Integration of strategic business planning and technology planning in globally operating companies by means of roadmapping

The following article introduces and investigates an approach to the successful management and coordination of strategic business and technology planning. First, the theoretical framework is given. Then, an approach is introduced to integrate technology planning within strategic business planning. The article is concluded by a critical assessment of the approach introduced.

Technology and strategic planning

Definitions and background

There are many published definitions of technology. This article refers to the definition of Phaal et al. (2004) who consider technology as a specific and applied type of knowledge that may be embodied within a physical artifact, such as a machine, component, system or product, as well as the processes that enable the effective application, for example of new product development and innovation processes, together with organizational structures and supporting knowledge networks.

Technologies and technological change not only have an impact on manufacturing. All sectors of the economy, as well as all activities are affected by technologies (Lowe, 1995). Thus, a key objective of technology management is to ensure that technological resources are well linked to business requirements (Phaal, Farrukh, Probert, 2000).

In practice however, one of the fundamental aspects in corporate strategic planning that is the alignment of business strategy towards possible products or services and potential markets on the one side, and the internal capabilities and technologies available, e.g. know-how, on the other side, often fails. Strategic business planning enforces the development of new products and strategies to meet the customer

requirements. In contrast to this, technology planning often tends to develop and implement technologies based on the company's technological and achievement potential with no reference to the identified customer requirements (Specht, Behrens, 2005a).

The best-known example in which a globally operating company just relied on the company's achievement potential and neglected customer requirements is Volkswagen.
Volkswagen's market share in China decreased form 50,4% in 2001 to 17,8% in the last year. Hitherto cars used to be distributed by a state-run distribution system. But the Chinese market changed from a supplier's market to a buyer's market. While introducing the Polo model as car for a Chinese 'mass market', Volkswagen did not consider that a car particularly is one thing, a status symbol. And the Polo model does not suggest being a status symbol.

In order to cope with this challenge, technology planning and business planning cannot be regarded independently. Both technology planning as well as business planning revert to a number of different methods for technological foresight and planning, such as scenario techniques and portfolio analyses.
Portfolio analyses are suited to analyse and depict the company's current situation as well as to compare target and actual business or technology results. Portfolio analyses, however, provide no information about future expected developments.
By means of scenario techniques, future developments in different economic, technical, scientific, and social environments can be forecast. Thereby, not only a particular future state is described but also the path of development to achieve this state. The application of this method aims at the consideration of as many relevant factors of influence as possible. Due to the multitude of factors and the resultant uncertainty of the actual development, scenario techniques provide mostly qualitative results that can be used for corporate planning in the long run. In the scope of product planning, however, these results have to be concretised and quantified.
A procedure to put these results in concrete terms is provided by roadmapping. Roadmapping can be described as a systematic approach to forecasting and includes the possibility of result visualization (Specht, Behrens, 2005b).

Even if roadmapping has a long history - Charles H. Willyard and Cheryl W. McClees (1987) describe Motorola's technology roadmap process in 1987 - as recently as 2004, two journals published special issues on roadmapping. Also at that time, research centres concentrated on technology roadmaps and roadmapping were established in the U.S. and U.K. By now, the subject roadmapping has been dominated by practical application and field reports rather than scientific treatment in the published English-speaking literature (Schaller, 2004).

Compared to this development, the German-speaking literature contains several roadmapping publications since the late 1990's. This literature, however, is dominated by field reports or articles about challenges to roadmapping applications in certain industries. Anthologies about the application of roadmaps to e-business, roadmaps to visualize development paths and milestones of modern logistics, as well as roadmaps to agile organisations represent the focus of German scientists. A comprehensive overview about roadmapping is given by Möhrle and Isenmann (2005).

Theory of roadmapping

***Purpose of roadmaps**:* Continuous enhancements of a system increasingly lead to interdependencies with other systems until the original system finally evolves into a novel system in the course of evolution. Such complex developments and convergences can be forecast and visualised by roadmapping. Roadmapping refers to the unstructured available knowledge of experts and attempts to inspire their intuition and creativity (Specht, Behrens, 2005b).

Roadmapping process: The sustainable development of a roadmap consists of three phases, each containing several essential steps (Garcia, Bray, 1997; Walsh, 2004).

The first phase is concerned with preliminary activities. It includes the satisfaction of essential conditions, as well as the assignment of responsibilities for the roadmapping project. Preliminary activities include the communication of sponsorship. Finally, the scope and boundaries for the roadmap to be developed must be defined in this phase.

The second phase concentrates on the roadmap development. For this reason, the object that will be the focus of the roadmap must be identified. In a next step, demands, requirements, and targets have to be identified, analysed, and forecast. This step is followed by the specification of potentials and drivers for the object to be roadmapped in order to achieve the targets set in the step before. After alternatives and their respective time lines have been identified and evaluated – 'what is technically possible, desirable and expected, and what needs to happen for moving ahead' (Lizaso, Reger, 2004) - the alternatives that should be pursued can be recommended. The second phase is completed by the creation of a Roadmap Report.

In order to benefit sustainably from the roadmap developed, a third phase integrating all follow-up activities is of special importance. The roadmap has to be critiqued and validated. The results of this step provide the foundation for the development of the roadmap implementation plan. In order to give the current state, the information the roadmap presents has to be reviewed and updated periodically.

Application of the roadmapping process: Roadmapping visualises and evaluates several paths to defined objectives, e.g. technologies, markets, or strategies. For this reason, roadmapping evaluation can be applied to identify the alternative to be pursued, as well as to coordinate development processes in case of multiple developments. Roadmapping supports the determination of strategies and timeframes required to achieve the defined objectives successfully (Lizaso, Reger, 2004; in contrast to this see Garcia, Bray, 1997).

Phaal et al. (2000) refer to a survey of UK technical directors revealing '… that 30% of respondents are actively seeking ways to improve technology planning by using technology roadmaps.' Motorola, Phillips, Lockheed-Martin, Honeywell, and others utilise technology roadmapping to capture and present '… information about the timing of technological developments, the resources needed to support these developments, as well as the ways in which the technology might be used within the company's current and future product offerings.' (Petrick, Echols, 2004)

Roadmapping is no distinct methodology to collect information but uses existing approaches (Rogge, 1981; Büning, 1981).

Preparations of decisions: Roadmaps show different paths to the future. Within the phase of strategy development, decisions have to be made about paths to be taken. Because of the detailed presentation of interrelations and time flows, as well as the assessment of individual objects within the feasibility and profitability analyses, roadmapping can be well applied to decision preparation.

Planning and control instrument: As for the preparation of decisions and strategy formulation, roadmaps can also provide the basis for planning and control. Once the product and technology roadmaps have been transferred/ transformed into project-specific roadmaps, management has gained an important planning tool as valuable information with regards to project objective and purpose, estimated competency profile of the project members/employees and organisational aspects such as timeframes, budgets, personnel capacity, etc., can be derived.

Future Projections: Roadmapping can also be applied to future projections. The involvement of expert opinions and scenarios in the scope of roadmap generation provides an opportunity to observe and assess future developments systematically. Roadmaps should be adjusted annually in order to record the state of knowledge at a time by including new knowledge, internal changes, and developments of the company's environment in the planning.

Controlling instrument: Roadmaps also can come into operation as instruments for control. By means of a project roadmap, defined objectives and strategies, as well as their implementation can be examined. The actual state can be compared to the state determined in the roadmap, at any time. Thus, deadline shifts, cost overruns, and problems regarding capacities can be recognised immediately, and measures for their elimination can be taken in time.

Moreover, roadmaps are valuable instruments for visualisation and communication. Due to their clearness and ascertainability, roadmaps can also serve as management instruments. Further possible applications exist in R&D management and human resource planning.

Integration of technology planning within strategic business planning by means of roadmaps

Roadmapping can support planning in diverse ways. In the following, it is to be investigated how roadmapping can be used to integrate technology planning in strategic business planning. For this purpose, the organisational conditions necessitating the integration are explained. Subsequently, a general concept for the integration of technology planning within strategic business planning is introduced.

Necessity and objectives

Depending on the company's organisational structure, strategic business planning and technology planning can be enforced on different company levels, and for the most part, however, these planning activities are independently undertaken in different departments. Strategic business planning is enforced under the managerial and finance-oriented view by the corporate management and the established staff unit respectively. Based on comprehensive analyses, strategic business planning pursues a market-driven strategy. In contrast to this, technology planning in R&D departments is assigned to engineers and naturalists, who often focus on technology-driven development.

As a result, adopted business plans can possibly not be met due to lacking coordination between both departments, and in the worst case, technologies are not available in time. This delay - in the case, the new technologies are required for new products that dispose a small 'window of opportunity'– can result in that the product launch date is totally missed. On the other hand, technological planning that is not directed to the company's technology demand leads to technological developments that cannot be exploited by the company. Examples for this are developed technologies that cannot be employed in current or future products or processes, and thus represent sunk costs if there is no possibility to grant a license or to sell these technologies. Usually, there is only a small possibility that these technologies can be sold or licensed cost-covering. Firstly, there are commonly more parties purposing to grant a license than potential licensees. Secondly, after a technological development is completed it is difficult to find a licensee who – in contrast to mission-oriented research - has no possibility to exert influence on the development.

An early adjustment between strategic business planning and technology planning thus proves to be essentially required.

The integration of technology planning within strategic business planning has to consider the following aspects:
The contents of technology planning and strategic business planning have to be adjusted in order to guarantee that required technologies are available and no technologies or products are developed or introduced contrary to the company's or customer's demand.
If new technologies have to be acquired, the timeframes for product, process, and technology development have to be coordinated so that development time and due-date do not contravene. Ideally, buffer times in case of unexpected delays during the development or testing phase are scheduled.
The resources required to implement strategic business planning and technology development, such as funds or infrastructure, have to be defined. But the success also notably depends on the deployed personnel. An integrated strategic business planning therefore also includes the cooperation with strategic manpower planning.

In order to determine the required steps for strategy implementation, a project schedule has to be defined and adopted. Furthermore, milestones for progress and internal control have to be set, as well as manageable and delegable work packages have to be defined. In order to achieve the defined objectives, a planned and structured procedure is required. In the following, a structured and to some extent in practice applied and verified procedure to an integrated technology and business planning will be introduced.

Effects of the organisational company structure on the integration concept

The company structure defines responsibilities as well as the level at which and to what extent technology and business planning are enforced.

Due to the fact that in cooperative structured companies all divisions are regarded as operating units that share corporate competences, such as R&D, finance, human

resources, etc., the integration of strategic business and technological planning can be easily effected at the corporate level in order to ensure inter-divisional linkage.
In competitively structured organisations the divisions are not horizontally linked by centralised functions on the corporate level, and thus share no corporate strengths. Generally, in the case of competitive organisation the integration of strategic business and technology planning can simplest be introduced by an interdisciplinary team consisting of staff from R&D and strategic planning departments, as no inter-divisional or vertical linkage is required. The coordination of these teams is effected on the business level within each division.
The extension of the cooperative structure by an additional organisation level is considered as SBU structure. This structure ensures inter-divisional linkage within an SBU. Linkages between SBUs are commonly not aspired. In contrast to cooperative structured organisations, corporate staff within the SBU structure must be considered as consultants respectively service providers to SBUs and divisions rather than executors (Hitt et al., 2005).

Assuming there is an automotive company specialised in powertrain engineering for passenger cars. This company may be cooperatively structured by several linked divisions, such as drive train, diesel system, gasoline system, hybrid system, and sensors division. The powertrain manufacturer now intends to extent its existing business. For this reason, the management decides for an SBU structure, the prowertrain SBU and the new established electric systems SBU. The new business unit combines the following divisions: safety electronics, car body and chassis, and motor drives.
The sensor division develops sensors for system suppliers, whereby the diesel or drive train, and now also the safety electronics division may be such a system supplier.
In this case, a sensor with its underlying technologies is currently required in the above-mentioned divisions, whereby the gasoline system division takes the largest part in percentage of sales. Due to technological progress concerning the underlying technology of the considered sensor in the gasoline system market, the gasoline system division in cooperation with its supplier – the sensor division – also has to rethink the underlying technology in order to develop a competitive sensor. In this case, a strict technology and strategic business planning within the sensor division

may result in optimal technological and economically advantageous results for the sensor and gasoline division but can be suboptimal with regard to the other divisions, which also require this technology and may probably not utilise this new technological solution.

Considering a globally operating company structured by several SBUs presenting different markets the company is active in, the linkage of technology and strategic business planning can be of special importance.

A global company structured by SBUs and operating on different markets, can, in principle, choose between two technology strategies. Either the company decides for a consistent technology strategy and offers on all markets the same and in general relative high technology standard, or the company pursues a diversified technology strategy. This diversified strategy considers the different market requirements of the different markets the company is active in. Such a diversification is required if different technical standards are prevailing on a certain market or prescribed due to legal regulations.

However, a diversified technology strategy is mostly based on prevailing market conditions. While the highly developed markets of industrial countries often call for high technological standards and innovative solutions, categories like favourable prices, simple maintenance requirements, longevity, and uncomplicated operability are of importance for developing countries.

An example of a global operating company's diversified technology strategy is given in Figure 1:

Figure 1: Example of a diversified technology strategy

	Western Europe	Southern / Eastern Europe	Asia
SBU 1	innovative / high tech	proven an tested technologies	innovative / high tech
SBU 2	proven an tested technologies	low tech	not present in the market
SBU 3	innovative / high tech	low tech	proven an tested technologies

As shown in the Figure, it even can be reasonable or inevitable not to be present in a particular market (SBU 2, market Asia). The company considered in Figure 1 does not possess adequate research and development competences in order to be active in this innovative market field. But due to a strong presence and long-term customer relations, the company can exist on the domestic market. There is a sustainable and great demand for products in the low-tech segment because of the robustness of these products in the South- and East-European market. However, the company cannot exist in the Asian market due to local and innovative competitors in this market.
This example shows, that within the whole company the combined consideration of strategic business units and technology strategies can be used as means of communication as well as planning aid for both strategic business planning and R&D planning. By this means, important and interesting market segments, weak points, as well expandable fields of action immediately abound.

Strategic business planning is effected within the individual SBU in accordance with corporate objectives and strategies. Depending on whether R&D activities are separately carried out within each division or centralised within the SBU, the organisational integration of strategic business and technology planning activities requires different procedures. In contrast to decentralised R&D activities, a centralised R&D requires less coordination efforts as there are fewer parties involved. Generally, a horizontal linked integration of strategic business and technology planning across the SBUs must be enforced within an interdisciplinary team coordinated by the corporate level. If necessary, the team must be supported by members of other functions, such as the human resources or finance department. A matrix organisation ensures that all members of the respective task force are simultaneously integrated within the daily business and thus possess the required cross project knowledge.

Requirements to integrate strategic business planning and technology planning exist in all company structures considered. An instrument that supports the integration is roadmapping. For this reason, a roadmapping procedure to the integration of

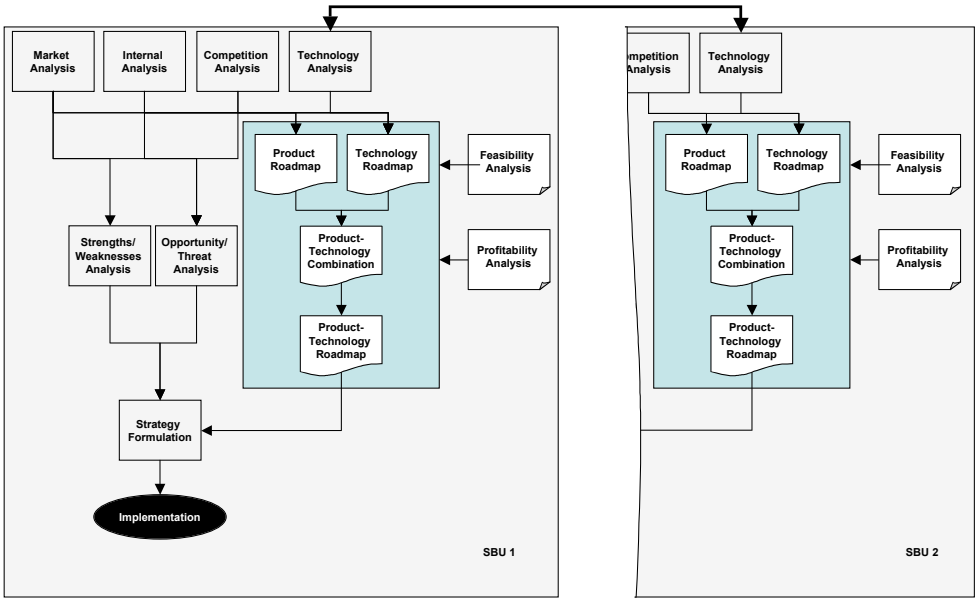
strategic business and technology planning will be introduced in the following chapter.

Roadmapping procedure to integrate strategic business planning and technology planning

A reasonable procedure must be organised in a way that business planning, as well as technology planning can be independently enforced by the respective department. In this context, it must be kept in mind that no competencies are violated and the scope of decision-making is not restricted. Mutual information, coordination and cooperation as regards content are necessitated during the entire process to guarantee that the desired planning results can be achieved.

For this purpose, a process - as depicted in Figure 2 - will be developed in the following chapters depicting two collateral sub-processes, strategic business planning and technology planning.

Figure 2: Process of an integrated business unit and technology planning



Market analysis, competition analysis, and analysis of the company within the strategic business planning process, as well as technology analysis within the technology planning process describe the first step of the method introduced. Within these analyses the initial situation is surveyed, analysed, and assessed, the primary objectives are defined, as well as ideas, development paths and possibilities regarding product and technology development are outlined.

The provisional results of the first step are recorded in a provisional product roadmap and a technology roadmap. In principle, the analyses can be independently enforced. Nevertheless, cooperation between market and technology experts is recommended during this step in order to reduce adjustments later, and to establish a shared understanding of terms and procedures. Moreover, the importance of this cooperation regarding the exchange of information cannot be neglected.

If possible, planning within both product and technology roadmap should undergo a feasibility study in this early planning phase. The objective of the feasibility review is to sort out ideas that are not suited for realisation.

A company intending to extend the existing business by entering into a new market, such as the Asian market, may create a new SBU.

Within the scope of a comprehensive market analysis, costumer requirements of the new market are analysed. Following, an appropriate business strategy to meet these

requirements is determined. As the launch of a totally new product in this new market is fraught with risk, the company may decide to place existing products on the new market, at first. In this case, the new SBU will revert to technologies and products that are already available in other SBUs, and thus benefit from the horizontal integration of technology planning activities across the SBUs as shown in Figure 2.

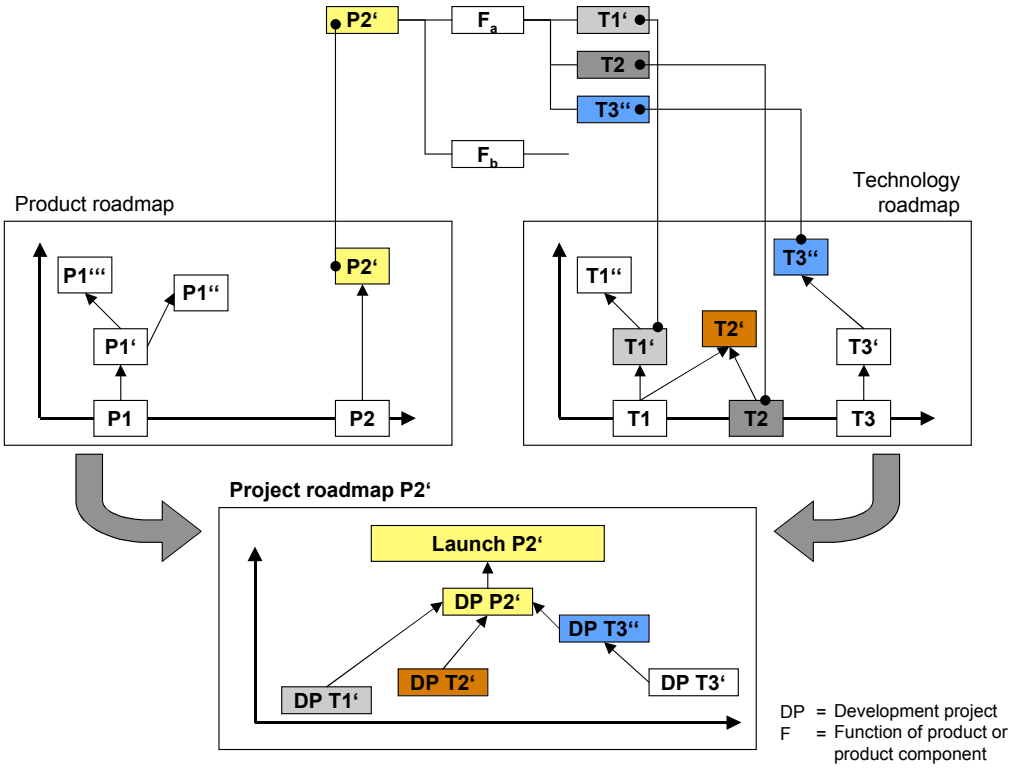
In the second step, strengths/weaknesses analysis, and opportunity/threat analysis are carried out. Furthermore, both roadmaps are brought together by a product-technology-combination, and an extended, and combined product-technology-roadmap is developed. Just as the alignment of both the technology and the product roadmaps, the strengths/weaknesses analysis and opportunity/threat analysis supplement the above mentioned analysis methods and thus form the basis for strategy building. Based on the results of both strengths/weaknesses analysis and opportunity/threat analysis, the prepared roadmaps can be examined and verified. Due to new results, the roadmaps possibly either must be adjusted - or if necessary - newly recorded. The objects within the combined product-technology roadmap undergo a profitability analysis that can lead to a further sorting of several objects within this roadmap.
The strategy formulation is carried out in the third step. Based on previous analysis results, procedures and strategies for both business planning and technology planning are developed, directives and objectives are determined, as well as milestones and desired results are defined. This information also serves as input for an efficient target achievement.
Further actions contain the implementation of the developed strategies, as well as the attentive observation and, if necessary, update and revision of the underlying information.

The outlined procedure reverts on known and proven methods of strategic business planning (Kuss, Tomczak, 2001; Busch, Dögl, Unger, 1997; Pepels, 1995). The early integration of technology planning and the application of the roadmapping process during the entire process of analysing and planning can be considered an essential characteristic.

Development of project roadmaps based on elaborated integrated roadmaps

R&D programme planning is regarded as an essential part of R&D management aiming at efficient coordination of individual R&D projects to guarantee an optimal degree of goal achievement with as efficient as possible a utilisation of the available resources (Bürgel, Haller, Binder, 1996). Based on the available product and technology roadmaps, project roadmaps can be elaborated to support the R&D management. In contrast to the product or technology roadmapping procedure, project roadmapping does not concern the 'creative search' for projects or research subjects. A project roadmap rather transfers the results of both product and technology roadmapping into an action plan. This action plan contains the identified development needs in form of a project structure whereby these development needs are not inevitably restricted to the enhancement of required technologies. Equally important, profitability analyses as well as market tests for new products are required. Thus, the project roadmap contains development projects of both technologies and requires further steps to the market launch of new products (see Figure 3).

Figure 3: Development of project roadmaps



Analogous to product and technology roadmaps, the relationship between several development effects as well as interrelations between individual projects can be depicted in a project roadmap. At this, the project roadmap, however, only serves as a visualisation instrument. The customary contents of a project description, such as an action plan, required resources, time and work schedule, etc. cannot be replaced by project roadmaps. Project roadmaps rather serve to highlight the interconnectedness of several projects. Similar to critical path planning, critical paths can also be defined within project roadmaps (Schwarze, 1994). A passing of the time budget of individual projects along the critical path causes delay in all subsequent steps.

In a further step, project roadmaps can even be extended by consideration of human resources management aspects. The time and professional assignment of employees of the R&D departments and project managers can be coordinated by means of a project roadmap. For this purpose, it is required to specify the project duration within the roadmap. The roadmap now can be considered as a time schedule in form of a Gantt chart (Specht, Beckmann, 2002). Furthermore, the roadmap contains information about the correlations between the individual R&D projects as regards content due to the identified relationships between several development effects. In employee-related project roadmaps the acquired competences of an employee can be depicted. Thus, roadmaps can also be used as an instrument to human resources development. A further possible application of roadmapping with regard to human resources management is strategic manpower requirement planning.

Assessment of the applicability of roadmapping to the integration of technology planning within strategic business planning

The company's organisation structure provides the platform at which basis the integration of technology planning within strategic business planning is effected. In the following, factors are investigated which impact the successful application of roadmapping as an integration instrument.

It is a condition for the integration of technology planning within strategic business planning by means of roadmapping to focus on an organisational unit with definable product- or market structures, such as divisions or business units from the start.

It is reasonable – also with regard to the team selection – to circumscribe the investigation object i.e., the definition of the target object whose development trends and options have to be analysed and roadmapped. Such target objects can be products, or product lines, technologies, technology groups, components, processes, etc.

Furthermore, not only the roadmapping object has to be defined but also the time horizon over which the planning will take place.

Long term planning: Long term planning with regard to the strategic orientation and thrust, such as whether to enter into a new market or not, and to be technology leader or follower respectively, can be supported by roadmapping. A strategic business planning with consideration of technological trends can identify strategic requirements at an early stage, and thus integrate these requirements within the business strategy. The demand for strategic alliances, as well as the necessity of an entry in new business segments or new markets can be such strategic requirements.

If strategic business planning and technology planning are enforced independently, these requirements will be noticed too late, thus can be implemented only by great efforts and expenses, or totally missed.

Problems in analysing a search domain arise with regard to disruptive technologies. 'When a competence-destroying technological discontinuity occurs, radical changes cause the evolutionary cycle of technology to move on a new trajectory', visualized as S-curve (Petrick, Echols, 2004). These radical changes can hardly be forecasted.

An approach to roadmap disruptive technologies has been introduced by Walsh (2004).

With respect to long term planning, the weak points of roadmapping approaches regarding the complexity of future, definitely apply.

A successful application of roadmapping for long term planning, thus mainly depends on the information and predictability of future trends and developments. The paths to defined objectives developed within the roadmapping process, however, are based on assumptions of a given future characterised by ‘a certain amount of foresight and a certain amount of consensus.’ (Lizaso, Reger, 2004) This uncertainty about the future can be limited by considering different conceivable futures (scenarios). Scenario techniques support recognition and evaluation of these scenarios, and help to identify critical factors affecting the paths to the defined objectives, as well as the options that managers should keep open. Scenario analysis should be especially included within the roadmapping process if there is major uncertainty about the object needs of the object that will be the focus of the roadmap (Garcia, Bray, 1997).

Lizaso and Reger (2004) also give an example of how to link both roadmapping and scenarios within the technology planning, emphasizing scenario analysis. This introduced approach consists in the following steps: Roadmapping Preparation, System Analysis, Scenario Projection, Scenario Building, Time Assessment, and Roadmapping.

However, the restriction on a limited number of development dimensions causes a decline in the occurrence probability of the derived occurrences with an increasing time horizon, because important factors are not considered or ‚one-dimensional’ predictions are made. One example of this is the forecast enhancement of a certain technology, while not considering that the environment may also develop, and thus, totally different basic conditions prevailing, are neglected. In contrast to morphological analyses, where the solution domain is clearly structured and delimited due to the systematic combination of all possible parameter values, the search domain depicted in a roadmap can be structured and delimited only insufficiently. In order to reduce the complexity, as well as to consider the right factors within the forecast, a Demands-Object-Potential model (DOP-model) may be introduced. This model relates the considered objects – that can be technologies, but also products or processes are possible - to their demands, as well as to the available potential, e.g. technological know-how, for realisation. The development of an object is analysed by

the respective development of both external demand, and internal or external technological potential. The demand – controlled by the demand-side environment – defines the object and is realised by the object on its part. The potential further underlies the external impacts from the potential-side environment, e.g. development of competitive technologies. The comprehensive derivation and explanation of a similar model is given by Specht and Behrens (2005b).

Medium term planning: Roadmaps for an integrated planning to develop business, as well as technology strategies for the medium run can be applied in order to point out whether adopted business targets can be achieved by the current products and technologies, and which efforts have to be made if these targets can not be achieved at the current technological stage respectively. Based on derived technological options, either the implementation of the technological alternative by which the adopted business targets can be met is enforced, or the business targets, e.g. target market share, or target cost-savings must be revised.

By means of roadmapping, thus gaps within the medium term planning of products or technologies can be identified and measures to overcome these gaps can be taken. Consequently, roadmapping results may have influence on several planning activities, such as budget planning, human resources planning, sales and operations planning, etc.

Interests of roadmapping consist in the pooling of technology and market know-how regarding the future that is available in the company. In most of the cases, however, this knowledge is far-flung among the company's employees. An efficient knowledge management, therefore, can be regarded as an essential factor for a successful application of roadmapping.

Short term planning: The information a developed roadmap presents has to be reviewed and updated periodically in order to present the current state. Roadmapping with respect to short term planning, thus, mainly serves as control mechanism and instrument to the provision of information. The comparison of target and actual business results, market observation, as well as the identification or elaboration, and examination of possible options can be supported by roadmapping.

A successful application of roadmapping in short term planning mainly depends on the notice and acceptability of roadmapping as a planning tool among executives and employees. They also must be aware that roadmapping can only support but not replace other strategic planning instruments.

In addition, the organisation of roadmapping processes must be considered as an essential factor for success. This includes the competence of analysts and experts, as well as the selected procedure. In this regard, the following aspects are of special importance:

- Detailed preparation of workshops,
- Competence, creativity, communication willingness of experts,
- Visualisation and documentation of results,
- Line-up and size of the analysing team,
- Analytical capabilities and roadmapping experience of team members,
- Allocation of responsibilities,
- Communication of roadmapping results,
- Steady revision and updating of the underlying information,
- Consistent implementation of roadmapping results.

Conclusion

Roadmapping is a method to forecast and visualise future developments. In a company, roadmapping is especially suited for the planning of products and technologies. Product and technology roadmapping should be interdisciplinary enforced in an integrated process within the company. Important to the success of the roadmapping process are communication and interaction during the roadmapping process rather than the visualisation of the results. The institutionalisation of roadmapping procedures in terms of a continuous planning proves to be reasonable. Roadmapping results provide the basis of technology management and strategic planning and - if appropriate applied –can also regard synergies across different SBUs. Furthermore, roadmapping also serves as an integral part for updating the business unit’s or division’s internal business plan as roadmapping results also influence other planning functions, e.g. human resource and financial planning.

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