



Fostering novelty while reducing failure: Balancing the twin challenges of product innovation



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ABSTRACT

This paper aims to further our understanding of how the degrees of innovation novelty and innovation failure are connected. It argues that a better understanding of the specific predictors of innovation novelty and failure would improve our understanding of the innovation process and inform R&D managerial interventions to reduce the occurrences of failure and enhance radical innovation. This investigation draws on data on 5387 Spanish manufacturing firms from the 2009 Spanish Community Innovation Survey (CIS). Unlike prior studies which examine product innovation, degree of innovation novelty, and innovation failures in separate models, this study relies on a multivariate model to account for the extent to which these outcomes are interdependent. Overall, the results indicate that innovation effort and innovation failure are closely linked, especially if the innovation involves a significant level of novelty. These interdependencies are problematic since firms aspire to higher propensity for innovation and novelty; however, this higher propensity is accompanied by a higher probability of failure. Our empirical results identify a number of factors that contribute to enhancing innovation novelty while also attenuating the probability of innovation failure. These factors are: (i) R&D employees, (ii) research and institutional sources of information, (iii) contracting external R&D, and (iv) corporate social responsibility practices.

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1. Introduction

The development of successful product innovations increasingly is seen as key to the survival and growth of firms. The degree of novelty of new products contributes to improving firms' competitive advantage, and allows firms to create new markets (Gassmann & Zeschky, 2008; Hernandez-Espallardo et al., 2012; Schmidt et al., 2009). However, product innovations, especially radical product innovation projects, fail at an alarming rate. Indeed, depending on the product category, 40% to 90% of innovation projects fail partly or completely (Cozijnsen et al., 2000; Gourville, 2006; Rizova, 2006; Välikangas et al., 2009). Consequently, scholars and managers are greatly interested in how to foster innovation and how to decrease the likelihood of innovation failure (Astebro & Michela, 2005; Conti, 2014; Henard & Szymanski, 2001; Mata & Woerter, 2013).

Work on technological innovation frequently emphasizes the factors that contribute to increasing the success and novelty of technological

innovation, with much less attention in either the conceptual or empirical literatures on innovation failure (Galia & Legros, 2004; Smith-Doerr et al., 2004). Innovation is a cumulative process (Magazzini et al., 2012; Scotchmer, 2004) which means that innovation failure is intertwined with learning experiences associated with previous successful innovation. Despite increasing recognition that innovation effort and innovation failure are closely related phenomena (Cabral, 2003; Madsen & Desai, 2010; Magazzini et al., 2012), the empirical literature generally treats the firm's decision to innovate – and about the degree of novelty of innovation – and the firm's decision to terminate an innovation separately.

In this paper, we examine the extent to which innovation success and failure are interdependent. We argue that by investigating this relationship, and the predictors of innovation novelty and failure, we contribute to improving understanding of the innovation process which has valuable implications for managerial interventions to reduce failures. We focus specifically on disentangling the association between novelty and failure by exploring the factors that both promote a higher degree of innovation novelty and lower occurrence of innovation failure. Our empirical analysis employs a Multivariate Probit Model (MPM) to address the potential interdependencies between innovation novelty and failure. To our knowledge, the MPM approach has not been

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used to examine how product innovation, degree of novelty, and failure are connected.

The paper addresses three questions: 1) To what extent are innovation novelty and innovation failure connected? 2) What are the differences among the factors that contribute to innovation project success and those that result in projects being terminated? 3) What implications can be derived to help managers develop strategies that foster product innovation novelty while minimizing the occurrence of innovation failure?

The rest of the paper is organized as follows. [Section 2](#) discusses the interdependence between product innovation, novelty, and innovation failure. It argues that the phenomenon of innovation failure should be seen as a fully-fledged phenomenon that is closely linked to innovation effort. [Section 3](#) introduces the predictors of product innovation, novelty of innovation, and innovation failure. [Section 4](#) provides an overview of the study context and discusses the data and descriptive statistics. [Section 5](#) introduces the variables and analytical models, and [Section 6](#) reports the results of the econometric analysis. [Section 7](#) discusses the main findings of our empirical study, and [Section 8](#) concludes with some implications for firms and policy makers, and a discussion of the study limitations and directions for future research.

2. Interdependence and asymmetries between innovation success and failure

There is a consolidated body of empirical evidence suggesting that innovation project failure is a frequent phenomenon, particularly in the context of radical innovation projects ([Rizova, 2006](#); [Välilikangas et al., 2009](#); [Wycoff, 2003](#); [Yap & Souder, 1994](#)). Some authors highlight that innovation failure is not separate from the overall innovation process ([Gino & Pisano, 2011](#); [Scotchmer, 2004](#)). Investigation into innovation practice shows that the firms' decision to develop innovations with a high degree of novelty inevitably results in their being forced to evolve beyond their existing technological capabilities ([Danneels & Kleinschmidt, 2001](#); [Townsend, 2010](#)). The greater the discontinuity between the firm's technological, human, and knowledge resources, and the existing bundle of resources that the firm can draw on to develop an innovation, the higher the likelihood the innovation project will be abandoned ([Cabral, 2003](#); [Conti, 2014](#); [Garcia & Calantone, 2002](#); [Magazzini et al., 2012](#)).

Previous work provides numerous insights suggesting that success and failure are closely linked, and that a deeper investigation into the nature of this relationship is required. However, the interdependence and joint occurrence of these phenomena has been rather under-researched. One aspect that requires further research is associated with the asymmetries between innovation success and failure. Several studies that compare innovation success and innovation failure depend on research designs that first identify the factors likely to explain success. Then, in a second step, and by extension, failure is explained by the lack of strength or the absence of one or many of these factors ([Connell et al., 2001](#); [Cooper & Kleinschmidt, 2007](#); [Cozijnsen et al., 2000](#)).

Several authors have underlined the profound asymmetries between success and failure in innovation projects ([Hoetker & Agarwal, 2007](#); [Madsen & Desai, 2010](#); [Mata & Woerter, 2013](#); [Singh & Fleming, 2010](#)). First, it has been pointed out that it can be more difficult to terminate unsuccessful ongoing innovation projects than to start new ones ([Balachandra et al., 1996](#)). Starting new innovation project is motivating for personnel, while stopping ongoing projects risks loss of motivation and increased uncertainty about future careers. Project teams may become emotionally involved in their projects, and consequently very reluctant to terminate them. This phenomenon is described in the literature as the "escalation of commitment" ([Jani, 2011](#); [Staw & Ross, 1987](#)). Innovation projects also create situations of entrapment whereby managers need to continue to support a project in order to

justify previous investments ([Brockner et al., 1986](#); [Schmidt & Calantone, 1998](#)).

Second, several studies highlight that there are different types of innovation failure. The project life cycle involves various stages when managers might decide to terminate the project ([Balachandra, 1984](#); [Stevens & Burley, 1997](#)). Termination in the idea or conception stage (idea or conception failure) avoids wasting large volumes of resources and sunk-costs which are lost if termination occurs during the project's development stage (development failure). It is important to investigate whether the factors underlying different types of innovation failure (e.g., conception versus development failure) are similar, or whether these types of failure are based on distinct sets of factors.

The interdependencies and asymmetries between success and failure suggest that the factors predicting success may also contribute to attenuating or mitigating the occurrence of failure.

3. Determinants of product innovation novelty and failure

There is a growing body of empirical evidence on the factors that explain product innovation and its degree of novelty. There is no agreement on a single explanation, and various alternative conceptual frameworks are used which stress the importance of different explanatory factors. These factors appear to focus on how firms work to compensate for internal and external knowledge deficits, and whether they define strategies to enhance their innovation capabilities ([Amara et al., 2010](#); [Cohen & Levinthal, 1990](#); [Dodgson, 1993](#); [O'Connor & DeMartino, 2006](#); [Zahra & George, 2002](#)). The explanatory variables in the present study fall into four categories: 1) knowledge creation assets (internal R&D, R&D employees, knowledge embodied in machinery, equipment, and software); 2) external sources of information (market sources, research and institutional sources); 3) external knowledge acquisition mechanisms (R&D cooperation, R&D contracting); and 4) corporate social responsibility strategy.

3.1. Knowledge creation assets

Firm innovation performance is contingent on the capacity to create new knowledge through internal R&D, through the capitalization on knowledge embodied in its employees and in machinery, equipment, and software ([Amara & Landry, 2005](#); [Caloghirou et al., 2004](#)). R&D investments are necessary to create the new knowledge required in innovation projects ([Becheikh et al., 2006](#)). Internal R&D activities also improve the learning capabilities that enable firms to absorb (acquire, assimilate, transform, and exploit) new knowledge developed by other organizations ([Cohen & Levinthal, 1990](#); [Todorova & Durisin, 2007](#); [Zahra & George, 2002](#)). Moreover, learning through R&D activities contributes to reducing the gap between the firm's existing in-house technological capabilities, and the technological capabilities required to develop new technology ([Kash & Rycraft, 2000](#); [Romijn & Albaladejo, 2002](#)).

Likewise, R&D employees are highly educated, and are prone to engage in transforming the idiosyncratic tacit knowledge created in the innovation projects in which they are involved, into codified knowledge which enhances the capabilities of the employees and their firm, and provides a basis for innovation activity ([Caloghirou et al., 2004](#); [Foray & Gault, 2003](#)). R&D employees are better able to self-organize their knowledge and to take advantage of networks to find solutions to existing or new problems, and to generate and share knowledge ([Connelly & Kelloway, 2003](#); [Gold et al., 2001](#); [Vinding, 2006](#)). Several studies point out that highly-qualified employees are more likely to act as drivers of radical innovation in companies ([Becker, 2009](#); [Marvel & Lumpkin, 2007](#)).

Finally, the firm's learning capabilities are enhanced by the use of advanced technologies, machinery, and other equipment ([Amara &](#)

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