Module Roadmapping

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Abstract

This module addresses roadmapping.

version: 1.1 status: draft July 1, 2011

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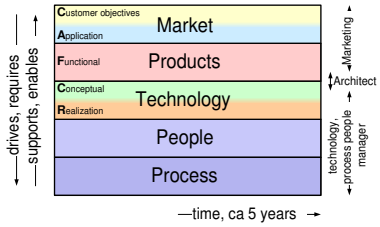
Chapter 1

Roadmapping



1.1 Introduction

The definition of new products is a difficult activity, which frequently ends in a stalemate: “It must be don” versus “It is impossible to realize in such a short time frame”. The root cause 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 a single generation of products to several generations in many years.

The roadmap is the integrating vision shared by the main stakeholders. A shared vision generates focus for the entire organization and enables a higher degree of cooperating concurrent activities.

We discuss 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 (for example 5 years) integrating all relevant business aspects. Figure 2.7 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.

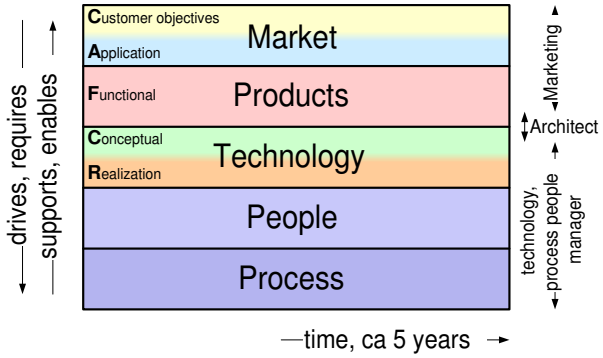


Figure 1.1: The contents of a typical roadmaps

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 aspect, when and how to achieve these items, are not directly shown. This information is often implicitly present, since people and process often have to be available before the availability of the technology, and technology often precedes the product.

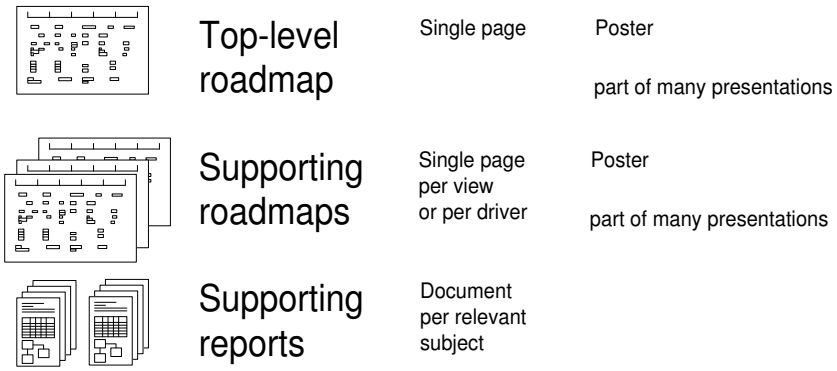


Figure 1.2: The roadmap is documented at several levels of detail

A good roadmap is documented and presented at top level and at a secondary level with more details. Figure 1.2 shows the desired granularity of the roadmap documentation, the secondary level is called supporting roadmaps. The top level

is important to create and maintain the overview, while the more detailed levels explain the supporting data. The choice of the decomposition into supporting roadmaps depends on the domain. Typically, the supporting roadmaps should maintain an integrated view. Examples of decomposition are:

- One supporting roadmap per key driver.
- One supporting roadmap per application area.

1.3 Why Roadmapping?

The Policy and Planning process as discussed in Chapter **??** 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 charter and 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?

When no roadmapping is applied then the following problems can occur:

Frequent changes in product policy due to lack of anticipation.

Late start up of long lead activities , such as people recruitment and process change.

Diverging activities of teams due to a lack of shared vision.

Missed market opportunities , due to a too late start.

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 view within the limited horizon when popular and disappear again when some other hype is passing by. This effect is shown in Figure 1.3

The availability of a roadmap will help the operational management to apply a low pass filter on their decisions. The control becomes more analog rather than discrete, where the amount of people can be increased or decreased dependent on the expected delivery date, as shown in figure 1.4.

An inherent benefit of roadmapping is the anticipation, which is especially important for all long lead time aspects. Examples are technology, people and

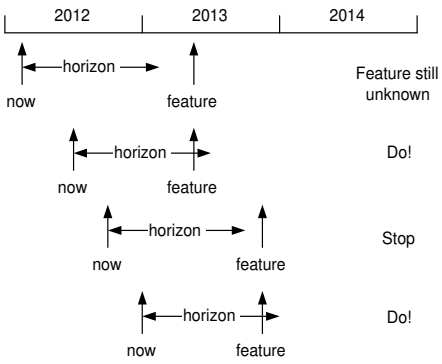


Figure 1.3: Management based on a limited horizon can result in a binary control of product policy decisions

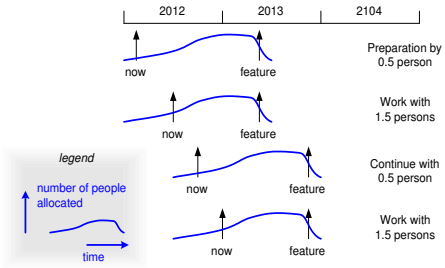


Figure 1.4: Management with a broader time and business perspective results in more moderate control: work with some more or some less people on the feature

process. This is not limited to development activities only; market preparation, manufacturing and customer support also require anticipation. For example, 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. Typical stakeholders for roadmapping at a typical high-tech company are

business manager , overall responsible for the enterprise

marketing manager(s)

people, process, and technology manager(s) , often called line or discipline managers

operational manager(s) , e.g. program managers or project leaders

architect(s)

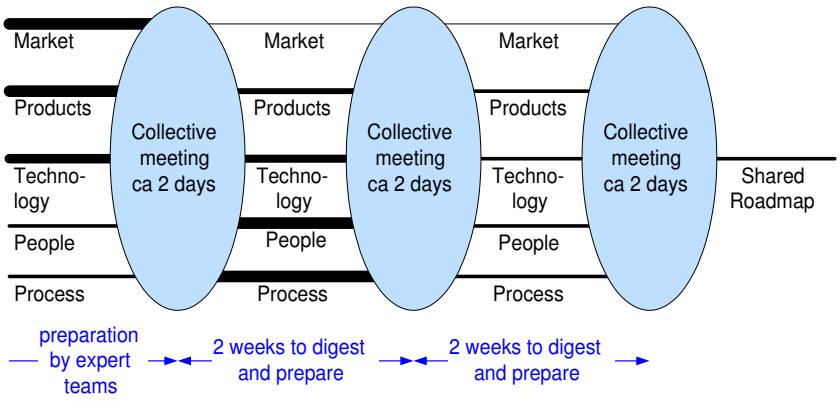


Figure 1.5: Creation or Update of a roadmap in "Burst-mode"

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

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

- to get a shared vision on the market
- to make an inventory of possible products as an answer to the needs and developments in the market
- to share the technology status, trends and ongoing work, as starting point for technology roadmap
- to explore the current status of people and process and 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:

- to obtaining a shared vision on the desired technology roadmap
- to sharing the people and process needs for the products and technology defined in the first iteration
- to analyze a few scenarios for the layers *products*, *technologies*, *people*, and *process*

The thickness of the lines in figure 1.5 indicates 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 attention corresponds with the asymmetry in figure 2.7: the market is driving the business, the people and processes are enabling the business.

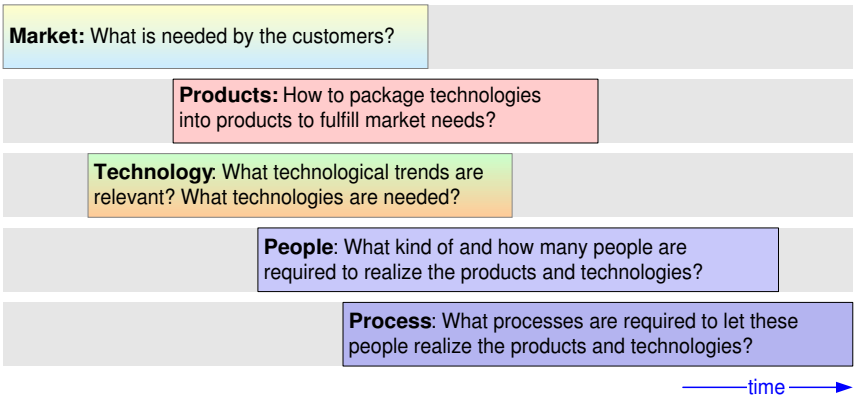


Figure 1.6: The roadmap activities visualized in time.

The function of the collective meetings is to iterate over all these aspects and to make explicit business decisions. The *products* layer of the roadmap should be consistent with the *technology*, *people* and *process* layers of the roadmap. Note that the marketing roadmap may not be fulfilled by the products roadmap, 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 2.7: the higher layers drive the lower layers 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 *products* layer 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 that sets the charter for the programs. The budget is revised with an higher update frequency, typically every 3 months. The budget itself sets goals and constraints for the operation. The programs and projects in the operation have to realize the outputs defined in the budget. The operational activity itself uses detailed schedules as means for control. The schedules are updated more

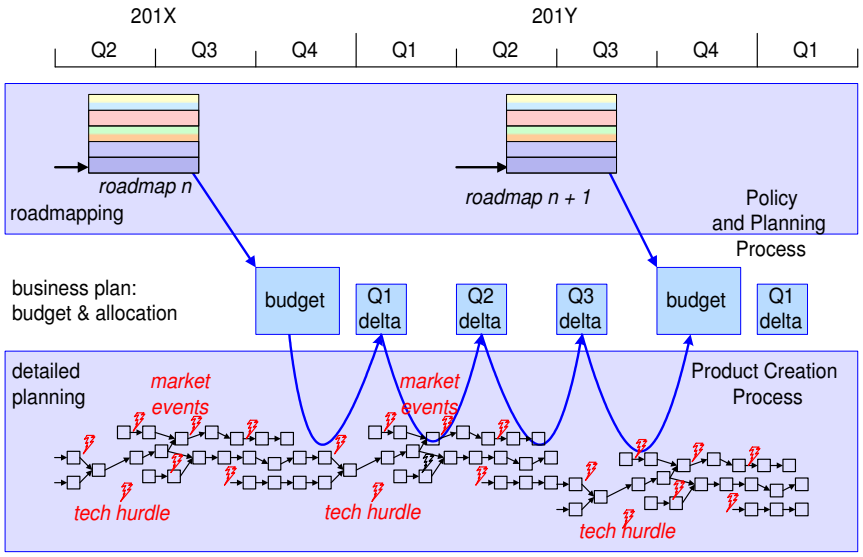


Figure 1.7: The roadmap is used to create a budget and resource allocation. The operational programs and projects use more detailed plans for control.

frequently than the budget update. Within the operational activity the updates are mostly event driven: changes in the market, technology or resources that render the existing plan obsolete.

	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	program or activity	control means

Figure 1.8: Three planning tiers and their characteristics

From long term vision to short term realization is a 3-tier approach as shown in Figure 1.8. The roadmap provides the context for the budget, the budget defines the context for the detailed plans. The highest tier, the roadmap, has the longest horizon, the slowest update rate, and the broadest scope. When going down in tiers, the horizon tends to decrease, the update rate increases, and the scope decreases. The roadmap provides a vision, and as such is not committal. A budget is a commitment to all involved parties. Plans are means to realize the programs and projects, and tend to adapt frequently to changed circumstances.

1.6 Roadmap Essentials

We recommend to create a roadmap that fulfills the following requirements:

- Issues are recognizable for all stakeholders.
- All items are clearly positioned in time; uncertainty can be visualized explicitly.
- The main events (enabling or constraining) must be present.
- The amount of information has to be limited to maintain the overview.

1.6.1 Selection of most important or relevant issues

The art of making a roadmap is the selection of the most relevant issues. It is quite easy to generate an extensive roadmap, visualizing all marketing and technological information. However, such superset roadmap is only the first step in making the roadmap. The superset of information will create an overload of information that inhibits the overview we strive for.

1.6.2 Key drivers as a means to structure the roadmap

In [2] key drivers are explained as an effective method to elicit and understand requirements. Key drivers can also be very helpful in the creation and update of the roadmap. At the marketing side the trend in these key drivers must be visible in the roadmap. Showing key driver trends also helps to structure the roadmap.

The supporting roadmaps can clarify how the key driver trends will be supported For instance, a technology roadmap per key driver is a very explicit way to visualize the relationship between the market in terms of key drivers, the products with the expected performance levels, and enabling technologies.

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 often enough that a roadmap is **only** a vision (or dream?).

The only certainty about a roadmap is that reality will differ from the vision presented in the roadmap.

As a consequence 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 disclaimer that *ambiguity is normal* can be used as an excuse to deliver sloppy work Unfortunately, a sloppy roadmap will backfire to the creators. It is recommended to base a roadmap on facts whenever possible Examples of 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 Do not panic in case of impossibilities

It is quite normal that the roadmap layers appear to be totally inconsistent For instance, a frequent occurring effect is that the budget estimate in response to the market requirements is 3 times the available budget[1]. Retrospective analysis of past roadmaps shows that 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 person weeks/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).

[1] This factor 3 is an empirical number which of course depends on the company and its culture

- Lack of pragmatism, a more extensive technical realization than required for the market needs.
- Too many bells and whistles without business or customer value.

Initial technical proposals might be more extensive than required for market needs, as mentioned in the lack of pragmatism. Technical ambition is good during the roadmap process, as long as it does not pre-empt a healthy decisions. The roadmapping discussions should help to balance the amount of technology anticipation with needs and practical constraints.

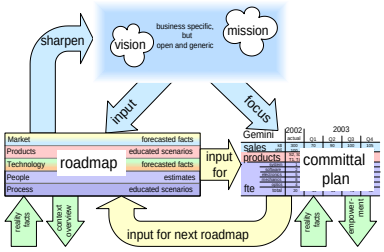
1.7 Acknowledgements

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.

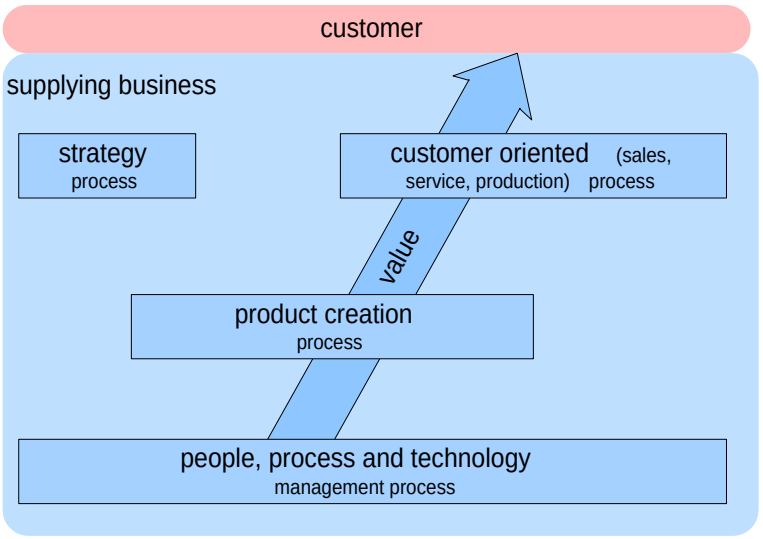


Figure 2.1: Simplified decomposition of the business in 4 main processes

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 feedback 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

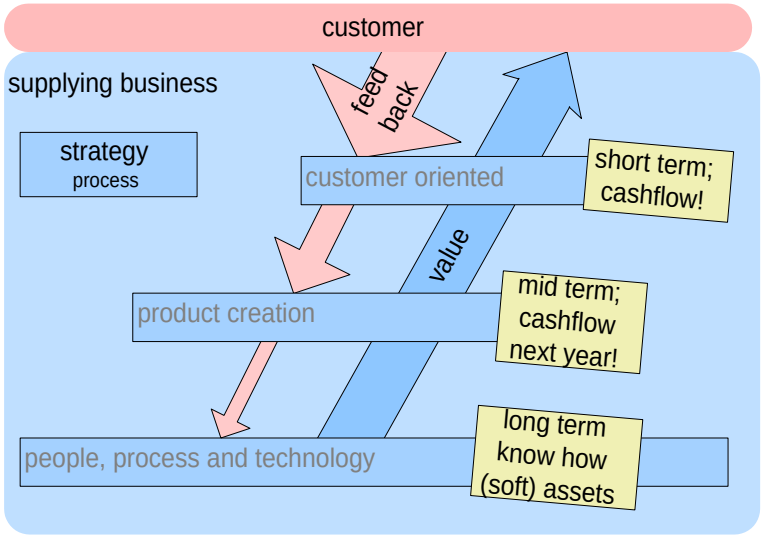


Figure 2.2: Tension between processes

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].

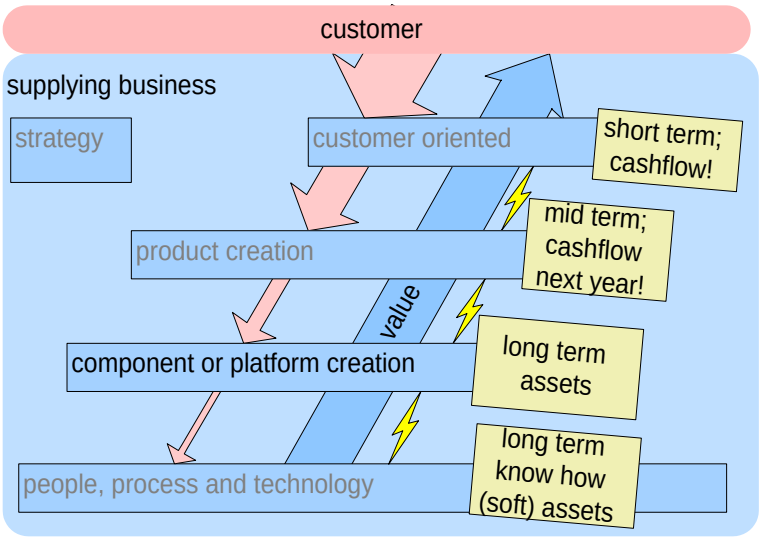


Figure 2.3: Platform strategy adds one layer

2.2 Framework for architecting and roadmapping

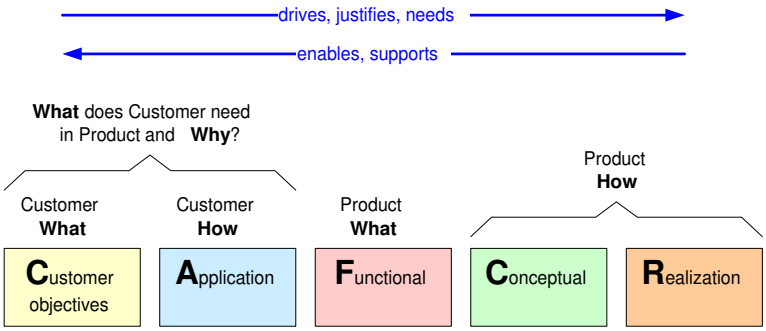


Figure 2.4: CAFCR framework for architecting

Figure 2.4 shows the ”CAFCR” framework for system architecting, see [5]. 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].

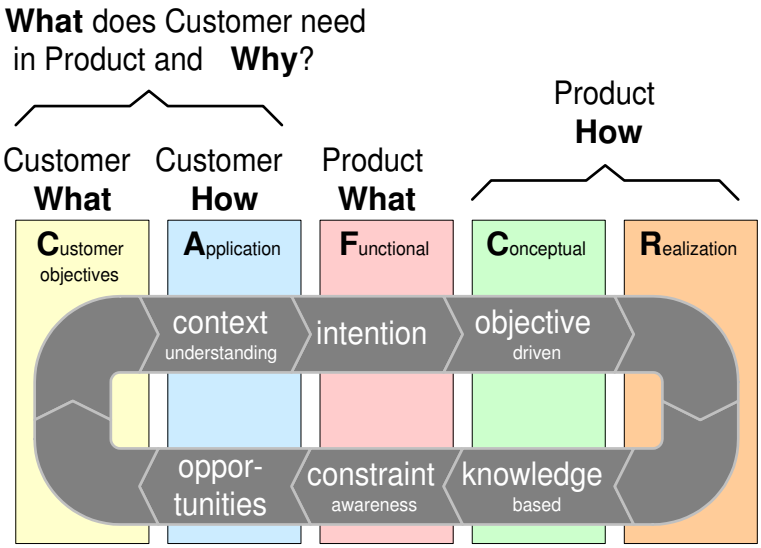


Figure 2.5: Five viewpoints for an architecture. The task of the architect is to integrate all these viewpoints, in order to get a *valuable*, *usable* and *feasible* product.

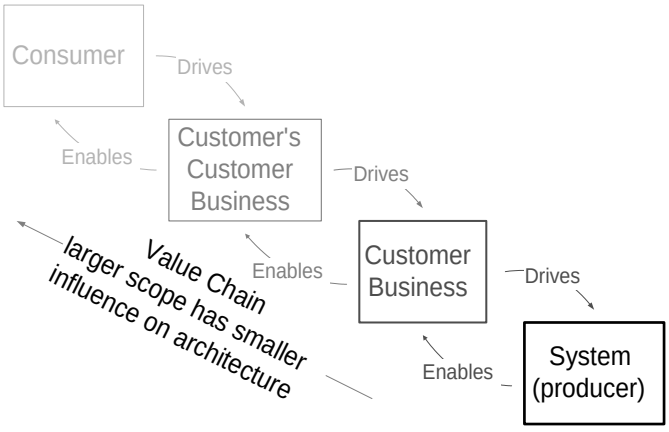


Figure 2.6: CAFCR can be applied recursively

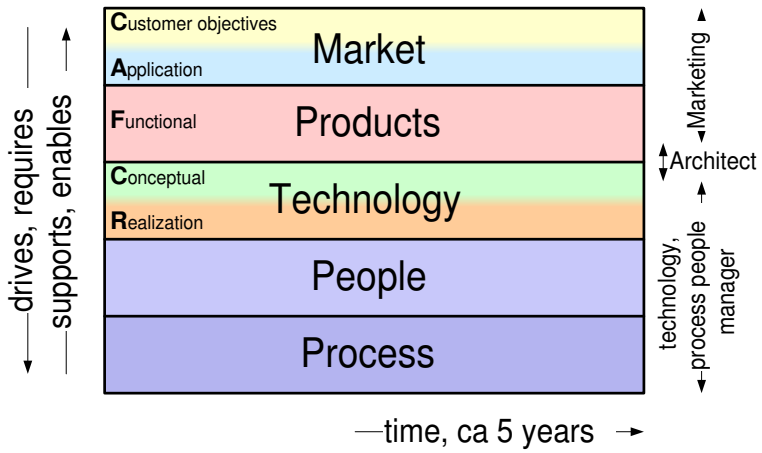


Figure 2.7: Structure of a roadmap

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.

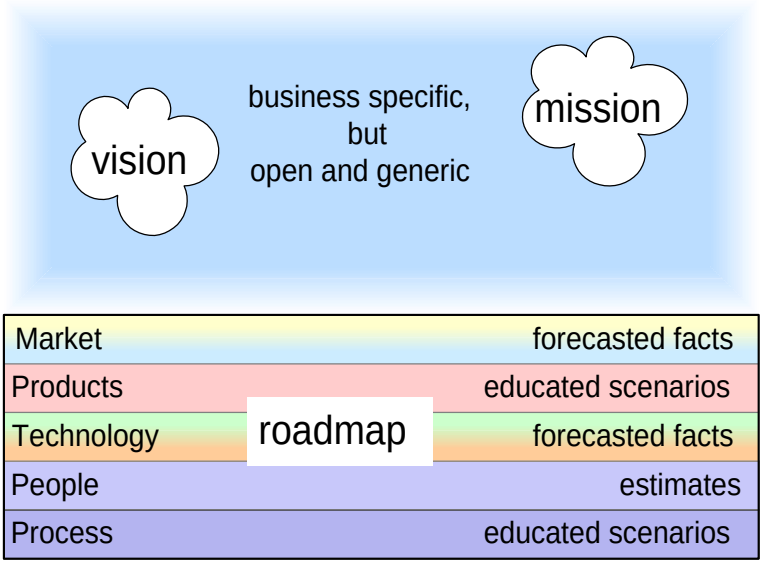


Figure 2.8: From generic mission to factual roadmap

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.

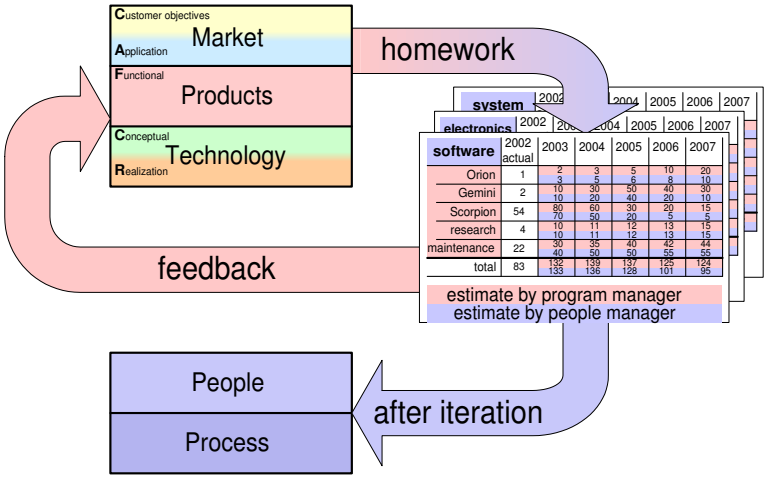


Figure 2.9: From Market, Product, Technology to People, Process

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	4	5	4	3
		3	5	6	5	4
software	2	10	30	50	40	30
		10	20	40	20	10
electronics	5	16	20	12	4	2
		12	18	16	12	6
mechanics	8	8	5	2	1	1
		12	14	8	6	3
optics	4	6	6	5	4	3
		6	6	5	4	3
total	20	42	64	74	52	39
		43	63	75	47	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

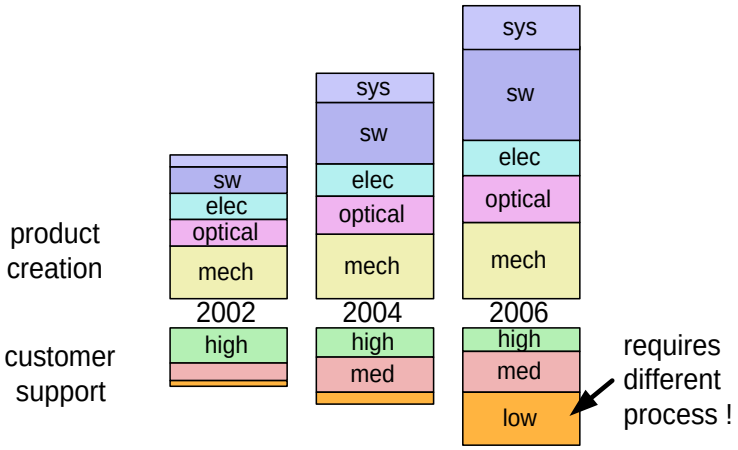


Figure 2.12: Roadmap of people skills

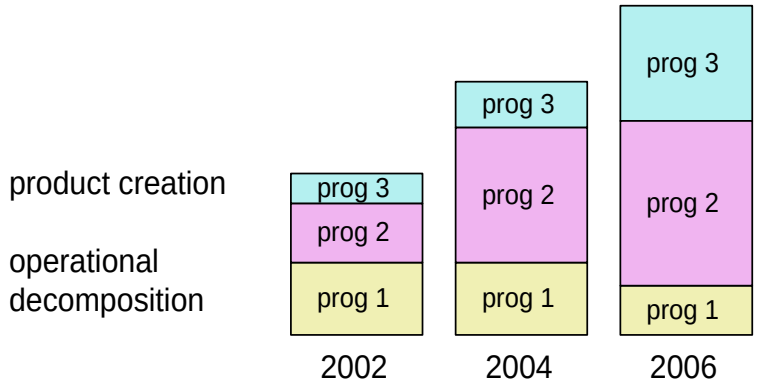


Figure 2.13: Operational axis is more dynamic

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).

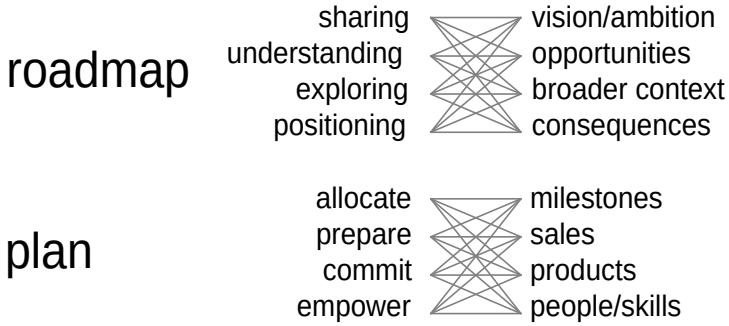


Figure 2.14: From roadmap to planning

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

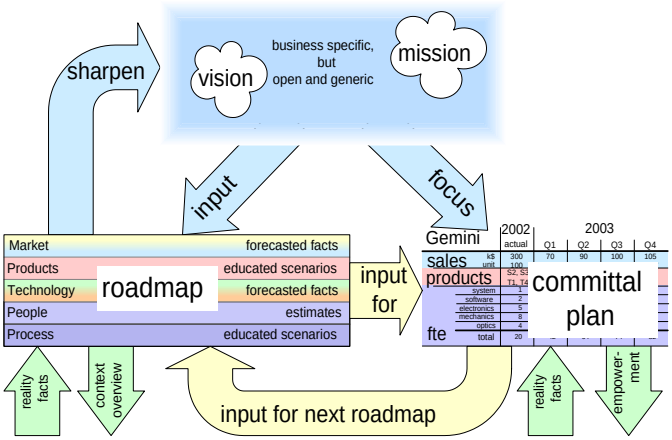


Figure 2.16: Overview of strategic entities

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

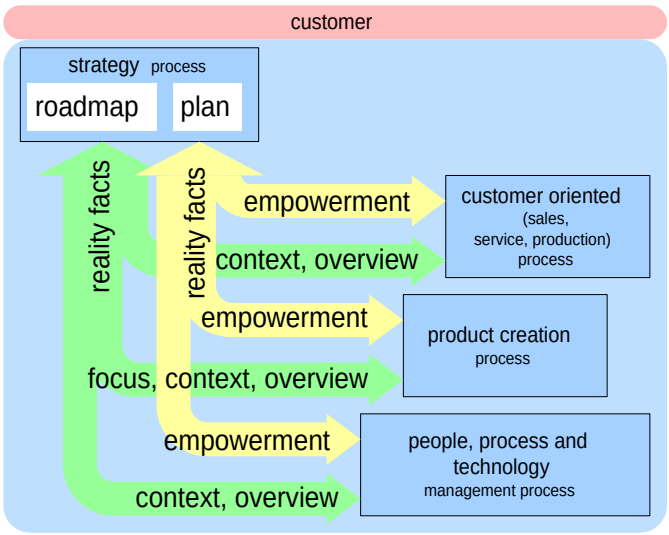


Figure 2.17: Summary of role in business

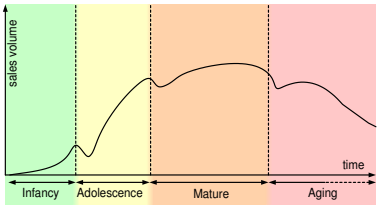
should provide the reality facts to be used in next roadmap and plan.

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 Life Cycle Consequences for Architecting



3.1 Introduction

A class of products serving a specific market evolves over time. This evolution is reflected in the sales volume of these products. The systems architecting approach depends where products are in this evolution.

The life cycle of a product market combination can be visualized by showing the sales volume as a function of the time. In literature the form of the curve of the sales volume as function of the time is described as bathtub, see figure 3.1. It is customary to recognize four phases in this curve:

- The life cycle starts with very small sales in the **infancy** phase, where the product finds its shape.
- A fast increasing sales volume in the **adolescent phase**.
- A more or less stable sales volume in the **mature** phase.
- A decreasing sales volume in the **aging** phase.

The curve and its phases represent the theoretical evolution. In the next paragraphs we will discuss observations in practice and an explanation, and we will show that the class of products and the market themselves also evolve on a macro scale.

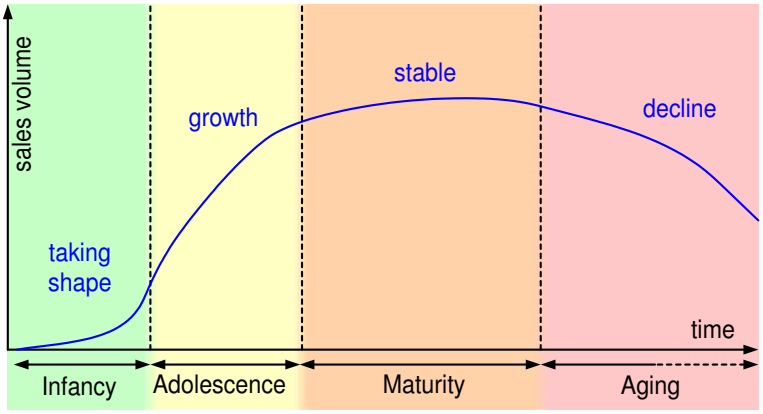


Figure 3.1: Compared with ideal bathtub curve

3.2 Observed Life Cycle Curve in Practice

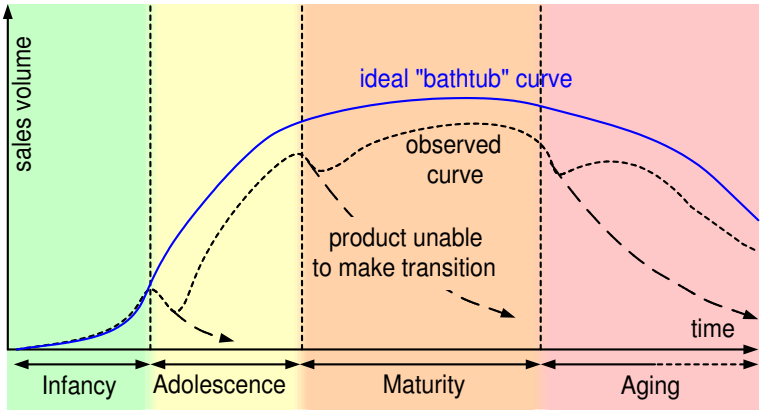


Figure 3.2: Market product life cycle phases

Henk Obbink (Philips Research) observed dips in the sales volume, as shown in figure 3.2. The transition from one phase to the next does not seem to happen smoothly. In some cases the sales drops further and the product does not make the transition at all.

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 of an organization is not adopted to these changes, then a mismatch with the changed circumstances results in decreasing sales. Figure 3.2 also indicates that, if no adaptation to the change takes place, that the sales might even drop to zero. Zero sales effectively is killing the business, while still plenty of market opportunity is present.

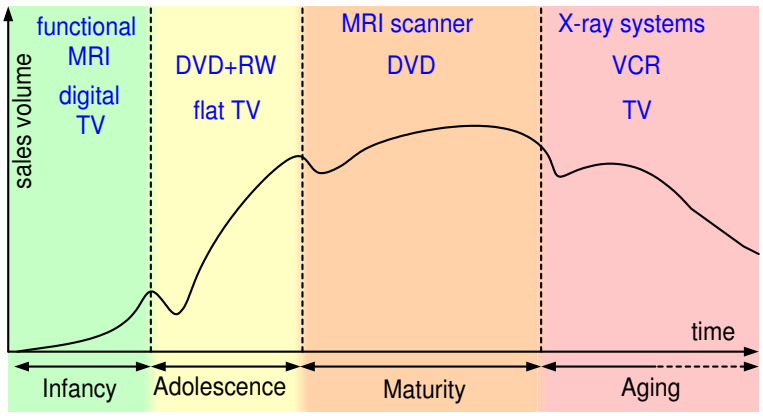


Figure 3.3: Examples of product classes on the curve

Figure 3.3 annotates the life cycle graph with a number of products and their positioning in the life cycle. As can be seen products can move backwards in the phases (i.e. become "younger") by the addition of innovative features. For instance MRS scanners moved backwards when *functional imaging* was added, an innovative way to visualize the activity of specific tissues. Similarly, conventional televisions rejuvenated multiple times by adding digital processing, flat screens, and digital interfaces.

3.3 Life Cycle Model

Figure 3.4 shows typical attributes of the life cycle 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 inherent uncertainty, the chaotic development, and the innovative and pioneering mind set. 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 over-dimensioning 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. The challenge is 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. Up-scaling the Customer Oriented Processes and the Product Creation Process requires more shared structure between the participants. This involves a mind set change: less

	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	Prioritize	Low effort high value only
Dominant technical concerns	Feasibility	Scaling	Legacy Obsolescence	Lack of product knowledge Low effort for obsolete technologies
Type of people	Inventors & pioneers	Few inventors & pioneers "designers"	"Engineers"	"Maintainers"
Process	Chaotic		Bureaucratic	Budget driven
Dominant pattern	Overdimensioning	Conservative expansion	Midlife refactoring	UI gadgets

Figure 3.4: Attributes per phase

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, while 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 mostly refined. The age of the product starts to interfere with the business, obsolescence 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, resulting mostly in small refinements to the existing product. Often the integral product know how and even specialist know how has been lost. Only very important obsolescence problems are tackled. Again the mind set of the people working on the product is changing to become more maintenance oriented. Cost is a very dominating concern, budgets are used to control the cost. Many changes are cosmetic or superficial, taking place in the most visible parts of the product: the user interface and the outer packaging.

3.4 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

Version: 1.1, date: July 6, 2004 changed by: Gerrit Muller

- removed startegy sheets from the presentations, except 2 overview diagrams

Version: 1.0, date: March 25, 2004 changed by: Gerrit Muller

- created reader