

R&D collaborations: to diversify or not?¹

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Abstract

It is widely acknowledged that the innovation paradigm is shifting towards an imperative for search of external actors to access new ideas for innovation, technologies and resources, or to externally commercialise internal ideas and exploit intellectual property (Chesbrough, 2006; Coombs *et al.*, 2003; Lundvall, 1992; von Hippel, 1988). In this respect, the relationship between R&D collaborations and internal innovation efforts, which in turn can positively influence firms' innovation performance, is gaining increasing attention (Laursen and Salter, 2006; Belrderbos *et al.*, 2004; Abramovsky *et al.*, 2008). However, the underlying complexity between internal and external knowledge sources where the potential existence of feedback loops and indirect effects is largely ignored. In certain sectors and counties, mostly at the edge of technological frontier, R&D alliances and networks have become a prominent practise in pursuing a range of objectives, such as to source and commercialise new technologies and to enhance the efficiency and productivity of new product development processes (Powell *et al.*, 1996; Shan *et al.*, 1994).

What happens in this paradigm when peripheral countries with industrial structures dominated by low and medium low tech industries with limited productive capacity and low business innovation profile are considered? In such contexts, there is a need to understand the role of R&D collaborations in firm innovation performance, not only due to the support that such collaborations receive from European, National and Regional authorities, but also due to the potential that such collaborations offer to achieve firm growth, alignment and adaptation (Chesbrough and Crowther, 2006).

In this paper, we attempt to shed some light on *the underlying relationships regulating firm innovation performance*, in the context of slow growing countries,

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such as Greece, which is predominantly comprised of SMEs operating in LMT sectors (Gkypali and Tsekouras, 2015; Voutsinas and Tsamadias, 2014). The exploration of such a potential is even more appealing in the SME context since it has been argued that because of their resource constraints and specialisation, R&D collaborations impose an imperative for accessing complementary competencies to commercialise innovations (Teece, 1986). In this vein, empirical evidence supports that SMEs benefit by accessing complementary competences through collaboration enhancing in turn their innovation performance (Flatten *et al.*, 2011; van de Vrande *et al.*, 2009). However, the opposite has been suggested and specifically, Tsai and Wang, (2009) argue that relying on external actors for R&D can lead SMEs to divert resources away from internal R&D which could jeopardise their potential to nurture and generate innovation as well as their ability to identify, assimilate and exploit external knowledge and future collaborative opportunities. Indeed, the ability of firms to benefit from external knowledge, either through informal networks or in formal collaborations, depends on their internal investments in R&D and highly skilled personnel, as such investments enable firms to develop absorptive capacity, which in turn, can enable initiating such partnerships (Arora and Gambardella, 1994; Mowery *et al.*, 1996), and facilitate knowledge sharing and transfer across organisational borders (Lane and Lubatkin, 1998).

Therefore, R&D collaborations could have either a substituting or complementing relationship with internal R&D (Caloghirou *et al.*, 2004; Tsai and Wang, 2009; Hotternott and Lopez-Bento, 2014). Investigating the substituting role of R&D collaboration is particularly apt in the context of SMEs due to their resource constraints. Therefore, the purpose of this paper is to explore the relationships among R&D collaborations, internal R&D and firm innovation performance, with the view of shedding further light on the underlying complexity of relationships that eventually shapes innovation performance. Specifically, this paper explores a twofold argument: first, that internal R&D and external knowledge sourcing are interrelated, however the nature of this relationship remains to be explored; second, that there is *a direct and indirect influence* of internal R&D and external knowledge sourcing in firm innovation performance.

We shed light on this multi-edged argument by employing a sample of Greek Manufacturing firms for the year 2010 which allows us to simultaneously estimate a non recursive three equations system and explore mediating relationships between

cumulative investments in R&D, R&D collaboration diversification portfolio and firm innovation performance. Our empirical findings suggest that between internal and external knowledge sources a strong substitution effect exists, suggesting that the open innovation paradigm has two faces; on the one hand firms' internal innovation efforts positively influence the search for external partners in their innovation activities, while on the other hand external knowledge sources inflict a negative effect on firms' internal knowledge creation processes.

This finding is further reinforced by the indirect effect of external and internal innovation efforts on innovation performance. Specifically, the total effect of firms' internal innovation efforts on innovation performance is positive, however, reduced in magnitude due to the negative indirect effect of R&D collaborations diversification portfolio on innovation performance. On the contrary, firms' internal innovation efforts indirectly and negatively influence innovation performance due to their search of external partners.

Taken together these findings suggest that Greek manufacturing firms' ability to manage, absorb, store and (re-)utilise knowledge from the external environment is a particularly difficult and ineffective process. In this respect policy efforts should be directed in assisting firms tracking and managing their R&D collaboration partnerships.

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