On the joint effect of technological and management innovations on performance: increasing or diminishing returns?

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Abstract: Most studies on innovation are aimed at covering technological innovation, neglecting other modes of innovation based on non-technological drivers. The latter, referred to as *management innovation*, consists of the implementation of new management practices, processes or organizational tasks. This work advances knowledge on the topic by exploring the joint effect of simultaneously introducing technological and management innovations on performance. Based on an analysis of 12,563 Spanish firms drawn from CIS data, our findings suggest that firms frequently pursue the simultaneous or joint introduction of both technological and management innovations and that integration impacts positively on a firm's performance, evidencing an inverted U-shape that suggest positive but diminishing returns. A theoretical framework using the capability-based view embraces the emerging conversation on management innovation issues and its relationship with the well-researched technological one.

Key words: management innovation, technological innovation, capability-based view, dynamic capabilities, complementarities, CIS

1. Introduction

Innovation has been primarily conceptualized as a technology-based phenomenon in the innovation literature (e.g. Cassiman and Veugelers, 2002; Hervas-Oliver et al., 2011). However, despite the persistent interest in that well-studied topic, scholars are in recent times shifting focus and paying more attention to innovation as a more comprehensive phenomenon that is not entirely based on technology but also on the introduction of new management practices or management innovation According to Birkinshaw et al. (2008), *management innovation* arises from the implementation of new management practices, processes, and organizational structures, aimed at furthering organizational goals. Similarly, following the OECD (2005), management innovation is the introduction of either organizational or marketing innovations or both. For better consensus and clarity, the suggestion of Damanpour and Aravind (2011: 35) is followed and the definitions of administrative, organizational and management innovation are viewed as broadly similar, although the distinctive nuances are relevant[1]. This study refers to that phenomenon following OCED definition.

As Damanpour (2014: 1279) has stated "*….management innovation is an untapped source of competitive advantage and organizational effectiveness without which the long-term contribution of technological innovations cannot be fully realized"*. Empirical evidence, however, about the introduction of management innovation is scarce. According to Damanpour (2014: 1265-66), Crossan and Apaydin (2010) reported that a review of a sample of 524 articles published in ten leading business and economic journals from 1981 to 2008 found that 50% of the articles clearly identified

[1] In this article we used all of them interchangeably. See more about concepts and definitions in Hervas-Oliver and Sempere-Ripoll (2015).

innovation types and that of these only 3% focused on management innovations. As such, it is said that scholarly conversation has overlooked the study of management innovation and, particularly, has not connected it to that of the technological innovation strand (Hervas-Oliver and Sempere-Ripoll, 2015; Hervas-Oliver et al., 2015; Hervas-Oliver and Peris, 2014; Damanpour, 2014; Volberda et al., 2013). Thus, this study contributes to innovation literature by studying the phenomenon of management innovation and its relationship with that of technological innovation. In this chain of thought, a first objective arises in our study. Given the fact that companies undertake different modes of innovation, technological and management innovation, an interesting question is posited in this study: are firms frequently and simultaneously undertaking both modes of innovation? This being the case, if firms simultaneously undertake both innovations, what are the potential effects? Thus, this study's second objective and major goal is based on exploring and disentangling the potential joint effect of simultaneously introducing technological and management innovation, that is, its consequences on a firm's efficiency performance[2]. The latter refers to the production-oriented (operational/efficiency) performance.

The paper analyses the responses of 12,563 firms which participated in the Spanish Community Innovation Survey (CIS) based on the Oslo Manual (OECD, 2005), covering the period 2004-2006. As Damanpour (2014) has stated, CIS data in European Union countries constitutes the only systemic data collection effort for management innovation. CIS data is very suitable for our purpose, as explained in the Empirical Section, and it has also been extensively used in recent studies (see Mol and Birkinshaw, 2009). The paper is organized as follows. In section 2 we carry out a review of existing theory on capabilities in order to develop our theoretical framework.

[2] We assume a *synchronous* pattern of technological and management innovation adoption, following the recommendation by Damanpour (2014: 1278-1279), rather than an antecedent (from one on another) approach, as Mol and Birkinshaw (2009) posits.

Section 3 presents our empirical design. Then, in the fourth section results are presented and discussed. Finally, section 5 concludes the analysis and summarizes the theoretical contributions and implications.

2. Literature review and hypothesis development

Our framework positions itself on a simultaneous or synchronized approach following previous literature (e.g. Hervas-Oliver et al., 2015; Hervas-Oliver and Sempere-Ripoll, 2015; Damanpour, 2014), rather than assuming that one type of innovation leads to another, as Mol and Birkinshaw (2012; 2009) posit. Different theoretical perspectives support and explain that potential joint effect on performance. Milgrom and Roberts (1995: 81) proposed the idea of "complements" in the sense of a *relationship among groups of activities*, stating that "…if the levels of any subset of activities are increased, then the marginal return to increases in any or all of the remaining activities rises". Activities that are mutually complementary need to be adopted together. If not, then a lack of coordination or integration might diminish returns. In all, and with the aim of following a more strategy based theory, we formulate our hypothesis by using a capability-based perspective. Resembling that view of complementarities, in the *strategic management* literature, and particularly in the RBV approach, *complementarities* and their key influence on a firm's innovation capabilities are also recognized (e.g. Stieglitz & Heine, 2007). According to the resource-based view (RBV, e.g. Barney, 1991), the joint introduction of technological and management innovation and their respective capabilities underpinning each one, will form synergistic and complex interrelationships difficult to imitate, contributing thus to improving a firm's competitive advantage: this complex integration of technological and managerial capabilities may prevent imitation due to the complementarity and ambiguity of the systems produced, in which the number of elements, and their interactions, produce an inimitable system that improve one another (e.g. Rivkin, 2000).

Besides, dynamic capabilities are said to "integrate, build and reconfigure internal and external competencies" (Teece et al., 1997:516). In this chain of thought, dynamic capabilities are understood as routines by which firms integrate and reconfigure resources (e.g. Teece et al., 1997). Hence, in our context, dynamic capabilities are the set of routines and processes underpinning the integration of the distinct technological and management innovation capabilities, achieving new reconfigurations and integrations of distinct capabilities that can increase the returns from innovation, creating the construction of a consistent system of interrelated activities and capabilities which mutually reinforce one another (Porter, 1996), albeit there exist more individual and firm-level factors influencing innovation (see Ardito et al., 2015). Thus, our first testable hypothesis is stated as follows:

Hypothesis 1. The joint introduction of new technological and management innovations impacts positively on a firm's performance.

Similarly to Ardito et al., (2016a), we posit that the benefits of that integration at some point diminish, limiting the potential benefits from that joint undertaking. The obvious reason is based on the fact that decision-makers cannot concentrate their attention on a large number of issues; rather, more realistically they just concentrate on a limited number of issues in order to achieve sound performance (Simon, 1947; Ocasio, 1997; Laursen and Salter, 2006). Our argument is similar to the above idea exposed by Laursen and Salter (2006) referring to absorptive capacity. We reinforce it by stating that the simultaneous integration of multiple knowledge areas that involve many issues does require new routines and an extra of allocation of resources and thus brings managerial constrains (Capaldo and Messeni-Petruzzelli, 2011; Messeni-Petruzzelli et al, 2015) that limit the potential benefits from integration. Therefore we expect that:

Hypothesis 2. The joint introduction of new technological and management innovations has a curvilinear (inverted U-shape) effect on a firm's performance.

3. Empirical design

The method and the types of questions in CIS are described in the Oslo Manual (Oslo manual: OECD, 2005). CIS data have been used in more than 100 recent academic articles (e.g. Cassiman and Veugelers, 2002; Leoncini, 2016). Regarding our research, CIS data set is capable of offering a large-scale survey across many industries, allowing full comparison and generalization of results, rather than just restricting the study to a single industry. CIS data set also provides the necessary variables to test the main variables (*technology* and *management*) in our study. As Damanpour has stated, CIS data is the best effort to measure management innovation and its potential relationship with technology.

Our final sample covers 12,824 firms. The variables are shown in table 1: including dependent (innovative performance measures), independent (technology and management) and control variables (size, external sources of knowledge, etc.), following a capability-based framework of internal and external sources of knowledge.

In short, our first approach, to test the first objective, consists of exploring whether or not there exists a simultaneous relationship between technological (TECH) and management innovation (MANAGEMENT). Specifically, we test whether one type of innovation is correlated with the other one and thus simultaneously undertaken. Following Ardito et al., (2016a) we use a *Tobit* method for this purpose. Other papers addressing a similar phenomenon and using CIS data have used other methods (such as *logit* and *probit*; see Sanchez-Gonzalez et al., 2009; Rammer et al., 2009; Mol and Birkinshaw, 2009; Leiponen and Helfat, 2010 ; Klingebiel and Rammer, 2013; among others). Subsequently, we also construct an additional robustness test using an *ordered logit* method. See variables in table 1. Eventually, the work also uses the industry classification as a control using 58 2-digit NACE-93 industry dummies, ranging from the 14 to 74 codes (59 industries or dummies). See table 1 describing variables.

Insert table 1 here

As regards control variables, the paper conducts an aggregation of internal and external sources (*search*) using Principal Component Analysis (PCA), as showed in Table 1. See tables 2 for descriptive statistics and correlations.

Insert table 2 here

4. Results

Insert table 3 here

As observed from table 3, the majority of firms in the sample (10,929 representing 87%) introduce technical innovations, and for this reason that innovation mode is always the most studied one (significant at $p<0.01$). This being the case, 43.75% of technical innovators do not choose to introduce management innovations, while 56.24% do. This result, at $p<0.01$, indicates that management innovations are less undertaken by firms and, when this is the case, we observe that the majority of firms introducing management innovations (6,148, 91.61% of the management innovators) are also introducing technological innovations. Overall, and according to table 3, it is confirmed that when firms introduce management innovation they do it simultaneously with technological innovation. Similarly, albeit less significantly, there is also evidence pointing out that most technological innovators (6,148 versus 4,782) also choose to introduce management innovations. The latter is also consistent with the fact that solely technological innovation is also observed but less frequently than the former. Overall, the crosstab shown in Table is statistically significant at $p<0.01$

Complementing the latter, table 4 presents the results using indistinctively technological and management variables as independents and dependents ones. See table 4.

Insert table 4 here

In table 4, the first objective is tested. The coefficients indicate that introducing one innovation mode (TECH or MANAGEMENT variables) influences the other, showing positive coefficients that are significant at $p<0.01$ in both cases. Overall, in the model it is shown that firms mostly introduce simultaneously both types of innovation, reporting the same results: the introduction of technological innovations is positively related to the introduction of management innovations and vice-versa, answering the first objective. In table 4, it is also shown that the influence of variables from the general innovation literature (see Ardito et al., 2015 for a comprehensive review and Datta et al., 2015) are said to be relevant for this simultaneous introduction or joint integration (size, internal sources and external sources, both industrial and science, etc.), showing in all variables a positive relationship with the probability of introducing innovations, all of which are statistically significant at $p<0.01$. One finding is that the *Size* variable is positive and significant, confirming thereby a body of literature which has emphasized size as an important driver of technical innovation (Cohen & Damanpour, 2010; Nord & Tucker, 1987; Reichstein & Salter, 2006), as well as management innovation. Finally, it is clear that industry differences matter when it comes to explaining the introduction of both types of innovation. See table 4.

We emphasize that our results do not provide evidence of a sequential cause-and-effect phenomenon whereby technological innovation is positively related to management innovation adoption. Rather, our paper provides evidence that the relationship between organizational subsystems is a correlative relationship representing a "coupling of dissimilarities", whereby each change in a subsystem requires alterations in the other subsystems.

Then, we test first hypothesis by running a *Tobit* model, regressing the joint effect (based on an interaction between both innovations, TECH x MANAGEMENT) on performance. See table 5. The dependent variable, measuring returns from innovation, is composed of one single indicator (efficiency performance) obtained from three variables capturing improvement of flexibility, capacity and reduction of costs in production, as indicated in table 1. We have proceeded as follows, following Laursen and Salter (2006) way. Each performance variable (*flexibility, capacity and cost* *reduction*) is measured as a categorical variable ranging from 0 (non-existing) to 3 (high), 2 medium and 1 low. We have aggregated those three into a single indicator, by summing each performance measure when mark as medium or high (value 1 for each of them; maximum value 3 and minimum 0) and then dividing it into the total number of performance measures included (final variable takes values between 0 and 1). This method building a dependent variable suggests the use of a Tobit model, as in Ardito et al., (2016a).

Insert table 5 here

As observed from table 5, results indicate that the introduction of technology innovation (TECH) is positively related to efficiency performance (1.56 at $p<0.01$) and the same result is obtained for the introduction of management innovation (MANAGEMENT, 0.021, significant at $p<0.1$). In addition, the joint effect, depicted in the interaction effect (TECH x MANAGEMENT) is positively related to the three innovative performance measures (0.052 at $p<0.01$). Besides, the rest of the variables, as above mentioned, such as Size and Internal and external sources are all positive and significant at $p<0.01$, except for science sources (*Science_sources* variable). Industry is also significant. The important conclusion from table 5 is the confirmation of the first hypothesis, confirming that the joint effect is positively related to performance. Put differently, the integration of technological and management innovation exerts increasing returns from innovation and, therefore, that joint introduction pays off. See table 5.

Subsequently, as a robustness test, we also test first hypothesis by running an *ordered logit*, regressing the joint effect (based on an interaction between both innovations, TECH x MANAGEMENT) on each individual indicator measuring performance, as depicted at table 1. Overall, results in table 6 (using an *ordered logit* and corrections for graphic representation) confirm those obtained from the Tobit model. See table 6.

Insert table 6 here

As observed from table 6, results indicate that the introduction of technology innovation (TECH) is positively related to efficiency performance, and the same result is obtained for the introduction of management innovation. In addition, the joint effect, depicted in the interaction effect (TECH x MANAGEMENT) is positively related to the three individual efficiency performance measures, corroborating those results from table 5. Besides, the rest of the variables, as above mentioned, such as Size, external sources (Industrial and Science) are all positive and significant at $p<0.01$. Industry is also significant. Overall, and confirming previous results, the integration of technological and management innovation exerts increasing returns from innovation and, therefore, that joint introduction pays off[3]. See table 6.

We also conducted graphic representations of the interaction obtained in table 6, in order to test second hypothesis. As observed in the six figures (Figure 1ab, 2ab and 3ab,

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[3] Dependent variables, in each case measuring different returns from innovation, are addressing a different efficiency performance such as improvement of flexibility, capacity and reduction of costs in production, as indicated in table 1. As Wooldrige (2012) explains, in table 6 we must interpret specifications 4 and 6 that both show interaction effects with extreme care. If we simply look at the coefficient on MANAGEMENT (model 4, 0.0482 non-significant and model 6, -0.0283 non-significant), we will incorrectly conclude that management innovation, when interaction is applied, has no effect at all (model 4) or even a negative effect (model 6, albeit non-significant) on a firm's innovative performance. But this coefficient supposedly measures the effect when TECH is 0, which is not interesting in this case. See more at Wooldridge, (2012), specifically examples in 199-200 pages[3]. Thus, first hypothesis is confirmed.

capturing each individual performance variable) we confirmed our conjecture that the joint effect presents a curvilinear (inverted U-shape) on performance. Following Ai and Norton (2003), the nonlinear nature of the logit model means that the marginal effect on an interaction effect is not simply the coefficient (and associated odds ratio) of their interaction. For this reason, corrections are presented graphically in all figures (from 1 to 3) in order to interpret results (following the above mentioned Ai and Norton, 2003). For the sake of brevity we focus on the graphic correction effects of the interactions for interpreting the curvilinear effect. Figure 1a (from table 6, referring to flexibility performance) shows the size effect of the interaction. Then, Figure 1b (from table 6, referring to flexibility performance) shows the statistical significance of that size effect. The same interaction effects are shown in figure 2a and 3a and their respective statistical significance at 2b and 3b, referring to capacity and lower cost, respectively. Overall, interactions (integration of technology and management) exert a positive effect on each individual indicator of a firm's performance. The second hypothesis is confirmed. See Figure 1ab, 2ab and 3ab.

Insert figures 1ab, 2ab, and 3ab here

Figure 1a shows a curvilinear (inverted U-shaped) effect (interaction on performance-flexibility), by which returns are diminishing once firms achieve a certain point (from 0.6 on) reflecting positive but diminishing returns from integration: the strongest interaction effect on performance occurs at the lower end of medium predicted levels of probability of being innovative (approximately up to 0.6), whereas the effect starts to decline, albeit being positive, for higher levels of predicted probability of innovation.

The other figures (2a and 3a) tell the same story on referring to both capacity and lower costs performance, respectively. Figures 1b, 2b, 3b all prove statistical significance. Thus, second hypothesis is confirmed.

5. Conclusions

This work advances knowledge on the topic of management innovation by exploring the interrelationship between technological and management innovation. Connecting both technologically-based and management-based innovation literatures facilitates the development of a broader and more comprehensive framework from which to address innovation phenomena. In doing so, this study examines the interdependence of technological and management innovations and their joint integration and potential influence on a firm's efficiency performance. Hence, this study's results shed light on and respond to the open calls on the topic (cf. Damanpour, 2014: 1279; Volberda et al., 2013) that demanded more efforts on that less-researched joint integration and its potential effects. Both hypothesis are confirmed: benefits from integration, however, are positive but diminish at some point, due to the related managerial constrains that arise when managers integrate multiple knowledge areas and simultaneously allocate resources to many issues.

5.1 Theoretical implications

Overall, the integration of technological and management innovation exerts increasing returns from innovation and, therefore, that joint introduction pays off. Managerial limitations and their related managerial constrains, due to the excessive simultaneous allocation of resources in many issues and the efforts for the integration of multiple knowledge areas, are also evidenced on the diminishing returns reflected in the results, suggesting that the integration and its benefits decrease at some point. Thus, our results confirm previous studies that suggest a curvilinear effect on performance (e.g. Ardito et al., 2016a; Capaldo and Messeni-Petruzzelli, 2011; Messeni-Petruzzelli et al, 2015; Laursen and Salter, 2006; Koput, 1997, among many others), albeit our results are unique regarding management innovation.

Similarly, our results shed light on the joint effect and its potential influence on performance, corroborating other different yet related studies that have studied the integration of different innovation modes (e.g. Battisti and Iona 2009; Mol and Birkinshaw 2009) and the effects that the integration of differing innovation capabilities exert on performance, contributing to both technology (e.g. Fagerberg, Mowery, & Nightingale, 2012; Evangelista & Vezzani, 2010) and management innovation (e.g. Damanpour, 2014; Hollen et al., 2013) literatures simultaneously, integrating those usually disconnected technological and management innovation strands, bridging the different literatures.

5.2 Managerial and policy implications

By demonstrating that the joint integration of technological and management innovations pays off, we encourage managers to go for it. The implication for managers running firms is that it is important that they be made aware of the benefits of that integration by the joint adoption of a more comprehensive view of the innovation: not only technological efforts but also a commitment to management innovations. The aim should be to promote an organizational context which fosters innovation in a broad sense: developing innovations that couple technology and organization together and thus integrating technology into organization and thus facilitating the building of stronger and more complex of innovation capabilities. Overall, our results help managers by showing the necessary support that organizational innovation constitutes as a complement to the implementation of new technology, thereby enhancing the performance effects. Managers' efforts, however, should be limited to certain knowledge areas, avoiding an excessive collocation of managerial attention in many issues, that is, encouraging them to concentrate their effort on a limited number of issues related to that integration.

Similarly, the paper's contribution for policymakers is that the findings imply that policymaking efforts to foster innovation should: (i) recognize the importance of integration and; (ii) facilitate access to both technological and managerial innovation activities, rather than just concentrating on pure technological efforts when planning industrial policy.

5.3 Limitations, future research directions, and conclusion

Finally, it should be pointed out that this paper has limitations. A notable one is that the nature of the CIS data means it is not possible to test for causality because of the lack of proper panels conducive to a longitudinal study. Furthermore, it is important to mention that results are also limited by the data set, which is sourced in a low-tech follower-technology country such as Spain. This fact may influence results. As for future research, in order to fill in the gaps in our knowledge of the adoption of management innovation, more countries using CIS data need to be researched.

References

Abrahamson, E. (1991). Managerial fads and fashions: The diffusion and rejection of innovations. *Academy of Management Review, 16*(3), 586-612.

Alvesson, M. (1995). *Management of knowledge-intensive companies*. New York: Walter de Gruyter Inc.

Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal, 14*(1), 33-46.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations a state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, *40*(5), 1297-1333.

Ardito, L., Messeni Petruzzelli, A., & Albino, V. (2015). From Technological Inventions to New Products: A Systematic Review and Research Agenda of the Main Enabling Factors. *European Management Review*, *12*(3), 113-147.

Ardito, L., Messeni Petruzzelli, A. and Albino, V. (2016a), "Investigating the antecedents of general purpose technologies: A patent perspective in the green energy field", Journal of Engineering and Technology Management, Vol. 39, pp. 81-100.

Ardito, L., Messeni Petruzzelli, A. and Panniello, U. (2016b), "Unveiling the breakthrough potential of established technologies: An investigation in the aerospace industry", Technology Analysis & Strategic Management, Vol. 28 No. 3, pp. 916-34.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Battisti, G., & Stoneman, P. (2010). How innovative are UK firms? evidence from the fourth UK community innovation survey on synergies between technological and organizational innovations. *British Journal of Management, 21*(1), 187-206.

Birkinshaw, J., Hamel, G., & Mol, M. (2008). Management innovation. *Academy of Management Review, 33*(4), 825-845.

Camisón, C., & Villar-López, A. (2014). Organizational innovation as an enabler of technological innovation capabilities and firm performance. *Journal of Business Research*, *67*(1), 2891-2902.

Capaldo, A., Messeni Petruzzelli, A., 2011. In search of alliance-level relational capabilities: balancing innovation value creation and appropriability in R&D alliances. Scand. J. Manag. 27 (3), 273–286.

Chandler, A. D. (1962). *Strategy and structure: Chapters in the history of the american industrial enterprise*. Cambridge: MIT Press.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology, 6*(1), 1-22.

Cohen, W., & Klepper, S. (1996). Firm size and the nature of innovation within industries: The case of process and product R&D. *The Review of Economics and Statistics, 78*(2), 232-243.

Crossan, M., & Apaydin, M. (2010). A Multi- Dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies, 47*(6), 1154-1191.

Cummings, T. G., & Srivastva, S. (1977). *Management of work: A socio-technical systems approach* [(Kent, Ohio)]. Kent, Ohio: Comparative Administration Research Institute : distributed by Kent State University Press.

Daft, R. L. (1978). A dual-core model of organizational innovation. *Academy of Management Journal, 21*(2), 193-210.

Damanpour, F. (1987). The adoption of technological, administrative, and ancillary innovations: Impact of organizational factors. *Journal of Management, 13*(4), 675.

Damanpour, F. (2010). An integration of research findings of effects of firm size and market competition on product and process innovations. *British Journal of Management, 21*(4), 996-1010.

Damanpour, F., & Aravind, D. (2011). Managerial innovation: Conceptions, processes, and antecedents. *Management and Organization Review, 8*(2), 423-454.
Damanpour, F., & Evan, W. M. (1984). Organizational innovation and performance: The problem of organizational lag. *Administrative Science Quarterly, 29*(3), 392-409.
Damanpour, F., Szabat, K. A., & Evan, W. M. (1989). The relationship between types of innovation and organizational performance. *Journal of Management Studies, 26*(6), 587-602.
Damanpour, F. (2014). Footnotes to research on management innovation. *Organization Studies, 35*(9), 1265-1285.
Datta, A., Mukherjee, D., & Jessup, L. (2015). Understanding commercialization of technological innovation: taking stock and moving forward. *R&D Management*, *45*(3), 215-249.
De Marchi, Valentina. "Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms." Research Policy 41.3 (2012): 614-623.
Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science, 35*(12), 1504-1511.
Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *The Academy of Management Review, 23*(4), 660-679.
Ennen, E., & Richter, A. (2010). The whole is more than the sum of its parts or is it? A review of the empirical literature on complementarities in organizations. *Journal of Management, 36*(1), 207-233.
Ettlie, J. E. (1988). *Taking charge of manufacturing: How companies are combining technological and organizational innovations to compete* . San Francisco: Jossey-Bass.
Ettlie, J. E., & Reza, E. M. (1992). Organizational integration and process innovation. *Academy of Management Journal, 35*(4), 795-827.
Evangelista, R., & Vezzani, A. (2010). The economic impact of technological and organizational innovations A firm-level analysis. *Research Policy, 39*(10), 1253-1263.
Fleck, J. (1994). Learning by trying: The implementation of configurational technology. *Research Policy, 23*(6), 637-652.
Galende, J., & de la Fuente, J. M. (2003). Internal factors determining a firm's innovative behavior. Research Policy, 32, 715–736.
Ganter, A., & Hecker, A. (2012). Deciphering antecedents of organizational innovation. *Journal of Business Research, 66*(5), 575-584.
Georgantzas, N. C., & Shapiro, H. J. (1993). Viable theoretical forms of synchronous production innovation. *Journal of Operations Management, 11*(2), 161-183.
Hansen, M. T., & Løvås, B. (2004). How do multinational companies leverage technological competencies? moving from single to interdependent explanations. *Strategic Management Journal, 25*(8-9), 801-822.
Hecker, A., & Ganter, A. (2013). The influence of product market competition on technological and management innovation: Firm-Level evidence from a Large-Scale survey. European Management Review, 10(1), 17-33.
Hervas-Oliver, J. L., Garrigos, J. A., & Gil-Pechuan, I. (2011). Making sense of innovation by R&D and non-R&D innovators in low technology contexts: A forgotten lesson for policymakers. *Technovation*, *31*(9), 427-446.
Hervas-Oliver, J., Sempere-Ripoll, F. and Boronat, C (2014) Process innovation strategy in SMEs, organizational innovation and performance: a misleading debate? Small Bus Econ (2014) 43:873–886
Hervas-Oliver, J. ; Sempere-Ripoll, F. (2015) Disentangling the influence of technological process and product innovations, Journal of Business Research, Volume 68, Issue 1, January 2015, Pages 109–118
Hervas-Oliver, J. L., Sempere-Ripoll, F., Boronat-Moll, C., & Rojas, R. (2015). Technological innovation without R&D: Unfolding the extra gains of management innovations on technological performance. *Technology Analysis & Strategic Management*, *27*(1), 19-38.
Hollen, R., Van Den Bosch, Frans AJ, & Volberda, H. W. (2013). The role of management innovation in enabling technological process innovation: An Inter-Organizational perspective. European Management Review, 10(1), 35-50.
Klingebiel, R., & Rammer, C. (2014). Resource allocation strategy for innovation portfolio management. *Strategic Management Journal*, *35*(2), 246-268.
Kimberly, J. R., & Evanisko, M. J. (1981). Organizational innovation: The influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. *Academy of Management Journal, 24*, 689-713.

Kogut, B., & Parkinson, D. (1993). The diffusion of american organizing principles to europe. In B. Kogut (Ed.), *Country competitiveness: Technology and the organization of work* (pp. 179-202). New York: Oxford University Press.

Koput KW. 1997. A chaotic model of innovative search: some answers, many questions. *Organization Science* **8**(5): 528–542.

Lam, A. (2005). Organizational innovation. In J. Fagerberg, D. C. Mowery & R. R. Nelson (Eds.), *The oxford handbook of innovation* (pp. 115-147). Oxford: Oxford University Press.

Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal, 27*(2), 131-150.

Leoncini, R. (2016). Learning-by-failing. An empirical exercise on CIS data.*Research Policy*, *45*(2), 376-386.

Messeni Petruzzelli, A., Rotolo, D., Albino, V., 2015. Determinants of patent citations in biotechnology: an analysis of patent influence across the industrial and organizational boundaries. Technol. Forecast. Soc. Change 91, 208–221

Milgrom, P., & Roberts, J. (1990). The economics of modern manufacturing: Technology, strategy, and organization. *The American Economic Review, 80*(3), 511-528.

Milgrom, P., & Roberts, J. (1995). Complementarities and fit strategy, structure, and organizational change in manufacturing. *Journal of Accounting and Economics, 19*(2), 179-208.

Mol, M., & Birkinshaw, J. (2009). The sources of management innovation: When firms introduce new management practices. *Journal of Business Research, 62*(12), 1269-1280.

Mol, M. J., & Birkinshaw, J. (2012). Relating management innovation to product and process innovation: Private rents versus public gains. *Handbook of organizational and managerial innovation.* (pp. 13-35). Cheltenham: Edwar Elgar.

Ocasio W. 1997. Towards an attention-based view of the firm. *Strategic Management Journal*, Summer Special Issue **18**: 187–206.

OECD. (2005). *Oslo manual: Guidelines for collecting and interpreting innovation data*. Paris: OECD.

OECD. 1997. Proposed guidelines for collecting and interpreting technological innovation data: the 'Oslo Manual'. Organization for Economic Development and Co-operation, Paris.

Hervas-Oliver, JL and Peris (2014) Management Innovation, Springer International Publishing, 2014. 1-17.

Peteraf, M. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal, 14*(3), 179-191.

Porter, M. E. (1996). What is strategy? *Harvard Business Review, 74*(6), 61-78.

Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116-145.

Rammer, C., Czarnitzki, D., & Spielkamp, A. (2009). Innovation success of non-R&D-performers: substituting technology by management in SMEs. *Small Business Economics*, *33*(1), 35-58.

Rivkin, J. W. (2000). Imitation of complex strategies. *Management Science, 46*(6), 824-844.

Rowley, T., Behrens, D., & Krackhardt, D. (2000). Redundant governance structures: An analysis of structural and relational embeddedness in the steel and semiconductor industries. *Strategic Management Journal, 21*(3), 369-386.

Siggelkow, N. (2001). Change in the presence of fit: The rise, the fall, and the renaissance of liz claiborne. *Academy of Management Journal, 44*(4), 838-857.

Singh, J. (2005). Collaborative networks as determinants of knowledge diffusion patterns. *Management Science, 51*(5), 756-770.

Stieglitz, N., & Heine, K. (2007). Innovations and the role of complementarities in a strategic theory of the firm. *Strategic Management Journal, 28*(1), 1-15.

Trist, E., & Murray, H. (1993). *The socio-technical perspective*. Baltimore, MD, US: University of Pennsylvania Press.

Vaccaro, I. G., Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2012). Management innovation and leadership: The moderating role of organizational size. *Journal of Management Studies, 49*(1), 28-51.

Vega-Jurado, J., Gutiérrez-Gracia, A., Fernández-de-Lucio, I., & Manjarrés-Henríquez, L. (2008). The effect of external and internal factors on firm's product innovation. *Research Policy, 37*(4), 616-632.

Volberda, H. W., Van Den Bosch, Frans AJ, & Heij, C. V. (2013). Management innovation: Management as fertile ground for innovation. *European Management Review, 10*(1), 1-15.

Volberda, H. W., Van Den Bosch, Frans AJ, & Mihalache, O. R. (2014). Advancing management innovation: Synthesizing processes, levels of analysis, and change agents. *Organization Studies, 35*(9), 1245-1264.

Walker, R. M., Damanpour, F., & Devece, C. A. (2011). Management innovation and organizational performance: The mediating effect of performance management. *Journal of Public Administration Research and Theory, 21*(2), 367.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal, 5*(2), 171-180.

Wooldridge, G. (2012), Introductory Econometrics A Modern Approach, Cengage Learning, 5th Edition