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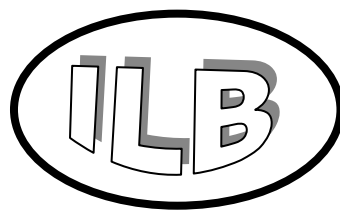
# **System Dynamics and Innovation in Food Networks 2014**

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## Exploration and Exploitation Innovations in the Food Firms<sup>1</sup>

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### 1 Introduction

In a context of increasingly intense competition, creating a unique mix of value through innovation has been considered one tenet for creating a competitive advantage (Porter, 1996). During the past decades, innovation has become a central issue of strategic management (Nag et al., 2007).

The literature has identified several problems in relation to firm failure innovation decisions, focusing on the supply-side (organizational competence, Henderson 2006; dependence of actual most profitable customers, Christensen, 1997; out-of-date competence due to technological breakthroughs, Tushman & Anderson, 1986), and on the demand-side (market turbulence, Abernathy & Clark 1985; institutional environment, Chesbrough, 2001).

Based on March's (1991) continuum perspective of exploitation-exploration<sup>2</sup>, we analyze the effects of knowledge-based innovation strategy on performance, testing the ambidexterity effect and extreme positions. Though both are necessary for survival and evolution (Levinthal & March, 1993; March, 1991), mindsets and organizational routines needed for each one are different. Tensions arise when firms make a simultaneous pursuit of both, being even impossible (March, 1996). Researchers have contributed from various literature streams to the discussion on balancing exploration and exploitation (Raisch & Birkinshaw, 2008; Lavie *et al.*, 2010). The fact that there are tensions among both has led to a relevant research paradigm (Gupta *et al.*, 2006; Raisch *et al.*, 2009). This ambidexterity effect has attracted several researchers examining the tensions between exploitation and exploration.

This study analyses how food manufacturers balance their innovation strategies. In particular, we analyze the effects of exploration and exploitation strategies and the type of innovation on performance. Since markets demand new and differentiated products, with high safety and quality standards (Grunert, 2005), innovation is a dominant strategy in this industry (Hauknes, 2001). Since supply chain management is critical, relationship-based innovation between distributors and suppliers has therefore been recognised as a major supply chain trend (Ganesan *et al.*, 2009).

The food and beverage industry is characterized by low levels of R&D intensity. As a consequence, it is considered a mature industry because of its low growth levels and is a low-technology industry too. Non-price competition and rivalry among foods firms indicate that such competition is very intensive and innovation strategies play a great role in addition to product differentiation (Galizzi & Venturini, 1996).

Innovation is a relevant source of competitive advantage, but its success depends on firm's environment, known as 'innovation ecosystem' and on organizational learning capability (Jiménez-Jiménez & San-Valle, 2011). Knowledge is recognized as a critical resource for innovation success and learning from external knowledge is considered as an antecedent of firm's performance providing knowledge and commercial outputs. Although the importance of knowledge is assumed in the Resource

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<sup>2</sup> Different interpretations of the concept have been proposed (see Li *et al.* 2008 for a review).

Based View literature (Grant, 1996), research about the impact of inter-firm knowledge related issues is still scarce (Hernandez *et al.*, 2011).

We adopt March's (1991) exploitation-exploration framework to characterize the type of innovation firms are pursuing. A firm's choice of the type of innovation can be distinguished by its motivation to either explore new opportunities or exploit existing income sources (Rothaermel & Deeds, 2004). This approach to the innovation process is not contradictory with the visions of innovation as a punctuated equilibrium (Abernathy & Utterback, 1978; Rosenkopf & Tushman, 1998) or continuous change (Brown & Eisenhardt, 1997).

Firm survival can be considered a combination of core capabilities (Prahalad & Hamel, 1990) and a repeated execution of tasks produces outcomes on a sustained basis (Argote, 1999). Since environment is diverse and changes (Chesbrough, 2001), and superior market positions are subject to erosion (Aaker & Day, 1986), competence should also evolve to avoid a fall in the 'capability-rigidity paradox' (Leonard-Barton, 1992). Paradoxically, what are the conditions for success may become rigidities for adaptation. Even, after a long period of success, firms may experience a period of failure, as the 'Icarus Paradox' predicts (Miller, 1994). As firms become mature, strategic innovation is a real organizational challenge that makes them more vulnerable to innovators (Markides, 1998). In particular, organizational inertia may make less attractive adaptations and changes in the firm (Schreyögg & Kliesch-Eberl, 2007). Though there are differences between resource-based inertia and capability-based rigidity (Gilbert, 2005), this paper is related to capabilities rigidities.

Dynamic capabilities are presented as an evolution of the resource-based view but all call for a dynamization of organizational capabilities: higher-level capabilities (Winter, 2003) monitoring the system's capabilities (Schreyögg & Kliesch, 2007) or resources and capacities to develop 'the sources of enterprise-level competitive advantage over time... avoiding the zero profit condition' (Teece, 2007: 1320).

Though literature research about innovation, exploitation-exploration and ambidexterity, we identify several issues that have been ignored by researchers. First, we deal with several, future research directions based on the review by Lavie *et al.* (2010). In particular, their review call for studying the optimal balance levels for exploration and exploitation under varying conditions. Also, they point out the need to uncover the conditions under which organizations benefit from balanced exploration and exploitation. In particular, Lavie *et al.* (2010) point out that "research on the performance implications of exploration and exploitation has been sparse" (p. 137).

Second, though research about exploitation and exploration is extensive, most studies analyze the consequences for innovation. However, few empirical studies have dealt with the trade-offs between both innovations and exceptions include Atuhane-Gima (2005), Auh & Menguc (2005) and Kim *et al.* (2012).

Third, there has been a major research issue on innovation at organizational level (Keupp *et al.*, 2012). However, firm innovation behavior and outcomes are situated not only within the focal firm but also in the firm's upstream suppliers and downstream buyers (Adner & Kapoor, 2010). Since distributors play a key role in innovation decisions (Hernandez *et al.*, 2011), this research is located in the inter-organizational context, in particular, on manufacturers in the supply-chain of a mature industry (food and beverage).

Finally, collaboration for innovation between manufacturers and retailers is a main research trend in supply chain research, since "the acquisition of knowledge from supply chain partners could enhance both radical and incremental innovations" (Ganesan *et al.* 2009, p. 91). In fact, vertical relations within the supply chain have a significant impact on innovation activity (Galizzi & Venturini, 1996).

Our key findings show that in the food industry exploitation and exploration are inversely related to performance. Also, our results provide support for the conception of exploration and exploitation as continuum instead of orthogonal. Process innovation is mainly incremental than radical, which also explains that exploitation provides better performance than exploration. Further, we found that exploration strategies moderate negatively the effect of exploitation on performance, providing support to the thesis of trade-offs (Benner & Tushman 2002).

## 2 Theoretical Background and Hypotheses

One fundamental conjecture in the exploration-exploitation literature concerns the relationship between exploration and exploitation on performance. Both learning activities are essential for adaptation, exploiting existing competences to produce profits and explore new opportunities to gain long term efficiency (Smith & Tushman 2005). Exploration activities account for long term performance and are related to long-term prospective opportunities, while exploitation decisions contribute mainly in the short term and are related to productivity (Raisch & Birkinshaw 2008, Li *et al.* 2007). March (1991) suggests that both should be pursued simultaneously, in what it is known as ambidexterity (Raisch & Birkinshaw 2008).

A central premise of this framework concerns the tensions between exploitation and exploration. Since each one requires different resources and capabilities, resource-allocation decisions tensions arise between them (Raisch *et al.* 2009). A position is that the interplay between them constitutes a zero-sum game due to the constraints of resources and capabilities (Gupta *et al.* 2006).

Other studies propose that organizations owing the capacity known as ambidexterity are able to reconciling exploitation and exploration (Duncan 1976, Tushman & O'Reilly 1996). We include in this stream those studies where resources are not affected by the constraint of scarcity (Katila & Ahuja 2002). In fact, this integrative vision of exploitation-exploration is consistent with the dynamic capability view (O'Reilly & Tushman 2008, Teece 2007).

Then, considering exploitation-exploration as continuous reconfiguration of resources, we adopt a conceptualization of the interaction of exploitation and exploration as a dynamic capability (Schreyögg & Kliesch-Eberl 2007).

The literature offers several modes to manage a balance between both concepts (see Lavie *et al.* 2010 for a review). We adopt an *organizational separation* approach as solution to the balance (He & Wong, 2004, Jansen *et al.*, 2009).

The literature of innovation has adopted these concepts to explain the process of innovation (Atuahene-Gima, 2005; Hernandez *et al.*, 2011; Rothaermel & Deeds, 2004). In particular, it provides insights about the link between type of knowledge and the type of innovation. Also, the complementarity of product and process innovations make convenience articulate both when studying the relationship between innovation and performance (Ar & Baki, 2011).

The food industry is a mature industry, with low levels of R&D investment where quality and food safety are major issues in consumer demand and both industry and regulators take these issues seriously. Though firms compete differentiating their offer (Galizzi & Venturini, 1996), and evolve continuously toward satisfying end-consumers (Grunert *et al.*, 2005), the high failure rates limit new product introduction (Grunert, 2005).

Then, we assume a positive local feedback in the form of customer demand and profits that produce a path dependence tilted toward exploitation (Benner & Tushman, 2003; Gupta *et al.* 2006; O'Reilly & Tushman, 2008). Vertical relations within the supply chain have a significant impact on innovation activity (Galizzi & Venturini 1996).

March (1991) recognizes the tensions between exploitation and exploration due to scarce resources. Then, organizations involved in exploration activities improve future adaptive capacity but incur in higher risks and opportunity costs (Lavie *et al.* 2010).

In services firms and at individual level, evidence suggests that the probabilities of success in exploration activities are lower than in exploitation activities (Groysberg & Linda-Eling 2009). However, no evidence of this has been found for food products.

Then, we argue that when considered together, the effects on performance of both exploitation and exploration are opposite. Then, we propose the following hypotheses (see also Figure 1):

H1a: Exploitation-based innovations have a positive effect on firm's rational performance

H1b: Exploration-based innovations have a negative effect on firm's rational performance

Exploitation improved efficiency in the short term and generate profits. However, the consequences may be negative in the long term. Thus, organizations try to counteract the effects on performance within operating activities in the long term by allocating resources to exploration-based innovation (Lavie et al. 2010). In fact, offset both innovation types are even considered a managers' capacity (Helfat & Peteraf 2009).

Another explanation is that since the supply chain is critical for food producers (Galizzi & Venturini 1999) and inter-organisational relationships are unique learning entities (Holmqvist 2009), manufacturers obtained knowledge from interfirm relationships with distributors (Hernandez *et al.* 2011). Distributors can be a source of knowledge (Mukhopadhyay *et al.* 2008), and then reduce the need for manufacturers to conduct research and discover new things. Even, with high dependence between manufacturers and retailers (Kumar & Steenkamp 2007), it can be more profitable to follow distributor proposal. Hence:

H2a: When firms combine exploration and exploitation innovation (ambidextrous effect), the effect on firm performance is negative

H2b: When firms focused on an innovation strategy (exploitation or exploration), the effect on performance is positive.

Food firms invest more in stability and avoid risks (Grunert 2005), produce a path dependence tilted toward exploitation (O'Reilly & Tushman 2008) and make innovations decisions biased towards short-term projects (Manso 2011, Narayanan 1985) restricting adaptation to things already known (Lewin et al. 1999). Exploration of new knowledge is essential for the long term survival and to obtain future economic gains. However, given the path dependence of the food and beverage industry (Grunert, 2005) and the trade-offs between exploitation and exploration, an increase in exploration may drive out exploitation investment, reducing profit and performance. Then, we posit the following alternative hypotheses:

H3a: When the level of exploration innovation is high, the positive effect of exploitation innovation on performance will be strengthened.

H3b: When the level of exploration innovation is high, the positive effect of exploitation innovation on performance will be attenuated.

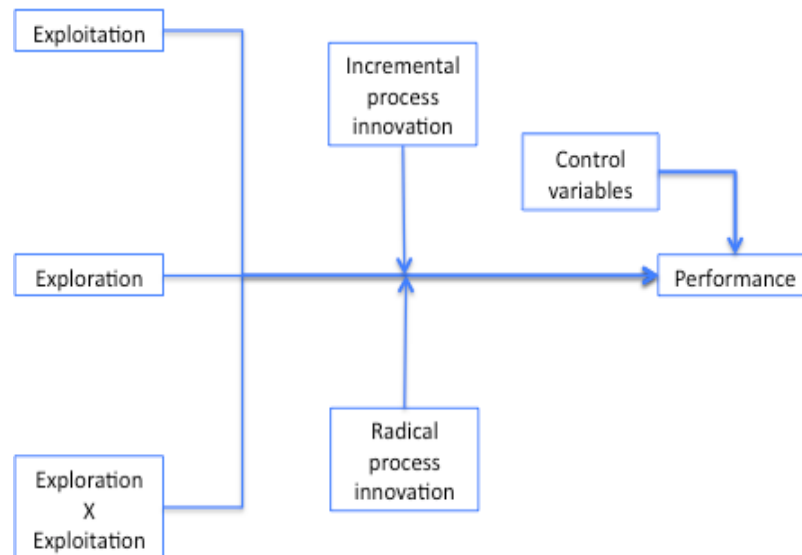


Figure 1. Framework and Hypotheses

### 3 Methodology

#### 3.1 *Sample and Data collection*

Data were collected from a sample of companies in the Spanish food and beverage industry. The agri-food industry in Spain represents 16% of the national industrial production, with more than 445,000 employees in 2011 (Spanish Federation of Food and Beverages Industry). The average number of employees per company is 18.09 for food companies and 15.23 for beverage. Most of the companies are SMEs but there are some important large firms. It is a sector of strategic importance with a relevance innovation activity.

A total of 591 manufacturers were initially identified using the SABI database by the national market information leader INFORMA D&B. Data were gathered through standardized personal interviews conducted by scheduled appointments with the key informants of each firm. Thus, questionnaires were answered by marketing managers (35.8%), vice-CEOs (28.9%), CEOs (23.4%), and production and R&D managers (11.9%). Finally, 201 valid questionnaires were obtained. We performed ANOVA to assess whether systematic bias exists among interviewers. Of the 32 items considered, we found only 3 with values significantly different among interviewers at  $p < 0.10$  (none at  $p < 0.05$ ). This indicates the absence of any systematic influence of the interviewers on the respondents' answers.

Due to on-site data collection, a test for response bias comparing early and late respondents is not appropriate (Atuahene-Gima, 2005). Instead, we compared participating and non-participating firms. We used firm size, measured by the number of employees, to control for greater complexity in decision making in larger firms (Atuahene-Gima & Murray, 2004). The ANOVA test was not significant for the number of employees ( $F = 0.815$ ;  $p > 0.1$ ) neither for revenues ( $F = 0.0$ ;  $p > 0.1$ ). The informants had a significant experience (the average experience in the sector was 18.9 years, with 15.3 years of experience in the firm). They also self-assessed their knowledge of the issues treated in the questionnaire from 0 (no knowledge at all) to 10 (absolute knowledge). The average of this item is 7.9, and none of the responses received less than 5 in that scale (Atuahene-Gima & Murray, 2004).

### 3.2 Measures

We included intermediate variables which are likely to explain better the impact of innovation strategy on performance than to reduce the model of the innovation-performance relationship (He & Wong, 2004; Morgan & Berthon, 2008). Thus, we included two process innovation variables, one for incremental and one for radical process innovation. Prior research has showed that process innovation contributes to the new product's market success (Clark & Fujimoto 1991; Parthasarthy & Hammond 2002) and explains firm performance (Ar & Baki 2011). This argument is consisted with the logic of the framework of dynamic capabilities, where competitive advantage is sustained with 'dynamic capabilities' but also with 'operational capabilities' (Teece 2007, p. 1344). This is used as an ex-ante condition to perform innovations. Radical and incremental product innovation should not be suitable since it would be an ex-post outcome (He & Wong, 2004).

Table 1 presents detailed description of the scales for the measurement of the constructs considered. In order to palliate the temporal dimension of organizational ambidexterity as dynamic capability concept (Raisch et al., 2009; Ancona et al., 2001, Webb & Pettigrew, 1999), we employed a time framework (four years) for measuring exploitation- and exploration-based innovations, and performance (Jimenez-Jimenez & Sanz-Valle, 2011; Quinn & Cameron, 1983). Performance was measured under a broad efficient perspective, pursuing to better understand the formation of the financial result, which constitutes a 'black box'. This characterizes the exclusive use of financial indicators (Venkatraman & Ramunujam, 1986, p. 804). Thus, we adopt a rational performance approach (Quinn & Rohrbaugh, 1983). Exploitation and exploration innovation were based on Atuhanene-Gima (2005) and Zahra *et al.* (2000).

Items were measured in a 0 (strongly disagree) to 10 (strongly agree) scale. In the case of the dependent variables (rational goal performance), we switched to a 5-point scale, with 1 signifying "not at all" and 5 signifying "completely" to introduce variations in the potential dynamics of the interviewee that could lead to a common-method bias (Podsakoff *et al.*, 2003). Process innovation capability accounts for abilities, resources, technologies and routines *ex-ante* to develop product innovations. Following Arnold *et al.* (2011), we measure radical and incremental innovations, with differentiated scales.

### 3.3 Control variables

As control variable we used firm size, since different levels of resources may generate different innovation outcomes (Carroll & Hannan, 2000; He & Wong, 2004) and may delimitate strategic groups with different profitability (Porter, 1979). One explanation for this evidence is that transaction costs arising from the market know-how are inefficient and not all firms can access the knowledge they need (Pisano, 1997). The age of the firm is also controlled because of its influence on firm growth (He & Wong, 2004). For both variables, natural log was used to compensate for skewness. Finally, we controlled the environment turbulence, since changing environments boost organization change and new opportunities (Calantone *et al.*, 2003). Table 1 reports measures description and descriptive statistics.

**Table 1.**  
Variables measurements summary

Item description	Scale average	$\sigma$	Cronbach's $\alpha$
<b>Dependent variables</b>			
<i>Rational goals performance</i> (Auh & Menguc, 2005, Kandemir et al., 2006, Kumar et al., 1992). To what extent in the past four years has your firm... <sup>d</sup> 1. ... increased sales 2. ... increased market share 3. ... increased profitability	6.138	2.000	0.918
<b>Independent variables</b>			
<i>Exploitation-based innovation</i> (Adapted from Atuahene-Gima, 2005). In the past four years, your firm... <sup>c</sup> 1. ...has based its strategy on knowledge and abilities your firm was already familiar with (*) 2. ...has invested mainly in enhancing skills in exploiting mature technologies 3. ... has searched for solutions to customer problems that were near to existing solutions rather than to completely new solutions. 4. ...has upgraded skills in product development processes in which the firm already possesses significant experience 5. ...has targeted the effort to improve the efficiency of the innovation processes rather than to initiate new adventures radically different from what the firm was familiar with	6.661	1.622	0.865
<i>Exploration-based innovation</i> (Adapted from Atuahene-Gima, 2005). In the past four years, your firm... <sup>c</sup> 1. ...has acquired manufacturing technologies and skills entirely new to the firm 2. ...has learned product development skills and processes (such as product design, prototyping new products, timing of new product introductions, and customising products for local markets) that are entirely new 3. ...has acquired entirely new managerial and organisational skills that are important for innovation (such as forecasting technological and customer trends, identifying emerging markets and technologies, coordinating and integrating R&D, marketing, manufacturing, and other functions or managing the product development process) 4. ...has learned new skills in areas such as funding new technology, staffing R&D, training and development of R&D, and engineering personnel for the first time (*) 5. ...has strengthened innovation skills in areas where it had no prior experience	5.038	2.595	0.941
<i>Radical process innovation</i> (Adapted from Tuominen & Hyvönen, 2004). Compared with the competition, your firm has introduced more changes in the past four years in... 1. ...production processes that are radically different from those used previously. 2. ...the processes to realize and commercialize innovations that are radically different from those used previously. 3. ...the mode of operation and analysis of information in your company that are radically different from those used previously 4. ...the development of the role of R & D that are radically different from those used previously.	3.633	2.563	0.946

5. ...the processes of logistics and distribution operations that are radically different from those used previously.			
<i>Incremental process innovation</i> (Adapted from Tuominen & Hyvönen, 2004). Compared with the competition, your firm has introduced more changes in the past four years in...: 1. ...production processes and changes which are only small improvements previously used. 2. ...processes to realize and commercialize innovations that are only used on top of the above improvements. 3. ...the mode of operation and analysis improvements that are only used above. 4. ...the development of the role of R & D that are only used on top of the above improvements. 5. ...the processes of logistics and distribution operations that are only used on top of the above improvements.	5.406	1.933	0.874
<b>Control variables</b>			
<i>Environmental turbulence</i> (Adapted from Calantone et al. , 2003): 1. Your company's competitors have changed very quickly. 2. Technological change in the business sector has been rapid and unpredictable. 3. Competitive market conditions are highly unpredictable. 4. Consumer preferences are changing rapidly. 5. Changing needs of end consumers have been rather unpredictable.	5.361	1.722	0.856
Firm size (number of employees) (From Rothaermel y Deeds, 2004)	100.33	283.965	-
Firm age (number of years) (From (Hasan et al., 2010)	43.85	29.701	-

\* Item deleted during the scale validation process

We employed Venkatraman's (1989) strategic fitting approach for measuring joint effects of exploitation and exploration (ambidexterity hypothesis), as it has been considered previously (He & Wong, 2004). Then, we used alternatively both 'fit as moderating' and 'fit as matching' for hypotheses testing.

To assess scale reliability, we conducted a factor analysis with Varimax rotation over the set of items, with all of them loading to on their hypothesized factor. Cronbach's alpha values provide support for reliability (Peterson, 1994). Content validity of scale is guaranteed by the way the scale has been developed, and by its application in different studies and contexts. Discriminatory validity is confirmed given that every Cronbach's alpha raises higher values than any of the correlations of the scale with the rest of scales (Bagozzi, 1981).

Finally, since data were collected from one single respondent, we checked for possible biases due to common-method variance (Podsakoff *et al.*, 2003) applying Harman's one-factor test. Common-method variance is not present, as the unrotated factor solution showed the presence of multiple factors and no one accounted for the majority of covariance.

### 3.4 Data Analysis and results

Considering the perspective of exploitation and exploration as a typology of innovation strategy (He & Wong, 2004), we define both strategies using a factor analysis on 10 items (table 2).

**Table 2.**  
Factor analysis for innovation strategy

Rotated factors matrix		
	Factor 1	Factor 2
<i>Exploitation 1</i>	-0.048	<b>0.764</b>
<i>Exploitation 2</i>	0.113	<b>0.836</b>
<i>Exploitation 3</i>	0.022	<b>0.851</b>
<i>Exploitation 4</i>	0.014	<b>0.823</b>
<i>Exploitation 5</i>	0.070	<b>0.766</b>
<i>Exploration 1</i>	<b>0.858</b>	0.078
<i>Exploration 2</i>	<b>0.900</b>	0.072
<i>Exploration 3</i>	<b>0.908</b>	0.061
<i>Exploration 4</i>	<b>0.910</b>	0.000
<i>Exploration 5</i>	<b>0.920</b>	-0.033
KMO test: 0.897    Bartlett's test of sphericity: ( $\chi^2=1,398.834$ , $p<0,001$ )		

As suggested by Aiken & West (1991), independent variables were mean-centered to minimize the threat of multicollinearity in equations where we created interaction terms.

Hierarchical regression analysis was used to test hypotheses. Table 3 reports the results of the estimations, for the two alternative operationalizations. Model 1 includes control variables. Model 2 adds the direct effects of exploitation-exploration and radical and incremental processes innovation. Models 3 and 4 add the ambidextrous effect, using both operationalizations, interaction and fit. F-test for these models indicates significant explanatory power.

In Model 2 the effect of exploitation strategy is positive and significant ( $\beta_4=0.149$ ,  $p<0.05$ ), confirming H1a. The effect of exploration strategy is negative and significant ( $\beta_5=-0.165$ ,  $p<0.01$ ), confirming H1b, which predicted that exploration strategy would impact negatively on performance when the firm adopts both innovation strategies.

To test hypotheses 2a and 2b of ambidexterity, Models 3 and 4 specify relationships without interaction and with interaction, respectively. The F change between both models is significant ( $p<0.05$ ), supporting the adding of an interaction variable. In Model 3, the ambidexterity effect is negative and significant ( $\beta_8=-0.765$ ,  $p<0.05$ ), supporting H2a.

Model 4 shows that when there is a focus on a strategy (imbalance or mismatch between the two strategies), the performance of the company increases ( $\beta_9=0.288$ ,  $p<0.05$ ), confirming Hypothesis 2b.

Hypothesis 3a and 3b are tested with Model 3. Exploitation has always a positive direct effect on performance. However, exploration only has indirect effects. The interaction coefficient is negative and significant ( $\beta_8=-0.765$ ,  $p<0.05$ ), rejecting H3a and supporting the opposite H3b. This result suggests that exploration have weakened the outcomes of exploitation on performance. We further show this effect plotting the result in Figure 2. When exploration innovation is high, an increase in exploitation innovations leads to smaller firm performance

**Table 3.** Regression analysis for the effects of Exploitation-Exploration Innovations and Innovation Intensity on Performance with ambidextrous specification with fit as moderation [1] and matching [2]

Variable	Model 1: Control variables	Model 2: Control variables + Direct effects	Model 3: Control variables + Direct effects + Ambidextrous effect with fit as moderation	Model 4: Control variables + Direct effects + Ambidextrous effect with fit as matching
	$\beta_{\text{estand}}$ (t-value)	$\beta_{\text{estand}}$ (t-value)	$\beta_{\text{estand}}$ (t-value)	$\beta_{\text{estand}}$ (t-value)
Constant	5.087 (7.040)*	6.657 (7.716)*	4.162 (3.186)*	6.016 (6.606)*
CONTROL VARIABLES				
Environmental turbulence	0.068 (0.990)	-0.049 (-0.724)	-0.057 (-0.854)	-0.046 (-0.680)
Firm size (log of number of employees)	0.391 (5.604)*	0.134 (1.719)**	0.114 (1.478)	0.132 (1.715)†
Firm age (log of years)	-0.061 (-0.881)	-0.077 (-1.181)	-0.064 (-0.990)	-0.074 (-1.151)
PREDICTORS				
Exploitation		0.149 (1.829)**	0.821 (2.942)*	0.361 (2.747)*
Exploration		-0.165 (-2.275)*	0.199 (1.234)	-0.305 (-3.073)*
Radical process innovation		0.180 (1.870)**	0.187 (1.977)**	0.182 (1.908)**
Incremental process innovation		0.293 (3.886)*	0.272 (3.649)*	0.276 (3.672)*
INTERACCIONES				
Exploitation X Exploration			-0.765 (-2.515)**	
Exploitation – Exploration				0.288 (2.045)**
F value	10.930 (p<0.001)	11.726 (p<0.001)	11.367 (p<0.001)	10.972 (p<0.001)
$\Delta F$			6.325 (p<0.013)	4.182 (p<0.042)
R <sup>2</sup>	0.156	0.322	0.346	0.338
$\Delta R^2$		0.166	0.024	0.016

\* p&lt;0.01; \*\* p&lt;0.05 5%; † p&lt;0.1

Notes: We report standardized regression coefficients (t-values are in parentheses). We used a two-tailed test for control variables and one-tail test for all hypotheses

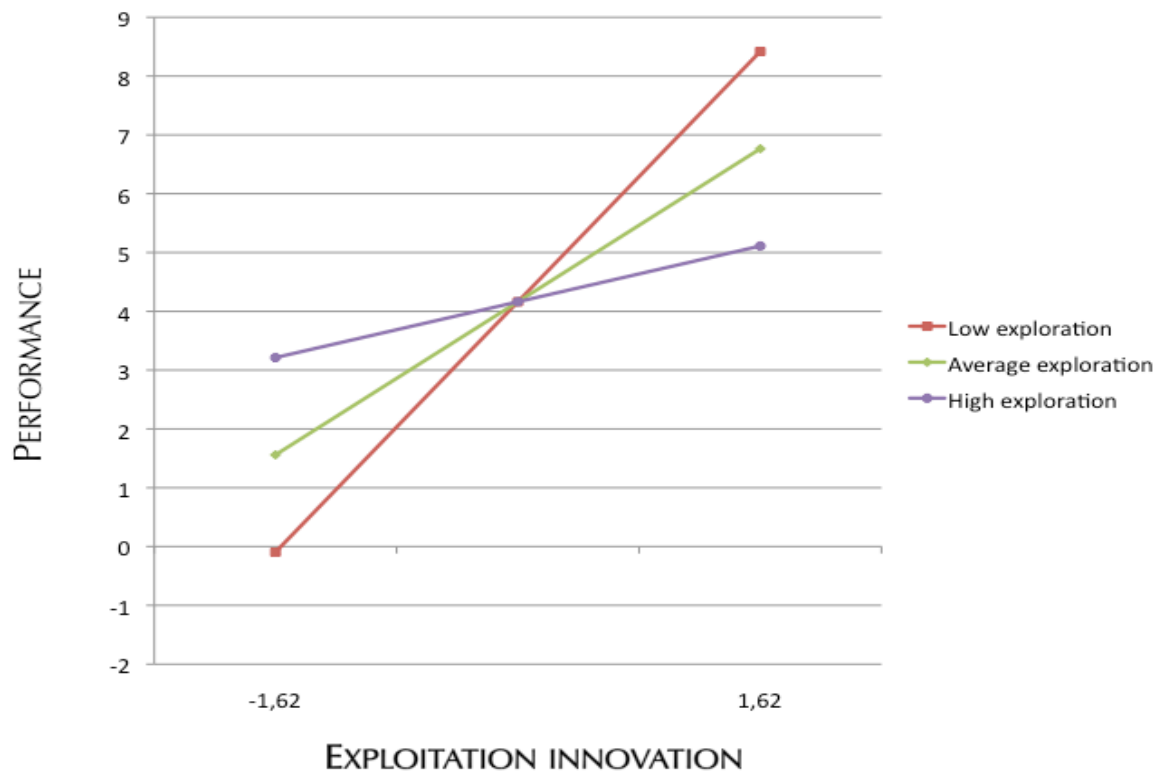


Figure 2. Moderating effect of exploration innovation strategy

Nomological validity for the relationship between performance and innovation was assessed by the (expected) positive effect the number of employees (a proxy of firm size) ( $\beta_2=0.134$ ,  $p<0.05$ ) and the positive effect of innovation processes on performance ( $\beta_6=0.182$ ,  $p<0.05$  and  $\beta_7=0.276$ ,  $p<0.01$ ) (Balanchandra & Friar, 1997; Earle *et al.*, 2001; Zahra & Das, 1993).

#### 4 Discussion and Conclusion

The aim of our research was to analyze the effect of exploitation and exploration based innovation strategies of firm performance. It should be noted that the model presented in this study reflects a rather simplistic linear relationship among these constructs.

The need of both strategies is recognized in literature for evolutionary theorizing (Nelson & Winter, 1982), but scarce resources make simultaneous pursuit difficult, if not impossible (March, 1996: 280). Overall, our work highlighted that, inter alia, exploration strategy impacts negatively on performance when firms adopt innovation strategies. In addition, exploitation has always a positive direct effect on performance. However, exploration only has indirect effects. Exploration has weakened the outcomes of exploitation on performance whilst when exploration innovation is high, an increase in exploitation innovations leads to smaller firm performance.

Finally, managers will find our work very useful considering the critical role for exploiting innovation in the food sector.

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