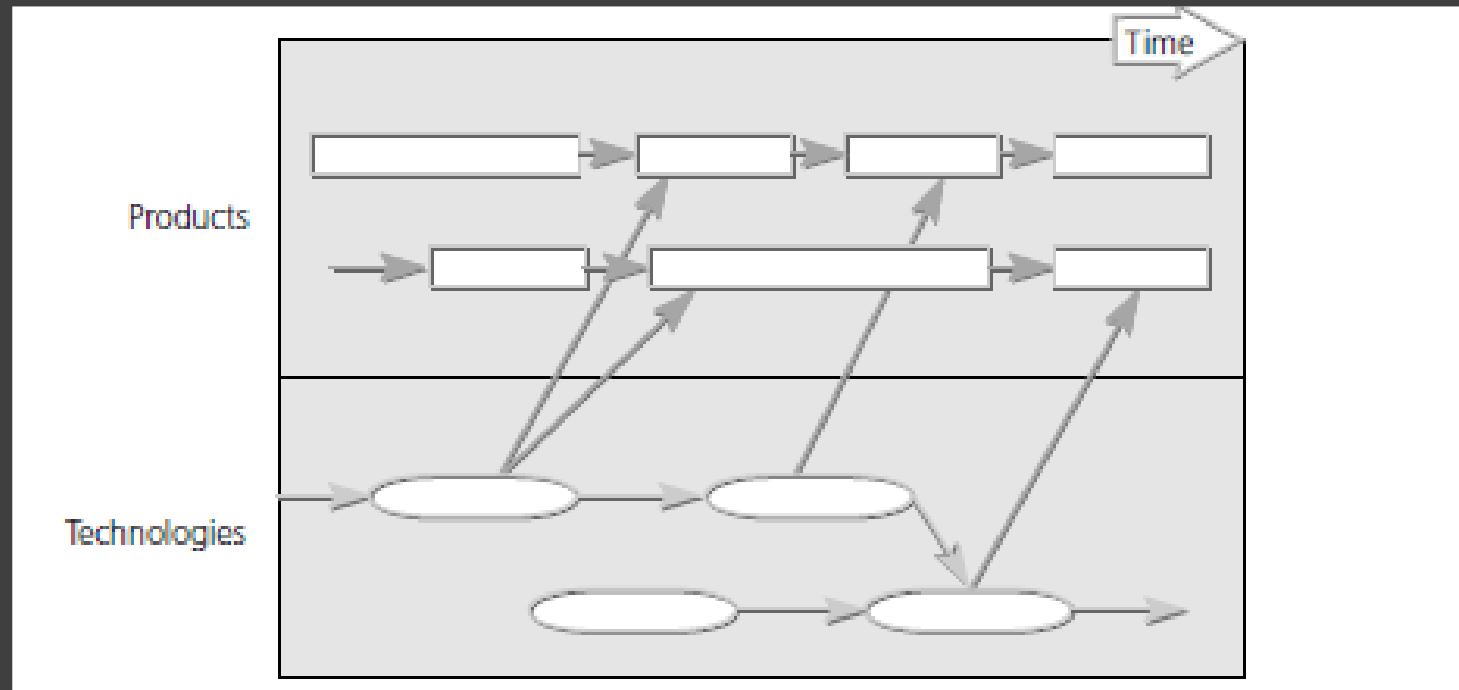
- **1st generation TRMs:**
 - mainly a method of technology forecasting, operated by researchers or scientists and with little linkage into company's operational business.
- **2nd generation TRMs:**
 - used as a tool for corporate strategic technology planning with a strong focus on the integration of market, product and technology aspects.
- **3rd generation TRMs:**
 - applied through all primary management functions from intelligence to implementation control

Product planning

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

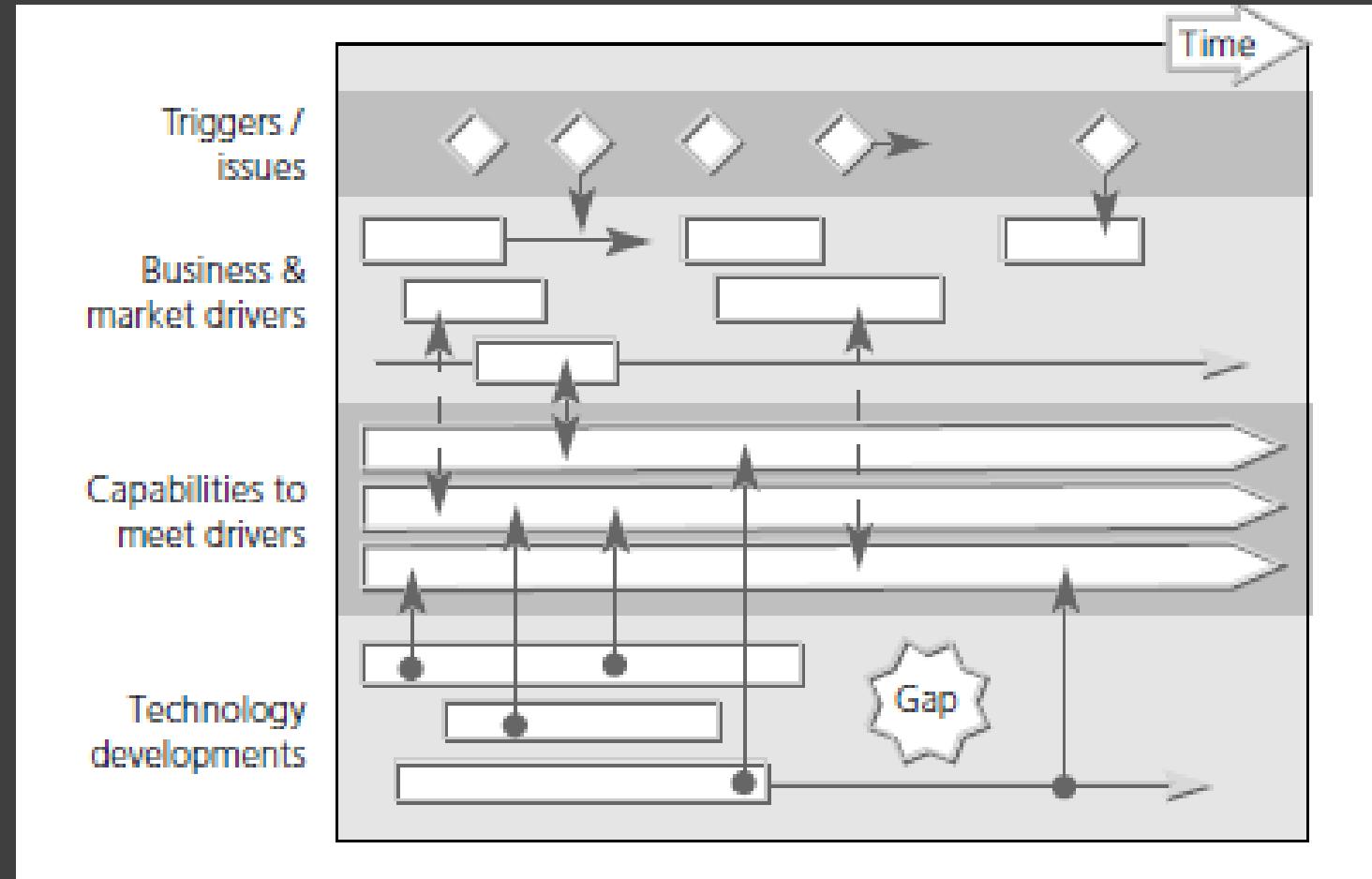


Service/capability planning

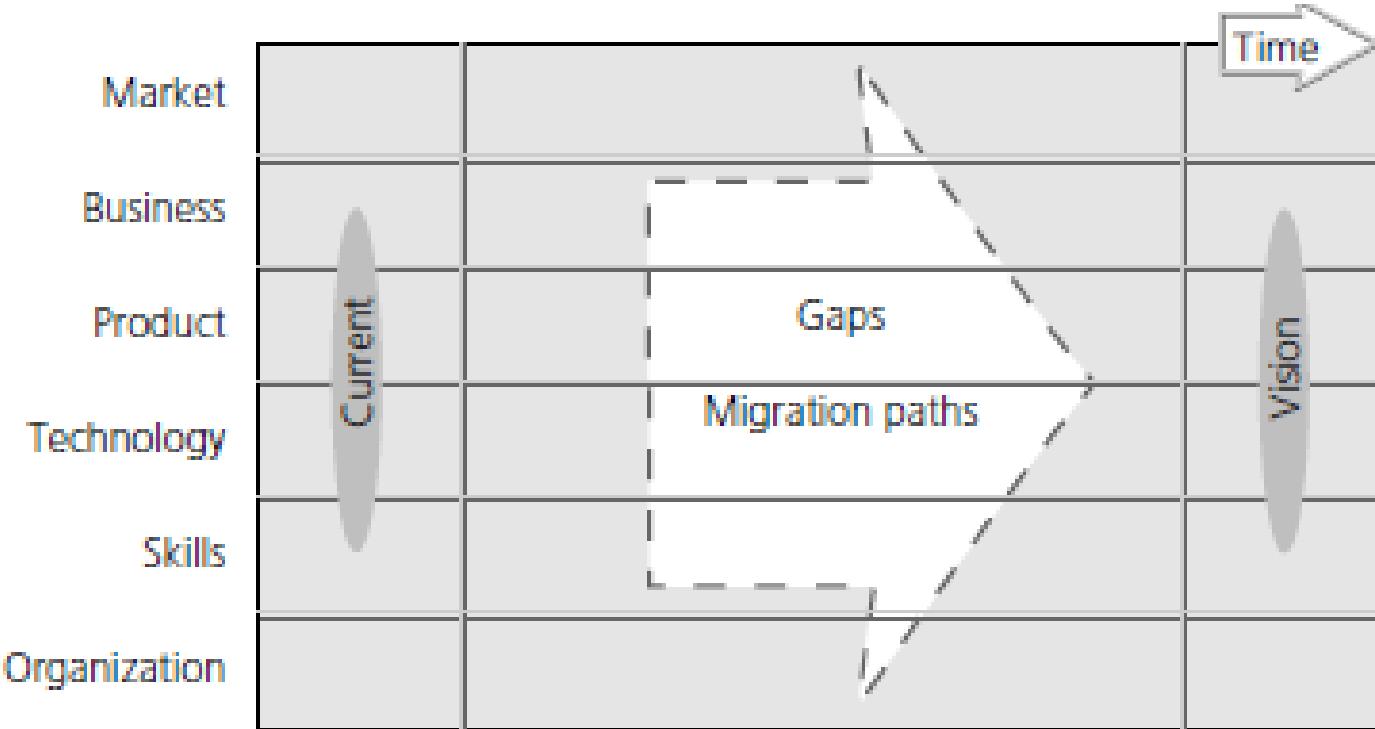
Example:

A Post Office roadmap/T-Plan⁷ application (Brown, 2001), used to investigate the impact of technology developments on the business.

Focuses on **organizational capabilities** as the bridge between technology and the business, rather than products.



Strategic planning



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.

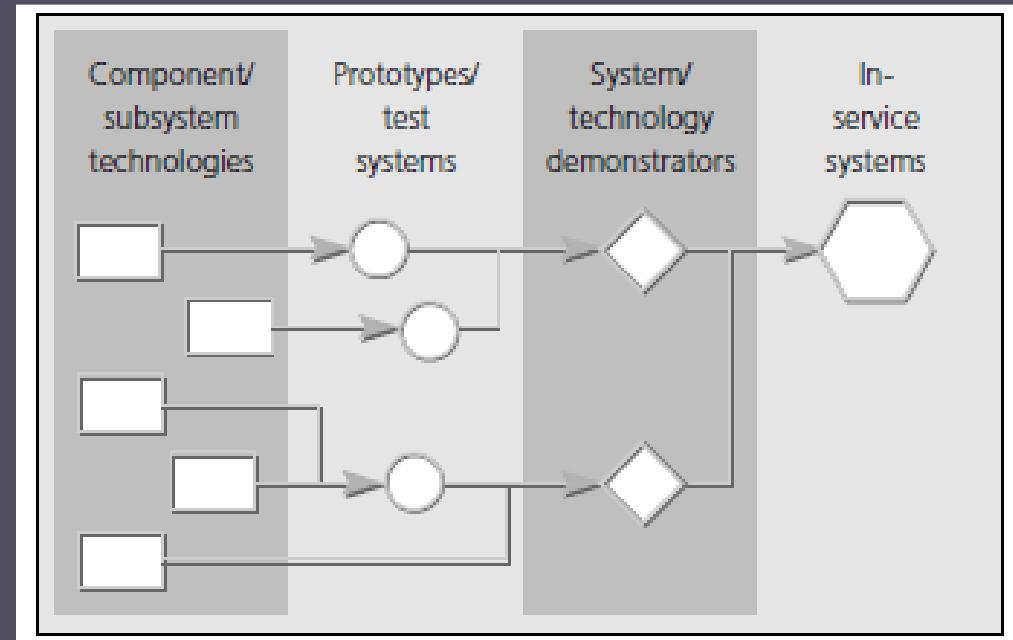
Integration planning

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).

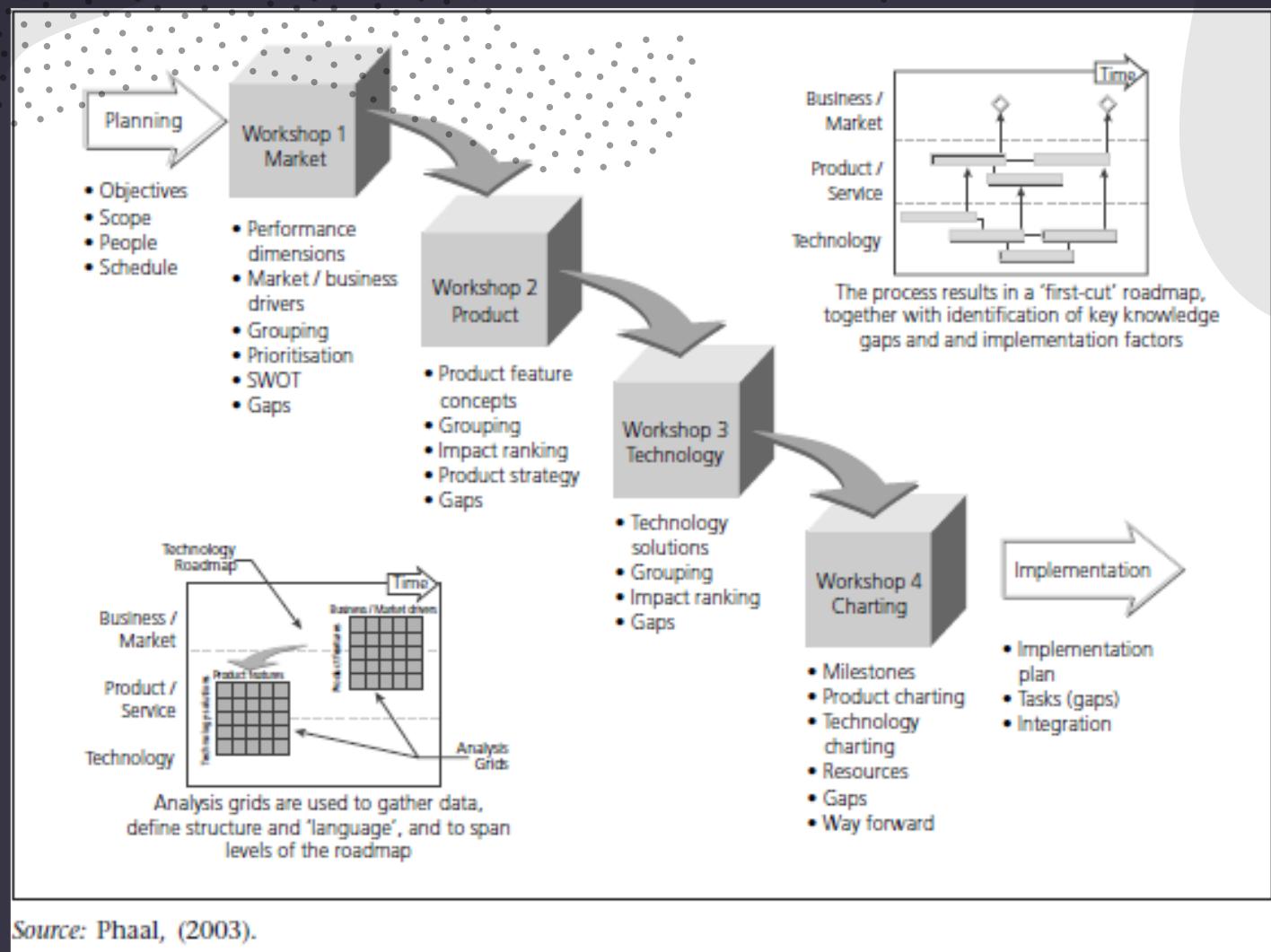
Example:

A NASA roadmap (Origins programme), 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)

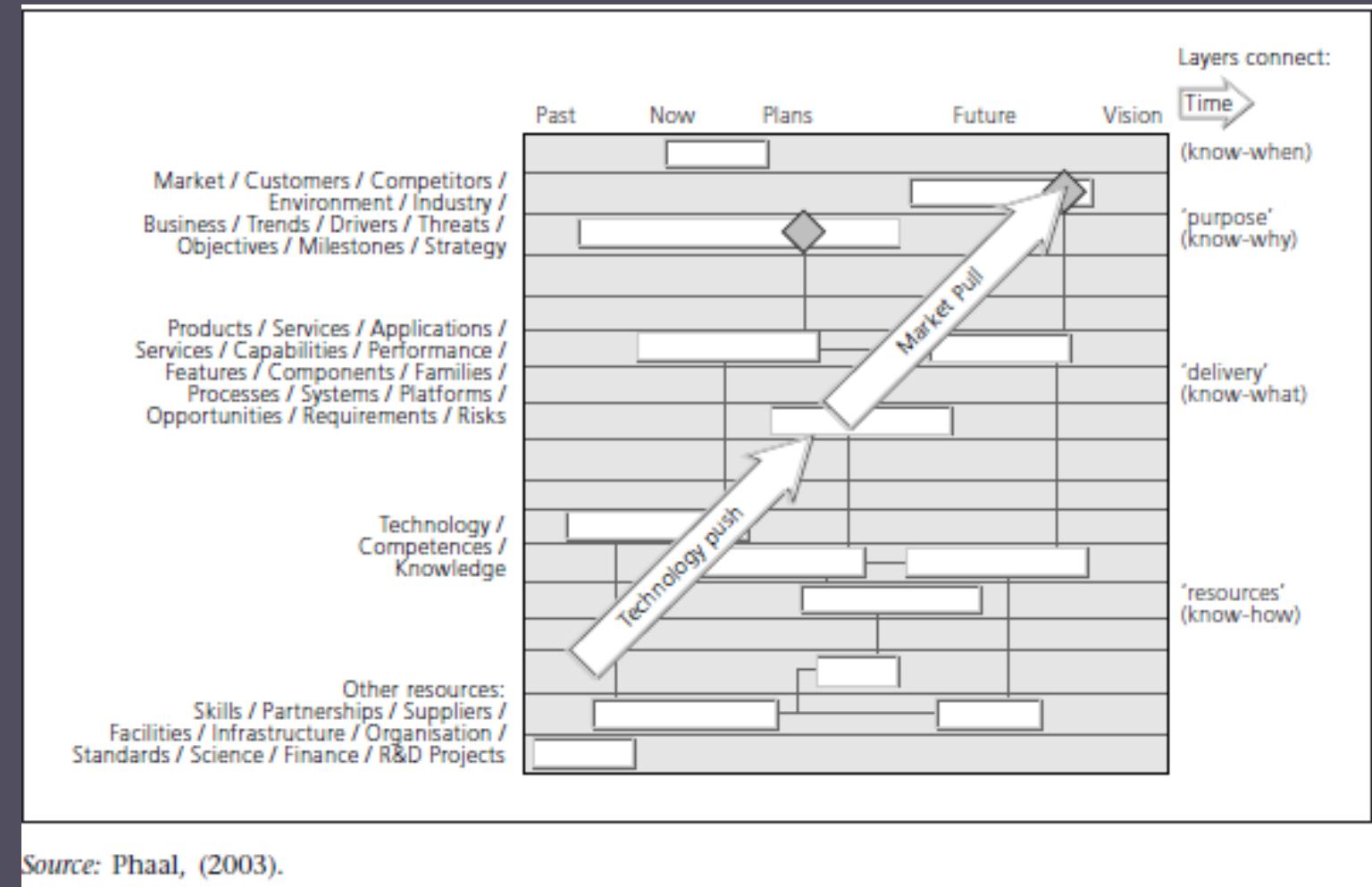
<http://origins.jpl.nasa.gov/library/techroadmap/roadmapidx.htm>



Standard process (integrated product- technology planning)

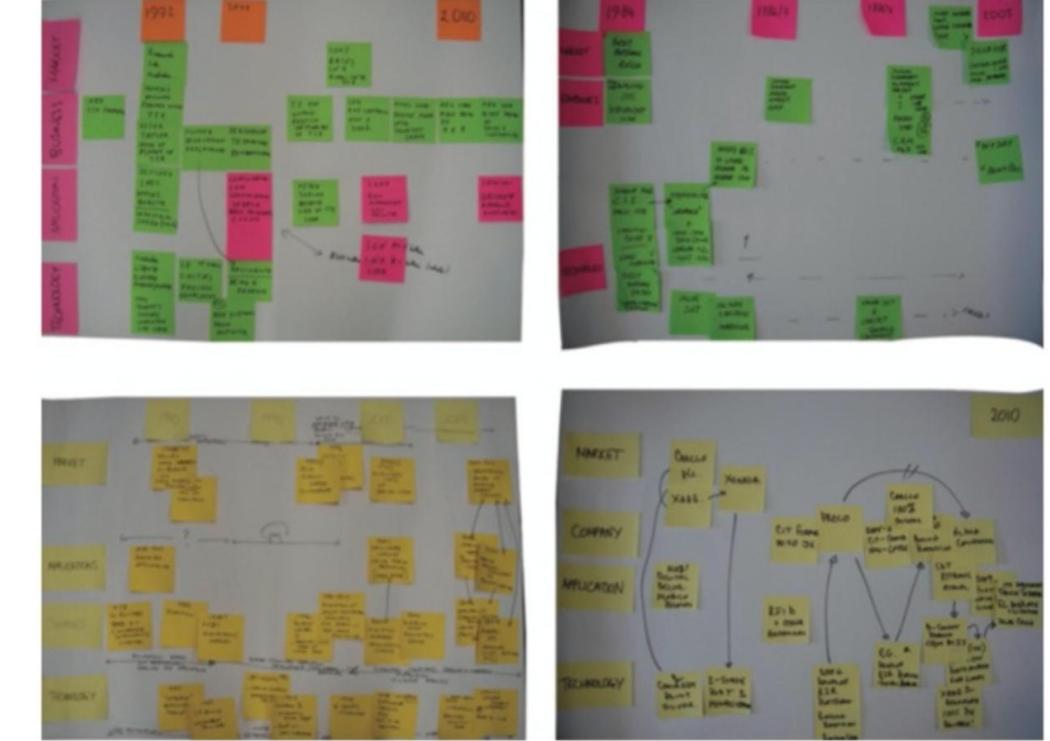


Generalized technology roadmap architecture





Roadmapping consultation and engagement processes:
 (a) corporate innovation strategy workshop
 (Phaal et al., 2007); and
 (b) retrospective roadmapping case-study interviews (Ford et al., 2012)



Park, et al. (2020)

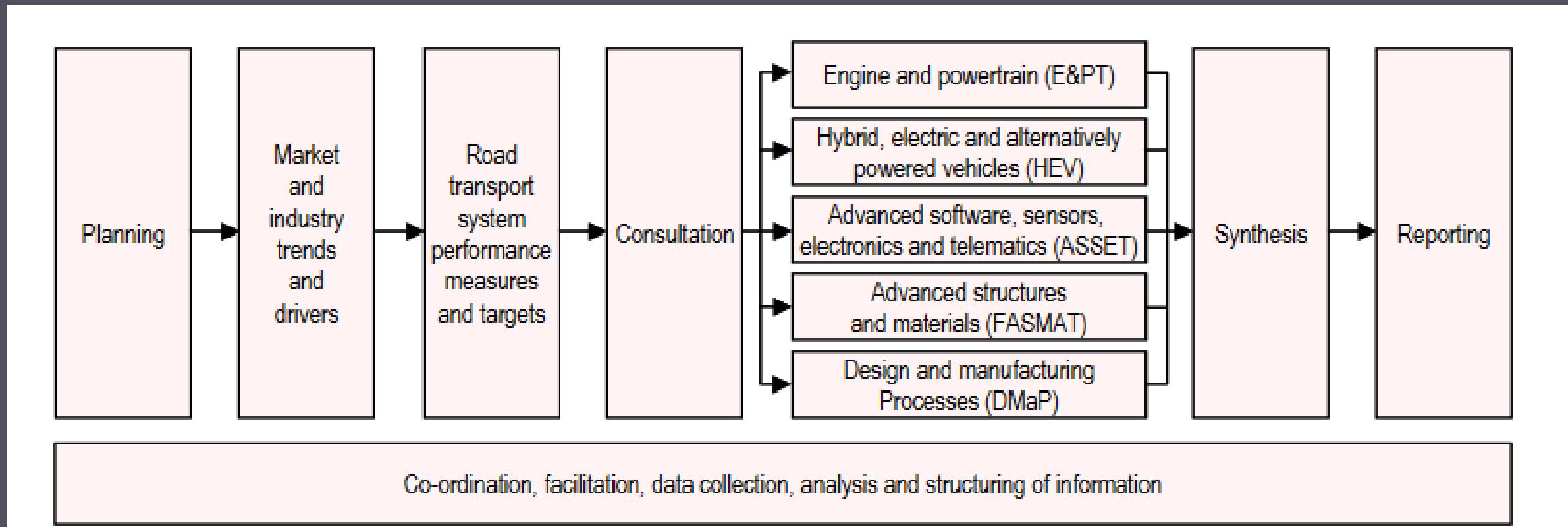
Foresight example

Vehicle technology roadmap

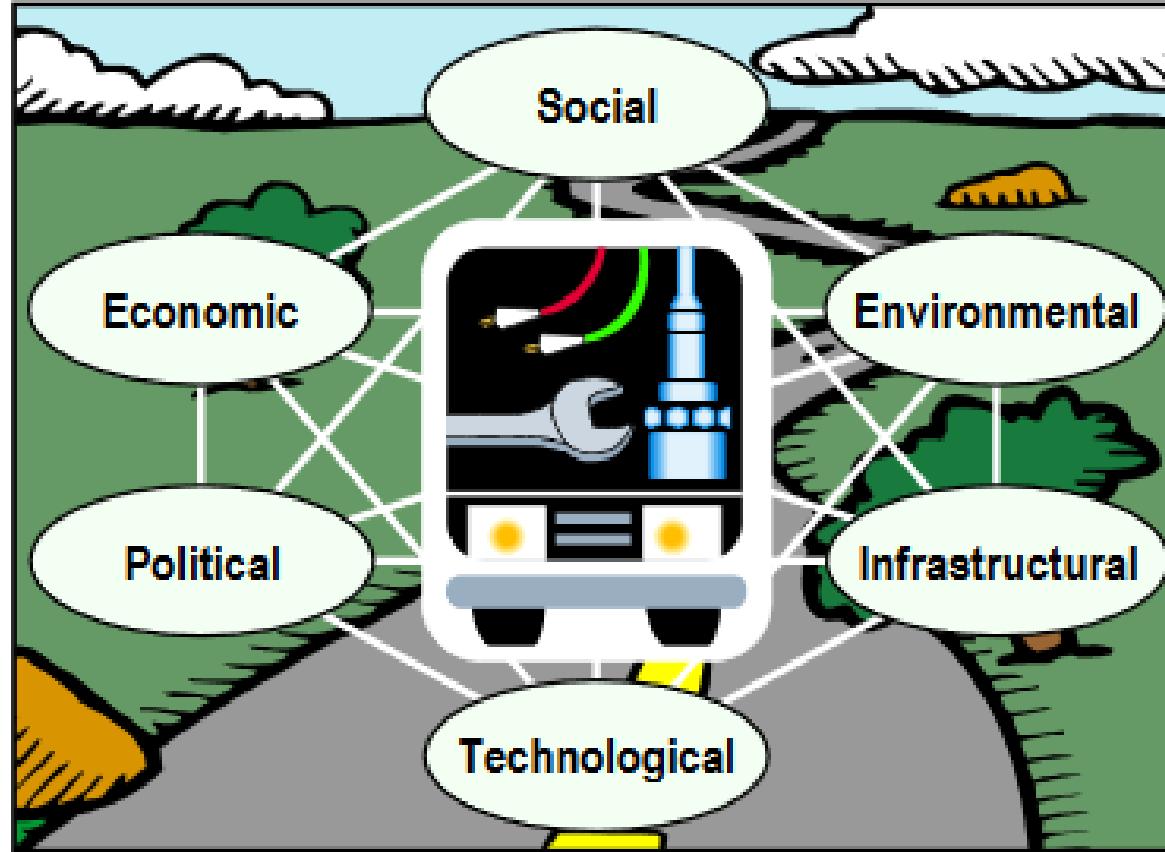
The Foresight Vehicle consortium has been active since 1997, involving more than 400 organizations and sponsoring collaborative research worth more than £80 million.

Goal: 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).

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



Trends and drivers that influence road transport system



Society, economy and the environment

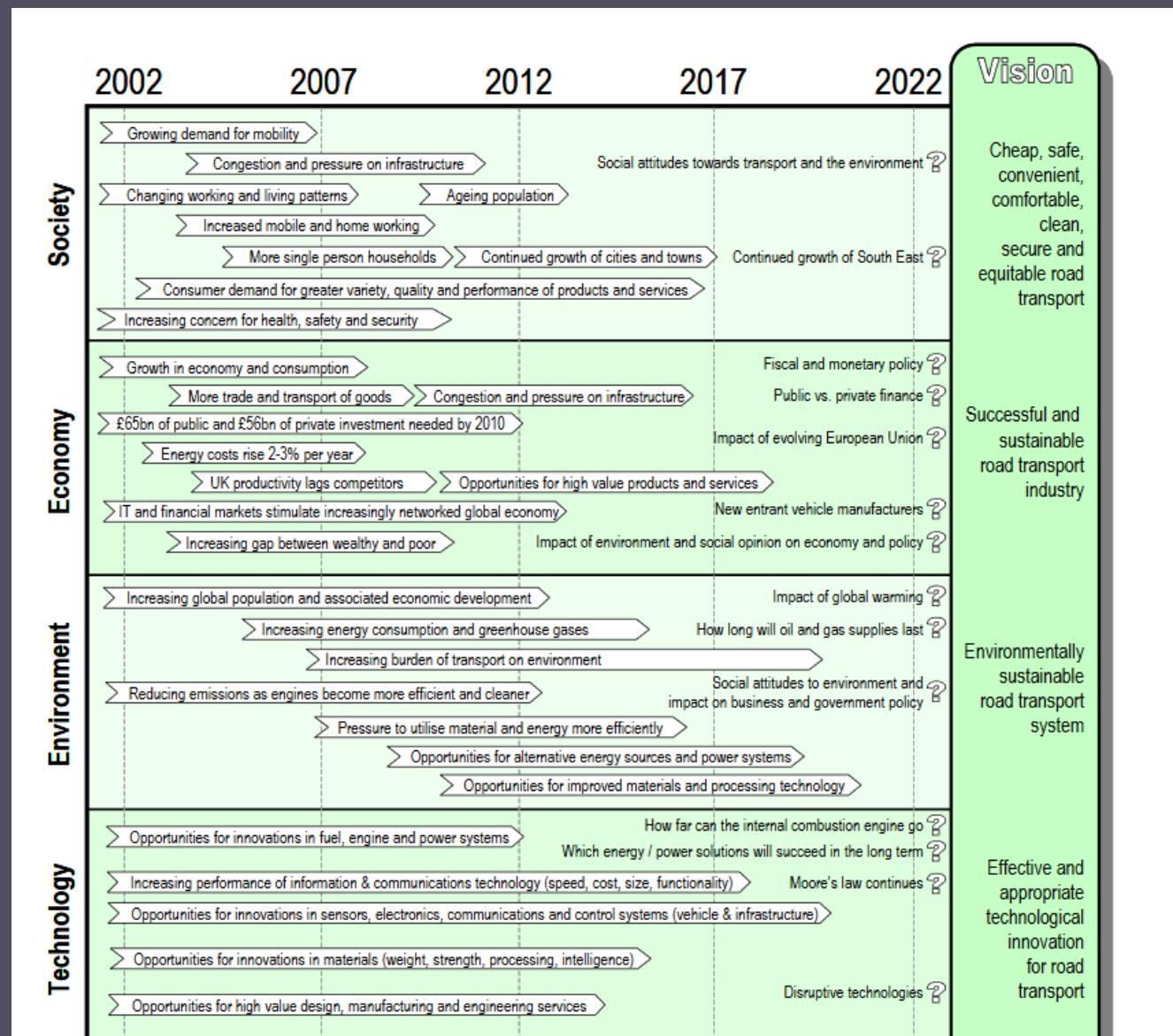
Social, economic and environmental drivers reflect the three cornerstones of sustainable development.

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.

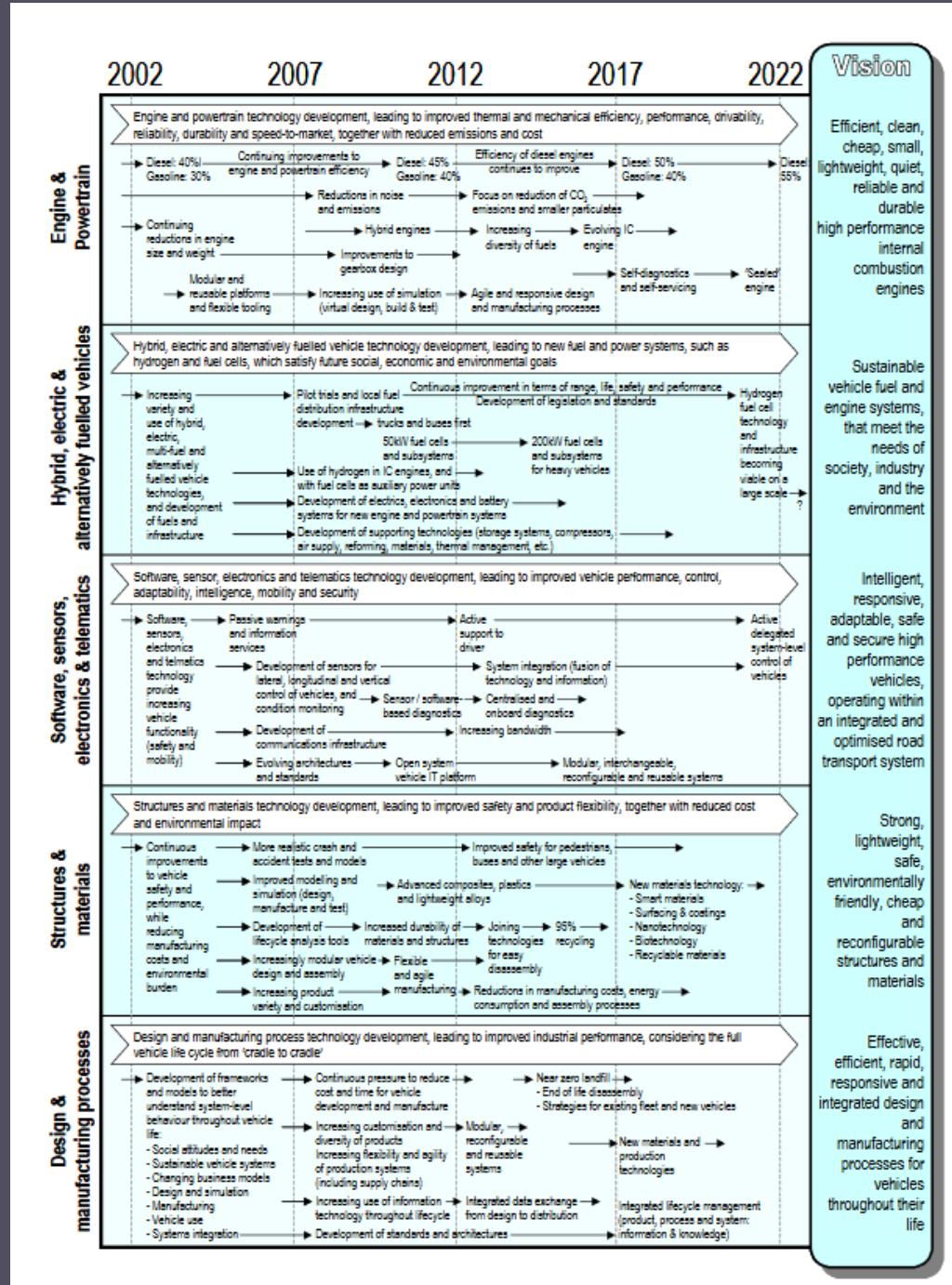
Technology, policy and infrastructure

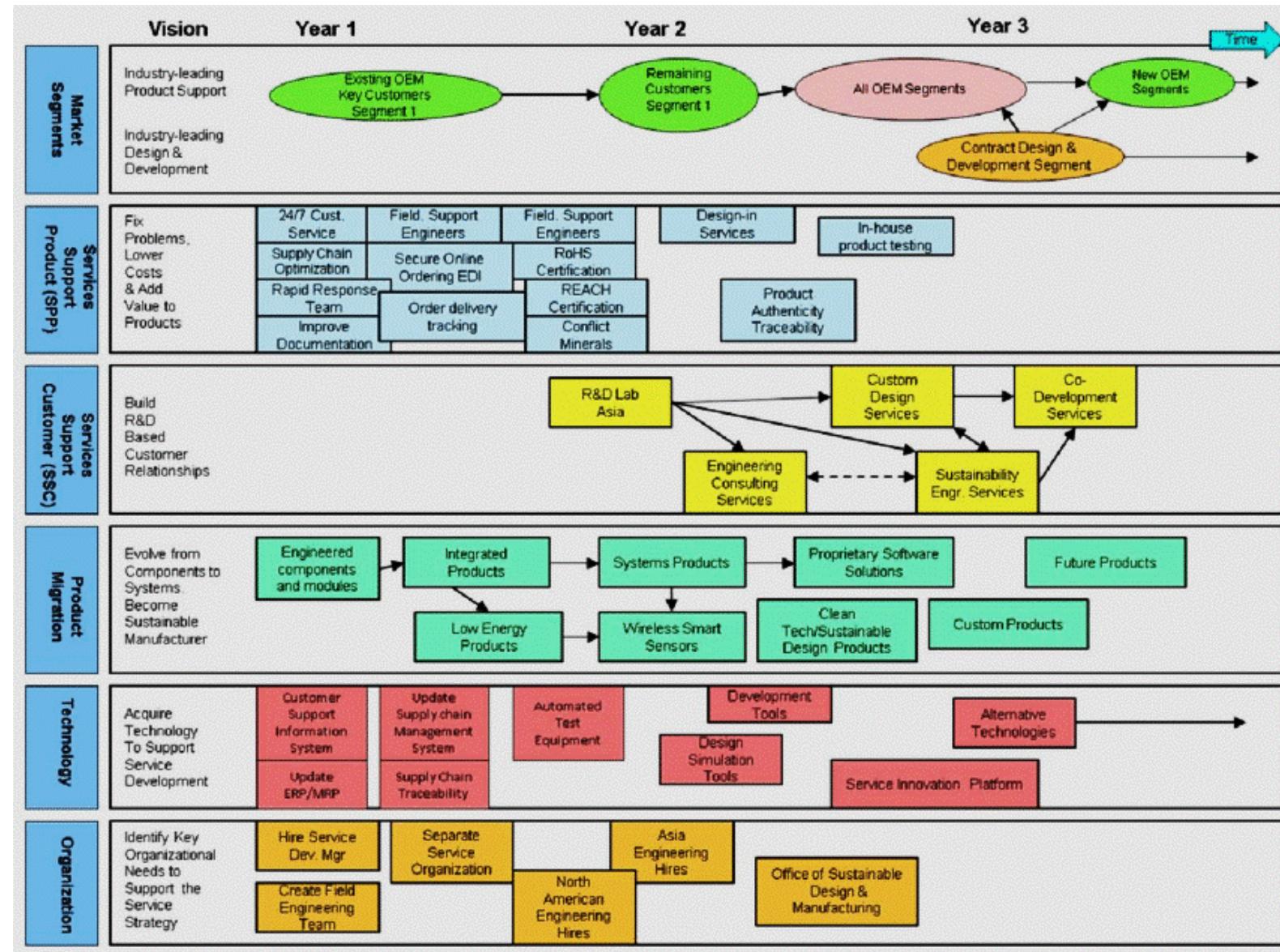
Technology, policy and infrastructure are different from the above three themes, in that activities here can either enable or constrain progress towards the primary social, economic and environmental goals

Industry and market trends and drivers



Technology evolution





Key Sources

Abbasi et al (2017) **Technology roadmap for the Creative Industries**, *Creative Industries Journal*, 10.1, 40-58

Geum, Lee & Park (2014) **Combining technology roadmap and system dynamics simulation to support scenario-planning: A case of car-sharing service**, *Computers & Industrial Engineering* 71 (2014) 37–49

Gindy, Cerit and Hodgson (2006) **Technology roadmapping for the next generation manufacturing enterprise**, *Journal of Manufacturing Technology Management*, Vol. 17 No. 4, pp. 404-416

Kerr and Phaal (2020) **Technology roadmapping: Industrial roots, forgotten history and unknown origins**, *Technological Forecasting & Social Change* 155

Lischka and Gemunden (2008) **Technology roadmapping in manufacturing: a case study at Siemens AG**, *Int. J. Technology Intelligence and Planning*, Vol. 4, No. 2, pp. 201-214

Modi, S., Vadhavkar, A. (2019). Technology Roadmap: Intelligent Mobility Technologies. Center for Automotive Research, Ann Arbor, MI.

Park et al (2020) **Twenty years of technology and strategic roadmapping research A school of thought perspective**, *Technological Forecasting & Social Change* 154

Phaal and Muller (2009) **An architectural framework for roadmapping: Towards visual strategy**, *Technological Forecasting & Social Change* 76 (2009) 39–49