Technological Forecasting & Social Change 110 (2016) 153–166

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

Integrated roadmaps for strategic management and planning

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ARTICLE INFO

Article history:
Received 6 July 2015
Received in revised form 17 October 2015
Accepted 27 October 2015
Available online 26 November 2015

Keywords:
Foresight
Roadmapping
Innovation strategies
Integrated roadmap
Market route
Scenario
Technology push
Market pull

ABSTRACT

Roadmapping is a complex long-term planning instrument that allows for setting strategic goals and estimating the potential of new technologies, products, and services. Until recently, roadmapping was used mainly for strategic planning, either from a technological or a market research perspective. Roadmaps emphasized either technological development or satisfaction of market demands but rarely both. Consequently, roadmaps either excessively stress the technology side, which might lead to technically sophisticated solutions that lack applicability, or overstress customer needs, neglecting business competence-building.

Therefore, this paper develops a new integrated roadmapping approach that combines these two perspectives: it focuses on strategic planning by firms and public authorities for the long run goals of social and economic development, bringing together the market "pull" and technology "push" approach. This dual technique provides the potential for alternative means of choosing the most effective resource allocation. Integrated roadmaps include the various development stages of prospective innovations, e.g. stages of the existing innovation value chain, including R&D, manufacturing, market entry, services, and market expansion as well as prospective stages, including new technologies, products and services.

The value of integrated roadmapping lies in its responsiveness to the challenges in innovation planning schemes for firms and sectors; it takes into consideration both future market requirements and the future resource basis for satisfying market needs, an approach not currently offered by traditional techniques. The paper develops a roadmapping methodology that can be used for planning firms' and public authorities' long-term innovation strategies.

1. Introduction

A widely used and powerful approach for strategic planning, integrating market and technology strategies, is roadmapping, which is seemingly suitable for meeting the challenges of the twenty-first century such as the emerging rapid and dramatically changing socio-economic conditions. These changes particularly affect knowledge-intensive industries, where extensive technological requirements and resource restrictions place pressure on firms to use reliable instruments for setting priorities. Motorola was the first to develop and introduce this approach in the late 1970s (Willyard and McClees, 1987). The technique then spread to other advanced large firms including Phillips, Corning, General Motors, Lockheed Martin, and Intel in the USA, Erickson in Sweden, and British Telecom in the UK (Lee et al., 2009a). Further, it was widely used for integrated product technology planning and technology roadmaps for firms, industries, and countries (Holmes and Ferrill, 2005). Consequently, small and medium-sized enterprises (SMEs) also began to employ roadmaps primarily for achieving benefits from the open innovation approach (Caetano and Amaral, 2011; Spithoven et al., 2011).

In addition to their application by firms, roadmaps have recently become an instrument used in the public sector, e.g. governments and public bodies involved in science, technology, and innovation (STI) policy. Here roadmaps aim to identify promising STI fields and the impact assessment of the decisions taken in this regard. Technology and the market dimension need to be integrated into one roadmap in order to shift the focus from developing pure technology to the application of technologies. Accordingly, there remains a need for improved and more sophisticated methodologies to make concrete innovation strategies based on roadmapping, which would include a comprehensive reflection of the technological and market prospects, taking into account expert knowledge from different fields (Vishnevskiy et al., 2015a; Khripunova et al., 2014).

A recent case study from Russian institutions provides reasonable evidence for the use and application of such integrated roadmaps (Karasev and Vishnevskiy, 2013). For example, the strategy of the Russian Corporation of Nanotechnologies (Rusnano) for 2020, points to the necessity of employing roadmaps for building a vision of innovations in the nanotechnology field: "Corporations participate in the development of mid- and short-term forecasts and plans of scientific,

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http://dx.doi.org/10.1016/j.techfore.2015.10.020
0040-1625/

technological and market nano-industry development, i.e. roadmaps. Roadmaps will be used by the corporation as an instrument for orientation and support of other participants of innovation process, and for development of investment projects" (Vishnevskiy et al., 2015a; Karasev and Vishnevskiy, 2013; Karasev et al., 2014).

The following paper proposes a methodological approach to roadmapping that is closely related to business planning and would allow public agencies and corporations to devise STI strategies. The paper is organized as follows. Based on a literature review we formulate the main research questions for our work, then provide our own methodology of integrated roadmaps including two elements — technology roadmap and business roadmap. Next, we describe the results of applying this concept to analyze a range of practical examples where roadmapping was used by corporate and public authorities. Finally, we discuss possible applications of our integrated roadmap and future for research.

2. Literature review

Although the first roadmaps were developed in the 1970s, significant methodological progress was achieved only in the 2000s when Rob Phaal published his book 'T-plan' (Phaal et al., 2001). This seminal work devoted to the new methodology of taking a market-pull approach, and gives a step-by-step outline on how to apply roadmapping in firms by using minimal resources. Consequently, his work became a fundamental framework for roadmapping for both market pull and technology push approaches (Phaal et al., 2001). The 'T-plan' is a special framework for roadmapping, which consists of three stages: planning, roadmapping, and roll-out stages (Phaal et al., 2001; Schaller, 2004). Phaal's approach is a tool for strategists to develop a roadmap quite quickly, gives an opportunity to combine the development of technologies and activities for their exploitation and commercialization. However, many companies are unable to launch roadmaps due to a lack of qualified staff for this process. In 2004, Phaal concluded that a qualified specialist in long-term planning should manage the roadmapping process (Phaal et al., 2004). The classic scheme of Phaal's roadmaps includes four main layers closely connected with the main research questions. The first layer involves identifying the business and market environment conditions that influence a company's behavior (know-why). The second layer (know-what) aims to visualize product and service development as well as the development of capabilities. The third layer (know-how) identifies the necessary resources for achieving the firm's goals. Finally, the fourth layer (know-when) provides a timescale for the roadmap (Phaal et al., 2001).

Although there have been a number of modifications over time to Phaal's approach (Albright and Kappel, 2003; Lee and Park, 2005; Daim and Oliver, 2008), the basic concept remains the same. The literature describes two main approaches to roadmaps — the market-driven and the technology-driven approaches (Fig. 1). The market-driven approach views the primary driver of R&D as market demand (see Holmes and Ferrill, 2005; Phaal et al., 2001; Albright and Kappel, 2003; Daim and Oliver, 2008; Lee et al., 2009b). The technology push approach starts with the most significant technologies and then defines the market needs that maybe served with the new technologies (see Lee et al., 2009a; Kim et al., 2009; Lee et al., 2007; Lichtenthaler, 2008).

Market-driven roadmaps start with identifying key needs of the marketplace and customers. It then considers the technologies and R&D requirements needed to meet that demand. A technology-driven roadmap in contrast starts with a key technology and seeks to determine the market needs that maybe served with that new technology (Albright, 2006).

Albright and Kappel (2003) followed the market pull approach outlining the experience of Lucent Technologies in developing and implementing technology roadmaps. The product-technology roadmap involves the product and technology program embedded in the market dimension including market analysis and competitive strategy. Based on this it defines the plan for the evolution of a product and elaborates the business strategy reflecting the evolution of product features. Eventually a summary/action plan charting out an action strategy and a risk roadmap is made. The main advantages of the roadmap lie in the analysis of the market and product drivers and in establishing a comprehensive view on the link between technology and products. However, this roadmap may not adequately consider the resources aspect; or, at least resources are not the focus of the analysis. Moreover, external factors are only partially included (Albright and Kappel, 2003).

Holmes and Ferrill (2005) modified the T-Plan methodology with an emphasis on the market pull approach and applied the proposed methodology to a pilot sample of 30 companies in different manufacturing sectors. Their methodology used a broader definition of technology that includes skills and competencies required to handle and develop technologies. Their surveys used semi-structured questionnaires and workshops, which involved company representative and external experts in the respective fields. The inclusion of technology soft skills is advantageous for the validity of the roadmap but inherits the danger of including too many different aspects and dimensions in the activity risking a miscalculation while setting priorities (Holmes and Ferrill, 2005).

Daim and Oliver (2008) introduced a process for developing technology roadmaps with an emphasis on potential markets. They discussed the particularities of implementing a roadmap in the energy services sector. They argued that companies need to include regular and targeted training for roadmapping the corporate human resources development programs, and in some cases, even integrate employee training as a phase in roadmapping projects. Currently they argue roadmapping is a time intensive exercise, which needs new developments to make it shorter and less resource consuming (Daim and Oliver, 2008).

Lee et al. (2009a) elaborated a methodological approach that gives special attention to future changes in consumer preferences. This methodology is applied to power line communications. They integrated expert knowledge from different fields using statistical methods for analysis such as conjoint analysis. The technological expert assessment was then combined with the market related findings by means of quality function deployment. The methodology provides a valuable approach towards determining the actual starting point for roadmapping

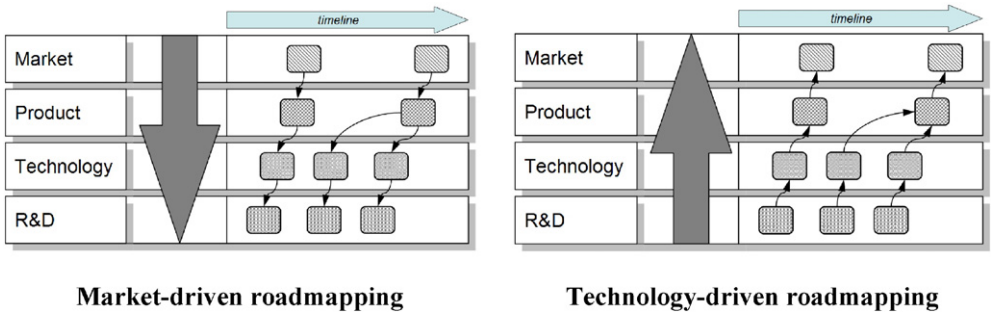

Fig. 1. Main approaches for roadmaps. Source: Lee et al. (2009a)).