

# How does innovation performance feedback influence the diversity of the technological alliance portfolio?

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## Abstract

Survival in technology-intensive industries require firms to maintain alliances with different types of technological partners. However, the decision to increase partner diversity also entails risks. Based on the fact that firm performance relative to aspirations is key to understand how firms assess risky changes, this study focuses on addressing how innovation performance feedback, both positive and negative, influence a firm's decision to adjust the diversity of its alliance portfolio. Our results show that this effect is highly dependent on firms' R&D intensity levels, as these efforts shape their ability to assess gains and costs associated with new collaborations.

*Keywords:* Partner diversity, R&D intensity, innovative performance, performance feedback.

*JEL classification:* O32, O36

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## 1 Introduction

In technology-intensive industries, a company's survival depends on its ability to acquire and develop new capabilities and technological knowledge. Technological alliances have become a crucial means of accessing external knowledge to enhance innovation and maintain competitiveness (Martínez-Noya & Narula, 2018). These alliances involve active cooperation for technological innovation, and a significant decision is choosing the right partners, such as customers, competitors, suppliers, or universities, both domestically and internationally. Each type of partner provides access to different external knowledge, and thus diverse partner collaboration can lead to knowledge complementarities, improving innovation performance, especially during technological turbulence. However, increasing

partner diversity introduces uncertainty and risks, resulting in higher managerial costs, and firms must navigate a trade-off between the potential benefits and risks of altering their alliance portfolio diversity (Jiang et al., 2010).

While research has extensively explored the motivations behind forming technological alliances and the outcomes of diversity, one critical aspect has received limited attention: performance feedback (Gavetti et al., 2012). Understanding how different types of feedback, whether positive or negative, influence a firm's decision to adjust the diversity of technological alliance partners is crucial for professionals in strategic management and/or in R&D policy. The behavioural theory of the firm serves as the theoretical foundation, suggesting that discrepancies between performance aspirations and actual performance trigger organizational change. When performance falls short of

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aspirations, firms engage in problemistic search, while exceeding aspirations may lead to slack search for new opportunities. This study applies this logic to innovation performance, as technology-intensive industries prioritize innovation, and proposes that firms performing below aspirations will be more inclined to diversify their alliance portfolio to try to close their performance gap; while those exceeding aspirations will also be more likely to do so but to explore new innovation opportunities. In addition, the impact of innovation performance feedback on alliance portfolio diversity is expected to be moderated by a firm's R&D intensity, which affects their ability to assess the gains and costs associated with these new collaborations.

Using data from the Spanish Technological Innovation Panel, our study finds support for our propositions, demonstrating that innovation performance feedback is a crucial factor in altering the diversity of a technological alliance portfolio. This research contributes to alliance management by emphasizing the role of innovation goals in organizational change. Furthermore, it highlights the moderating effect of R&D intensity on the relationship between performance feedback and alliance portfolio diversity, contributing to our understanding of organizational responses to behavioral drivers.

## 2 Theoretical background

The decision to choose partners in collaborations is critical, with various partner types available, including customers, competitors, suppliers, and universities, at both domestic and international levels. Different partner types provide access to distinct external knowledge, and thus diverse partner portfolios have been shown to enhance innovation performance through knowledge complementarities and synergistic effects. Nevertheless, increased partner diversity introduces uncertainty and risk, elevating

managerial costs due to communication and coordination challenges. Thus, firms face trade-offs when considering changes in their alliance portfolio diversity (Lee et al., 2017). Research has delved into firms' motivations for forming technological alliances and the performance outcomes of diversifying their portfolios. Yet, the role of performance feedback in managing this diversity trade-off remains relatively unexplored. This research gap is crucial because performance feedback provides insight into how firms make change decisions (Gavetti et al., 2012).

To address this question, we build on the Behavioral Theory of the Firm. This theory, originally proposed by Cyert and March in 1963, offers valuable insights into how firms react to uncertainty and adjust their strategies based on performance feedback. This performance feedback could be about falling short of goals or exceeding them. When firms perform below their aspirations, they engage in the so-called problemistic search, trying to find solutions to bridge the gap. Conversely, when they surpass their aspirations, they explore new opportunities for value creation, known as "slack search". Performance aspirations, as outlined in the theory, are influenced by a firm's historical performance and the performance of its peers, which evolve over time. These aspirations serve as reference points for managers, guiding their perceptions of what constitutes success or failure.

While much research has concentrated on the role of financial performance metrics (Greve, 2003), our study contributes to the scarce literature that applies this theoretical logic to a non-financial performance measure such as innovation performance (measured through patents) (Kavusan & Frankort, 2019; Lungeanu et al., 2016; Tyler & Caner, 2016). This is because, for technology-intensive firms, innovation goals may precede financial goals, as staying competitive in these industries is all

about keeping innovative activities on the right performance track.

Based on this rationale, because R&D alliances are often used to access solutions to new product development problems, and as a means to create future new product opportunities (Grant and Baden-Fuller, 2004), we expect that the more firms deviate from their innovation performance aspiration levels, the more likely they will increase their alliance partner diversity.

On the one hand, we expect firms falling short of their innovation performance targets to increase their technological alliance portfolio diversity. Despite the risks, these firms may be more inclined to increase partner diversity because a new partner bringing complementary external knowledge and fresher perspectives may be the recipe to improve the performance gap (Tyler & Caner, 2016).

On the other hand, when a firm performs better than expected, it engages in slack search that can lead to experimentation and organizational change. Therefore, for firms deviating above their innovation aspirations, we also expect them to be more likely to incorporate more diverse partners in their technological portfolio. In this case, their current innovation performance will make them probably more likely to strengthen their current successful partnerships, but also more confident in exploring new technological opportunities requiring to collaborate with new types of partners that otherwise would not be considered. Accordingly, it will be less costly for them to attract new partners (Baum et al., 2005).

In addition, we expect that these effects of performance feedback on alliance portfolio diversity will be moderated by a firm's R&D intensity, as these efforts will shape the firms' ability to assess technological alliance risks. Other things being equal, we consider that firms having a higher R&D intensity will have

developed a higher technological absorptive capacity (Cohen & Levinthal, 1990), allowing them to better calibrate the expected gains and anticipate the costs of establishing collaborations with new types of partners. Therefore, depending on their ability to attract partners based on their recent innovation performance (Ahuja, 2000), they will be more willing or not to increase the diversity of their alliance portfolio.

More specifically, we expect that for firms performing below aspirations, R&D intensity will reduce their propensity to increase alliance portfolio diversity. This is so because the observable current underperformance of the firm is not expected to attract the best partners, but rather similarly underperforming firms, which would be discarded as valid partners thanks to the firm's technological absorptive capacity. In this context, we expect that problemistic search would lead the more R&D intensive firms to reconfigure their existing alliance portfolio by downscoping it, keeping only the current successful alliances, maintaining, or even reducing their alliance diversity.

On the contrary, for firms performing above aspirations, we expect R&D intensity to positively moderate this relationship. This is because, first, the more firms perform above expectations, the more attractive they become as partners, increasing their bargaining power when negotiating alliances with new types of partners (Ahuja, 2000). Second, their R&D efforts will help them to better identify available innovation value creation opportunities resulting from incorporating more diverse partners, and manage the complexities of increasing the diversity of its alliance portfolio.

### 3 Data and results

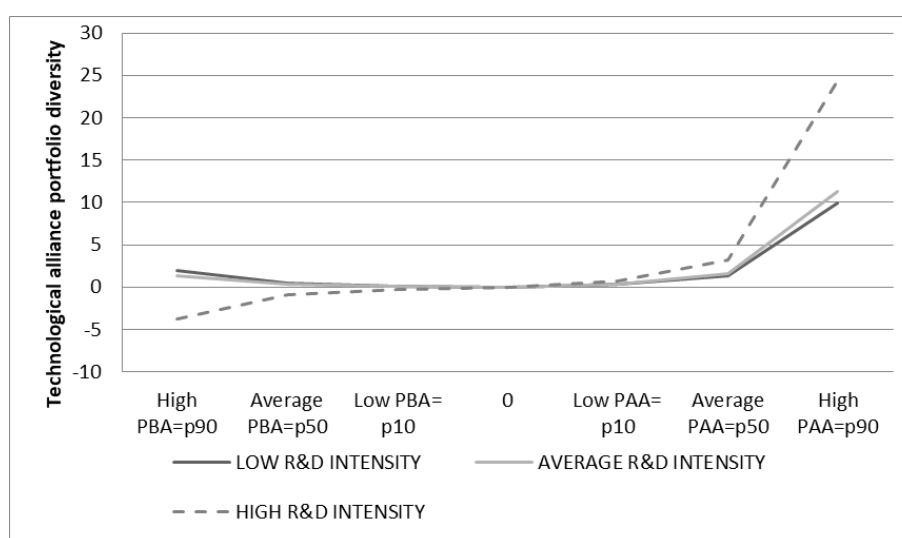
We find support for our propositions using an unbalanced panel with more than 6,500 non-state-owned firms operating in technology-intensive sectors for the period 2008-2015. This

data was obtained from the Spanish Technological Innovation Panel, Spain's contribution to the European-wide Community Innovation Survey. It is important to note that in order to measure the degree of a firm's technological alliance portfolio diversity, we analysed with whom of the following partners it indicated to be actively engaged in technological cooperation each year: (1) other firms belonging to the same group, (2) suppliers, (3) clients, (4) competitors, (5) commercial labs, (6) universities and (7) technological research centres. In addition, for each type of the previous alliance partners, firms have to indicate their geographical location, being the options: (1) its country of origin (in this case, Spain), (2) other EU country, (3) the US, (4) China or India, and (5) other countries. Based on this information, we calculated our dependent variable

(ALLIANCE PORTFOLIO DIVERSITY) as the count of the different partner-location combinations that a firm had each year, being the maximum number of possible combinations 35 and the minimum 0.

The results obtained can be summarized in Figure 1. This figure demonstrates that firms performing close to their innovation aspirations do not embrace changes in their alliance portfolio. However, they tend to increase their partner diversity as they deviate either above or below their innovation aspirations. In addition, we find support for the idea that when performing above aspirations, higher R&D intensity levels increase the firms' propensity to increase partner diversity. Conversely, when performing below aspirations, higher R&D intensity levels decrease this propensity.

**Figure 1. Moderating effect of R&D intensity on technological alliance portfolio diversity for firms performing below innovative aspirations (PBA) and above aspirations (PAA).**



#### 4 Managerial implications

We believe that our results offer several valuable insights for practitioners:

- Performance feedback matters: It's essential to understand how various types of performance feedback influence your alliance portfolio decisions. Assess whether your innovation

performance aligns with your aspirations and consider how changes in partner diversity can help you achieve your objectives.

- Balance risks and rewards: Diversifying your alliance portfolio offers advantages and risks. Carefully evaluate the trade-offs and consider your R&D intensity when making these decisions.

- **Innovation-driven focus:** In technology-intensive industries, innovation is often the key to success. Prioritize innovation performance as a driving force behind your strategic decisions.
- **Customized your strategies:** Tailor your approach to your specific circumstances. Firms performing above and below their innovation aspirations may require different alliance portfolio strategies.
- **Leverage your R&D strengths:** If your firm has strong R&D capabilities, leverage them for informed decisions on partner diversity.

In conclusion, our study underscores the significance of a balanced approach when managing technological alliances in dynamic industries. This approach takes into account innovation performance feedback, the unique challenges of technological cooperation, and the moderating influence of R&D intensity. By integrating these insights into your strategic decision-making, you can be better prepared to navigate the complex landscape of technological alliances and stay ahead in your industry.

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