

# briefing

## Technology roadmapping: facilitating collaborative strategy development

Roadmapping approaches are now widely used at company, sector and national levels to align research investments and other actions with goals and policy. This Briefing provides an overview of the technique and of the processes developed by the IfM's Centre for Technology Management. It focuses on how roadmapping can support industrial and research networks to build consensus about technology and other priorities required to move forward. It is illustrated with three case studies.

### Background

Originally developed by Motorola in the 1970s, technology roadmapping was designed to support improved alignment between technology and product development. Bob Galvin, the company's then CEO, defines a 'roadmap' as: "an extended look at the future of a chosen field of inquiry composed from the collective knowledge and imagination of the brightest drivers of change in that field". Since then the approach has been adopted widely by many organisations in different sectors around the world, at company, sector and national levels. The underlying concept is very flexible, and roadmapping methods have been

adapted to suit many different goals, supporting innovation, strategy and policy development and deployment. The most frequently cited benefit of the approach is communication. The process of roadmap development brings together the various key stakeholders and perspectives, building consensus. Once a roadmap has been developed it can be more widely disseminated, acting as a reference point for ongoing dialogue and action.

### Why undertake roadmapping?

Roadmapping provides a framework to help tackle some fundamental questions that apply in any strategic context:

- Where do we want to go? Where are we now? How can we get there?
- Why do we need to act? What should we do? How should we do it? By when?

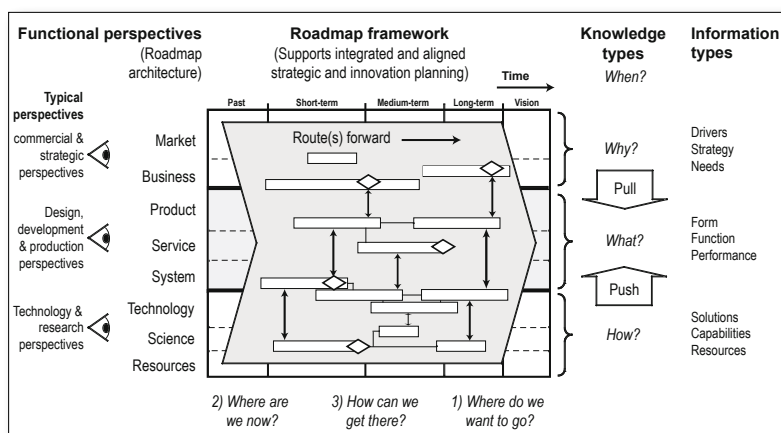
These questions highlight the flexibility of the approach, which can be readily adapted to suit a wide range of goals and contexts. In essence roadmaps are simple, adaptable 'strategic lenses' through which the evolution of complex systems can be viewed, supporting dialogue and communication.

### Roadmapping in practice

From its origins in the consumer electronics sector in the 1970s, roadmapping techniques spread initially to organisations in other technology-intensive sectors – aerospace and defence in particular. A key milestone in the evolution of the method was its adoption by the semiconductor industry, where in 1992 the first sector-level roadmap was published. This has been very influential, defining the collective vision of the industry and establishing a benchmark for technology development, accelerating innovation in the semiconductor sector. Unlike company roadmaps, which are usually confidential, the International Technology Roadmap for Semiconductors is in the public domain, leading to a much wider awareness of the approach.

A recent survey of public-domain roadmaps by the IfM has identified more than 1,500 examples from a wide range of sectors, including energy, transport, materials, aerospace, electronics, ICT, manufacturing, construction, healthcare, defence and pure science.

It is often claimed the process of developing roadmaps is as important as the roadmaps themselves, due to the associated communication and network-building benefits. The process needs to be customised to suit the context, along with the structure and format of the roadmap. Consideration should be given to how the first roadmap is developed and then also how it can be maintained to provide an ongoing reference point for communities of interest. Typically, for substantial sector level roadmaps it might take several months or more for a first good quality roadmap to be developed that is suitable for publication.



*Schematic multi-layered roadmap, aligning multiple perspectives*

## International applications

In 2003 the Dutch Ministry of Economic Affairs sponsored a study of the effectiveness of 'supra-company' (network level) roadmapping initiatives around the world, with the aim of assessing how roadmapping can support Dutch innovation policy and systems. The study reviewed a total of 78 roadmapping initiatives, mainly in Europe, USA, Canada and Japan, from which a number of 'good practices and lessons' were identified. These included:

- It is important to link roadmapping to broader strategy initiatives (for example, national innovation priorities).
- Launching a roadmapping activity was easier when it was within an existing 'social infrastructure' (for example, an industry association) firm-level applications.
- Creating high-level commitment from the start is critical, involving decision makers within companies (and government) throughout the process.
- There was no single format suitable for all situations – the approach has to be customised.
- Roadmapping is inherently exploratory in nature and so the plan should be flexible to accommodate learning as the process advances.
- A spirit of openness is important, to encourage new participants and thinking throughout the process.
- The financial aspects need to be clear – generally the costs of such initiatives are shared between the administering and participating organisations.
- Roadmapping is typically an iterative process, benefiting from review after the first roadmap is produced.

## Case illustrations

The IfM has facilitated more than 200 roadmapping applications, at firm and sector levels. Two examples are summarised here.

### UK Foresight Vehicle Programme

The technique has been used across a number of industry sectors, for example the UK Foresight Vehicle Programme, a group designed to foster innovative collaborations within the automotive industry. The programme



is administered by the UK Society of Motor Manufacturers and Traders (SMMT), and supported by the DTI. The initiative has been running since 1996, providing a national focus for technology development within the automotive sector in the UK. More than 100 individual projects have been generated, covering a wide range of manufacturing processes and product concepts.

A major roadmapping initiative was undertaken in 2002, with the aims of identifying the technology areas that would benefit from government support (aligned with EPSRC funding) and building the network of organisations involved. The process for developing the first version of the roadmap involved a total of ten workshops over a period of ten months, involving more than 160 participants from 60 organisations (including industry, academia and government).

The Foresight Vehicle Technology Roadmap has been widely disseminated, and has become a key reference point within the UK automotive sector, and internationally. The success of the first roadmap is demonstrated by the fact that the SMMT commissioned an update in 2004 (version 2), and a third is planned.

## Measurement and standards for emerging technologies

Another case example is the Measurement and Standards for Emerging Technologies (MSET) series of roadmaps which were developed in 2006 to identify measurement technology needs and research themes in a number of key UK sectors. A series of one-day workshops was held, each relating to a different sector: environmentally friendly transport; secure environment; sustainable consumption and production; emerging energy technologies; healthcare and bio-science; intelligent connected world; design, engineering and advanced manufacture; and the built environment.

## Workshops and roadmapping

While the particular approaches vary considerably, the use of workshops as a key ingredient is a common feature of the process, owing to the communication and network-development benefits, building consensus about what the key issues of interest and concern are, and the actions that are needed to move forward. The photo (left) shows how the roadmap framework is used in a workshop, using the 'S-Plan' approach developed by the IfM's Centre for Technology Management, providing a coherent structure ('common language') to guide discussion and capture views, in an active hands-on process. Two activities are illustrated:

- A large roadmap wall chart is used to share perspectives across the full scope of the topic of interest, to create a 'strategic landscape', providing context within which specific opportunities or issues of concern can be identified ('landmarks').
- Small groups then explore the specific topics in more detail, using a common template, to develop 'first-cut' roadmaps for review and discussion, to agree priorities, way forward and actions

Further work is typically required before, between and after workshops to collect data, analyse results, develop roadmap representations and associated reports.

A ninth workshop focused on crosscutting themes and synergies, drawing on the results from the eight sector workshops. This was enabled by the use of consistent structures and workshop methods across all eight sectors. As well as common technological issues, a large degree of commonality in industry drivers was observed across the eight sectors.

## Further information

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### Publications

*T-Plan: the fast start to Technology Roadmapping. Planning your route to success.* 2001

*Roadmapping for strategy and innovation: Aligning technology and markets in a dynamic world*

To be published 2010

[www.ifm.eng.cam.ac.uk/books](http://www.ifm.eng.cam.ac.uk/books)