Roadmapping

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TBD

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Abstract

This module addresses roadmapping.

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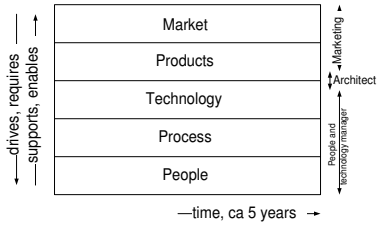
Chapter 1

Roadmapping



1.1 Introduction

The definition of new products is a difficult activity, which frequently ends in a stalemate: "It must be done" vs "It is impossible to realize in such a short time frame". The rootcause of this frustrating stalemate is most often the fact that we try to solve a problem in a much too limited scope. Roadmapping is a method to prevent these discussions by lifting the discussion to a wider scope: from single product to product portfolio and from single generation of products to several years.

In addition to the scope change the roadmap is the integrating vision which shared by the main stakeholders. A shared vision generates focus for the entire organization and enables a higher degree of cooperating concurrent activities.

This article describes what a roadmap is, how to create and maintain a roadmap, the involvement of the stakeholders and gives criteria for the structure of a roadmap.

1.2 What is in a roadmap?

A roadmap is a visualization of the future (typical 5 years) integrating all relevant business aspects. Figure 1.1 shows the typical contents of a roadmap. At the right hand side the owner of the view is shown, while the left hand side shows

the asymmetry of the views: the market is driving, while technology people and process are enabling.

Figure 1.1: The contents of a typical roadmaps

Key to a good roadmap is the skill of showing the important, relevant issues. The roadmap should provide an immediate insight in the most relevant developments from the 5 mentioned points of view. These issues are primarily related by the time dimension.

The convention used in this article is to show products, technologies, people or process when they are or should be available. In other words the convention is to be extrovert, be oriented to the outside world. The introvert question when and how to achieve these items are not directly shown, although the availability of people and process is quite often before the availability of the technology, which again predates the product or market.

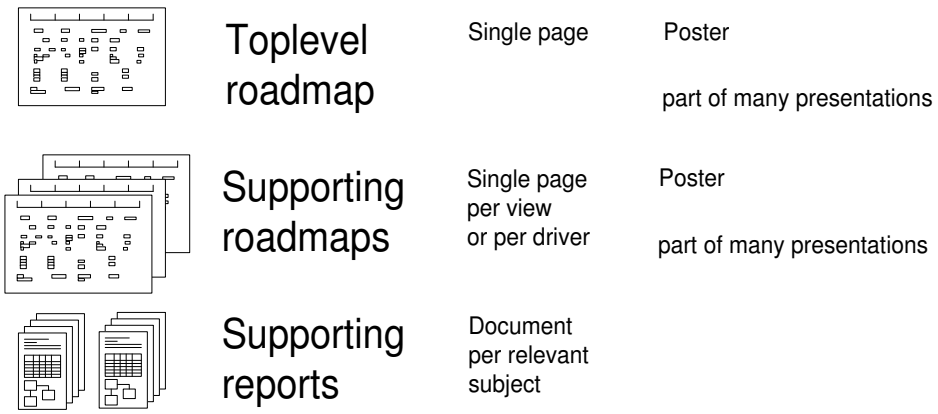


Figure 1.2: The roadmap is documented at several layers of detail

A good roadmap is documented and presented at several layers of detail. The higher levels are important to create and maintain the overview, while the more

detailed levels explain the supporting data. Figure 1.2 shows the desired granularity of the roadmap documentation.

1.3 Why Roadmapping?

The policy and planning process [5] relies heavily on roadmapping as tool. The main function of roadmapping is to provide a shared insight and overview of the business in time. This insight and overview enables the management of the 3 other processes:

- the customer oriented process
- the product creation process
- the people process and technology management process

Where managing these processes means defining the constraints for these processes in terms of budgets and results: Where do we spend our money and what do we get back for it?

At business units without roadmapping the following effects can be observed:

- Frequent changes in product policy
- Late start up of long lead activities, such as people recruitment and process change
- Diverging activities of teams
- Missed market opportunities

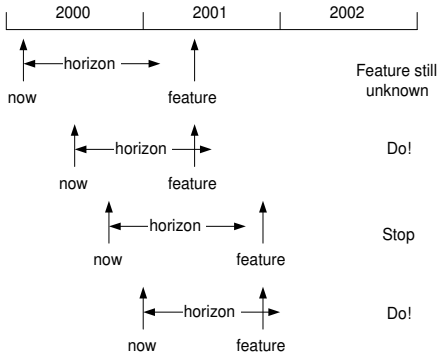


Figure 1.3: Management based on a limited horizon can result in a binary control of product policy decisions

The frequent changes in the product policy are caused by the lack of time perspective. In extreme cases the planning is done with a limited time horizon of for instance 1 year. External events which are uncertain in time can shift into the limited horizon when popular and disappear again when something else is hyping. This effect is shown in figure 1.3

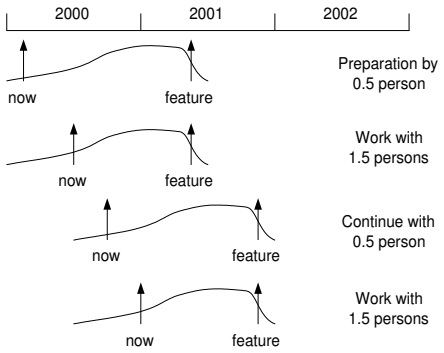


Figure 1.4: Management with a broader time and business perspective results in an analog control: work with some more or some less people on the feature

The availability of a roadmap will help the operational management to perform a low pass filter on their decisions. This is shown in figure 1.4.

An inherent benefit of roadmapping is the anticipating value, which is especially important for everything which has a long lead time. Examples are technology, people and process. This is not limited to development, for example for manufacturing it is the same; reliable mass production has a significant lead time.

1.4 How to create and update a roadmap

A roadmap is a joint effort of all relevant stakeholders. For a typical High-tech company the stakeholders will be:

- Business manager (overall enterprise responsible)
- Marketing manager
- People and technology manager(s)
- Operational manager(s)
- Architect

An efficient way to create or update a roadmap is to work in "burst-mode": concentrate for a few days entirely on this subject. To make these days productive

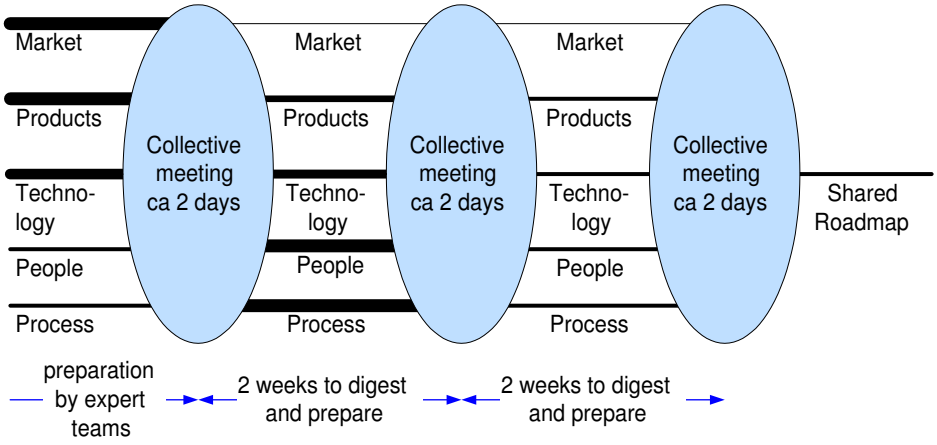


Figure 1.5: Creation or Update of a roadmap in "Burst-mode"

a good preparation is essential. Figure 1.5 shows the roadmap creation or update as three successive bursts of 2 days.

The input for first days is prepared by expert teams, which focus on the market, the product and the technology section of the roadmap. The people and process status should be available in presentable format. The target of the first burst is:

- Shared vision on market
- First iteration of possible products as an answer to the market
- Share technology status, as starting point for technology roadmap
- Explore people and technology status, to identify main issues

Between the first and second burst and between the second and third burst some time should be available, at the one hand to digest the presented material and the discussions, at the other hand to prepare the next session. The target of the second burst is:

- Obtaining a shared vision on the desired technology roadmap
- Sharing the people and process issues required for the products defined in the first iteration
- Analyzing a few scenarios for products, technologies, people, and process

The thickness of the lines in figure 1.5 indicate the amount of preparation work for that specific part of the roadmap. It clearly shows the the shift in attention from the market side in the beginning to the people and process side later. This shift in

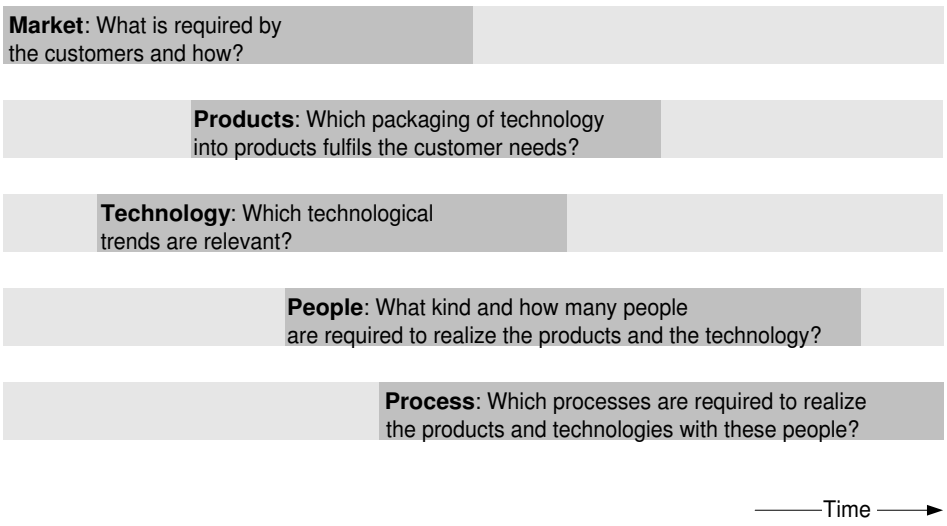


Figure 1.6: The roadmap activities visualized in time.

attention corresponds with the asymmetry in figure 1.1: the market is driving the business, the people and processes are enabling the business.

The function of the collective meetings is to iterate over all these aspects and to make explicit business decisions, which means that the product roadmap should be matched by the technology, people and process roadmap. Note that the marketing roadmap can deviate, in other words an explicit business decision can be made to leave market segments to the competition.

Figure 1.6 shows the roadmap activities in time. Vertical the same convention is used as in figure 1.1, the higher entities drive the lower entities in the roadmap. This figure immediately shows that although "products" are driving the technology, the sequence in making and updating the roadmap is different: the technological opportunities are discussed before detailing the product section of the roadmap.

1.5 Roadmap deployment

The roadmap is a shared vision of the organization. This vision is implemented in smaller steps, for instance by defining outputs per program and the related resource allocations per program. In Figure 1.7 it is shown that roadmap updates are performed regularly, in this figure every year. After determining the vision a "budget" is derived, which is revised with an higher update frequency, here every 3 months. The budget itself is used as the framework for the operation, which realizes the outputs defined in the budget. The operational activity itself updates the schedules again with a much higher frequency than the budget update frequency; within the operational activity the updates are mostly event driven: changes in the

market, technology or resources which render the existing plan obsolete.

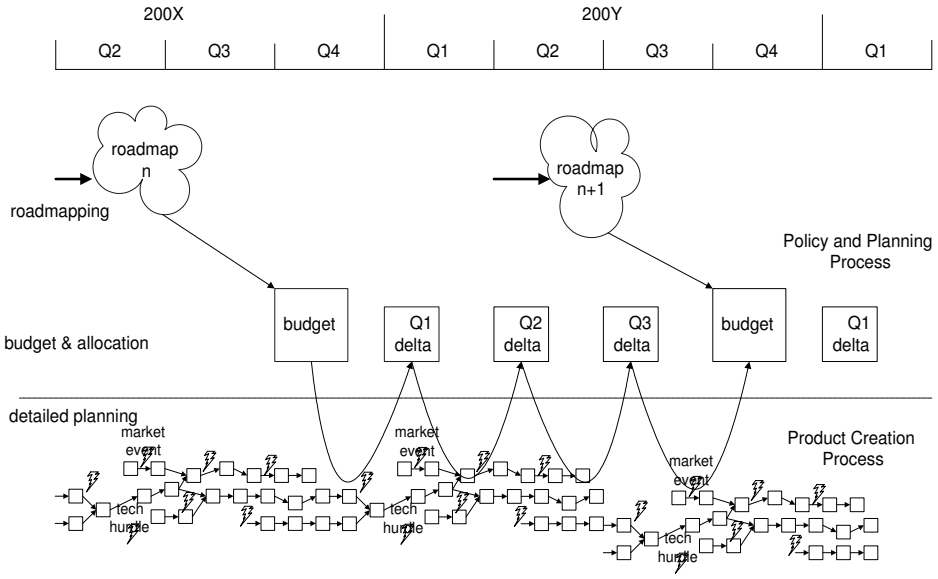


Figure 1.7: The roadmap is used to establish committed resource allocations and outputs as an baseline for development. Such a budget is updated regularly, for instance every quarter. Note that project plans change much faster, these plans are the control means for projects.

In other words from long term vision to short term realization is a 3-tier approach:

	horizon	update	scope	type
Roadmap	5 years	1 year	Portfolio	Vision
Budget	1 year	3 months	Program	Commitment
Detailed plan	1 mnth..1yr	1 day..1 mnth	Project or activity	Control means

The roadmap gives the context for the budget, the budget defines the context for the detailed plans.

1.6 Roadmap Essentials

Each roadmap should fulfil the following requirements:

- Recognizable issues for all stakeholders
- Clear positioning in time; uncertainty can be visualized
- The main events (enabling or constraining) must be present

- Limited amount of information to maintain the overview

1.6.1 Selection of most important or relevant issues

The most essential art of making a roadmap is the selection of the most relevant issues. It is quite easy to generate an extensive roadmap with all marketing and technological events visualized, however this kind of roadmap is only the first step in making the roadmap, because the overload of information will inhibit the necessary overview.

1.6.2 Keydrivers as a means to structure the roadmap

In [2] keydrivers are explained as an effective method to capture requirements. These keydrivers can also be very helpful in the creation and update of the roadmap. At the marketing side the trend in these keydrivers must be visible in the roadmap. This also helps to structure the roadmap as well.

The supporting roadmaps should clarify how the keydriver trends will be supported. For instance a technology roadmap per keydriver is a very explicit way to visualize the relationship between the market in terms of keydrivers and technology.

1.6.3 Nothing is certain, ambiguity is normal

A roadmap is a means to share insight and understanding in a broader time and business perspective. Both dimensions are full of uncertainties and mostly outside the control of the stakeholders. It can not be repeated enough that a roadmap is **only** a vision (or dream?).

The only certainty w.r.t. a roadmap is that reality will be differ from the vision presented in the roadmap.

This means that the investment in making the roadmap more accurate and more complete should be limited. Nobody can predict the future, we will have to live with rather ambiguous visions and expectations of the future.

1.6.4 Use facts whenever possible

The previous subsection can be used as an excuse to deliver sloppy work. Unfortunately a sloppy roadmap will backfire to the author. It is recommended to base a roadmap on facts whenever possible. Sources of facts are:

- Market analysis reports (number of customers, market size, competition, trends)
- Installed base (change requests, problem reports, historical data)
- Manufacturing (statistical process control)

- Suppliers (roadmaps, historical data)
- Internal reports (technology studies, simulations)

Use of multiple data sources enable cross-verification of the sanity of assumptions. For instance predictions of the market size in units or in money should fit with the amount of potential customers and the amount of money these customers are capable (and willing) to spend.

1.6.5 Don't panic in case of impossibilities

It is quite normal that the roadmap sections appear to be totally inconsistent. For instance a frequent occurring effect is that the budget estimate in response of the market requirements is 3 times the available budget[1]. Looking back in retrospect the realized amount of work for the given budget is often twice the estimate made for the roadmap. In other words, due to a number of effects, the roadmap estimates tend to have a pessimistic bias.

The overestimation can be caused by:

- Quantization effects of small activities (the amount of time is rounded to manweeks/months/years)
- Uncertainty is translated into margins at every level (module, subsystem, system)
- Counting activities twice (e.g., in technology development and in product development)
- Quantization effects of persons/roles (full time project leader, architect, product manager, et cetera per product)
- Lack of pragmatism (technical ambition is not too bad during the roadmap process, as long as it does not pre-empt a healthy decision)
- Too many bells and whistles without business or customer value

1.7 Roadmap example

Due to the strategic value of roadmaps for the business it is impossible to illustrate the article with real actual roadmaps. Figure 1.8 shows an academic example of a

[1] This factor 3 is an empiric number, which of course depends on the company and its culture. In one of the companies I have worked for the pragmatic Anglo-Saxon culture had a somewhat smaller gap between the estimated requirement and the available budget. In this company a well supported shortage was taken seriously by the management, which in return might have resulted in less defensive overestimations.

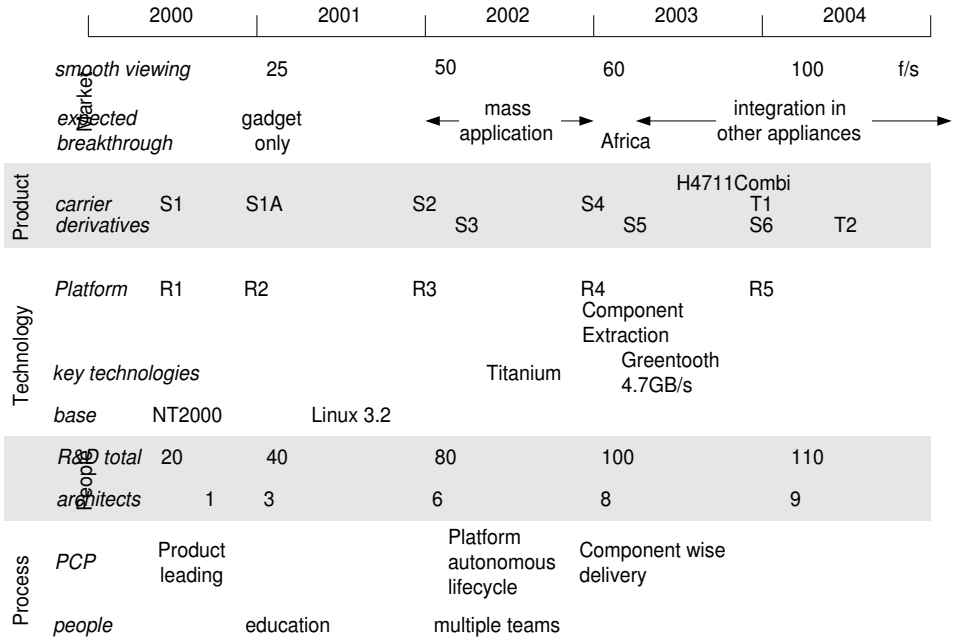


Figure 1.8: An academic example of a roadmap, to illustrate the structure of the highest part of the roadmap

highest level roadmap.

This example shows that the highest level roadmap should fit on a single A4. Presented on an overhead sheet or projected by means of a beamer the text should be readable for the audience. As can be seen from this example this requirement is quite a challenge. For the overview it is essential to show the information entirely, to enable everyone to see the broader perspective and to see the many underlying relationships.

Supporting roadmaps can concentrate on specific relations, for instance between keydriver and the required technology. These supporting roadmaps should be linked to the highest level roadmap by the time axis and a small set of recognizable landmarks, for instance quantified keydrivers and the main products.

1.7.1 Time Axis

Every roadmap has a time axis, where the left hand side should correspond to the near future (between the day of creation and half a year in the future). The right hand side typical is 5 years in the future. For supporting roadmaps both zooming in and zooming out can help to bring a specific message. For instance for a subsection of technology it might be useful to show the next 3 years only, if a lot of information is present in that period. To make some marketing or technology

trends clear a larger span of time might be useful, for instance for Moore's law a 10 or even 15 year window might be required.

In some cases it is also helpful to show the historical context. Historical data is an important source of information. For instance in the lithography market it is relevant to know the introduction dates of new exposure wavelength. A single introduction date is not enough in the lithography case, the introduction lead times play an important role in the product definitions. Hence showing the R&D use and showing the volume production use for historical wavelength transitions helps to get an historical perspective.

1.7.2 Vertical axis

The vertical axis describes the subject in the roadmap. The main division in market, product, technology, people and process is visually supported by the background color. The headers are required as legend for the less experienced roadmap readers, however these should use as little space as possible, from information point of view this is overhead. Quite often more vertical structure is present, for instance grouping towards market, product or technology type, grouping per keydriver et cetera. In figure 1.8 examples are *smooth viewing* as keydriver, *expected market breakthroughs* and *Platforms*. Again this structuring can be made explicit by showing it at the vertical axis, where it should look different from the roadmap contents itself. Here also the space usage should be minimized.

Space in the roadmap diagrams is the most scarce resource. Common information is sometimes present only once, for instance the units for the frame rate *f/s* is at the right hand side of the diagram. The information in the center of the roadmap is reduced to the essence, although it should stay recognizable.

1.7.3 Market

In this example only 1 keydriver *smooth viewing* is shown. This keydriver is here expressed in terms of a frame rate, which in the user community appears to be the dominating parameter to express the smoothness of viewing. The numbers here indicate the user expectations with respect to this frame rate. This expectation is the result of the general perception of technology and the competition at the one hand and the real need at the other hand. It might well be that at a certain frame rate, the focus shifts towards resolution. If that is the case this should be visible in the roadmap.

Although shown in the market part are market relevant breakthroughs which are expected. In this example it is expected that the first generation of products will be *gadget only* products. This single phrase will result in a cascade of requirements and decisions, ranging from *appealing to gadget oriented people* to *small series production and logistics only*.

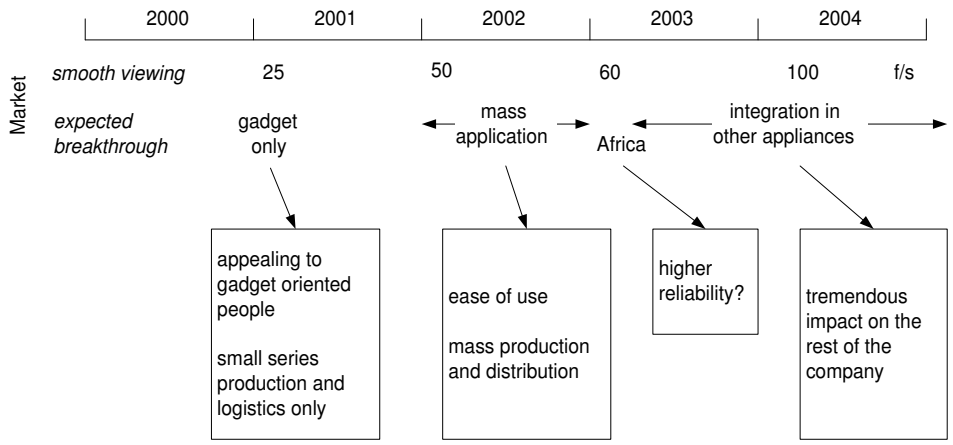


Figure 1.9: The market part of the highest level roadmap

The next breakthrough in this example is the use of the product in the mass market. An uncertainty of one year is shown for this breakthrough, the opinion is that it will happen, however the timing is somewhat uncertain. Again this single phrase hides a world of requirements such as *ease of use* and *mass production and distribution*.

Once the product is well established it is expected to become integrated in different appliances. The timing of this breakthrough is inherently more uncertain. The impact of this market trend for the company and the rest of the roadmap is tremendous a well defined self-sustained product suddenly becomes an integrated part in some other product.

The last breakthrough shown here is the expectation that the product will be introduced in Africa as well. This might for instance result in higher reliability requirements.

1.7.4 Products

A number of products are synchronized with the market heartbeat, for instance the christmas buying period. In the example the products S1A, S2, S4, S6 and T1 are explicitly synchronized with this external event. A number of derived products or improved products will be introduced at a different moment. The products on the *carrier* line serve as a carrier for the platform technology development, this shows a relationship between the product section and the technology section.

The product identification gives some indication of the expected product content. The numbering suggest some improvement/extension of the same type of product. Going form S1 to S1A suggests an improvement only. The T1 appears to be a new product of a new generation of the same product which co-exists for some time

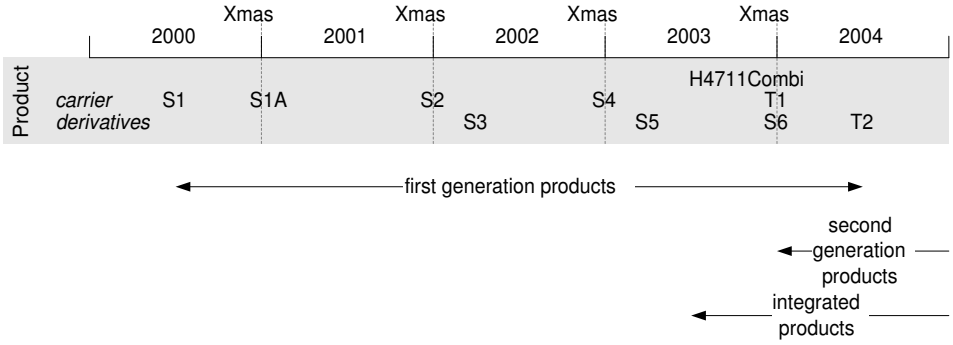


Figure 1.10: The product part of the highest level roadmap

with the old product line (S6).

A very challenging product in this part of the roadmap is the H4711combi, which is an existing H4711 product with the functionality of the S5 product integrated. This product is in fact a reference to the next level of roadmapping at portfolio level.

1.7.5 Technology

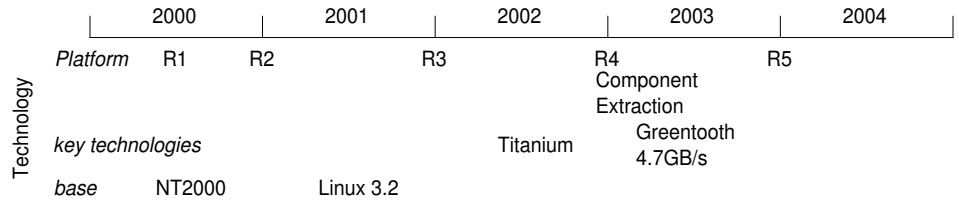


Figure 1.11: The technology part of the highest level roadmap

The technology roadmap shows the expected timing of the platform developments. In this example the platform development is coupled to a carrier product: Release 1 is coupled to product S1, release 2 to product S1A and so on until release 5, which is coupled to product T1. The platform technology becomes available at the same time as the corresponding product.

The next line shows that a component like approach will become available at the same time as the release 4 platform. This component approach is needed for the H4711combi product, which is derived from an totally different product.

The line *key technologies* shows the expected timing of 2 technology breakthroughs in the outside world, which will have an high impact on the products. The *Titanium* Gigaprocessor will enable the flexible component based architecture, while the *Greentooth* communication infrastructure will remove data transfer bottlenecks, which is important to realize the required frame rate.

The *base technologies* line show the relevant events in the base technology, in this case the operating system which is used. Apparently a switch is foreseen from NT2000, which is rather monolithic and therefore memory intensive and expensive NT2000, to the configurable Linux variant. The version of Linux to be used is the stable version (.2) of the next generation of Linux (3).

1.7.6 People

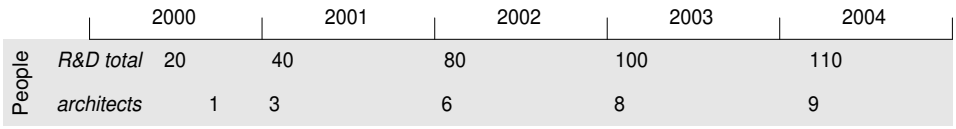


Figure 1.12: The people part of the highest level roadmap

The people roadmap in this example is kept rather limited. The total need of developers (*R&D total*) is shown at the beginning of every year. The discussions about headcount are synchronized with the calendar year, the budget discussions take place at the end of the year and discuss the headcount in terms of january 1. By using the same convention in the roadmap the essential numbers are comparable.

Next in this section of the roadmap the most critical resource is shown. In view of the fact that this article fits in the Gaudí articles, which describe system architecture, it is clear that architects are seen as the most critical resource[2].

The roadmap at this level does not yet spell out the problem behind these number, which is that the lead time to acquire or educate architects is quite long. Acquisition of new architects will cost between half and one year, followed by a period from 1 to 3 years to become productive and to operate at architect level. Education of R&D people already present also costs between 1 and 3 years. Unfortunately only 10% of a typical R&D population has the potential skills to become an architect. In this example about 2 existing developers will be capable to grow into this role, hence the other architects will have to be recruited.

1.7.7 Process

The core *PCP* process in the beginning is product oriented. The technology consolidation in a platform is a spinoff from the product development. After the 3^{rd} iteration of the platform the product development and the platform development are decoupled. This allows for lifecycle independent development of the platform. Tight coupling of product and platform development is a complicating factor when many products are derived from the platform.

[2] Although it is partly a joke, reality is that in many cases the architects are truly the most critical resource.

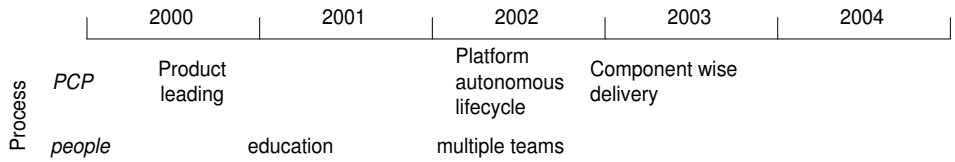


Figure 1.13: The process part of the highest level roadmap

Forced by the vision that integrated products are required a further decoupling is required. In the technology section this decoupling is shown as *Component extraction*. A critical success factor for working with a component strategy is that the processes need to be in place to create, change, manage and deploy components. These processes are summarized in the highest level roadmap as *component wise delivery*.

The strong increase in the amount of developers will also have a dramatic impact on the processes in use. When the group reaches a size of approximately 80 people, it should be working in multiple relatively autonomous teams. This requires that processes are in place to split up the work, but also to manage the overall consistency and balance. The phrase *multiple teams* is used to reflect this requirement.

1.8 Bootstrapping the roadmapping process

Many companies and business units have no ongoing roadmapping activity or only a limited roadmapping activity, for instance a product roadmap only. It is a daunting task for a system architect to introduce a roadmapping process as described until now.

Introduction of a roadmapping process must be viewed as part of a change management process. Successful introduction of roadmapping coincides with changes in all aspects of the business.

Important heuristics of change management are:

- People don't want to **be** changed. They are quite often willing to change.
- Changing the way of working or the culture costs many years.
- Work at multiple tracks at the same time, a.o. managerial, operational, strategic, etc.
- Earn credit by showing usable results.

Based on these heuristics it is clear that the introduction of roadmapping should be done in a number of smaller steps. The motto here is: *Think big, act small*.

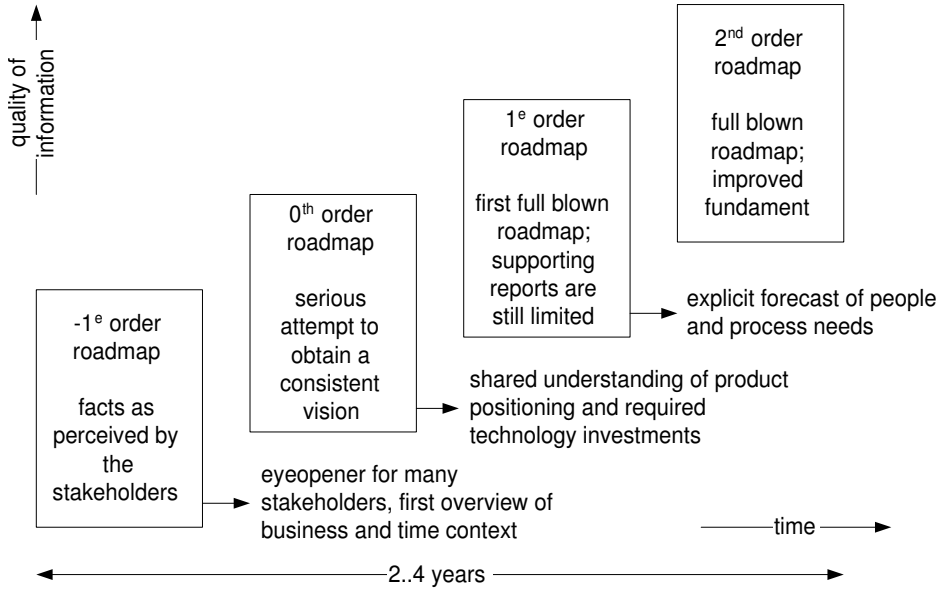


Figure 1.14: Bootstrapping the Roadmap Process

Figure 1.14 shows the bootstrapping of the roadmap process, which typical will take 2 to 4 years. The benefits of starting the process are available more or less immediately, the ultimate maturity with the related efficiency costs the mentioned 2 to 4 years.

A good start is to capture the existing visions, plans, budgets, et cetera and integrate this information into a -1 order roadmap. In most cases this forces the stakeholders to reflect on the current status, which in most cases is rather unbalanced (for instance the first half year is covered in minute detail, the latter period is fuzzy) or it appears to be totally inconsistent (for instance marketing has an entirely different expectation than development). Best case people suddenly get an overview and gain insight in the broader context.

The result of the -1 order roadmap is that the architect gains credit and that the stakeholders are motivated to change a little bit and are willing to make a next step, for instance to make a 0 order roadmap.

A 0 order roadmap is the first attempt to get the market, the product and the technology roadmap in place. Such a partial roadmap again helps to earn credit, but it also helps to keep the stakeholders involved. Critical aspect here is the team building aspect. Roadmapping is a team activity, which requires mutual respect and trust, to enable the open and critical communication needed for the selection of the truly essential issues in the roadmap.

The entire roadmapping process is a repetition of the same activities, visualized in figure 1.15. Of course the 4 steps are not entirely sequential, they represent the

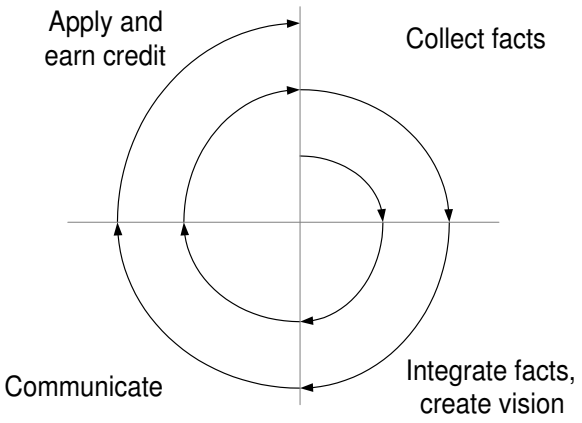


Figure 1.15: Bootstrapping the roadmap process requires a repetition of 4 steps, as visualized by this spiral

main flow of the process.

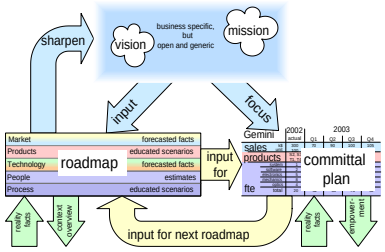
1.9 Acknowledgements

The insight that a roadmap should cover all 5 views form market to process came to me via Hans Brouwhuis. Roadmapping as a business tool gained momentum within Philips during the quality actions inspired by Jan Timmer.

The critical and constructive remarks by Jürgen Müller helped to shape this article.

Chapter 2

The role of roadmapping in the strategy process



2.1 Process decomposition of a business

The business process for an organization which creates and builds systems consisting of hardware and software is decomposed in 4 main processes as shown in figure 2.1.

The decomposition in 4 main processes leaves out all connecting supporting and other processes. The function of the 4 main processes is:

Customer Oriented Process This process performs in repetitive mode all direct interaction with the customer. This primary process is the cashflow generating part of the enterprise. All other processes only spend money.

Product Creation Process This Process feeds the Customer Oriented Process with new products. This process ensures the continuity of the enterprise by creating products which enables the primary process to generate cashflow tomorrow as well.

People and Technology Management Process Here the main assets of the company are managed: the know how and skills residing in people.

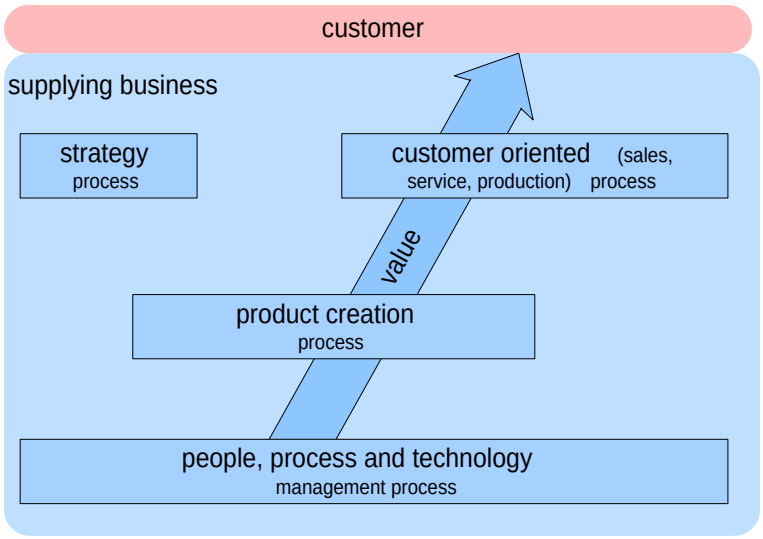


Figure 2.1: Simplified decomposition of the business in 4 main processes

Policy and Planning Process This process is future oriented, not constrained by short term goals, it is defining the future direction of the company by means of roadmaps. These roadmaps give direction to the Product Creation Process and the People and Technology Management Process. For the medium term these roadmaps are transformed in budgets and plans, which are committal for all stakeholders.

Figure 2.2 characterizes the processes from the financial point of view. From bottom to top soft or latent value (the assets) are transformed in harder value, to become true money when the customers are paying for the products and services (the cashflow).

At the same time figure 2.2 shows that the feedback flow from the customer into the organization moves in the opposite direction. A nasty phenomenon is the deformation and loss of feddback information while it flows through these processes. The further away from the customer, the less sense of urgency and the less know how of the customer needs. In many organizations this is a significant problem: competence organizations which have lost the sight of the customer and become introvert.

In many companies the value chain is optimized further, by using the synergy between products and product families. Figure 2.3 shows that the simplified process decomposition model can be extended by one process *component or platform creation* to visualize this strategy. This optimization is far from trivial. At the one hand synergy must be used, most companies cannot afford to create everything from scratch all the time. At the other hand is the consequence of the set up shown

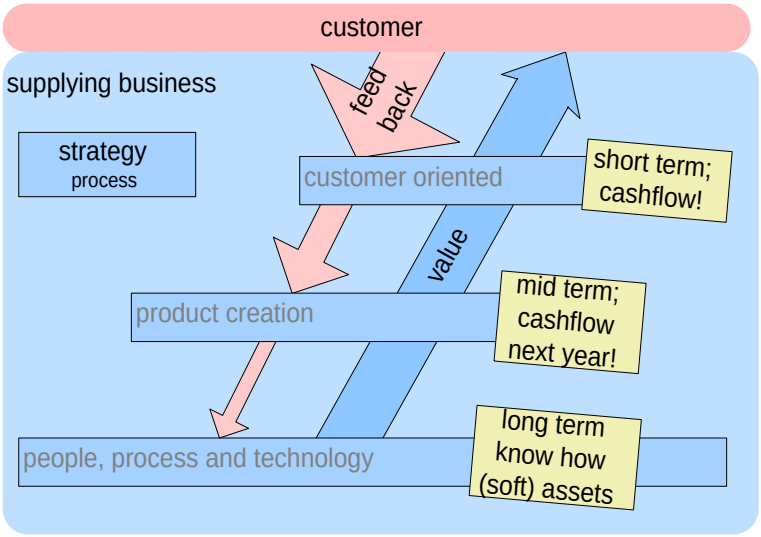


Figure 2.2: Tension between processes

here that the value chain becomes longer (and takes somewhat longer), while the feedback deformation and loss increases even further! A more elaborated discussion on these aspects can be found in [1].

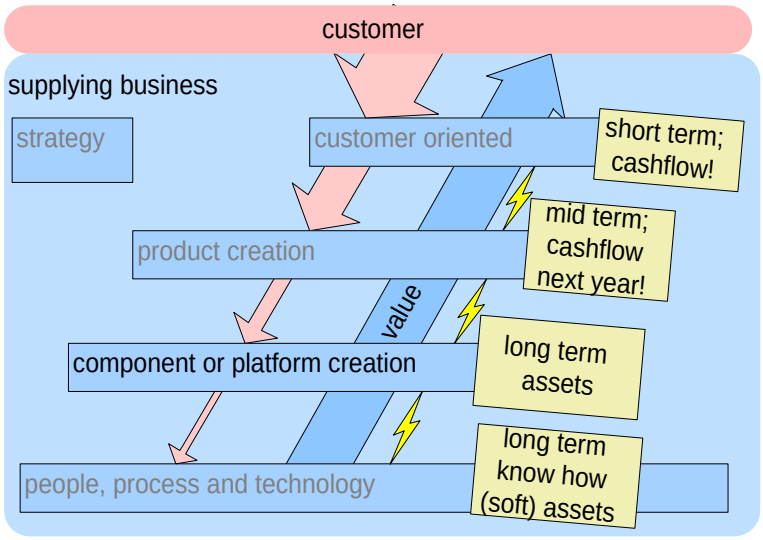


Figure 2.3: Platform strategy adds one layer

2.2 Framework for architecting and roadmapping

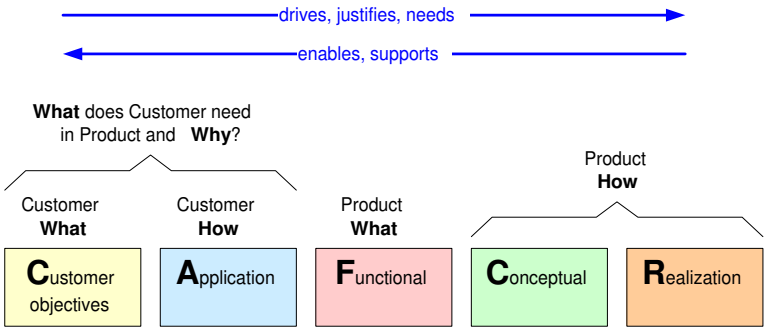


Figure 2.4: CAFCR framework for architecting

Figure 2.4 shows the ”CAFCR” framework for system architecting, see [6]. The *customer objectives* view and the *application* view provide the **why** from the customer. The *functional* view describes the **what** of the product, which includes (despite the name) also the *non functional* requirements. The **how** of the product is described in the *conceptual* and *realization* view, where the conceptual view is changing less in time than the fast changing realization (Moore’s law!).

The job of the architect is to integrate these views in a consistent and balanced way. Architects do this job by *frequent viewpoint hopping*, looking at the problem from many different viewpoints, sampling the problem and solution space in order to build up an understanding of the business. Top down (objective driven, based on intention and context understanding) in combination with bottom up (constraint aware, identifying opportunities, know how based), see figure 2.5.

In other words the views must be used concurrently, not top down like the waterfall model. However at the end a consistent story must be available, where the justification and the needs are expressed in the customer side, while the technical solution side enables and support the customer side.

The term *customer* is easily used, but it is far from trivial to determine the customer. The position in the value chain shows that multiple customers are involved. In figure 2.6 the multiple customers are addressed by applying the CAFCR model recursively.

The customer is a gross generalization. Marketing managers make a classification of customers by means of a market segmentation. Nevertheless stay aware of the level of abstraction used when discussing **the** customer/market/market segment.

The viewpoints of the ”CAFCR” framework are useful for setting up a roadmap as well. However on top of these views also *business*, *people* and *process* views are needed in a roadmap, see figure 2.7 and [3].

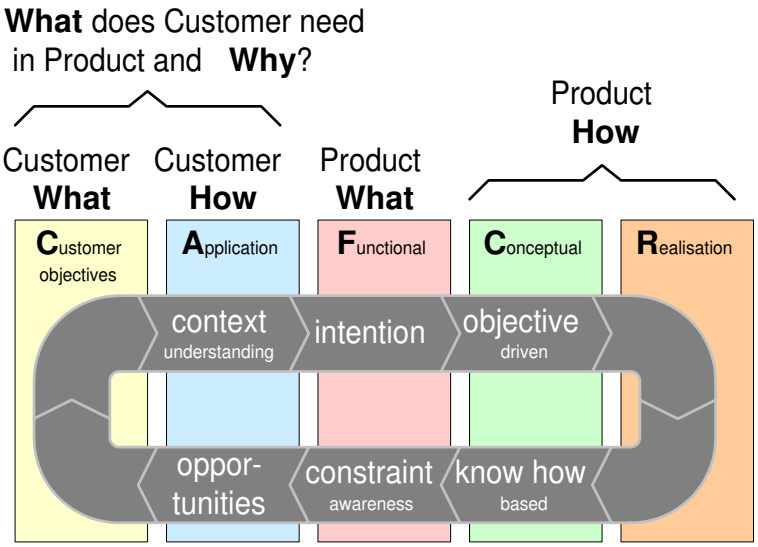


Figure 2.5: Five viewpoints for an architecture. The task of the architect is to integrate all these viewpoints, in order to get a *valuable*, *usable* and *feasible* product.

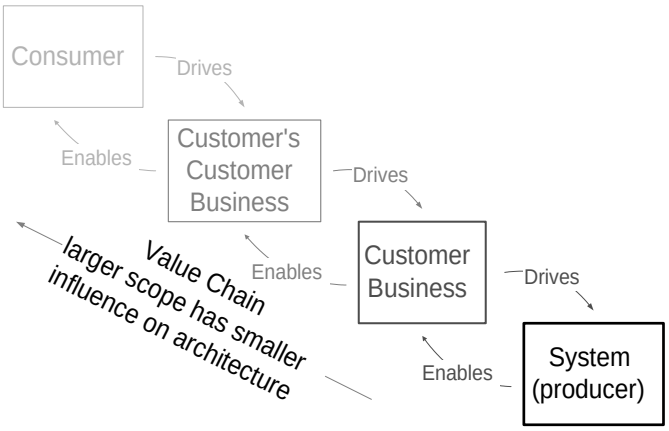


Figure 2.6: CAFCR can be applied recursively

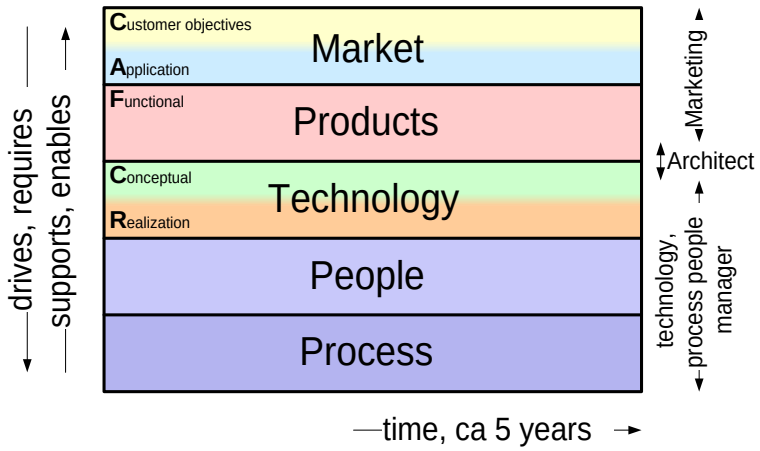


Figure 2.7: Structure of a roadmap

2.3 From vision to roadmap to plan and further

The identity or the main focus of a company is often expressed in a mission statement, supported by a vision on the market, the domain and its own position in market and domain. The nature of both mission and vision is highly generic, although business specific. Mission and vision is a compact articulation of the company and its strategy.

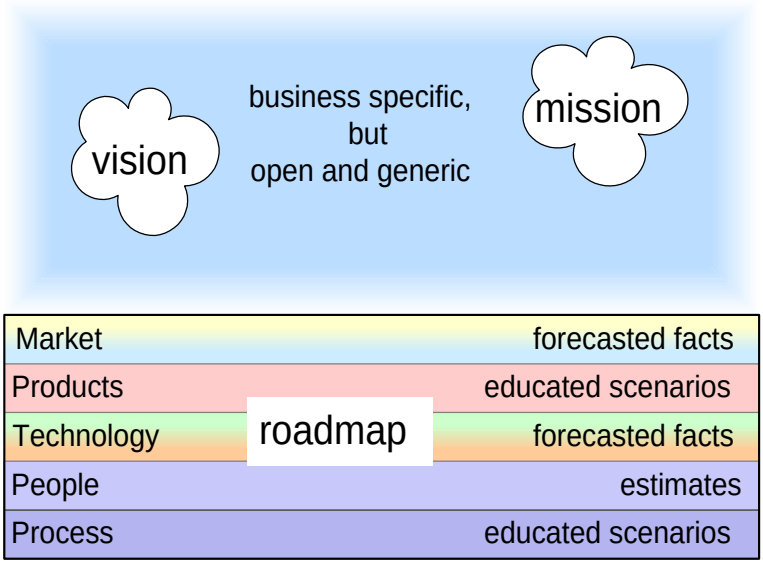


Figure 2.8: From generic mission to factual roadmap

The roadmap builds on vision and mission and makes the strategy much more specific in time as well as in contents. Figure 2.8 shows the generic mission and vision statement as overarching entities for the roadmap. As indicated within the roadmap segments its content is much more specific, containing (forecasted) facts, (educated) scenarios and estimates.

An integrated roadmap is made in steps:

1. Explore *market*, *product* and *technology* segments; what is happening in the outside world, what is needed, where are opportunities in market and/or technology.

2. Estimate *people* and *process* needs for the identified *product* and *technology* needs. These estimates should be made without constraints. The question is what is **needed**, rather than what is **possible**.

3. Determine a balanced, economic attractive and skills wise feasible content for *product*, *technology*, *people* and *process*. Here trade-offs have to be made

and creative marketing as well as technological skills are required to define an effective product roadmap, which is at the same time realistic with respect to the people and processes.

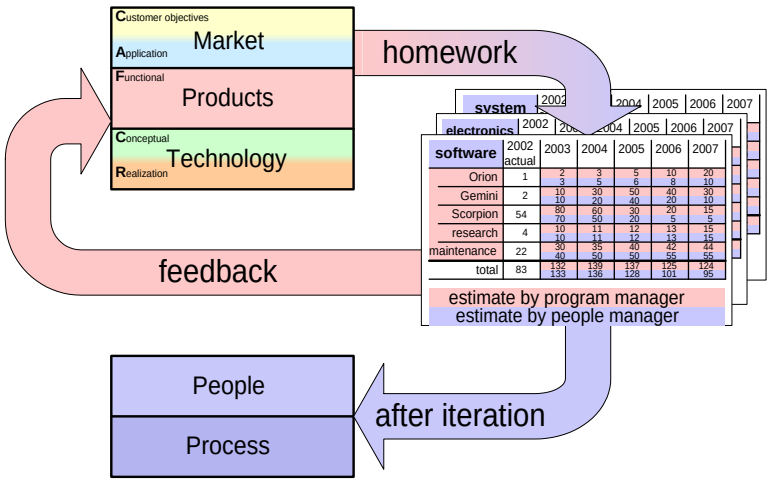


Figure 2.9: From Market, Product, Technology to People, Process

Figure 2.9 shows how to make the last few steps. The estimations for the amount of people are made from 2 viewpoints: the people and technology manager (the supplier of resources) and the operational manager (responsible for the timely and reliable result of the product creation process and hence the ”consumer” of these resources).

software	2002 actual	2003	2004	2005	2006	2007
Orion	1	2	3	5	10	20
		3	5	6	8	10
Gemini	2	10	30	50	40	30
		10	20	40	20	10
Scorpion	54	80	60	30	20	15
		70	50	20	5	5
research	4	10	11	12	13	15
		10	11	12	13	15
maintenance	22	30	35	40	42	44
		40	50	50	55	55
total	83	132	139	137	125	124
		133	136	128	101	95

estimate by program manager
estimate by people manager

Figure 2.10: People estimate, discipline view

The people and technology manager will make estimates which are discipline specific, decomposed towards the programs, see figure 2.10

Gemini	2002 actual	2003	2004	2005	2006	2007
system	1	2 3	4 5	5 6	4 5	3 4
software	2	10 10	30 20	50 40	40 20	30 10
electronics	5	16 12	20 18	12 16	4 12	2 6
mechanics	8	8 12	5 14	2 8	1 6	1 3
optics	4	6 6	6 6	5 5	4 4	3 3
total	20	42 43	64 63	74 75	52 47	39 26

estimates by program manager

estimates by discipline manager

Figure 2.11: People estimate, program view

The operational manager (or program manager) will make an estimate which is program specific. A program is a cohesive set of products, where the program manager is responsible for the timely development and quality of all products within the program. This estimate will be decomposed into disciplines, see figure 2.11.

Every activity is estimated twice via this approach. In both figure 2.10 and figure 2.11 the corresponding second estimate is shown as well, in other words the results are merged. This merge immediately shows differences in interpretation of the input or differences in opinion. These differences should be discussed, so either the inputs are reiterated, resulting in a shared estimate, or the difference in opinion is analyzed and a shared estimate must be the result (although the compromise may be marked as highly uncertain)

After this ”harmonization” of the estimates the real difficult work starts, of tweaking the product program, the required features and being more creative in the solutions in order to come to a feasible roadmap. This step will change the *product* and *technology* segments, with corresponding changes in *people* and *process*.

Figure 2.12 shows the people roadmap from another domain in a more visual format. In this example a clear growth of the staffing is visible, where for instance system and software are growing much faster than electronics. Besides these typical product creation disciplines also the *customer oriented* people and skills are shown. The decomposition choosen here is to the needed or expected education level (high, medium and low). The clear trend here is a significant growth of customer support people, while at the same time it is expected that the education level will decrease significantly[1].

[1]This is a quite normal trend. Young products are supported by highly skilled people, which is possible because the installed base is still small. When the installed base is growing it is difficult to find sufficient well trained people, who are motivated to work as support personnel. At the same time the cost pressure increases, which makes it economically unattractive to hire expensive support

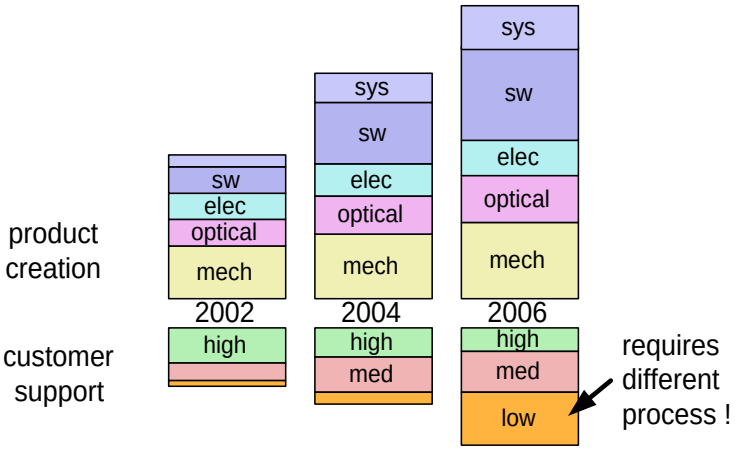


Figure 2.12: Roadmap of people skills

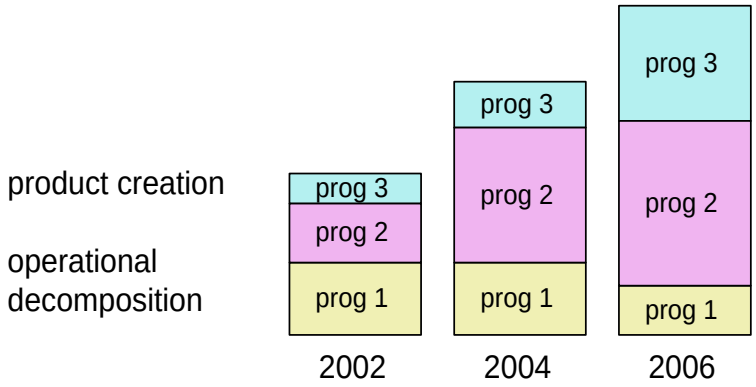


Figure 2.13: Operational axis is more dynamic

If we decompose the people estimates from figure 2.12 in the operational direction then a much more dynamic picture emerges. Operational activities have a faster rhythm than disciplines. Understanding of this dynamics helps in the total balancing act required from the strategy process. Special attention should be given to the often implicit programs, such as:

- installed base management
- component and platform creation
- research

people. All together the consequence is that investments in the product and the processes are required to operate in the more mature phase with less educated customer support people.

- development infrastructure

At the end a sanity check should be made of the balance between the explicit programs and the less explicit programs mentioned here. The explicit, product oriented programs in general should use a significant amount of the total man count, otherwise it is a symptom of an introvert organization (focus on **how** do we do it, instead of **what** is needed).

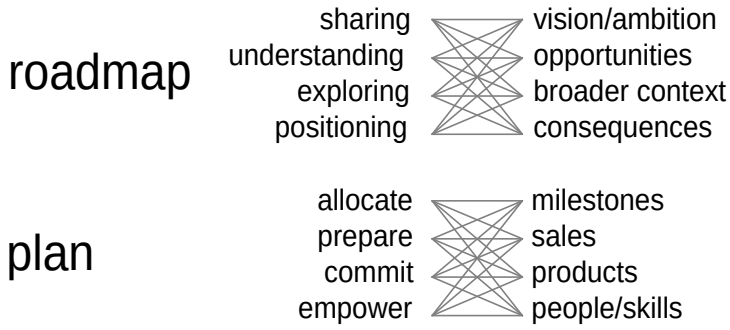


Figure 2.14: From roadmap to planning

The roadmap created as described above is a means to share insight in the market and the future and to provide overview and focus to the entire organization, in a broad time perspective. This process should take place in an open, explorative atmosphere. This can be achieved by keeping the roadmap as a shared snapshot of the future and not make it a committal plan. In other words nobody gains any right because of the roadmap. The roadmap does not contain hard decisions, it contains shared understanding and expectations.

The roadmap is used as input to create a committal plan, with a shorter time horizon. It does not make any sense to make long term commitments, the future is way too uncertain for hard decisions. The committal plan will typically have a scope of 1 year. Within this year a consistent set of decisions are needed, ranging from sales and turnover commitments to product creation commitments (main product characteristics and timing) to technology, people and process commitments. This commitment serves also as a means to delegate and empower, which also requires allocation of resources. Figure 2.14 shows the essentials of the roadmap and the committal plan.

Figure 2.15 shows an example of a committal plan, containing the business commitments (sales), the PCP commitments (products to be created) and the people and technology commitments (allocated fte's[2]). Such a plan must be available per program, in this example it is the *Gemini* program.

[2] fte = full time equivalents

Gemini		2002 actual	2003 Q1	Q2	Q3	Q4
sales	k$	300	70	90	100	105
	unit	100	20	25	25+3	22+7
products		S2, S3 T1, T4	S4		V6	S6
fte	system	1	2	3	3	4
	software	2	10	18	24	28
	electronics	5	16	17	19	20
	mechanics	8	8	8	6	6
	optics	4	6	6	6	6
	total	20	42	50	58	64

Figure 2.15: Example of committal plan

2.4 Summary

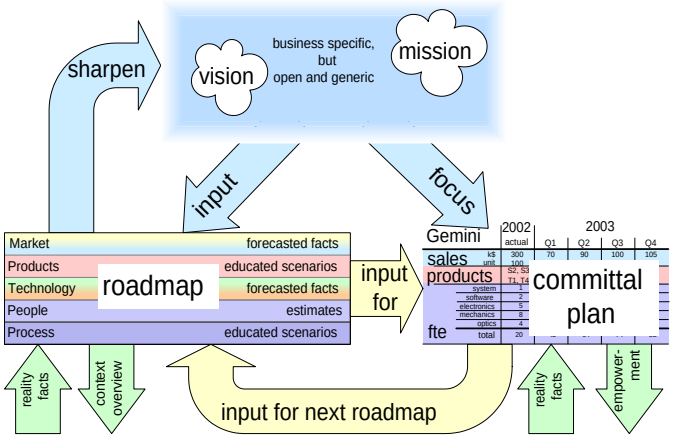


Figure 2.16: Overview of strategic entities

The mission, vision, roadmap and plan will normally be used as part of the business plan, which is used towards the financial stakeholders of the company. These entities together define the strategy and the deployment of the strategy. Figure 2.16 shows an overview of the entities which play a role in the startegy process.

The value of roadmap for the other processes is to provide context and overview for the specific goal of that process. Especially for the product creation process it also provides focus, the development team can concentrate on the product, which is currently being developed, without discussions of all other alternatives.

The value of the plan for the other processes is that it provides the delegation boundaries, which allows for empowerment. Figure 2.17 shows the value of roadmap and plan for the other processes. In the opposite direction the other processes

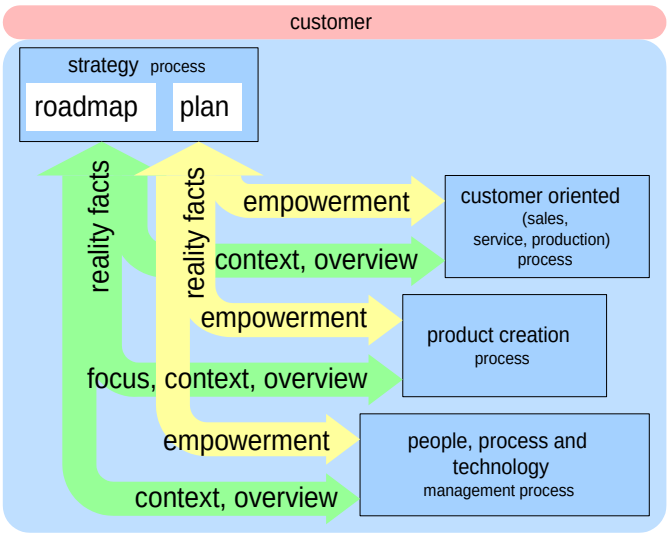


Figure 2.17: Summary of role in business

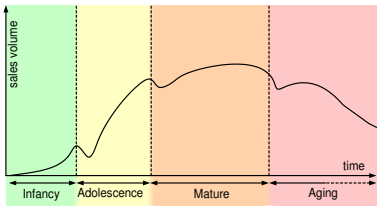
should provide the reality facts to be used in next roadmap and plan.

2.5 Acknowledgements

Philip Bucher asked me for this presentation for the GATIC workshop, which provided me with the right trigger to write this already long ago planned article. Philip also helped by discussing the purpose and content.

Chapter 3

Market Product lifecycle consequences for architecting



3.1 Observed lifecycle curve

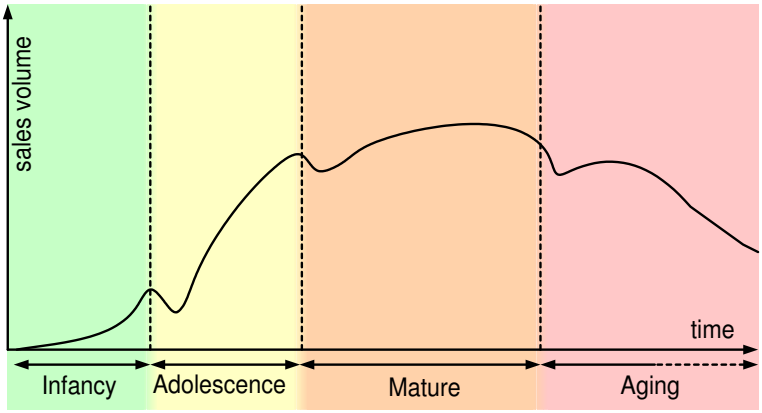


Figure 3.1: Market product lifecycle phases

The lifecycle of a product market combination can be visualized by showing the sales volume as a function of the time. The lifecycle will start with very small

sales in the *embryonic* phase, a fast increasing sales volume in the *adolescent phase* a stabelized sales volume in the *mature* phase and a decreasing sales volume in the *aging* phase.

Dips in the sales volume are observed as shown in figure 3.1. In anticipation of the explanation below these dips are shown at the transition of one phase to the next phase.

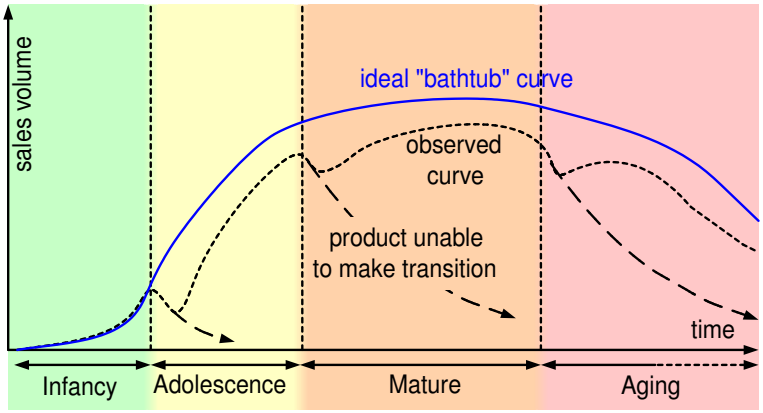


Figure 3.2: Compared with ideal bathtub curve

In literature the form of the curve of the sales volume as function of the time is described as bathtub, see figure 3.2. The hypothesis for the dips in the curve is that characteristics of all stakeholders are different for the different life cycle phases. If the way of working is not adopted to these changes, then a mismatch results in decreasing sales. Figure 3.2 also indicates that if no adaptation of the change takes place that the sales might even drop to zero, effectively killing the business, while still plenty of market opportunity is present.

Figure 3.3 annotates the lifecycle graph with a number of products and their positioning in the lifecycle. As can be seen products can jump back (i.e. become younger) in the lifecycle by addition of innovative features (for instance MRI scanners and functional imaging or conventional television and digital television).

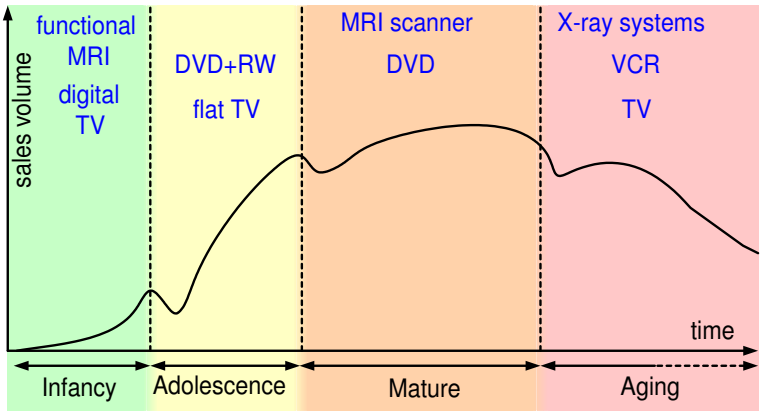


Figure 3.3: Examples of market product lifecycle

3.2 Lifecycle model

	infancy	adolescence	mature	ageing
driving factor	business vision		stable business model	harvesting of assets
value from	responsiveness	features	refinements / service	refining existing assets
requirements	discovery	select strategic	prioritise	low effort high value only
dominant technical concerns	feasibility	scaling	legacy obsolescence	Lack of product know-how Low effort for obsolete technologies
type of people	inventors& pioneers	few inventors& pioneers "designers"	"engineers"	"maintainers"
process	chaotic		bureaucratic	budget driven
dominant pattern	over-dimensioning	conservative expansion	mid-life refactoring	UI gadgets

Figure 3.4: Attributes per phase

Figure 3.4 shows typical attributes of the lifecycle phases.

The *infancy* phase is characterized by uncertainty about the customer needs, and therefore the product requirements. Essential is that the creator/producer is responsive to the customer needs, which will provide insight in needs and requirements. The way of working in this phase reflects the uncertainty, chaotic, innovative, pioneering mindset. Product cost is still less of an issue, the risk related to the uncertainty is the dominant concern. The design copes with the uncertainty by overdimensioning those aspects which are perceived to be the most uncertain.

The *adolescent* phase is characterized by strong (exponential) growth of the sales volume, concurrent with an increase in performance, features and product variants. Essential to cope with this strong growth in many dimensions. With respect to the requirements a strategic selection is needed, to serve the growing customer base, without drowning in an exploding complexity. The technical and process challenge is to scale up in all dimensions at the same time. Upscaling the customer oriented processes and the product creation process requires more shared structure between the participants. This involves a mindset change, less inventors, more designers. The design pattern used frequently in this phase is conservative extension of a base design.

The *mature* phase is characterized by more stability of the business model and the market, but the market has become much more cost sensitive. Instead of running along in the feature race more attention is required to optimize the specification and development choices. The value can be shifting from the core product

itself to services and complements of the product, while the features of the product are refined. The age of the product starts to interfer with the business, obsolence problems occur, as well as legacy problems. Innovative contributions become counterproductive, more rigid engineers are preferred above creative designers. The cost optimization is obtained by process optimization, where the processes also become much more rigid, but also more predictable, controllable and executable by a large community of less educated engineers. The design copes with the aging technology by performing limited refactoring activities in areas where return on investment is still likely.

The *aging* phase is often the phase where the product is entirely seen as cash cow, maximize the return on (low) investments. This is done by searching all the low effort high value requirements, which is mostly only small refinements to the existing product. Often the integral product know how and even specialist knpw how has been lost. Only very important obsolence problems are tackled. Again the mindset of the people working on the product is changing to become more maintenance oriented. Cost is a very dominating concern, budgets are used to manage. Many changes are cosmetical or superficial, taking place in the most visible part of the product: the user interface.

3.3 Acknowledgements

Henk Obbink observed the discontinuity of market success at the phase transitions. The analysis of this phenomenon was carried out by Jürgen Müller, Henk Obbink and Gerrit Muller.

Pierre America improved the layout of the diagrams.

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History
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