



Technology roadmapping architecture based on technological learning: Case study of social banking in Iran



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ABSTRACT

Technology roadmapping is a planning tool that plays a key role in technology, innovation and R&D decisions in range of business, industry and national levels and shows the path for development of required skills. As technology development engine in late industrialized countries is technological learning rather than innovation, we observe that the considerations and requirements of technology development in developing countries have been neglected in current published literature on technology roadmaps. In this paper, by introducing technological learning as an appropriate analysis level for technology roadmapping in developing countries, the main components of technological learning including technological capabilities (TCs) and catch up strategy have been identified and efforts have been made to integrate these components in the ordinary technology roadmap architectures and thereby introduce an appropriate architecture for industries in developing countries. Finally to validate the proposed architecture, technology roadmapping is applied for social banking in Iran based on the architecture.

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1. Introduction

Technology roadmapping is a method to manage, plan and develop technology at enterprise, industry or national levels and is used whenever the scale of systems is large, there is a high degree of complexity with strategic decisions involved with future uncertainties, and association of several stakeholders in the formulation, implementation, support and use of technology (Phaal et al., 2004; Phaal et al., 2010). This approach has been developed with vastly differing levels of specificity and for vastly different audiences. The principal functions of technology roadmaps have been for representation, communication, planning, and coordination and, to a degree, for technology forecasting and selection (Rinn, 2004). It was first used in Motorola in 1997 and thereafter it was adopted by several industries and sectors with different purposes. Various approaches for technology roadmapping have so far been established that can be classified in terms of goals, architectures and applications (Lee and Park, 2005) (Phaal et al., 2006). The wide range of approaches and architectures of technology roadmapping is a reason for high flexibility of this tool that can be customized for different applications, strategic and innovation contexts (Phaal and Muller, 2009).

Technology roadmapping usually has two key components: roadmapping process which shows phases and stages of development and roadmapping result which indicates the graphical multilayer presentation that reflects the rate of changes and important time horizons by having specified time frame (Phaal et al., 2004). According to Carvalho et al. (2013) published technology roadmaps may be classified in three levels of analysis including business and strategy, innovation and new product development (NPD) with no distinction between the processes of technology development in industrialized and industrializing economies. It is observed that innovation, particularly through research and development, plays a key role in the analyses. But according to Viotti (2002) technology development engine in late industrialized countries is technological learning rather than innovation, so that the activities, institutions and their relationships are based on learning which is focused on gradual absorption and dissemination of technologies and then incremental innovations. On the other hand, the pattern of technology development in developing countries is different from developed ones, because technology development in developing countries does not start with innovation, but usually begins with absorption and improvement in innovations developed in industrialized countries (Lee and Park, 2005). To cover this gap, this paper is an endeavor to investigate components of technological learning as an appropriate analysis level for industries in developing countries and merge the identified components in current technology roadmap architectures. So the research questions are as follow: 1) what is the appropriate analysis level for technology roadmapping in developing

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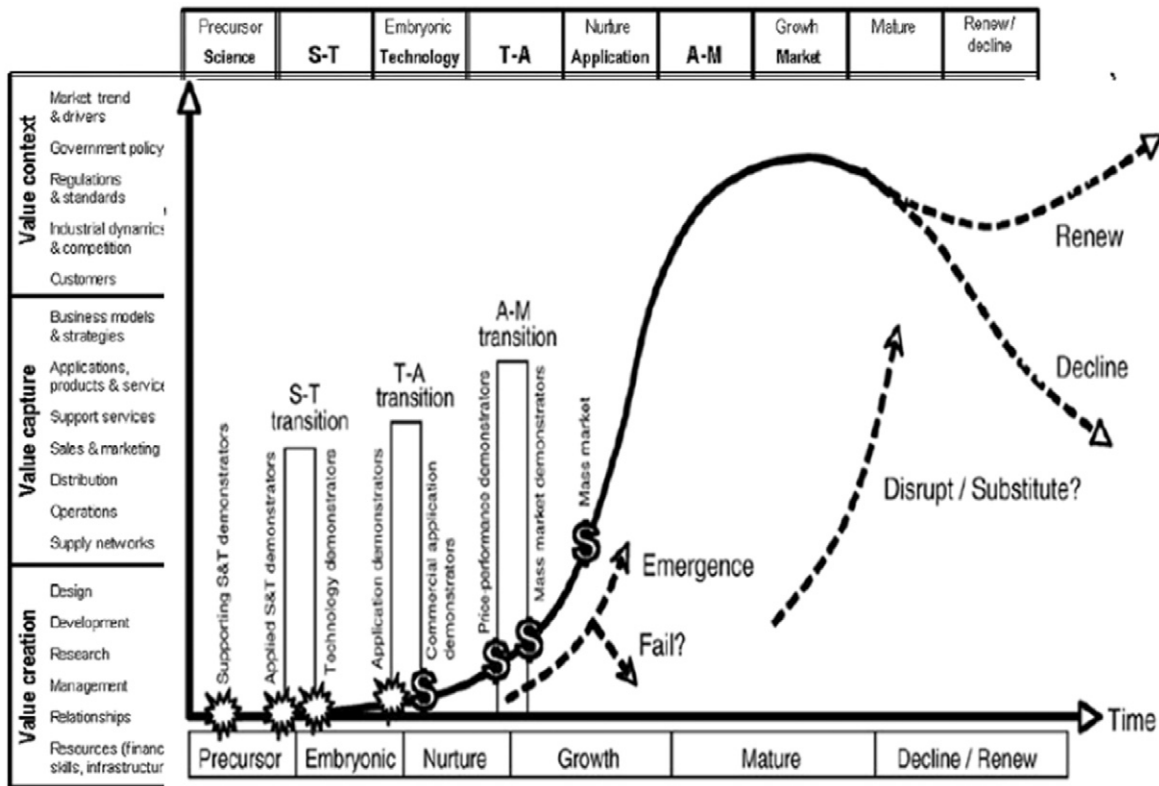


Fig. 1. Architecture of technology roadmap for technology-intensive emerging industries (Phaal et al., 2011).

countries? 2) What are the components of the identified analysis level and how to merge them in current roadmap architectures? 3) How to apply the proposed roadmap architecture for social banking in Iran?

Therefore, In Section 2, ordinary technology roadmapping architectures are discussed and key layers are described. In Section 3, the components of technological learning have been outlined. Section 4 customizes the process and structure of roadmapping framework based on results achieved in aforementioned sections. Finally, in Section 5, technology roadmapping has been developed for social banking in Iran as a case study.

2. Technology roadmap architecture

Each technology roadmap architecture usually consists of three main layers (Phaal et al., 2010): 1) Upper layer is related to trends and drivers that determine overall goals or objectives of technology roadmapping and market demand, 2) Middle layer is focused on products and services that should be developed to respond to Trends and drivers in upper layer, 3) Lower layer is related to internal and external resources that need to be provided for creating products, services and systems. For drawing technology roadmaps, after the preliminary activities for preparing the roadmap team and identifying scope and boundaries, the following steps should usually be accomplished (Phaal and Muller, 2009)(Lee et al., 2007):

1. Define statements of purpose.
2. Define the industry and needs of customers now and in the future.
3. Identify products and technologies.
4. Identify features of key technologies and products.
5. Identify time horizons for technology development.
6. Identify technology drivers and targets.
7. Identify technology alternatives and their development timelines.

8. Define skills and knowledge requirements for developing and implementing technologies.

According to the above steps, Phaal (Phaal et al., 2011) and Rouley (Rouley et al., 2013) have customized the layers and time frame (vertical and horizontal axis) for technology development in emerging industries. So that the layers are classified to three categories of value context, value capture and value creation and time frame is mapped to industry life cycle in emerging industries (Fig. 1).

Value context layer includes opportunities in environment for value capture and creation. This layer comprises market drivers and trends, government policies, regulations and standards, and industrial dynamics. Second layer, value capture, includes mechanisms and processes used by organizations to deliver new products and services, and comprises business models and strategies, applications, products and services, support services, sales and marketing, supply networks, distribution and operation. Third layer, value creation, illustrates the competencies and capabilities used by organizations to generate new products and services and include resources (skill, infrastructure and finance), relationships, research and development, design and management. This layer shows how organizations use R&D, resources and relationships to create value.

The cycle shown in Fig. 1 indicates industry life cycle for emerging industries that is a path from science to technology, technology to application and application to market (Phaal et al., 2011). The first step of cycle (S–T) is support of scientific activities in a way that leads to the development of market-based technologies and then improvements in performance and reliability of them until can be delivered to market. The second step (T–A) is promotion of technology applications in such a way that leads to sustainable commercial potentials for the product and make it profitable. The next step (A–M) is promotion of price and performance that leads to sustainable business potentials in the product. The growth step deals with marketing, commercialization and

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