



# Integrating technology roadmapping and portfolio management at the front-end of new product development

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## ABSTRACT

Many authors point out that the front-end of new product development (NPD) is a critical success factor in the NPD process and that numerous companies face difficulties in carrying it out appropriately. Therefore, it is important to develop new theories and proposals that support the effective implementation of this earliest phase of NPD. This paper presents a new method to support the development of front-end activities based on integrating technology roadmapping (TRM) and project portfolio management (PPM). This new method, called the ITP Method, was implemented at a small Brazilian high-tech company in the nanotechnology industry to explore the integration proposal. The case study demonstrated that the ITP Method provides a systematic procedure for the fuzzy front-end and integrates innovation perspectives into a single roadmap, which allows for a better alignment of business efforts and communication of product innovation goals. Furthermore, the results indicated that the method may also improve quality, functional integration and strategy alignment.

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## 1. Introduction

The front-end of new product development (NPD) comprises the activities that precede the formal development of new product projects. This phase defines the new products that should provide competitiveness and revenue for the business, which makes it a critical phase for NPD process performance. If a company is ineffective at this point, despite its successful technical development, there is a high probability of product failure in terms of financial, strategic or commercial expectations [1–9].

Research on NPD process performance has shown the need for improving this initial phase [10–13]. Front-end inefficiencies are related to features such as cross-functional uncertainties, multiple goals, lack of information and dynamic decisions [2–4, 8]. Nevertheless, companies should learn how to deal with the front-end to gain a competitive advantage and to launch successful products.

Among many management practices currently applied at the front-end, technology roadmapping and portfolio management have been widely adopted because of their capability of achieving effective outcomes [9, 14].

At the front-end, technology roadmapping can be used mainly for strategic planning, product planning, program planning and integration planning [15]. Some advantages of applying TRM are integrating innovation perspectives (market, product and technology), facilitation of intraorganizational communication and long-term planning [16].

Project portfolio management (PPM) supports the evaluation, selection, prioritization and control of the company's project portfolio. Consequently, it helps to ensure strategic alignment, maximization of project portfolio value and resource planning [17], facilitating the selection of the best new product concepts for the development and launch of successful products. This is one of the main front-end objectives.

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Since TRM and PPM have complementary features, some authors have indicated their integration as an opportunity to improve the front-end [14, 18]. This makes sense, because on the one hand the standalone application of TRM does not result in a portfolio of NPD projects and on the other hand PPM needs a list of projects as input which should be future-oriented or aligned with the company's strategy. Therefore, if PPM is applied without this orientation, i.e., as a standalone tool, it may have a limited list concerning future orientation. Consequently, the results of the front-end based on the standalone application of TRM or PPM may be ineffective for the NPD process.

Nevertheless, there is little evidence of their integration. In our review of the literature we found only two studies focusing on this topic: Park and Park [19] and Albright and Nelson [20]. Moreover, both propose roadmapping as an alternative to traditional portfolio management practices, i.e., for selecting and planning a portfolio of projects, rather than focusing on its complementary application.

In this context, this research intends to explore the complementary features of TRM and PPM at the front-end of NPD. To achieve its aim, this paper proposes a method based on the integration of TRM and PPM. The acronym of the proposed method is the ITP Method, which stands for (I) Integrated, (T) Technology Roadmapping and (P) Portfolio Management. Using a case research methodology, this integrated method was implemented at a small Brazilian high-tech company in the nanotechnology industry with the purpose of testing the integration itself and of analyzing benefits for front-end execution. Thus, it contributes not only to the theory by analyzing how TRM and PPM would be integrated, but also to practice by developing an initial reference for companies interested in improving their application of TRM and PPM.

The next section reviews the literature of the front-end of NPD, TRM and PPM to contextualize the research and clarify its theoretical backgrounds. Section 3 describes the methodology adopted in the research. Section 4 then presents the development and proposal of the ITP Method. Section 5 describes the case study and the analysis of integrated application of TRM and PPM. Finally, Section 6 concludes with a description of how the integrated application worked during the case study, giving insights regarding its contribution to front-end execution and suggesting opportunities for future research.

## 2. Literature review

### 2.1. The front-end of new product development (NPD)

The front-end of new product development has caught the attention of researchers and companies. Some of the reasons for this interest stem from its strong impact on the success of NPD and its ineffectiveness when compared to other parts of the NPD process [2, 4, 10, 11, 13]. Moreover, the front-end creates a link between business goals and the new product development process [6, 21], which makes it an important channel to achieve successful innovations.

The activities of the front-end of NPD precede product design, determining product opportunities in terms of strategic goals, market needs and technological solutions. These, in turn, lead to product concepts and to projects to deliver these concepts. Upon conclusion of these activities, the pool of product projects is evaluated, and the ones that converge with business interests are selected for development in the design phase of NPD [3–5].

The front-end groups people from many functional areas of business, such as: senior management, marketing, design and manufacturing [22]. In addition, it works with complex and uncertain information [1, 3, 4]. Other characteristics that challenge companies during front-end execution are the application of tools from different knowledge areas and the difficulty in defining responsibilities among stakeholders, which has an impact on its management [23, 24].

### 2.2. Technology roadmapping

Technology roadmapping serves to describe the market, to plan product and process development, to establish technological capacities and to analyze resources [25]. It reveals the interrelations among market, product and technology parameters, and identifies objectives that justify company efforts [26].

The roadmap structure should be linked with technology roadmapping objectives in order to achieve the expected results. The most generic roadmap has a horizontal timeline and three layers: market, product and technology [16]. Fig. 1 depicts a generic roadmap.

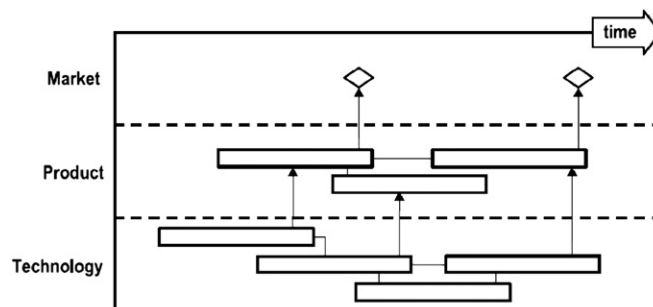


Fig. 1. Generic roadmap [16].

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