



Table of contents

Abstract

1.	Initial situation	4
2.	Application-oriented guideline – „How to?“	5
2.1	Process for the application of integrated roadmapping	5
2.1.1	Objectives of roadmapping	6
2.1.2	Types of roadmaps	8
2.1.3	Participants and commitment	10
2.1.4	People involved, roadmap structure and process	10
2.1.5	Integration into higher-level innovation management	12
2.1.6	Software for integrated roadmapping	12
3.	The future - from integrated to open innovation roadmapping	14
4.	About the authors	15
5.	Background of the quoted people	17
6.	Literature review	19

Abstract

”

The roadmapping technique has been used in industry since the 1970s and has been extensively scientifically analyzed and further developed. The challenges faced by companies today must be identified promptly, efficiently and resolved proactively.

This paper is intended to give all companies - from corporations to SMEs - a quick and effective opportunity to deal with the topic of roadmapping and to use this method in their own companies.

Identifying new technologies and embedding them in one's own corporate strategy is difficult for many companies. Such examples as the invention of the smartphone or digital photography illustrate us how long-established industries and manufacturers have been displaced within only a decade. It is therefore very important to proactively shape one's own future. The method of roadmapping can help any company to meet the challenges of the future.

In addition to internal company roadmapping (technological and strategic roadmap), open innovation roadmapping is another form of roadmapping that can bundle the knowledge of an "ecosystem" and make it usable for all stakeholders.

”

1. Initial situation

Every company that wants to be competitive in the long term in an uncertain and complex environment must systematically analyze and forecast future developments (Rohrbeck & Bade 2012: 7; Rothenberg & Ettlie 2011: 127, 138; Schoemaker 1993: 193, 199). However, 80% of executives say that there is a gap between strategy and product development (Halpern 2008). The method of roadmapping offers an ideal tool for structured planning, implementation, and visualization of one's own innovations as well as the corporate strategy.

Within the framework of roadmapping, very different questions can be answered:



Which trends and markets will influence our future business?



Which products do we want to offer?



With the help of which technologies, competencies and resources can we achieve our goals?

By the late 1970s, Motorola was one of the first companies to address the interconnections between products, product features, and related technologies and competencies. This enabled Motorola to align all of its business activities with future market entries of product and functional innovations, thus reducing risk factors and bottlenecks.

Since then, the concept of roadmapping has been further developed and studied

scientifically. Accordingly, there is now vast literature and associated recommendations for action (see, among others, Albright & Kappel 2003; Bray & Garcia 1997; Barker & Smith 1995). These are mostly very extensive and require a time-consuming study of the contents. Large corporations such as Philipps, General Motors and Intel in the USA as well as Erickson and British Telekom in Europe have successfully introduced and implemented roadmapping (Lee & Park 2005).

Unlike them, SMEs do not have large innovation departments to deal with this topic (Phaal & Farrukh & Probert 2004: 26-37). Therefore, SMEs, in particular, need easy and fast access in order to recognize the advantages of roadmapping and use it effectively.

Therefore, the objective of this white paper is therefore to provide an application-oriented overview using scientific findings and best practice examples from the industry to demonstrate advantages and success factors of roadmapping. In addition, the spectrum will range from technology roadmapping and internal strategic roadmapping to a cross-company open innovation roadmapping approach.

“Consistency and transparency of roadmaps promote interdepartmental cooperation and provide a sustainable monitoring tool.”

Alexander Strauß,
Bayern Innovativ GmbH

2. Application-oriented overview - How to?

2.1 Process for the application of integrated roadmapping

A roadmap is neither a network plan nor an environment radar. Rather, a roadmap is the temporal and logical representation of the factors influencing the development of a company over a longer period of time (< 5 years). One of the main goals of roadmapping is to support communication. Transparency and clarity of strategic plans should be created and the psycho-social effects used in workshops.

The integrative roadmapping goes beyond product technology roadmaps and includes internal and external views of the relevant stakeholders and processes (Lichtenthaler 2008). In the course of the Roadmapping

Summit (<https://www.innovation-road.de/>) in April 2018 in Nuremberg, trends, best practices and clear recommendations for the use of roadmaps in practice were discussed. It became clear that a success factor is not the stringent application of the method, but a custom-fit adaptation to the company.

The steps described below in the process of creating and communicating a roadmap are decisive for success and can be implemented with varying intensity depending on the individual company.

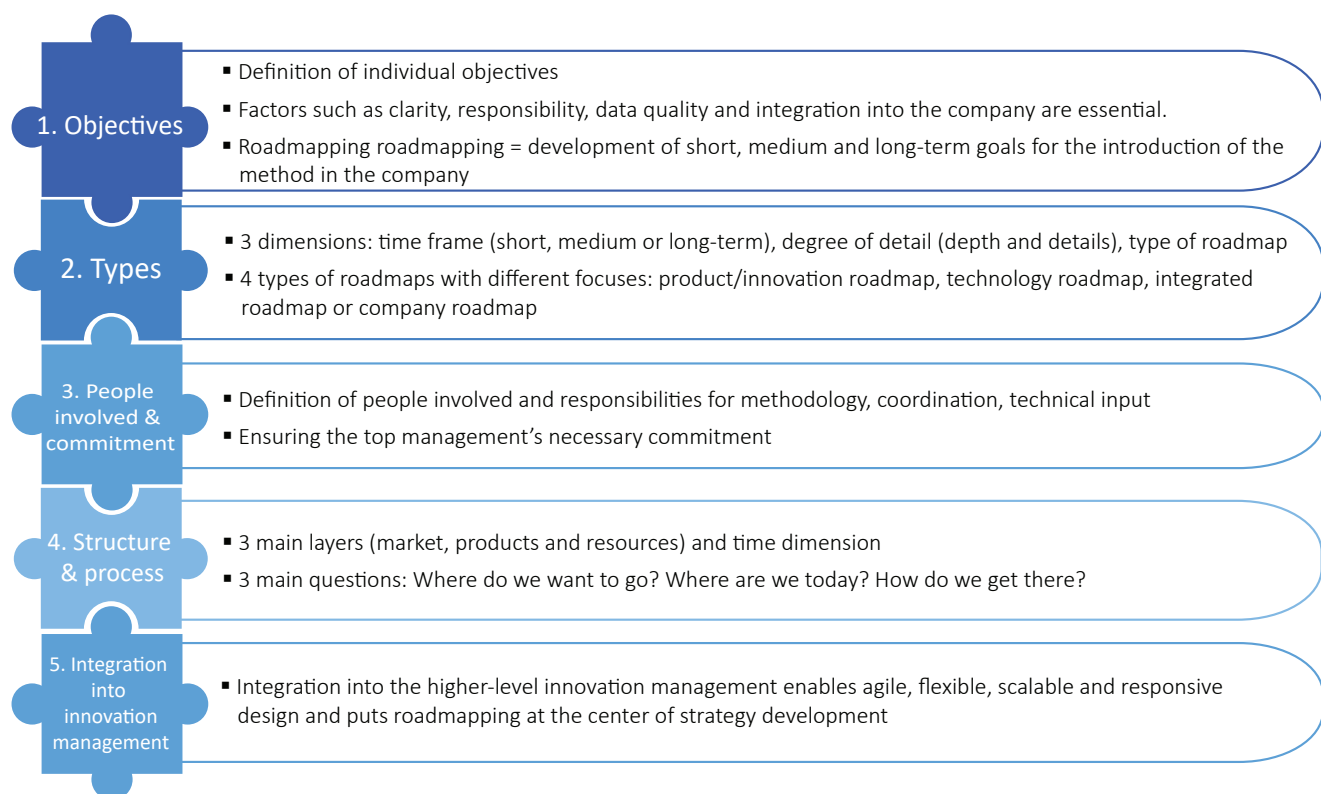


Figure 1: Process for the application of integrated roadmapping

2.1.1 Objectives of roadmapping

The following question should be addressed at the beginning of roadmapping: What do we want to achieve with roadmapping in our company? This question is essential since a corresponding commitment can only be achieved through a presentable benefit (see also 3.1.3).

Depending on the objective, roadmapping offers a structured and simple overview of temporal and logical correlations relating to a technology or within a company. This, in turn, can be used for communication at all levels - from employees to the executive board - in order to create a uniform understanding. Roadmapping must not be the top management's sole discipline. The involvement of all employees is an essential component of success.

In addition to visualization, the roadmap also supports the focus on certain activities and, thus, facilitates strategic prioritization. This allows short comings in the planning to be identified (e.g. white spots) and a minimization of risks to be achieved. A further objective can be the gain in knowledge, in addition to the finished roadmap, e.g. supported by software solutions.

Regardless of the aim of implementing roadmapping in a given company, the factors of clarity, responsibility, data quality and integration into the company are essential. In order to avoid misunderstandings in advance, clear framework conditions and guidelines are needed. A roadmap can, for example, be for a clearly defined topic area, a special techno-

logy room or an individual business unit in the company. In addition, necessary capacities and authorities must be clearly regulated and communicated. The quality of the data used also plays an important role. At the latest in the first revision loops, a suitable method for increasing data quality should be considered. The verification of the data from different "points of view" (triangulation) can be used for this purpose. Thus, the roadmap also depends on links to other tools and methods.

The first step in process for common understanding and communication of roadmapping objectives of roadmapping can also be expanded with R²: Roadmapping Roadmapping. This not only includes understanding roadmapping, but also involves concrete planning. The introduction of the roadmapping method in a company can be an elaborate, uncertain and lengthy project.

The Institute for Manufacturing (IfM) of the University of Cambridge has, therefore, developed the "Roadmapping Roadmapping R²" method to take into account the short, medium, and long-term goals pursued with roadmapping as well as the available resources when introducing the roadmapping method. Using the template in figure 2, the most important aspects of the introduction of the roadmapping method are worked out on the basis of four key questions:

1. Why should roadmapping be introduced? The current status, as well as the short- and medium-term needs and expected results of roadmapping, elaborated here (step 1a and step 1b).
2. What does perfect roadmapping look like in the future? In this step, you describe the vision or the expectations of the roadmapping method you have. In which way can roadmapping contribute to business success in the future (step 2a)? How should the roadmapping process be structured in the future (step 2b)? Which resources and capacities are needed to realize the long-term vision of roadmapping (step 2c)? What has to be done in the short-term and how? What is the current status of the roadmapping processes and what should be achieved in the short-term (step 3a)? Which resources and capacities are available to me (step 3b)?
3. What has to be done in the short term and how? What is the current status of the roadmapping processes and what should be achieved in the short term (step 3a)? What resources and capacities are available to me (step 3b)?
4. What needs to be done and how in the medium-term? What should our roadmapping process look like in the medium-term (step 4a)? What resources and capacities are available to me (step 4b)?

In the classic workshop setting, these questions are answered cooperatively in groups. The template is printed on A0 and the answers or partial aspects are attached to stickers in the respective field. On the one hand, a concrete roadmap for the introduction of the roadmapping method will emerge after the workshop; on the other hand, consensus will be reached on short- and medium-term goals and measures as well as on the long-term vision of the roadmapping method.

“Objectives? The transparency and clarity of strategic plans and the psycho-social effects in a roadmapping workshop.”

Dr. Clemens Chaskel,
University of Cambridge



Figure 2: Template Roadmapping Roadmapping (Source: Phaal 2018)

2.1.2 Types of roadmaps

Depending on the objective and the company, different dimensions have to be considered. Essentially, there are three dimensions:

1. **Timeframe:** Would you like to develop a short, medium or long-term roadmap?
2. **The degree of detail:** To what depth and with what details is the roadmap drawn up?
3. **Type of roadmap:** What should be identified?

The choice of a certain roadmap type is the most decisive. There are basically four types of roadmaps:

Technology roadmap:

This involves focusing on one or more technologies- regardless of suppliers on the market. The result of such a technology roadmap is an overview of opportunities and risks (and/ or barriers) for the management of a company. It often makes sense for the results of a technology roadmap to also be presented in a technology radar (Möhrle & Isenmann 2017).

Product and innovation roadmap:

The range of services can also be the focus of a roadmap. This refers to the current and future product range. Product and innovation roadmaps deal with the planning of new products

and innovative development projects - often taking into account the underlying technologies.

Integrated roadmap:

Integrated roadmaps consider several topics in parallel, such as product and technology planning. Depending on the focus, a roadmap comprises different dimensions (also called levels or layers) in different depths (also called lanes): products, technologies, markets, resources, drivers, projects, company goals or milestones.

Company-wide roadmap:

This type is a special form of the integrated

roadmap. The company is regarded as an overall system. Technologies and products of a company are evaluated in its “complete ecosystem” of the company. This means that existing technologies can be related to new products (technology push), which in turn are identified by existing trends and drivers. But also, the opposite (market pull) is conceivable. Here, so-called “white spots” become visible that have not yet been considered in the company or are currently not available - e.g. technologies or resources (Möhrle & Isenmann 2017).

2.1.3 Participants and commitment

Why and what type of roadmap is drawn up is determined in a joint discourse. The next step for a fast and effective development and implementation of a roadmap is to define clearly and bindingly the persons involved and their responsibilities. This creates the necessary commitment and intrinsic motivation.

A roadmap promotes communication in a company. Therefore, it is not just a tool for management and top management. Rather, the explicit goal must be to integrate the affected departments into the process as early as possible. A clear responsibility for methodology competence, coordination, and input must be communicated and experienced as clearly and transparently as possible. Typical classifications such as RACI are ideally suited for this (Jacka & Keller 2009: 256).

Clarity in responsibility and in the resource input creates transparency. The common understanding of goals, the vision and the benefits of a roadmap are the first elements to increase motivation.

“Roadmaps make goals transparent - this is not desired by all employees.”

Jochen Flohrschütz, Advanced Development,
Brose Group

2.1.4 People involved, roadmap structure and process

The basic structure of a roadmap first differentiates between three main levels (so-called main layers), represented by a sensibly selected timeline (minimum +5 years). The line “market” includes sublayers such as trends, drivers, barriers, customers, stakeholders etc. and deals with the question of “Why?” (market pull). For larger companies, the introduction of a business layer that can be used for individual business units or corporate strategy (strategic projects) is also recommended at this point. The second main layer bundles the products and services offered by a company as well as the technologies required for them. Thus, it offers space for the question of “What?” The last mainline deals with the “How?” (e.g. technology push). Sublayers such as personnel, employee skills, finance, real estate or strategic partnerships can be listed below (Phaal & Farrukh & Probert 2011: 95ff.).

However, these layers can be adapted and/or supplemented from company to company according to individual requirements. Different approaches can also be chosen for the order of layer filling (bottom-up or top-down). However, it has been shown in many workshops that numerous contents and ideas have developed in a constructive way and across layers. It is always important to involve all employees. The principle of every roadmap should always be as follows:

The simple process behind each roadmap consists of three questions. These key questions are described in detail below. The order of questions listed below is essential for creating a meaningful roadmap.

**“As simple as possible,
as complex as necessary.”**

Thomas Abele (2006), Founder,
TIM CONSULTING

1. Where do we want to go? Vision

The strategic goals and therefore the vision of a company must be clearly defined. Without this focus, it is practically impossible to set a clear structure for the future. The vision can be developed in advance of the roadmap via internally or externally moderated workshops. Since this point is the basis of the future roadmap, sufficient time and care should be devoted to it. Furthermore, the involvement of management and top management are essential due to strategic decisions.

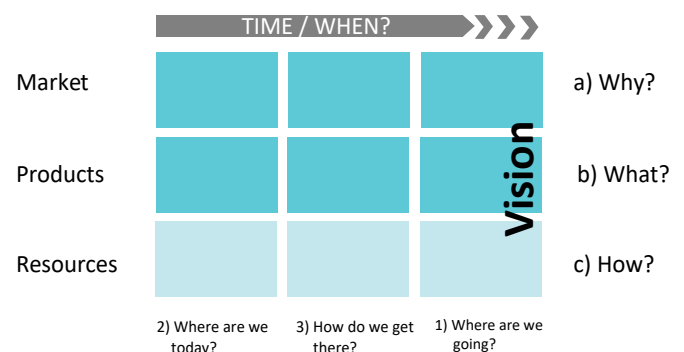


Figure 3: Structure of roadmap vision

2. Where are we today? Status quo

The next step is to determine the status quo. Also here, workshops are an adequate means of querying the current situation and the near future (+1 year) across all layers. As already

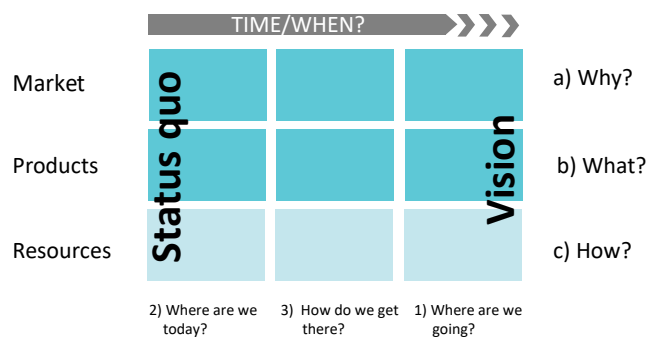


Figure 4: Structure of roadmap status quo

mentioned above, all levels of hierarchy and departments should be integrated.

3. How to get from status quo to vision?

The last step is also the most difficult. The task now is to find a way to further develop the current “activities” into a vision and to point out temporal and logical connections (“building bridges”). In addition, gaps - such as necessary technologies or human resources- can be identified.

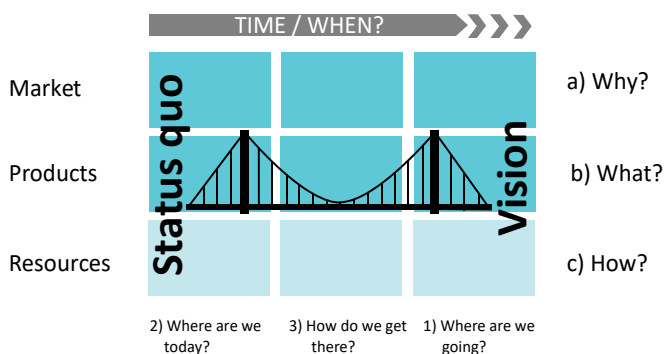


Figure 5: Structure of roadmap status quo to the vision

An important goal for one’s own roadmap should be the continuous improvement of the database. For example, trends and drivers developed in management workshops can be collected using a scientific approach and evaluated with regard to their effects

or probability of occurrence. This data can, in turn, be incorporated into the roadmap and help with the development of new products and services.

According to Lee and Park (2005), maintaining roadmaps is the most common obstacle to the effective use of roadmaps.

The completion of the first roadmap version is the starting point for a regular review process. This must also be planned and carried out carefully. Depending on the scope of the roadmap, the revision can take place every three, six or twelve months. The time intervals are strongly dependent on the market and changing dynamics for a given case. Approximately 50 % of the time spent must be spent on keeping the process alive (Phaal & Farrukh & Probert 2001).

“Roadmapping links different perspectives, especially market, product, technology and resources. This makes innovation planning more concrete and dependencies and critical paths more transparent.”

Dr. Michael Durst, Founder and CEO, ITONICS GmbH

2.1.5 Integration into higher-level innovation management

Another point is the integration of the roadmap into company-wide innovation management. In this way, the roadmap can serve as a stimulus for your own idea management. Idea campaigns can be derived from the trends and drivers developed for the roadmap. These, in turn, can be put back into the roadmap after passing through a suitable evaluation process (e.g. stage-gate).

In addition, roadmapping offers numerous possibilities to implement the results of analyses, surveys, etc. that have already been carried out in a structured way to bring them into an overall context. As a result, all tools and methods of corporate foresight (Technology Futures Analysis Methods Working Group 2003) can be interlocked and visualized within the roadmapping process.

This integration enables an agile, flexible, scalable and responsive design that puts roadmapping at the center of strategy development and innovation management (Phaal & Simonse & Ouden 2008).

“Interlocking of innovation, strategic work and consistent moderation and monitoring of all innovation activities is not trivial and requires a lot of perseverance.”

Dr. Rainer Seßner, CEO,
Bayern Innovativ GmbH

2.1.6 Software for integrated roadmapping

The high effort involved in creating and updating roadmaps is a deterrent to many companies. In addition to the efforts required to create roadmaps for the first time, difficulties in maintaining roadmaps are often cited as the main obstacle to the effective use of roadmaps (Phaal & Farrukh & Probert 2001; Lee & Park 2005). In practice, roadmaps are usually created once in Microsoft Excel, PowerPo-

int or Visio. These documents are rigid and cannot be dynamically updated or further developed (Lee & Park 2005). Consequently, the roadmap remains an isolated instrument that is detached from current corporate planning and development and quickly becomes obsolete.

However, the hurdles in roadmapping can be overcome, at least in part, with specialized software. The company ITONICS offers a flexible and customizable software. ITONICS Roadmap (<https://www.itonics.de/de/software/itonics-roadmap-innovationsroadmapping/>) combines product and technology roadmapping in an integrated solution. Depending on the focus of the company, the software can be

customized to a specific roadmapping project. The most common application is technology and product roadmapping. Through collaborative components, this software solution helps to master numerous practical challenges (see Figure 6).

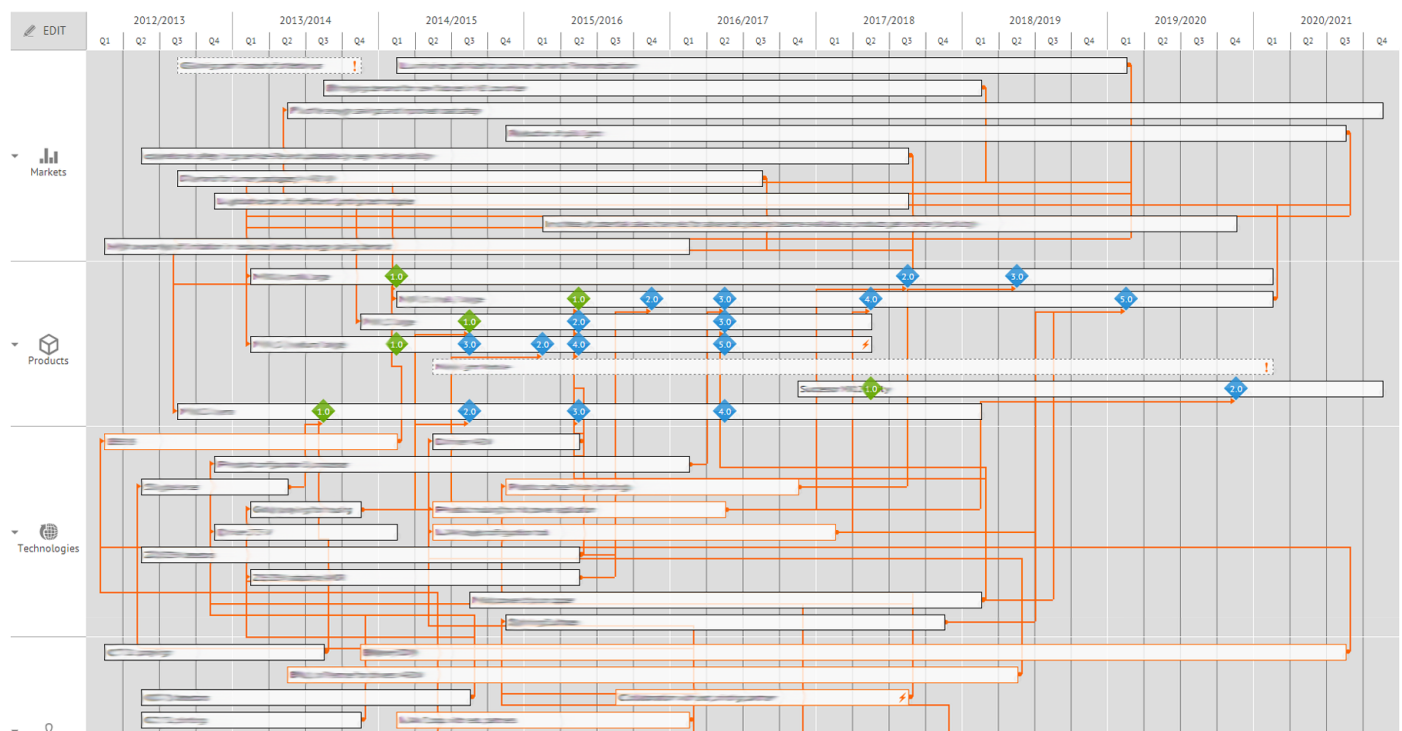


Figure 6: Section of the interactive roadmap visualization. Source: ITONICS

3. The future - from integrated to open innovation roadmapping

The roadmapping approaches described above so far are primarily used in a very small, internal company context. The disadvantage here is the limitation of the available database as well as the limited view of a company. Important aspects that have not yet been considered can easily be overlooked and thus not be included in the further development of the company.

For this reason, the roadmapping method was further developed and combined with the open innovation approach. This approach is particularly suitable for pre-competitive issues (see also e.g. Open Innovation Roadmapping- HAD).

Open Innovation Roadmapping ...

... is a tool to increase the innovation potential of players across a company. There are primarily technology roadmaps that can be edited by experts in a collaborative and overarching approach. The advantage here is the stimulated communication of different actors and the associated networking. In addition, company-specific considerations can be compared with the open innovation roadmap. Therefore, existing deficits in the own strategic planning can be recognized early, and joint benefits can be generated for all.

Bayern Innovativ GmbH offers various formats for collaborative roadmap creation and networking, see the example below.

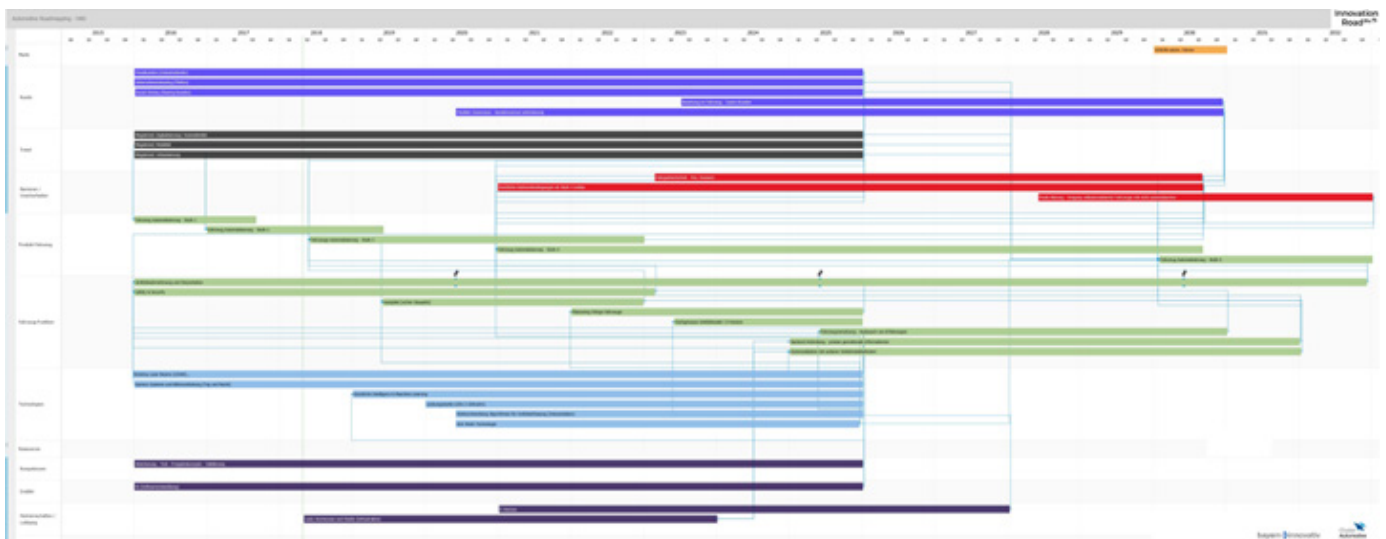


Figure 7: Open innovation roadmapping – HAD (highly automated driving)

4. Background of the quoted people

[Dr. Clemens Chaskel, IfM, University of Cambridge:](#)

Dr. Chaskel is a Senior Industrial Fellow at the University of Cambridge's IfM Educational Consultancy Services, where his work focuses on helping medium-sized and large companies adopt roadmapping approaches. By working closely with the IfM's Center for Technology and its leading scientists such as Dr. Phaal and Dr. Kerr, his projects are aligned to the current state of research and clients benefit from in-depth knowledge transfer during the collaboration. The roadmapping expert wrote his doctorate on the connection between technology and corporate strategy and the role that tools, such as roadmapping and portfolio management, play in this context.

[Dr. Rainer Seßner, CEO, Bayern Innovativ GmbH:](#)

Since April 4, 2016, Dr. Rainer Seßner has been Chairman and Managing Director of Bayern Innovativ GmbH. Previously, Dr. Seßner was Vice President Technology and Innovation at LEONI Kabel Holding GmbH, in Roth near Nuremberg, where he was responsible for setting up and managing the strategic subgroup divisions technology and innovation management, IP management, project management and development coordination. After studying mathematics and physics at the Friedrich-Alexander-University Erlangen-Nuremberg, he received his PhD in optics, information and photonics.

[Dr. Michael Durst, , Founder and CEO, ITONICS GmbH](#)

Prof. Dr. Michael Durst holds a PhD from the FAU Erlangen-Nuremberg on „Value-Oriented Management of IT Architectures“ and has worked as a management consultant for numerous Fortune 500 companies in innovation and technology management. From 2007 to 2009, he headed the Innovation & Research department at adidas AG. Today, he is the Founder and CEO of the software and consulting company ITONICS GmbH.

[Prof. Dr. Martin Möhrle, University of Bremen](#)

Prof. Dr. Martin G. Möhrle holds the Chair of Business Administration with a focus on innovation and competence transfer and is Director of the Institute for Project Management and Innovation (IPMI) at the University of Bremen. His research focuses on the various facets of innovation management.

[Jochen Flohrschütz, Advanced Development, Brose GroupCompany](#)

Jochen Flohrschütz works for the Brose Group in the Advanced Development division. At Brose Group he is responsible for cross-company technology roadmapping using ITONICS Roadmap, a dedicated software solution integrated into the company since 2016. The integrated roadmapping method is designed to visualize and simplify the interlocking between product and technology planning.

About Bayern Innovativ:

Bayern Innovativ GmbH is the company for innovation, technology and knowledge transfer in Bavaria. The company supports players from industry and science at all stages of the value chain with tailored services in order to increase their innovation dynamics. Bayern Innovativ operates at the interface between a wide variety of industries and technologies. Its goal is an ecosystem with dynamic networks for an accelerated innovation process. In addition to its own energy technology, automotive and new materials clusters, one focus of its activities is cross-clustering with other Bavarian clusters and networking with the other key players in Bavaria's innovation landscape.

About ITONICS GmbH:

ITONICS is a leading provider of software solutions and services for innovation management. With ITONICS' modular software suite, companies can collect, connect and track relevant information, inspirations, ideas, initiatives, and projects. The innovation strategy can be actively shaped and managed - from environmental scanning over trend, technology and idea management all the way to strategic foresight and road mapping. The end2end approach of ITONICS Enterprise allows for a holistic innovation process on a web-based collaboration platform.

Innovation leaders around the globe rely on the professionalism of ITONICS. Its customers include companies such as Audi, BMW, CISCO, DZ Bank, INTEL, PepsiCo, Siemens, and Total.

5. On the authors

Alexander Strauß

After studying mechanical engineering, Alexander Strauß worked for several years as an engineer in the automotive and aviation industries. From 2017, he worked as a consultant for innovation, project and process management in strategy at Bayern Innovativ GmbH. There, he was responsible for the implementation of the strategic roadmapping. Since September 2018, Alexander Strauß has been working as a manager in the automotive sector at Q_PERIOR AG. Besides automotive specific topics, he continues to work on the methods of roadmapping and innovation management.



Luisa Katzenberger

Luisa Katzenberger is Team Lead in Corporate Development & Coordination at Bayern Innovativ GmbH. Her team designs an integrated innovation management system for Bayern Innovativ's diverse product and services portfolio. Here, roadmapping entails an essential communication and planning function. Luisa studied International Business in Nuremberg, Sydney and Zurich and as a branch manager she collaborated on the further development of an innovation network. She is currently scientifically examining innovation management and platforms as part of her PhD.



Prof. Dr. Carolin Durst

Prof. Dr. Carolin Durst is Professor for Digital Marketing at Ansbach University. In research and teaching she deals with innovative technologies and their effects on business models, industries and trends. As Scientific Director at ITONICS GmbH, Carolin Durst accompanies strategic decisions and product development from the scientific side and presents the findings at conferences and in scientific articles.



6. References

- Abele, Thomas (2006): Verfahren für das Technologie-Roadmapping zur Unterstützung des strategischen Technologiemanagements, Stuttgart.
- Albright, Richard E. und Kappel, Thomas A. (2003): Roadmapping in the Corporation: Product-Technology Roadmaps Define and Communicate Product and Technology Strategy along with a Longer, Smarter View of the Future, in: Research-Technology Management, Jg. 46, Nr. 2, S. 31-40.
- Barker, D. und Smith, D. (1995): Technology foresight using roadmaps, in: Long Range Planning, Jg. 28, Nr. 2, S. 21–29.
- Bray, Olin H. und Garcia, Marie L. (1997): Fundamentals of Technology Roadmapping, Albuquerque.
- Halpern, Mark (2008): Expand Markets Yet Reduce Costs with Winning Product Portfolios,” Gartner Group,
- Jacka, JM und Keller, PJ (2009): Business process mapping: improving customer satisfaction, p. 256
- Lee, Sungjoo; Park, Yongtae (2005) Customization of technology roadmaps according to roadmapping purposes: Overall process and detailed modules, in: Technological Forecasting and Social Change, Jg. 72, S. 567–583.
- Lichtenthaler (2008): Research-Technology Management, Taylor & Francis.
- Möhrle, MG und Isenmann, R (2017): Grundlagen des Technologieroadmapping, Technologie-Roadmapping, Springer.
- Phal, Robert und Farrukh, Clare und Probert, David (2011): Roadmapping for strategy and innovation, S.95ff
- Phal, Robert (2011): Roadmapping for strategy and innovation, Fast-start roadmapping workshops techniques, Chapter 4, S. 107ff.
- Phaal, Robert und Farrukh, Clare und Probert, David (2001): Technology Roadmapping: linking technology resources to business objectives, in: International Journal of Technology Management, Jg. 26, Nr. 2. doi: 10.1504/IJTM.2003.003140.
- Phaal, Robert und Farrukh, Clare und Probert, David (2004): Customizing roadmapping. Research Technology Management, Jg. 47, Nr. 2, S. 26–37.
- Phaal, Robert und Simonse, Lianne und Ouden, Elke (2008): Next generation roadmapping for innovation planning, in: International Journal of Technology Intelligence and Planning.
- Phaal, Robert (2018): Roadmapping template for strategic technology and innovation

management, https://static1.squarespace.com/static/580a088fff7c50685dae805e/t/5b2d21c3758d46726f84dce9/1529684423346/cambridge-roadmapping_rob-phaal_R2_template.pdf [22.06.2018].

- Rohrbeck, R. und Bade, M. (2012): Environmental scanning, futures research, strategic foresight and organizational future orientation: A review, integration, and future research directions. ISPIM Annual Conference 2012, Barcelona, Spain, 1-14.
- Rothenberg, S., und Ettlie, J. E. (2011): Strategies to cope with regulatory uncertainty in the auto industry, in: California Management Review, Jg. 54, Nr. 1, S. 126-144.
- Schoemaker, P. J. H. (1993): Multiple scenario development: Its conceptual and behavioral foundation, in: Strategic Management Journal, Jg. 14, Nr. 3, S. 193-213.
- Technology Futures Analysis Methods Working Group (2003): Technology futures analysis: Toward integration of the field and new methods, <https://pdfs.semanticscholar.org/8336/545596cee158a076c35ae523a251737b7e82.pdf> [7.11.2003].