

# Technology roadmap

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A **technology roadmap** is a plan that matches short-term and long-term goals with specific technology solutions to help meet those goals.<sup>[1]</sup> It is a plan that applies to a new product or process, or to an emerging technology.<sup>[2]</sup> Developing a roadmap has three major uses.<sup>[3]</sup> It helps reach a consensus about a set of needs and the technologies required to satisfy those needs; it provides a mechanism to help forecast technology developments and it provides a framework to help plan and coordinate technology developments.

The existence of product managers in the product software industry indicates that software is becoming more commercialized as a standard product. This manager is responsible over the whole line of software requirement management, defining of products and their releases and this with all internal and external stakeholders involved. In this context, product roadmapping can be placed to aid software product managers in planning and placing their products with the use of scientific and technological resources. For managing and using the technological resources technology planning can be used.

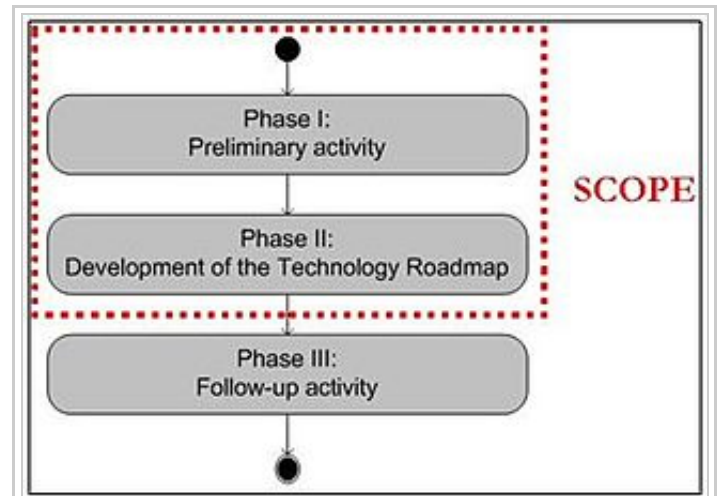


Fig 1: The Technology Roadmapping phases.

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## The Roadmapping process

The Technology Roadmapping Process conducts 3 phases (see figure 1.): preliminary activities, the development of the roadmap and the follow-up activities phase. Because the process is too big for one model the phases are modeled separately. Only the first two phases are considered. In the models no different roles are made, this is because everything is done by the participants as a group.

### Phase 1: Preliminary phase

The first phase, the preliminary phase (see figure 2.), consists of 3 steps: *satisfy essential conditions*, *provide leadership / sponsorship* and *define the scope and boundaries for the technology roadmap*. In this phase the key decision makers must identify that they have a problem and that technology roadmapping can help them in solving the problem.

#### Satisfy essential conditions

In this step it must become clear what the conditions are (they have to be identified) and if they are not met that somebody will take the actions necessary to meet the unmet conditions. These conditions include for example the following: there must be a need for the technology roadmap, input and participation from several different parts of the organization (e.g. marketing, R&D, the Strategic Business Units ) with different planning horizons and different perspectives and the process should be needs driven. All the conditions should be satisfied (or someone is going to take the actions necessary) in order to continue to the next step. The participants can have zero or more conditions of their own. It applies to all the conditions that they have the attribute to be met or not.

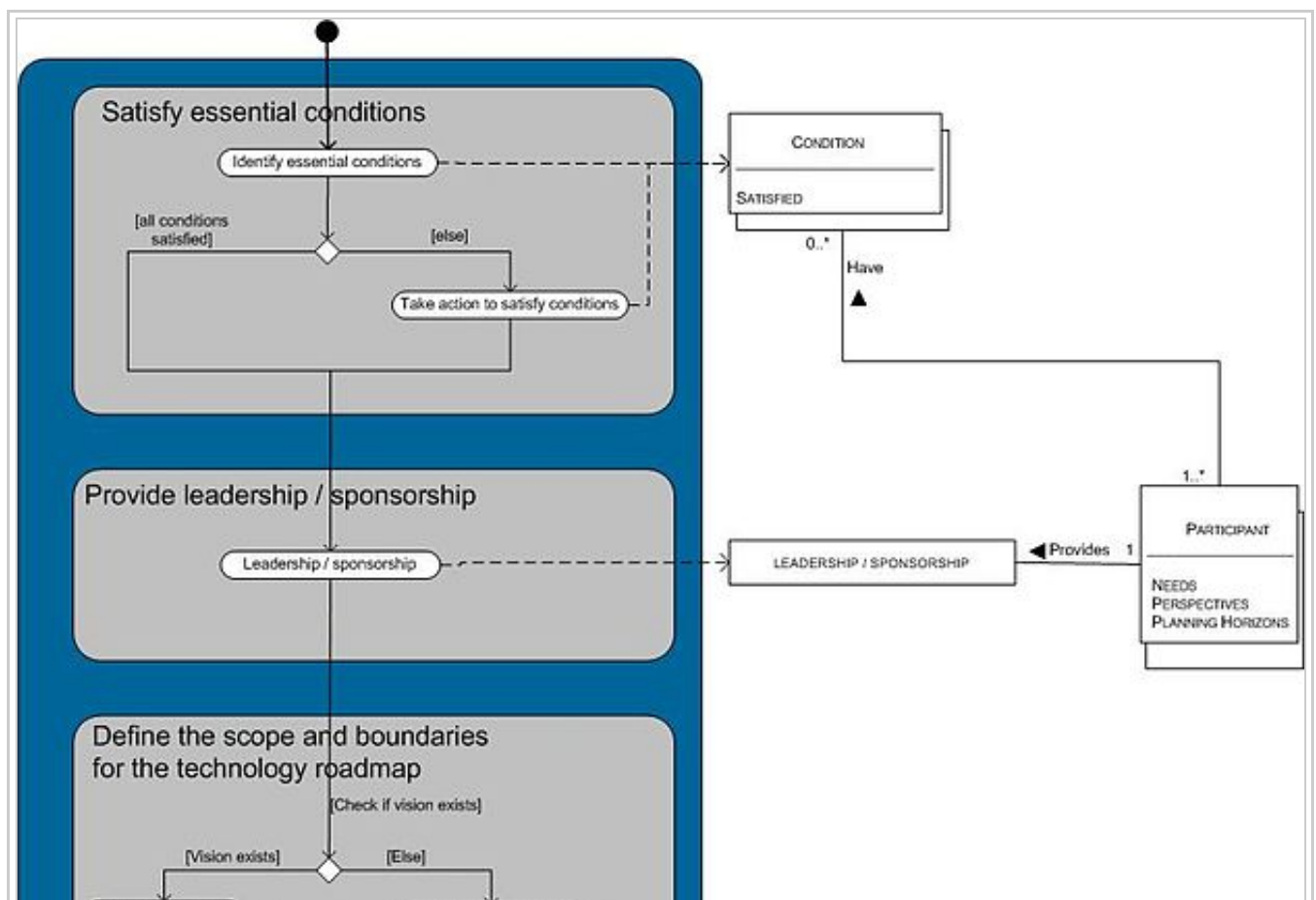
#### Provide leadership / sponsorship

Committed leadership is needed because time and effort is involved in creating the technology roadmap. Additionally the leadership should come from one of the participants, one of them provides leadership / sponsorship. This means that the line organization must drive the process and use the roadmap to make resource allocation decisions.

#### Define the scope and boundaries for the technology roadmap

In this step the context for the roadmap will be specified. In the company a vision should exist and it must be clear that the roadmap can support that vision. If the vision does not exist one should be developed and clearly stated. When that is done the boundaries and the scope of the roadmap should be specified. Furthermore the planning horizon and the level of details should be set. The scope can be further divided into the technology scope and the participation scope.

In table 1. all the different sub-activities of the preliminary activity phase can be seen. All the sub-activities have concepts as end “products”, these are marked in bold. These concepts are the actual meta-data model, which is an adjusted class diagram .



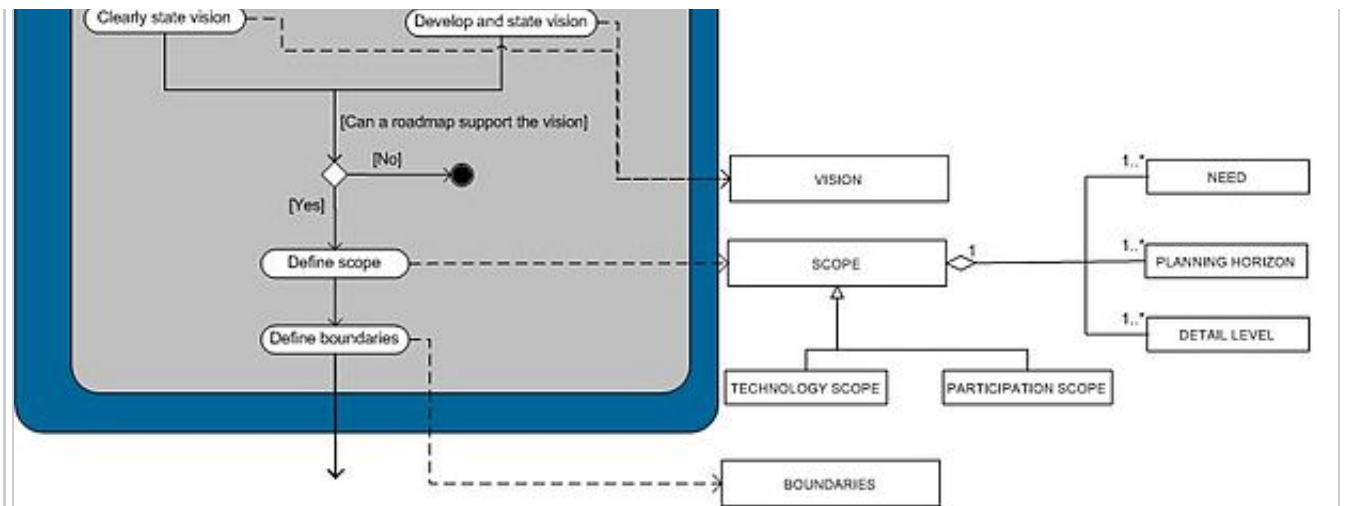


Figure 2. The process-data model of the preliminary phase.

**Table 1. Activity table for the preliminary activity phase**

| Activity  | Sub-Activity                      | Description  |
|---|-----------------------------------|--|
| <b>Satisfy essential conditions</b>                               | Identify essential conditions     | When all the <b>participants</b> come together, essential <b>conditions</b> can be identified (e.g. what groups should be involved, what are the key customers and what are the key suppliers).  |
|   | Take action to satisfy conditions | For technology roadmapping to succeed, <b>conditions</b> from the <b>participants</b> must be satisfied.   |
| <b>Provide leadership / sponsorship</b>                           |                                   | The part of <b>leadership / sponsorship</b> should be taken by line organization; they must drive the roadmapping process and use the roadmap to make resource allocation decisions.   |
| <b>Define the scope and boundaries for the technology roadmap</b> | Clearly state vision              | The already existing <b>vision</b> has to be clear.  |
|   | Develop vision                    | The <b>vision</b> is developed and stated clearly.   |
|   | Define scope                      | The <b>scope</b> of the project can further define the set of <b>needs</b> , <b>planning horizon</b> and level of <b>detail</b> . The scope can be further divided into the <b>technology scope</b> and the <b>participation scope</b> . |
|   | Define boundaries                 | The <b>boundaries</b> should also be included.   |

## Phase 2: Development phase

The second phase, the development of the technology roadmap phase (see figure 3.), consists of 7 steps: *identify the “product” that will be the focus of the roadmap, identify the critical system requirements and their targets, specify the major technology areas, specify the technology drivers and their targets, identify technology alternatives and their timelines, recommend the technology alternatives that should be pursued and create the technology roadmap report.* These steps create the actual roadmap.

### Identify the “product” that will be the focus of the roadmap

In this step the common product needs are identified and should be agreed on by all the participants. This is important to get the acceptance of all groups for the process. In case of uncertainty of the product needs scenario-based planning can be used to determine the common product needs. In figure 3. it can be seen that the

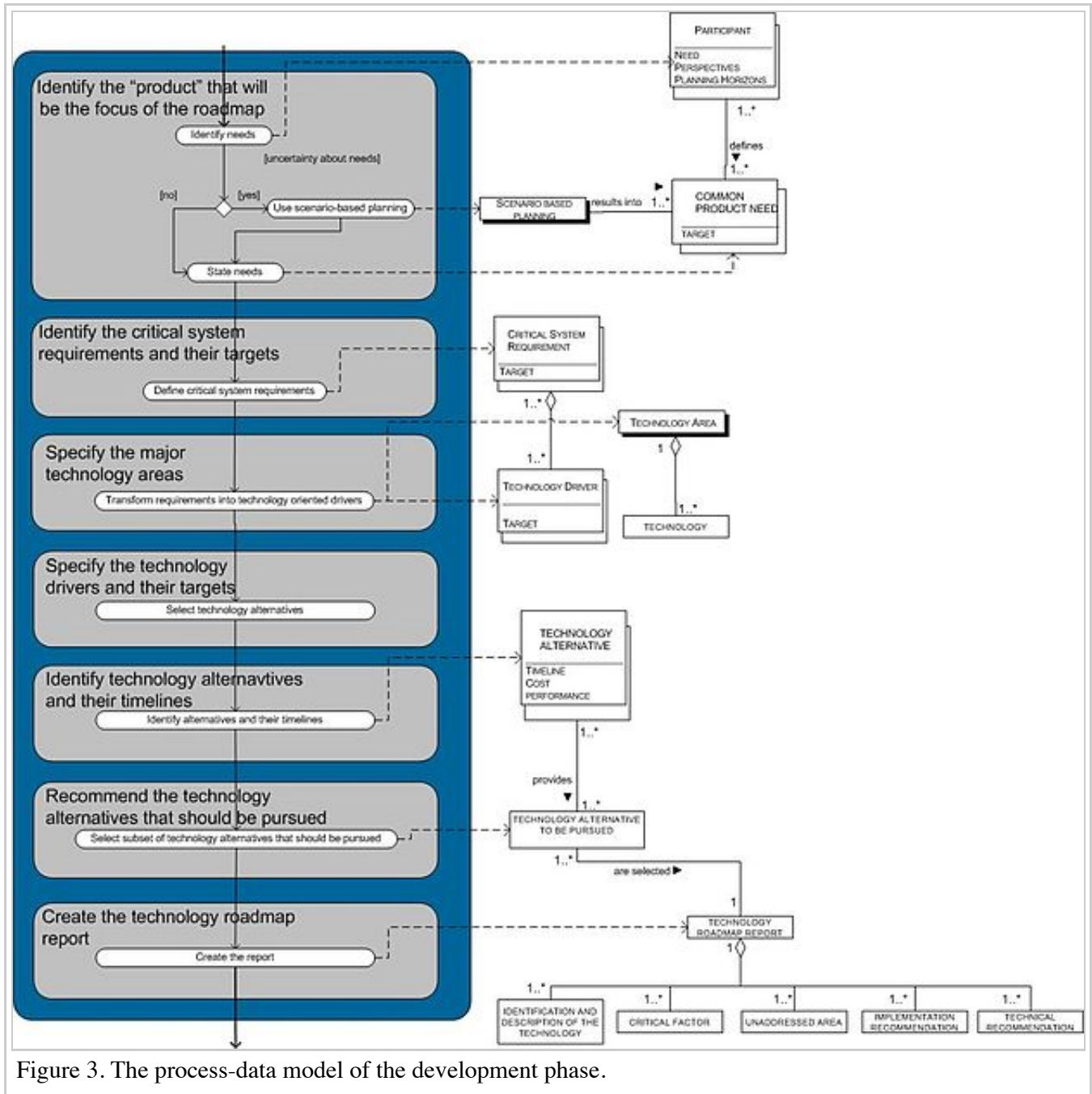


Figure 3. The process-data model of the development phase.

participants and possibly the scenario-based planning provide the common product needs.

### Identify the critical system requirements and their targets

Once it is decided what needs to be roadmapped the critical system requirements can be identified, they provide the overall framework for the technology roadmap. The requirements can have targets (as an attribute in figure 3.) like reliability and costs.

### Specify the major technology areas

These are the areas which can help achieve the critical system requirements. For each technology area several technologies can be found. Example technology areas are: Market assessment, Crosscutting technology, Component development and System development.

### **Specify the technology drivers and their targets**

In this step the critical system requirements from step *Identify the critical system requirements and their targets* are transformed into technology drivers (with targets) for the specific technology area. These drivers are the critical variables that will determine which technology alternatives are selected. The drivers depend on the technology areas but they relate to how the technology addresses the critical system requirements.

### **Identify Technology alternatives and their timelines**

At this point the technology drivers and their targets are specified and the technology alternatives that can satisfy those targets should be specified. For each of the alternatives a timeline should be estimated for how it will mature with respect to the technology driver targets.

#### **Time**

This factor can be adapted suitable for the particular situation. The time horizons for E-commerce and software related sectors are usually short. Other distinctions can be made on scale and intervals.

### **Recommend the technology alternatives that should be pursued**

Because the alternatives may differ in costs, timeline etc. a selection has to be made of the alternatives. These will be the alternatives to be pursued in figure 3. In this step a lot of trade-off has to be made between different alternatives for different targets, performance over costs and even target over target.

### **Create the technology roadmap report**

At this point the technology roadmap is finished. In figure 3, it can be seen that the technology roadmap report consists of 5 parts: the identification and description of each technology area, critical factors in the roadmap, unaddressed areas, implementation recommendations and technical recommendations. The report can also include additional information. In table 2. all the different sub-activities of the development phase can be seen.

**Activity table for the Development phase**

| <b>Activity</b>  | <b>Sub-Activity</b>                                     | <b>Description</b>  |
|--|---|---|
| Identify the “product” that will be the focus of the roadmap | Identify needs  | This critical step is to get the participants to identify and agree on the <b>COMMON PRODUCT NEEDS</b> . This is important to get their buy-in and acceptance.  |
|  | Use Scenario-based planning                             | If there is major uncertainty about the <b>COMMON PRODUCT NEEDS</b> <b>SCENARIO-BASED PLANNING</b> can be used. Each scenario must be reasonable, internally consistent and comparable with the other scenarios.  |
|  | State needs   | These are the <b>NEEDS</b> for the product.   |
| Identify the critical system requirements and their targets  | Define critical system requirements                     | The <b>CRITICAL SYSTEM REQUIREMENTS</b> provide the overall framework for the roadmap and are high-level dimensions to which the technologies relate. These include things like reliability and costs.  |
|  | Define targets  | For each of the system requirements <b>TARGETS</b> have to be defined.  |
| Specify the major technology areas                           | Transform requirements into technology oriented drivers | The major <b>TECHNOLOGY AREAS</b> should be specified to help achieve the <b>CRITICAL SYSTEM REQUIREMENTS</b> for the product. The <b>CRITICAL SYSTEM REQUIREMENTS</b> are then transformed into <b>TECHNOLOGY DRIVERS</b> for the specific <b>TECHNOLOGY AREAS</b> .                           |
| Specify the technology drivers and their targets             | Select technology alternatives with their targets       | <b>TECHNOLOGY DRIVERS</b> and their <b>TARGETS</b> are set based on the <b>CRITICAL SYSTEM REQUIREMENT TARGETS</b> . It specifies how viable <b>TECHNOLOGY ALTERNATIVES</b> must be to perform by a certain date. From the available <b>TECHNOLOGY ALTERNATIVES</b> a selection has to be made. |
| Identify technology alternatives and their timelines         | Identify alternatives and their timelines               | The <b>TECHNOLOGY ALTERNATIVES</b> that can satisfy the <b>TARGETS</b> must be identified. Next to this the <b>TIMELINE</b> from each alternative has to be identified.   |
| Recommend the technology alternatives that should be pursued | Select subset of technology alternatives to be pursued  | Determine which <b>TECHNOLOGY ALTERNATIVE TO PURSUE</b> and when to shift to a different <b>TECHNOLOGY</b> . Consolidate the best information and develop consensus from many experts.  |
| Create the technology roadmap report                         | Create the report                                       | Here the actual <b>TECHNOLOGY ROADMAP REPORT</b> is created. This report includes: <b>IDENTIFICATION AND DESCRIPTION OF THE TECHNOLOGY</b> , <b>CRITICAL FACTOR</b> , <b>UNADDRESSED AREA</b> , and <b>IMPLEMENTATION RECOMMENDATION AND TECHNICAL RECOMMENDATION</b> .                         |

**Phase 3: Follow-up activity phase**

This is the moment when the roadmap must be critiqued, validated and hopefully accepted by the group that will be involved in any implementation. For this a plan needs to be developed using the technology roadmap. Next there must be a periodical review and update point, because the needs from the participants



and the technologies are evolving.

# Planning and Business Development Context for Technology Roadmapping

The process of technology roadmapping fits into corporate strategy, corporate strategic planning, technology planning and the business development context. Three critical elements should be connected: needs, products and technology.

## Knowledge and skills required

### Consultant with skills

In order to create a technology roadmap it is required to have a certain set of knowledge and skills. This means that some of the participants must know the process of technology roadmapping. Next to this group-process and interpersonal skills are required since the process includes a lot of discussions and finding out what the common need is. If the amount of participants is really large there might be need for a consultant or facilitator.

## The purpose of technology Roadmapping

### Product planning

This is the most common type of a technology roadmap; linking the insertion of technologies into products.

### Programme planning

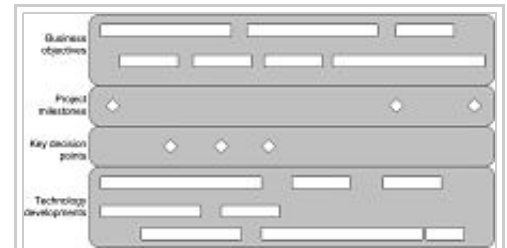
This type is more directed to the implementation of strategy and related to project planning. Figure 5 shows the relationships between technology development phases, programme phases and milestones.

## The formats of technology Roadmapping

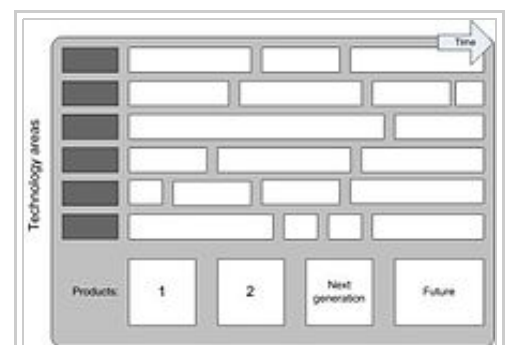
- Bars : Almost all the roadmaps are (partly) expressed in bars for each layer. This makes the roadmaps very simple and unified, which makes the communication and integration easier.
- Graphs : Also a technology roadmap can be expressed as a graph, usually one for each of the sub layers. (e.g. IMEC uses the second method).

## See also

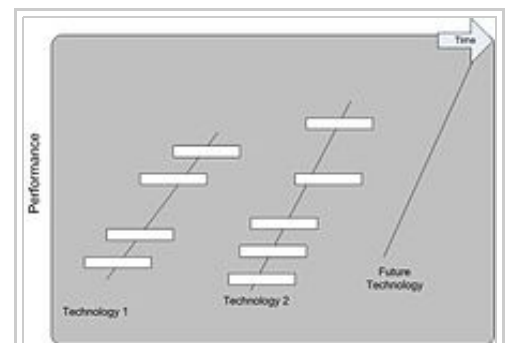
- Business plan



5. Programme planning example.



6. Bars example.



7. Graphs example.



- Corporate strategy
- Foresight (management)
- Prioritizing Requirements using a Cost-Value Approach
- Portfolio Management for New Products

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## Further reading

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