

Managing the implementation of innovative strategies in Russian companies based on the concept of “roadmaps”

Lubov Matich^{1*}, and Alexander Zheltenkov²

¹NRU “High School of Economics”, 101000, Myasnitskaya str, 11, Moscow, Russia

²Moscow Region State University, Moscow, 105005, Radio str, 10A, Moscow, Russia

Abstract. One of the main conditions for ensuring a high level of competitiveness of the Russian economy in modern socio-economic and political realities is to increase the innovative activity of its largest enterprises. Their accelerated innovation development has become a priority of state policy and, as a result, an urgent task for Russian companies with state participation is to find and use the tools that can ensure the successful implementation of innovative strategies, as well as solve the problems of implementing innovative activities. The paper presents the results of a study devoted to the tool named “technology roadmaps”, which is in demand in foreign companies. This study confirms the feasibility and possibility of its use in large Russian companies with state participation, provided that the weaknesses of the tool under study are leveled. The main provisions of the developed approach to the use of technology roadmaps are presented, which implies the need to model and execute a new business process for companies. The classification of technology roadmaps is given depending on the type of innovative strategies.

1 Introduction

Stirring of innovation activities of the largest Russian companies, especially companies with state participation (Companies with state participation include: state companies – non-profit organizations that do not have membership and are created by the Russian Federation on the basis of property contributions to provide public services and perform other functions using state property on the basis of trust management; state corporations – non-profit organizations that do not have membership, established by the Russian Federation on the basis of a property contribution and created for the implementation of social, managerial or other socially useful functions; joint-stock companies are commercial organizations whose authorized capital is divided into a certain number of shares certifying the obligation rights of members of companies (shareholders) in relation to companies in which the state has a share (block of shares) in the authorized capital) is one of the priorities of state innovation policy. They act as key participants in various markets, being at the

* Corresponding author: lmatic@hse.ru

same time consumers of significant amounts of production resources, employers, initiators and investors of research and innovation projects, and manufacturers of high-tech products. In order to stimulate the innovative activity of such companies, the state is taking active measures: a number of methodological and regulatory documents have been adopted. Starting since 2011, a number of state-owned joint-stock companies, state corporations, state-owned companies, and federal state unitary enterprises must implement innovative development programs (about 60 companies), which are monitored by the Government of the Russian Federation and the ministries in charge.

On the one hand, significant results have been achieved thanks to the measures taken. Russia's ratings in the global innovation index have increased ("Global Innovation Index": Russia has risen from 64th to 43rd place for six years; "Global Competitiveness Index" of the Davos economic forum: from 63rd to 43rd place). On the other hand, these ratings reflect, first of all, the efforts of the state in innovative development, creating a favorable innovation environment, but their individual components confirm a slightly increased innovative activity of companies (for example, in the "Global Innovation Index", Russia's position improved slightly (47th place compared to 51)). The overall *level of innovation activity* of Russian organizations (extractive manufacturing, production and distribution of electricity, gas and water, services, and construction) remains low in international comparisons: in 2017-9.6%, in 2015-9.3% (for comparison, in 2015: Switzerland-75.3%, Brazil-73.1%, Belarus-21.1%, Poland-21%, Romania-12.8%) [1].

As a result, an urgent task for Russian companies with state participation is to find and use tools that can ensure the successful implementation of innovative strategies, as well as to overcome the problems of implementing innovative activities.

Technology roadmaps (hereinafter referred to as TRM), which have been used by foreign companies for about 50 years, can be used as one of these tools [2, 3, 4]. To date, various definitions of technology roadmaps have been formed, which are understood as "a way to identify, evaluate and select available options for technological development to meet a wide range of needs" [5], and "a special type of strategic plan that describes the actions that an organization can take over a certain period of time to achieve the set goals and results [6].

The feasibility of developing and using roadmaps is indicated in a number of Russian strategic and regulatory documents regulating innovation activities. They also define the broad capabilities of this tool: ensuring effective coordination between functional divisions, identifying promising target markets, competitive products, best technological solutions, etc.

The purpose of the study is to form an approach to the use of the "technology roadmaps" tool by large Russian companies with state participation for the implementation of innovative strategies. The paper presents the main provisions of the developed approach.

2 Research methods and stages

The theoretical and methodological basis of the study was made up of scientific works of domestic and foreign researchers in the field of strategic and innovative management, business process modeling and technology roadmaps. General scientific methods of cognition were used, such as analysis and synthesis, induction and deduction, abstraction and generalization. A bibliometric analysis of publications included in the Web of Science citation database was carried out; as well as an analysis of normative documents regulating innovative activities in Russia.

The main stages that allowed us to achieve the goal of the study were the following five:

- Research on classifications and the role of innovative strategies.
- Analysis of the problems of implementing innovative strategies in the world and Russia.

- Review of existing tools for implementing innovative strategies.
- Determining the role and place of technology roadmaps in the innovation activities of Russian and foreign companies.
- Research on classifications and the role of innovative strategies

Summarizing the results of research on strategies in general and innovation strategies in particular, we can distinguish two opposite approaches to the interpretation of the concept of “strategy”:

- detailed plan for achieving the company’s long-term goals and objectives [7, 8, 9];
- principles or behaviors that are not formalized in corporate documents [10];
- a system of decisions and actions formed during the daily activities of the company’s management and employees [11].

In practice, it is desirable that, regardless of the interpretation of the concept of “strategy”, the company should strive to synchronize all aspects of the strategy: a document defining long-term goals and objectives; plans for the implementation of the strategy; tactical actions of management, managers and employees.

Functional strategies, a special case of which is an innovative strategy (along with marketing, patent, technological, etc.), are designed to facilitate the implementation of the corporate strategy. Innovative strategies play an increasingly important role in ensuring long-term competitive advantages of companies and, in general, can be divided into two groups – technological leadership and imitation. For example, according to L. G. Ramensky [12], if an organization plans to occupy a leading position in the market, it should adhere to an offensive strategy. Conversely, the relatively low importance of leadership and the primacy of entering the market with the product for the company is one of the factors that determine the strategy of waiting.

2.1 Overview of existing tools for implementing innovative strategies

The effectiveness of implementing innovative strategies depends on many factors, from the state of the company’s scientific and technical base to the level of its innovation culture and the involvement of employees in the decision-making process [13,14]. The conceptual task of successful implementation of the innovation strategy is its operationalization, i.e., decomposition into sub-strategies and the formation of a set of documents with different levels of hierarchy and time perspectives that provide the ability to control its implementation [8, 15].

Understanding the innovation strategy as a set of priority goals in the field of innovative development of the company and ways to achieve them, we can refer to the tools for its implementation all that allows us to implement the operationalization of the innovation strategy, including choosing and applying various ways to achieve innovative goals. Among the most well – known are the innovation life cycle, the Strategy Canvas [14], tools for developing divergent thinking [16], parallel procedures for selecting innovations [13], and others. Russia mainly focuses on tools such as the system of key performance indicators, technology audit, benchmarking, and a number of other initiatives to interact with the external innovation environment.

2.2 Analysis of problems in implementing innovative strategies in the world and Russia

Despite the use of tools for implementing innovative strategies, companies face many challenges. We carefully studied foreign literature and the conclusions obtained from long-term research of foreign companies by key experts in the field of innovation-K.

Christensen, R. Foster, S. Kaplan, D. Andrew, G. Sirkin, and others. The authors identify the most common problems, including: contradictions between products, technologies and business models that bring the company the main income, and new initiatives [11, 13], the inertia of the organization in comparison with the market, which prevents a quick and effective response to changes [16], and others. As a result, we have identified three main groups of problems in implementing innovative strategies that are typical for foreign companies:

Inconsistency and weak relationship between the innovation strategy and the company's innovation activities.

Priority is given to procedures and mechanisms for searching for and selecting ideas (projects) that match the company's core business model.

Insufficient communication between employees, managers, and company management, including when implementing innovative strategies.

Then we compared these problems with the problems that exist in Russian companies with state participation. From research on the innovative development of the Russian economy conducted by major analytical and research organizations (Russian Venture Company, National research university "Higher school of Economics", PricewaterhouseCoopers), we have concluded that Russian companies face similar problems. For example, the procedures adopted for selecting innovative projects act as barriers to making a decision to support high-risk projects with a long implementation period; there are actual problems of coordination and interaction between employees and management of various functional divisions, etc. Thus, it is necessary to develop tools for implementing innovative strategies.

2.3 Role and place of technology roadmaps in innovation activities of Russian and foreign companies

The "technology roadmaps" tool has been used in the world for about 50 years. Experts in the field of roadmaps development note that the TRM allows to ensure consistency between the organization's goals and the technologies necessary to achieve them; to determine, and then, if necessary, adjust the directions of technological development [17]. TRMs are used to form plans to achieve innovative goals, identify and create the necessary technologies for this [18, 19, 20].

Presented in figure 1 the typical structure of the TRM reflects the capabilities of technology roadmaps to operationalize of innovative strategies, including the formation of cause-and-effect relationships between innovative goals and ways to achieve them (specific technologies, products, research programs, and necessary resources).

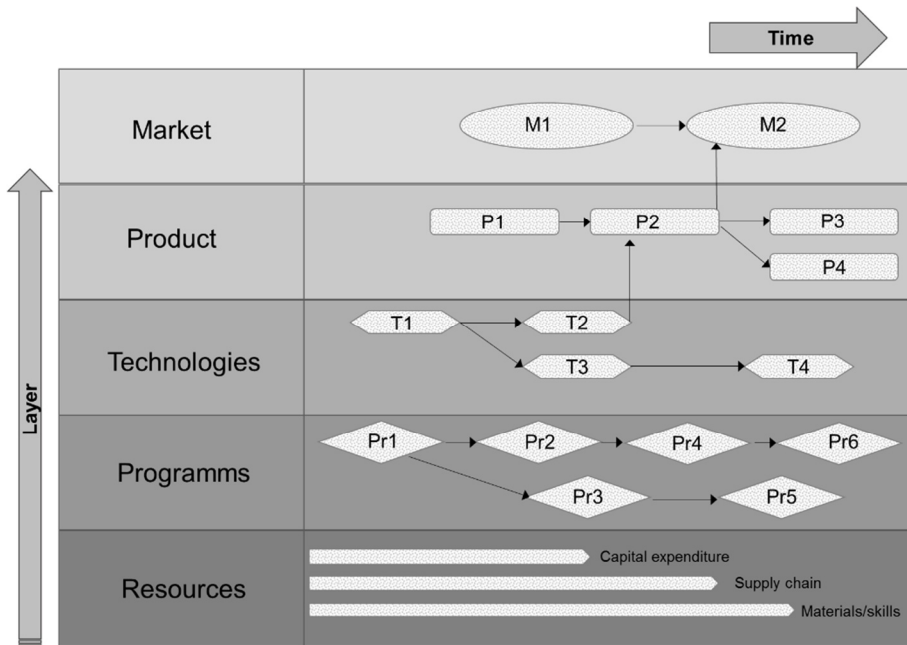


Fig. 1. The structure and main elements of roadmaps.

Note: the figure shows the structure of technology roadmaps proposed by the European Industrial Research Management Association (EIRMA) [21]. It demonstrates the main elements of the TRM, their relationships and the sequence of creating new products.

Source: [22].

Depending on the tasks for which companies plan to use TRM, various types of maps are developed, including in accordance with the classification of R. Phaal and K. Farrukh [22] roadmaps for product line planning (product planning); strategy development (strategic planning); supply and demand — for planning the state of the market, industry or segment (service/capability planning); general planning of programs and projects (program planning); planning of business processes (process planning), etc.

3 Results

The following three key tasks of implementing innovative strategies in large Russian companies with state participation, which can be solved by using technology roadmaps, are identified:

Ensuring consistency between the company's innovation strategy and its ongoing innovation activities.

Development of tools and methods for collecting and analyzing information about existing and future technologies.

Development of communications at various levels of the organization between employees, managers and management of the company.

The use of technology roadmaps allows to get positive effects for corporate innovation in general, but for Russian companies, it is most preferable to use the TRM tool in order to improve the effectiveness of the implementation of innovative strategies.

It should be noted that the key advantage of the TRM compared to other tools used is system and complexity – the tool allows exploring and managing various aspects of innovation in a single logic: identify innovative goals, taking into account the trends of the

external environment and the company's capabilities; create plans, intermediate stages and targets; identify potentially popular innovative products and technologies. This tool is also able to ensure the coordination and continuity of the activities of various functional units.

An approach to the construction of technology roadmaps by large Russian companies has been developed, which requires modeling and execution of eight sub-processes of the process "development of technology roadmaps".

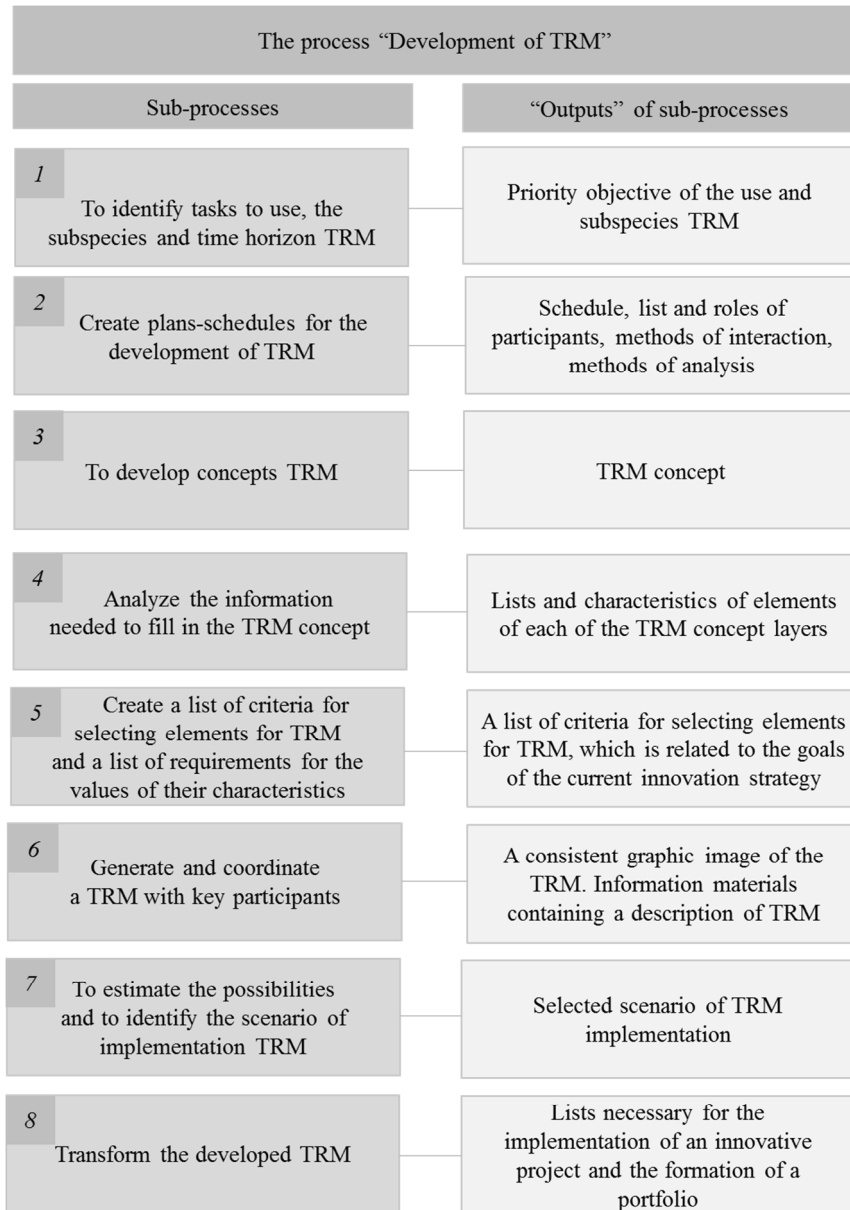


Fig. 2. The subprocesses of the process "to develop a TRM" and their main results.

Using the research tool to implement strategies, companies should pay special attention to the structure and content of technology roadmaps (in figure 2, it corresponds to subprocess 3 "develop TRM concepts" and 5 "create a list of criteria for selecting elements

for TRM”). They should be able to answer questions about what needs to be included in the technology roadmaps being developed and according to what criteria (that is, be able to choose alternatives, for example, existing or new markets that improve or break through innovations, products and technologies that match or exceed the world level, etc.). The answers to these questions depend on the type of innovation strategies that companies plan to implement.

Based on the results of the research, we also proposed our own classification of technology roadmaps, which will help companies solve the above-stated task of determining the structure and content of technology roadmaps (table 1).

Table 1. Types of TRMs (depending on the type of innovative strategies), their structure/content (Source: compiled by the author).

Types of TRMs	Structure/content of TRMs
Simulation strategy (waiting)	
TRM “Perspective products”	Promising markets and their segments for the company Goods, claimed and released by others organizations Core competencies that the company can use to improve the product (Core (root) competencies of a company are defined as distinctive abilities or a number of properties specific to a particular organization that allow it to produce products of higher quality than the average accepted in this industry. Thanks to them, it is possible to produce products that customers value more than their competitors’ products). Ways to get competitive advantages for products
Simulation strategy (copying)	
TRM “Ways to acquire rights to products”	Market-demanded products Ways to acquire rights to create products Marketing innovation Activities to create marketing innovations and the acquisition of rights to create products
Simulation strategy (borrowing and improving)	
TRM “Borrowing and improving technologies”	Priority goals and expected results Advanced technologies and their characteristics Optimal ways to obtain technologies Characteristics of methods for obtaining technologies
4. Simulation strategy (following the leader)	
TRM “Comparative advantages”	Opportunities and threats to enter new market niches Market segments and niches New products in demand The direction of changes in the characteristics of products Research and development to change the properties of the products
5. Offensive strategy (Technology leadership)	
TRM “New products”	Changes in the needs Promising markets and their segments Product concepts Ways to quickly create products
6. Offensive strategy (Strategy for creating new markets)	
TRM “New markets and new products”	Opportunities and threats to enter new markets Innovations Directions for improving innovation Ways to promote innovation Potential partners and forms of interaction with them

The structure and content of TRM types specified in Table 1 can be used as the basic ones and adapted taking into account the features and capabilities of companies. For example, let’s take a closer look at some of them.

TRM “Promising products” for the implementation of the simulation strategy of waiting reflect the interests of companies that do not seek to enter the market with new products first. TRM “Perspective products” will reflect the basic logic of the simulation strategy of waiting, in which the following tasks are solved:

- search for promising markets (analysis of influence factors, including trends);
- search for potentially in-demand products (already sold or planned to be put on the market by competing companies);
- identification of ways to eliminate shortcomings and improve innovative products (their improvement);
- identify opportunities to enter the market with an improved product and displace competitors.

TRM “Borrowing and improvement of technologies” for implementation of the imitation strategy of borrowing and improvement. Companies that adhere to this strategy may not develop technologies on their own, but acquire and adapt them to the specifics of their production. Within the framework of this strategy, important tasks are:

- defining the company’s production goals (in the field of energy efficiency, safety, environmental friendliness, etc.);
- search and selection of technologies that contribute to the achievement of goals;
- determining how to obtain technologies (conducting your own R&D, licenses, etc.).

TRM “Comparative advantages” for implementation of the simulation strategy of following the leader. Companies that focus on innovative leaders, monitor their plans and develop innovative products, and then create analogues, but with different characteristics that ensure the company’s success in certain market niches. As part of this strategy, important tasks for the company are:

- analysis of best practices (success stories, benchmarking);
- the search for promising market segments;
- identifying products that are in demand on the market;
- change the characteristics of the products;
- identifying promising niches to enter with own products.

TRM “New products” for the implementation of an offensive strategy (technological leadership) is aimed at choosing ways to implement an offensive strategy. To implement this strategy, important tasks are:

- search for promising markets (analysis of influence factors and trends);
- search for new product concepts that have no analogues, but can meet existing and emerging needs;
- forecasting and forming an idea of existing and emerging needs.

Thus, in accordance with the company’s strategy, the structure and content of the TRM should be formed.

As a result, the integrated process of developing a TRM in the company should provide those responsible for innovative development with reliable, relevant and objective information that will help make management decisions, including:

- determine how to implement the innovation strategy and its individual aspects. For example, the use of criteria for selecting elements in the development of a TRM and the presence of their characteristics in its graphic image make it possible to compare and select the most optimal alternative ways for the company to achieve innovative goals.
- create portfolios of innovative projects with different implementation dates, risks, and expected economic and non-economic effects.
- monitor and implementation of innovative projects.

In addition, new information can be obtained and justified during the development of the TR, which will influence the decision to change the current innovation strategy.

4 Discussion

Using the results of the study will improve the implementation of innovative strategies and will help to solve the most common problems that are typical for the innovation activities of large companies. The results will be particularly useful for those companies from high-tech industries that are relevant to one or more of the following points:

- the company’s products and technologies are characterized by a long life cycle of innovation and the need for large-scale investments;
- the company has problems meeting the planned values of key indicators of innovation performance, projects and activities approved in the innovation development program;
- the company is focused on achieving leading positions, including in global markets;
- the company solves the tasks of coordinating various groups of stakeholders to create innovations (divisions, external and internal R&D performers, suppliers, executive authorities), etc.

In order to use the results of the research more effectively in practice, it is also necessary to complete the four points listed below, aimed at introducing the new tool “technology roadmaps” for the company into the existing processes of the company’s innovation activity:

1. Model the business process “development of technology roadmaps for implementing an innovation strategy”, including sub-processes and their parameters.
2. Develop and approve internal corporate documents: procedures, methods, standards for developing technology roadmaps, etc.
3. Evaluate the possibility and feasibility of executing subprocesses of the TRM development by the company’s internal resources and decide.
4. Create an action plan for the use and improvement of the process and sub-processes for the development of technology roadmaps.

The results of the study have already been tested during the implementation of projects aimed at improving the management of corporate innovation strategies in the oil refining and aircraft manufacturing industries, in particular:

- technology roadmap for the development of oil refining and petrochemicals;
- roadmap of the company’s interaction with R&D performers;
- roadmap of scientific and technological development of aircraft industry;
- methodological approach to substantiating the feasibility of financial support for research in the field of aircraft construction.

The results obtained made it possible to carry out the operationalization of innovative strategies and to agree on the vision of key groups of stakeholders regarding the ways and features of implementing such strategies.

5 Conclusion

The results of the study are basic and can be used for the benefit of companies with different organizational structures from different industries. Meanwhile, in order to apply the key findings of the study in practice, it is necessary to adapt them to the characteristics of specific companies. In particular, it is necessary to identify existing processes of innovation activity, features of decision-making, determine the needs and capabilities of the organization and only then model the process of developing the TRM, its “inputs” and “outputs”, and form corporate documents necessary for its execution.

It should also be noted that without special software, there will be limited opportunities for effective collective access to the technology roadmaps being developed, which may reduce the positive impact of the tool on the implementation of innovative strategies.

As a result, further areas of development of key findings may include a deeper analysis of the parameters of the TRM development processes, including their functional and cost analysis; specification of results depending on the industry affiliation and other characteristics of companies; formation of a standardized language that allows the development and use of software for the implementation of innovative strategies based on technology roadmaps.

References

1. N.V. Gorodnikova, L.M. Gokhberg, K.A. Ditkovsky, *Indicators of innovative activity: 2019: statistical collection* (NRU “higher school of Economics”, Moscow, 2019)
2. D. Hack, J. DeTar, *Electronic News* **40**, 2035 (1994)
<http://connection.ebscohost.com/c/articles/9410282364/sematech-vows-future-fiscal-independence>
3. P. Groenveld, *Res. Technol. Manag.* **50(6)**, 48-55 (1997)
4. *Best Practices for innovation: Microsoft's Innovation Management Framework* (Microsoft Corporation, 2013)
5. O.H. Bray, M.L. Garcia, *PICMET'97: Portland International Conference on Management and Technology*, 25-28 (1997)
6. *Organization for economic cooperation and development, International energy agency. Roadmaps for energy technologies. Development and implementation guide* (2011)
http://portal-energo.ru/files/articles/portal-energo_ru__razrabotka_dorozhnih_kart.pdf
7. P. Lorange, *Formal Planning Systems: Their Role in Strategy Formulation and Implementation. Strategic/Managements New View of Business Policy and Planning* (Little, Brown, Boston, 1979)
8. G.A. Steiner, *Top Management Planning* (Macmillan, New York, 1969)
9. H.L. Ansoff, *Corporate Strategy* (McGraw-Hill, New York, 1965)
10. G. Mintzberg, *The Schools policies* (Peter, SPb, 2002)
11. K.M. Christensen, M.E. Raynor, *Solving the problem of innovation in business. How to create a growing business and successfully support its growth* (“Alpina Business books” LLC, Moscow, 2004)
12. L.G. Ramensky, *Introduction to complex soil geobotanical study of land* (Selhozgiz, Moscow, 1938)
13. P.G. Pisano, *You Need an Innovation Strategy* (Harvard business school, 2015)
<https://hbr.org/2015/06/you-need-an-innovation-strategy>
14. A. Mottaeva, B. Melovic, *MATEC Web of Conferences* **193**, 00001 (2018)
doi.org/10.1051/matecconf/201819300001
15. M. Goold, A. Campbell, *Strategies and Stales: The Role of the Center in Managing Diversified Corporations* (Basil Blackwell, Oxford, 1987)
16. R. Foster, S. Kaplan, *Creative destruction: Why companies “built forever” do not show the best results and what needs to be done to raise their efficiency* (Alpina Business books LLC, Moscow, 2005)
17. J.H. Lee, R. Phaal, C. Lee, *R&D Management* **41(5)**, 485-508 (2011)
18. R. Phaal, G. Muller, *Technological Forecasting & Social Change* **76(1)**, 39-49 (2008)
19. M. Rinne, *Technological Forecasting and Social Change* **71**, 67-80 (2004)

20. R.E. Albright, *Roadmapping Convergence* (Albright Strategy Group LLC, 2003)
21. EIRMA. *Technology Roadmapping — delivering business vision, Working Group Report* (1997)
22. R. Phaal, C.J.P. Farrukh, *Research Technology Management* **47(2)**, 26-37 (2004)