



Roadmaps Classification

Mikhail P. Loginov¹, Victor P. Ivanitsky², Maksim S. Maramygin³, Vasilii A. Tatyannikov⁴

¹Corresponding author: Doctor of Economic Sciences, professor at Ural state University of Economics (620144, Yekaterinburg, 8 Marta street, 62, Russia); loginovm@yahoo.com

²Doctor of Economic Sciences, professor at Ural state University of Economics (620144, Yekaterinburg, 8 Marta street, 62, Russia); nvp@usue.ru

³Doctor of Economic Sciences, professor at Ural state University of Economics (620144, Yekaterinburg, 8 Marta street, 62, Russia); maram_m_s@mail.ru

⁴Candidate of Economic Sciences, professor at Ural state University of Economics (620144, Yekaterinburg, 8 Marta street, 62, Russia); vat55@mail.ru

Abstract

Creating modern maps is one of the methods for simplifying business and improving logistics. This research systematizes the main methods for making ties, object mapping, Ob-EKT planning, specific types of road maps and their features. Different roadmaps are systematized in four types: public, corporate, thematic (expert) and the project roadmaps (project/program/portfolio management plan). We introduce an original approach to identifying the road map maturity level. There are four maturity levels: network, expert opinion, the concept (strategy), management plan.

Key words: roadmap; roadmapping; classification; maturity level

1. Introduction

The technology roadmapping was formalized by *Motorola* in the late 1970s in order to draw the attention of managers to the future status of technology, as well as to provide them with a forecasting tool [1-3].

Technology roadmaps were applied as a Foresight tool in strategic planning, scenario development and cause-effect relationships presentation. At the same time, technology roadmap is just a product of planning, but not an element of strategic management [4-6].

At the beginning of the XXI century, technology roadmapping becomes a worldwide standard for strategic planning and forecasting in various sectors of economy. Roadmaps began to be actively applied in a wide range of strategic planning tasks while the very strategic planning involved the components of technology, business, social and political development [3, 7-8].

The following organizations developing the roadmappingology are best known: UNIDO (Austria), the University of Manchester Institute of Science and Technology (Great Britain), Madrid Institute for Advanced Studies (Spain), Fraunhofer Institute for Systems and Innovation Research (Germany), Science and Technology Policy Institute (Korea), the National Research University Higher School of Economics (Russia).

In Russia, roadmaps began to be in considering at the federal level from December 2011, when the President of Russia set the task of implementing the National Business Initiative project, which included roadmapping for simplifying, making cheaper and accelerating business procedures [9-10].

In the period of five years, product development roadmaps have been developed by almost all ministries and departments. However, they have used a simplified approach, when roadmapping refers to drawing up a step-by-step action plan or a network (calen-

dar) plan of actions. Such a situation arose when attempts were made to introduce a project methodology into the government agency's activities and replace the term *network plan* with the term *roadmap*.

Our task is to classify the types of roadmaps and to reveal their features based on the systematization of existing approaches to roadmapping in Russia. It should be noted that foreign and domestic scientific literature provides only the elements of roadmap design systematization.

2. Roadmapping

Project milestones/key points (intermediate results) are one of project management tools. Milestone methodology involves the structural decomposition of activities, consisting of intermediate results (milestones), while planning is carried out from the result to project beginning (reverse planning). Time interval is determined for each milestone (key point). Milestone decomposition can be presented as a table (activities/time frames); schedule (events/dates); Gantt chart; network graphs; graphic image; different diagrams.

At its core, structural decomposition is a goal-achieving scenario or strategy, a path or a set of measures taken to produce a result. In the case of implicit goals (for example, in research projects or when a project strategy is defined after achieving intermediate results), goal-achieving strategy may be branched or multi-scenario.

In project management, *graphic imaging by key points (milestones) using a time scale* was called the *roadmapping*. In roadmapping, there could be one or more projects planned with one or more scenarios, and only goal-achieving strategies (scenarios) without projects alike.

Roadmapping is the most effective in case of milestone-based planning for projects included in programs and portfolios, as well as at strategic planning. In this case, we can track the main advantage of this method – visualization of links between the key points of the roadmap.

Roadmapping is characterized by the following basic components:

- mapping is carried out by a customer or a roadmap designer (subject of mapping);
- object mapping refers to the set of elements depicted on the roadmap. The object of mapping can be a project/program/portfolio management plan, concept, development strategy or scenarios, problem solution planning, etc.;

– object of planning (hereinafter object) is a set of structural roadmap elements represented as sections or layers.

Roadmapping centers around using a bounded field with a time scale plotted with graphic pictures of milestones (intermediate results, key points) and interaction between them as arrows. The subject of mapping determines the methods for locating key points, the number of layers (sections), as well as the order of key points (arrows) development and plotting.

Table 1 provides the systematized basic characteristics of roadmapping.

Table 1: Basic Characteristics of Roadmapping

Characteristic	Content
Type	Graphic
Matter	Graphic object planning
Content	Graphic concept/strategy/scenario/management plan imaging by means of expert methods with additional application of mathematical-analytical methods
Subject	Experts, authorities, management of enterprises and organizations
Object of Mapping	Project/program/portfolio management plan; concept, strategy or object development scenario at various levels of management; problem-solving strategy or scenario; multi-object – combination of different objects at the choice of the subject.
Object of Planning	Interstate relations, state, industries, enterprises and organizations, territories, territorial and administrative entities, regions, legislation, market, technologies, products, processes, R&D, projects, programs, project portfolios, problems, risks, threats, etc.
Planning Level	Federal, regional, local, technology, social, economic, political
Result	Graphic image of the project/program/portfolio management plan; Object development roadmap based on probabilistic assumptions.
Application	As a planning and forecasting tool while developing the object (primary research tool); as a graphic representation of the existing plan or scenario (secondary research tool).
Basic Approaches	Building a graphical scheme and/or an algorithm that illustrates the milestones (intermediate results) or key points of object development using inter-key relationships and a time scale; from the result (right-to-left) – determining final result on the time scale and subsequent stage-by-stage decomposition with defining the necessary resources and intermediate results (milestones) – <i>from the future to the present</i> ; from the resources (left-to-right) – step-by-step decomposition based on available resources and set deadlines – <i>from the future to the present</i> .

The roadmapping allows visualizing the goal-achieving strategies (scenarios) and gives the opportunity to choose the optimal one. Presented information is high-visualized and structured due to accessible and understandable symbols.

Prospects for the method are limited by its subjective nature caused by high uncertainty in long-term expert planning. Thus, there is a need in applying scenarios and mathematical-analytical methods. In case of using project methodology, road mapping acts as a supplement to visualize the project/program/portfolio management plan.

The result of roadmapping is the *roadmaps*, which are divided into types and differ in the level of maturity depending on the objects of planning.

3. Roadmaps Features and Classification

We have analyzed different definitions for various types of roadmaps available from the scientific literature and allocated four approaches to determining the matter:

1. visualization of step-by-step scenario, strategy and object development plan [11-12];
2. system approach, strategy development and development trends identification tools [13-14];
3. document containing requirements (indicators, alternatives and target milestones) and providing an object development trend [15];
4. collective knowledge and foresight product [16]. These approaches characterize various types of roadmaps considered in the literature: technology, food, research, social, regional, etc [17-18].

We suggest four basic types of roadmaps for their systematization: public, corporate, thematic (expert) and the project roadmaps (project/program/portfolio management plan) (Table 2).

Table 2: Roadmaps Classification

Type	Description
<i>Public Roadmaps</i>	
Areal	Development concept or strategy for any sphere at the level of several states, state, region or district with due account for identified problems and threats, interests, key trends in area development
Military	Planning military, intelligence and other operations with due account for specific strategies and plans, and the interests of the opposing sides
Federal	Pointing national problems, developing concepts and strategies for their solution, integrating the results of state programs and projects related to various spheres of national economy; synchronizing and executing processes that occur in different spheres of state activity
Regional	Pointing regional problems, determining projects and programs for their solution, developing regional economy, social and other spheres of activity; synchronizing regional and municipal processes in various fields of activity
Municipal	Pointing municipal problems and measures for their solution, developing municipal economy, social, housing and other spheres of activity;

	synchronizing processes that occur in different spheres of municipal activity
Industry (market, product, industry, economy)	Assessing the impact of markets, linking them to specific technologies, adapting scientific and technical research and production to external and internal conditions; market/industry/ sector development concepts, strategies, scenarios
Political	State policy concepts and strategies forming the mechanisms of state regulation, creating favorable economic environment, improving the quality of life, developing international relations, etc.
Social	Concepts and strategies for state or other measures taken to develop any area of social relations
Ecology	Concepts and strategies for environment protection with set goals and defined activities in the field of interaction with natural environment
<i>Corporate Roadmaps</i>	
Corporate	Enterprise/organization development concept/strategy/scenarios based on an industry roadmap; organization development plan designed by main areas of activity, integration of technological, product and functional-corporate programs (plans) of various divisions; assessing opportunities and threats for business development
Functional-corporate	Planning production/service development with allocating technologies required to fulfill organizational needs; planning knowledge assets of the enterprise and their relationship with skills, new products, technologies and capabilities required to meet market demands; planning various enterprise processes
Food	Strategy of bringing the product to the planned state; product (product line) development scenarios through time; identifying technical processes, risks and opportunities associated with particular product/service development
Product Technology	Integrating product/technology planning, identifying the required technology improvements, the most efficient production technologies, eliminating the existing technology gaps
Marketing	Commercial mapping (marketing strategy) with an emphasis on the specific features of product lines that will be in demand in the future
<i>Thematic (Expert) Roadmaps</i>	
Corporate card (business)	Analyzing the product demand structure and potential development, market development scenarios, competition; identifying the attractive products in demand; assessing the importance of advanced technologies in various market segments
Innovation	Assessing the possibilities of applying innovation technologies to achieve the goals; identifying production opportunities and introducing an innovative product/service with specified characteristics to the market; introducing variants of innovation cycle stages
Technology	Improving one or several technologies with required resources; technology push strategy, specifying key technologies and factors of technology development; analyzing market or industry trends, current and future technology capabilities, identifying relationships between trends, necessary products, technologies and available opportunities
Problem-oriented	Considering the stages associated with problem emergence or solution
Competency Development	Analyzing competencies and developments required to create any technology, product, problem solution
Research	Analyzing key factors and forming scenarios to allocate critical problem links different levels, building decision chains
Science	Research strategies, scenarios or plans
Science Technology	Integrating science and technology maps, choice between new technologies based on designed development scenarios
<i>Project Roadmaps (project/program/portfolio management plan)</i>	
Project (target)	Project/program/portfolio management plan; functional areas of project implementation strategy (project management plan)
R&D	Strategy and/or scenario for finding problems and solutions within the framework of project management
Program	Program implementation strategy, identifying relationship between technology, product or other development and key stages of the program; visualizing the interaction between the program milestones (intermediate results); assessing the impact of external/internal environment on program implementation

Roadmaps variety is determined by the need in various objects of planning. However, all roadmaps have common characteristics: purpose and objectives of development, functions, design format and planning horizon. Basic characteristics of roadmaps are presented in Table 3.

Table 3. Basic Characteristics of Roadmaps

Characteristic	Content
Purpose	Visualizing the project/ program/portfolio management plan; visualizing the results of strategic forecasting, planning or foresight
Objectives	Integrating requirements for the object development; building trajectories to achieve the goals
Functions	<i>Forecasting</i> – presenting object development scenarios; <i>planning</i> – representing project/program/portfolio management plan and object development scenarios as graphic images; <i>managerial</i> – managing the situation depending on strategic goals; <i>information</i> – information support of decision-making related to object development; <i>regulatory</i> – roadmap as a mandatory regulation; <i>marketing</i> – object promotion in order to attract investors; <i>communication</i> – creating unified strategic reference points for the subject, identifying the vector of object development.
Format	Single-axis single-layer (X axis – time, layer – one object); two-axis single-layer (X axis – time, Y axis – object development); two-axis multi-layer (X axis – time, Y axis –several objects developing); multi-axis multi-layer – applying a multi-graphic image of object development; polar/monocentric – single center of development trajectories for several objects, circular image; polycentric –several centers with development trajectories for one or more objects

Planning Horizon	Tactical – 2–3 years; medium-term – 3–5 years; strategic – 5–8–10 years or depending on subject’s needs
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Considering a roadmap as a multi-object document, we should mention it has different functionality levels. We introduce the following functionality levels depending on the roadmap maturity level characterizing its completeness.

Level 1. Network or calendar plan

The roadmap is a plan or set of actions indicating the responsible executors, time scales, resources and benchmarks. As a rule, it is a basic document designed in text or table form. This level is typical for roadmaps designed by authorities and characterized by a poorly developed strategic perspective, lack of external/internal environment factor analysis, subjective preferences of developers. As a rule, these roadmaps are intended for declaring object development expectations and perform a regulatory function.

Level 2. Expert vision

The roadmap is designed as a forecast of object changes through time. In this case, there are identified the key time points and relationships between them. The road map is a basic document that consists of a several-layer diagram. This level is typical for roadmaps that determine the vector of object development and perform the communication and information functions.

Level 3. Concept/strategy

The roadmap is a concept/strategy/scenario of object changes through time. In this case, there are identified the key time points and relationships between them. The roadmap with a note attached

can be the basic document and be included in the set of documents used as a base for roadmaps. It consists of a set of diagrams and layers. The level is characterized by the process of developing the main goal-achieving stages and performs marketing, communication, information, forecasting and planning functions. It can be used as a Foresight tool.

Level 4. Management plan

The roadmap is based on a project/program/portfolio management plan. It serves for visualization of intermediate results, links between the functional project areas, etc. The roadmap is not an independent document, but is included in the set of documents used as a base for roadmaps. It involves a set of diagrams, layers, and several roadmaps; it can involve independent parts that together create an integral picture allowing us to determine the necessary actions. Roadmap design complexity is characterized by the scale of projects or programs being implemented. The level performs a control function.

Table 4 presents our original classification of roadmaps based on the hierarchy of characteristics (criteria). The classification includes five levels of roadmap characteristics; decomposition is carried out downwards (higher level is the first one). Besides, it is possible to further classify roadmaps according to the following characteristics: subject of mapping, planning level, roadmap functions, maturity level, etc.

Table 4.: Roadmap Classification

Level	Indicator	Classification elements
1. Grade	Object of Mapping	Concept; strategy; scenario; plan; multi-object
2. Type	Type	Public (areal), corporate, thematic (expert) and project roadmaps (project/program/portfolio management plan)
3. Kind	Kind	<i>Public Roadmaps:</i> areal; military; federal; regional; municipal; industry (market, product, industry, economy); political; social; ecology
		<i>Corporate Roadmaps:</i> corporate; functional-corporate; food; product technology; marketing
		<i>Thematic Roadmaps:</i> corporate card (business); innovation; technology; problem-oriented; competency development; research; science; science technology
		<i>Project Roadmaps:</i> project (target); R&D; program
4. Planning	Object of Planning	Interstate relations, state, industries, enterprises and organizations, territories, territorial and administrative entities, regions, legislation, market, technologies, products, processes, R&D, projects, programs, project portfolios, problems, risks, threats, etc.
	Capture Rate	The whole range of scientific and public issues regarding (changes in) the object; a number of directions; one scientific area or forecast for specific area development
	Application	As a primary research tool (forecasting and planning); secondary research tool (visualization)
	Structural Completeness	Complete set of layers (complete roadmap); partial use of layers (simplified or shortened roadmap)
	Planning Horizon	Tactical – 2–3 years; medium-term – 3–5 years; strategic – 5–8–10 years or depending on subject’s needs
5. Structure	Composition Format	Single-axis; multi-axis; polar; polycentric
	Graphic Format	Layers; columns; tables; graphs; drawings; diagrams; graphics; flowcharts; text
	Mapping Approaches	From the result (right-to-left); from resources (left-to-right); from general to particular (top-to-bottom); from particular to general (bottom-to-top)

Our classification is not final and can be completed after additional studies.

the template in the form of a network or calendar plan consisting of several layers with a horizontal time axis. The number of graphic elements is determined by the roadmap designer and def of layers (sections), required decomposition depth. The basic elements of roadmap template are presented in Table 5.

Based on the fact that structuredness and visual representation are the major advantages of roadmaps, there is no strictly regulated template for mapping. The most common is depends on the roadmap maturity level and purpose, as well as on the number

Table 5.: Basic Elements of the Roadmap Template

Template Element	Description
Objectives	Objective statement may vary: developing concept, strategy, scenario, plan, visualizing project/program/portfolio management plan; targets, indicators, expected results (benchmarks); long-term objectives for each layer; identifying critical factors (stages), effort milestones, optimizing solutions; forecasting; goal as object transition from the initial to the specified state.

	Objective may be stated as a bounded set of sub-objectives. Based on the objective, one determines the roadmap type, layers, structural completeness, planning horizon and the format. Objectives are displayed as a result or fixed at end of the roadmap
Goal-achieving Strategy (Scenario)	Strategy (scenario) is a method for achieving goals by identifying the required intermediate results (milestones, activities, actions). It is represented by drawing graphic elements as key points and links between them. The goal is decomposed to the required level into tasks, action complexes, etc., which are milestones (key points) reflected in the roadmap. Each layer has its own decomposition that can be carried out: from the result to the current status (right-to-left), from the current status and available resources to the goal (left-to-right). If there are three or more strategies (scenarios), decomposition results are displayed as a map system representing each strategy (scenario) on a separate map or as several levels of the map placed vertically using the <i>window of opportunities</i> to switch between strategies (scenarios)
Layers	These are the roadmap sections illustrating the objects. They can be horizontal, vertical, sequentially-interconnected, parallel-interconnected and non-interconnected
Key Points	Key point size, type and location depend on the layer and execution period. Location sequence is determined by the goal decomposition strategy and logic. There are the following types of key points (milestones): project // development stage // problem // action // measure // control point // event // object // environment /process change; intermediate result // document // expert assessment; plan change points for the case of risks or threats; managerial decision point; scenario fork in the case of layer-to-layer interaction; window of opportunities – transition from one strategy (scenario) to another; break points, etc.
Links	Key points that characterize successive events or cause-and-effect relationships are linked. Links can be designated as arrows of different thickness, shape and color. Key points together with links represent a network or a schedule graph
Graphic symbols	Graphic representation of key points and links can differ in shape, size, color, typestyle, have textual and numerical designation alike depending on the layer
Time Axis	Time axis (usually the X-axis) remains the same for the entire map or is used separately for each layer. It is a time schedule for implementation and a tool for allocating key points
Other Information	At the discretion of the mapping subject, it is introduced in the roadmap or in the note if the subject so decides

4. Conclusion

In closing, we shall give an overall assessment of roadmaps used as a planning and forecasting tool.

Using roadmaps is reasonable for the following reasons:

- at low maturity levels, roadmap is a simple tool for visualizing strategies and plans developed for identifying logical mismatches and gaps that may not be visible in text;
- road mapping allows creating a simplified network (calendar) plan to achieve the goal using several interrelated/non-interrelated layers (sections);
- modern market dictates the need to take risks, threats, resources and other factors into account when setting goals and making managerial decisions.

Roadmaps have a number of advantages versus other strategic planning and forecasting tools:

- highly-illustrative concepts/strategies/scenarios (this contributes to better understanding and to the possibility of making managerial decisions in a single vector of development);
- science-based forecasting of changes in the external/internal environment of the objects;
- roadmaps are a means of communication between roadmap participants and increase the level of investor's confidence.

Like any other tool, roadmaps not lacking in drawbacks:

- at high maturity level, roadmap is an additional visualization tool and requires additional costs for development, control and maintenance;
- first-level maturity roadmaps designed by authorities as concepts and strategies are long-term calendar plans of action that do not take into account the changes in the external/internal environment, risks, the possibility of change management, future object development scenarios, etc.
- roadmap quality is predetermined by designer's knowledge and experience.

In public administration, roadmaps should be used on a clear methodological basis. We have made an attempt to identify the basic components of this methodology. It should be noted that Russian roadmappingology is at an early stage of development that requires further study development and formalization of approaches to roadmapping.

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