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WHEN NEW PRODUCT DEVELOPMENT IS NOT ENOUGH FOR SUSTAINED PERFORMANCE. AN EMPIRICAL VALIDATION OF "THE CONTINUOUS INNOVATION STOOL"

Henrike E.E. Boer[1, 2], Luca Gastaldi[3], Paolo Neirotti[4], Mariano Corso[3] and Harry Boer[5]

[1] Aalborg University, Denmark

[2] Corresponding author, henrike@business.aau.dk

[3] Politecnico di Torino, Italy

[4] Politecnico di Milano, Italy

[5] Aalborg University, Denmark and Corvinus University of Budapest, Hungary

ABSTRACT

Hyland and Boer (2006) introduce the "continuous innovation stool", describing continuous innovation in terms of operational, innovation and strategic capabilities. They hypothesize that the better a firm aligns, coordinates and/or integrates the functions responsible for these areas, the higher and more sustainable the firm will perform. The purpose of this paper is to test the stool model, using data obtained from the Chief Operating Officers and the Chief Technology Officers from 189 firms in eight countries. The analyses show that firms that excel at innovation management, are also more likely to be good at managing operations and strategic choices. Also, and more important, the higher the firm's capabilities on these three domains, the better their business performance, which is a first confirmation of the "continuous innovation stool".

***Keywords**: continuous innovation, strategic alignment, operational excellence, sustained business performance.*

1. INTRODUCTION

In their "continuous innovation stool" (Figure 1), Hyland and Boer (2006) describe continuous innovation in terms of three critical capabilities which, if orchestrated and performed to an excellent degree, should lead to sustained business performance:

- Operational capability, which enables a firm to satisfy today's customers' demands in terms of indicators such as price, quality, speed and variety (Boer, 2001).
- Innovation capability, which enables the satisfaction of (the-day-after-) tomorrow's customers (Boer, 2001).
- Strategic capability, the capability to make strategic decisions aimed not only at "doing things right" but also at "doing the right things" (Teece, 2014).

Expressed in March's (1991) terminology, operations excellence requires exploitation excellence; innovation and strategic excellence require exploration excellence. This paper contributes to the development of continuous innovation theory on one of the most debated challenges in the literature, by testing one of Hyland and Boer's (2006) hypotheses, namely that combining operations/exploitation and innovation and strategic/exploration excellence produces superior performance.

First, we present the continuous innovation stool. Next, referring to research conducted since the Hyland and Boer (2006), we show that there is no reason to change the model. Then, we account for the research design, and present and discuss the statistical results. Finally, we formulate the contribution of the paper to continuous innovation theory, together with suggestions for further research.

2. THEORETICAL BACKGROUND

2.1 THE CONTINUOUS INNOVATION STOOL

Figure 1 depicts the continuous innovation stool put forward by Hyland and Boer (2006).

Continuous innovation finds its basis in March's distinction between exploitation and exploration and the need to combine them effectively. "*Exploitation includes ... refinement, choice, production, efficiency, selection, implementation, execution*", while "*[e]xploration includes ... search, variation, risk taking, experimentation, play, flexibility, discovery, innovation*" (March, 1991, p. 71). According to Stacey (1992, p. 19), "*… continually innovative organizations ... cannot choose between ... systems and ... structures …* that support exploitation [authors] *and ... systems that* support exploration [authors] *... successful organizations must have both at the same time*".

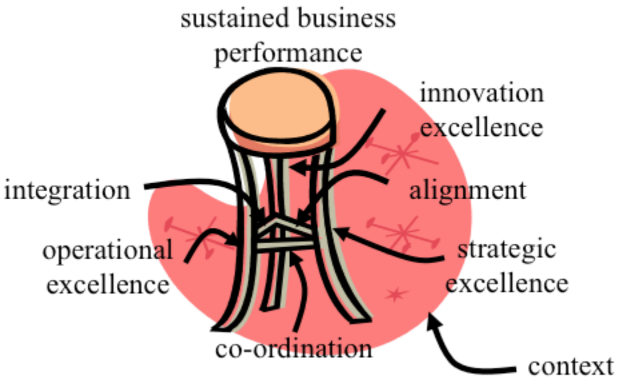

Figure 1. The continuous innovation stool (from Hyland and Boer, 2006)

The question is: how can firms deal with the exploitation/exploration paradox (March, 1991) and make "both/and" rather than "either/or" choices (Stacey, 1992)? Hyland and Boer (2006) argue that strategic capability could be the missing link. Referring to the notion of dynamic capability theorized by Teece (2007), we argue that continuous innovation requires the capability to sense (requiring strategic capability), seize and transform (requiring innovation and operational capability) market and technological opportunities (Teece, 2007), to be and remain successful in the market place at the same time, all the time (Hyland and Boer, 2006).

2.2 THE CONTINUOUS INNOVATION STOOL REVISITED AFTER 2006

After 2006, when Hyland and Boer developed their model, many authors have researched exploitation and exploration. A cursory literature review of papers published since 2006 shows a high variety of:

1) Definitions/operationalizations.
2) Research designs, in the form of conceptual, literature-based studies, studies using archival data, including company data and external databases, case studies and surveys.
3) Contextual variables and ways in which these variables are modeled, e.g. as drivers, antecedents or enablers, control, moderating or mediating variables.

While some authors do not define exploitation and exploration (e.g. **Birkinshaw and Gupta, 2013**; **Markides, 2013**), most papers largely fall into one of two categories:

1) Papers using March's description of exploitation and exploration (e.g. **Gupta *et al.*, 2006;** Lavie and Rosenkopf, 2006; **Lubatkin *et al.*, 2006**; **Menguc and Auh, 2008**; **O'Reilly and Tushman, 2008**; **Raisch and Birkinshaw, 2008**; Bierly *et al.*, 2009;

Simsek *et al.*, 2009; **Simsek, 2009**; Farjoun, 2010; **Lavie *et al.*, 2010**; **O'Reilly and Tushman, 2013**; Tamayo-Torres *et al*., 2015).
2) Papers focusing on exploitative and explorative *innovation* (e.g. Greve, 2007; Jansen *et al*., 2006, 2009a, 2009b; Zhou and Wu, 2010; **Chang and Hughes, 2012**; **Junni *et al.*, 2013**).

All the papers in bold above discuss the role of structural, temporal and/or contextual ambidexterity, and consider organization-related variables as a driver, antecedent or enabler of exploitation and exploration. Jansen *et al*. (2006, 2009a, 2009b) use behavioral practices to operationalize exploitation and exploration. Fajoun (2010), Zhou and Wu (2010) and Tamayo-Torres et al. (2014) hint at the possible role of technology. In the resource-based and related views, there is a wealth of nouns, adjectives and verbs associated with the term "resource" – see Kellermanns *et al*. (2016) for an overview, and an endless discussion on the differences and relationships between terms such as capacity, capability, competence, knowledge and resource. Rather than engaging in that debate, we adopt an operations management approach and define capability as the practices and technologies that can drive the achievement of a competitive advantage.

Although there (still) is a lack of consensus regarding operationalization and the role of contextual variables in the literature, the review shows that the stool model remains unchallenged. Specifically, the following conclusions emerge:

- It is generally accepted that exploitation and exploration are distinctively different capabilities.
- A firm's goodness of exploitation, exploration and their combination has important performance effects, which, however, are context-dependent.

3. RESEARCH DESIGN

Although unchallenged by literature, empirical evidence is needed to test the "stool" model. In this paper, we make the first step by testing its central hypothesis:

The stronger a firm's strategic, innovation and operational capabilities (the legs), the better the firm's business performance (the seat).

Figure 2 shows our research model, including the three capabilities and the underlying constructs considered in this paper.

We tested our hypothesis using data obtained from the Continuous Innovation Survey conducted in 2017 in Denmark, Hungary, Italy, Pakistan, Spain, Sweden and Switzerland. A sample composed of 189 firms was built through a multiple respondent questionnaire. The firms' Chief Operations Officers (COO) responded to questions on operations and strategic capabilities. Their Chief Technology Officers (CTO) provided information on innovation and strategic capabilities. The sample includes medium-sized and large enterprises in various manufacturing industries. In this paper we only consider the firms from which all relevant responses from both the COO and the CTO were received. Table 1 summarizes the sample demographics.

Operational capability is limited to the firm's production function at plant level. Based on an exploratory factor analysis using maximum likelihood (Costello and Osborne, 2005) as the extraction method and direct oblimin as the rotation method, we identified six factors measuring (the use of):

- Job design and teamwork related practices (three items).
- Rewards and incentives (three items).
- A range of production management tools and techniques (six items).

- A range of production tools and techniques (five items).
- Lean tools and techniques (three items).
- Production investments (three items).

All items were measured on a scale ranging from 1 = "low" to 5 = "high".

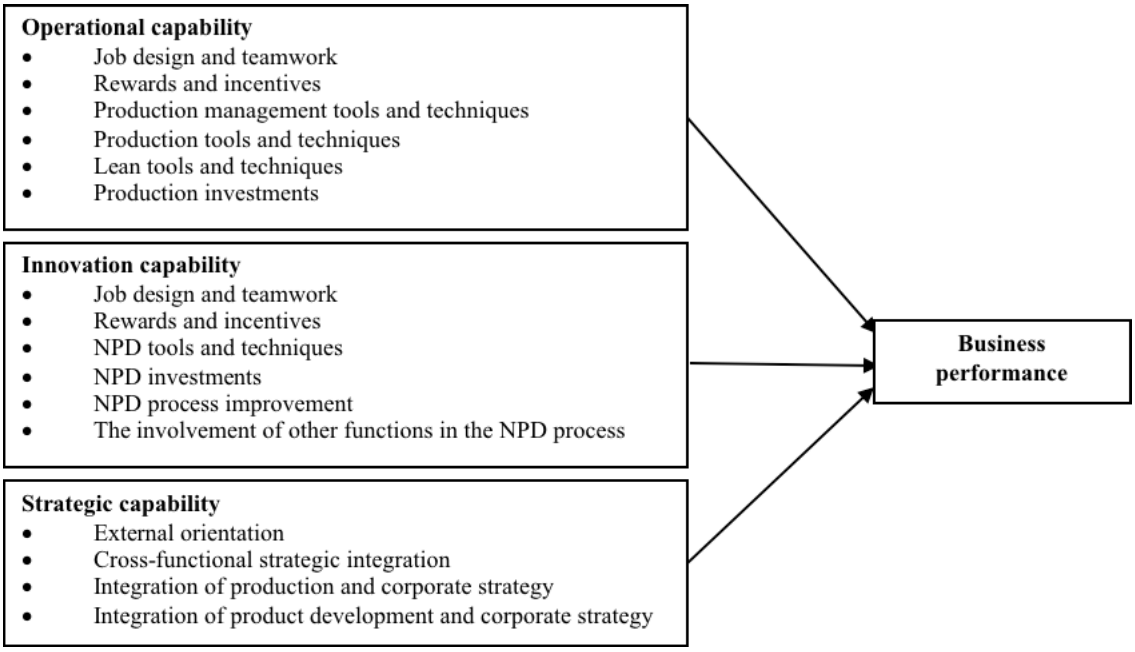

Figure 2. The research model

Table 1. Sample demographics (N= 189 firms)

Country	# firms	(%)
Denmark	7	3.70%
Hungary	40	21.16%
Italy	32	16.93%
Pakistan	41	21.69%
Spain	37	19.58%
Sweden	7	3.70%
Switzerland	9	4.76%
Brazil	9	4.76%
Canada	7	3.70%
Total	**189**	**100.00%**

Size	# firms	(%)
50-99	53	28.04%
100-249	64	33.86%
≥250	72	38.10%
Total	**189**	**100.00%**

Innovation capability is limited to a firm's new product development (NPD) function at plant level. We identified six factors measuring (the use of):

- Job design and teamwork related practices (three items).
- Rewards and incentives (three items).
- A range NPD tools and techniques (seven items).
- NPD investments (three items).
- NPD process improvement (three items).
- The involvement of other functions in the NPD process (three items).

All items were measured on a scale ranging from: 1 = “low” to 5 = “high”.

Table 2. Operational, innovation and strategic capability

Operational capability		
Production job design and teamwork **(Cronbach's Alpha: Cronbach's Alpha: 0.72)**	***Factor loadings***	***Sources***
The degree of adoption of the following practices in the production function		
1. Teamwork involving employees with different know-how and skills	0,54	Adapted from Vázquez-Bustelo et al. (2007)
2. Self-managed teams with decision-making capacity	0,73	
3. Teams that collaborate with suppliers and customers	0,68	
Production rewards and incentives **(Cronbach's Alpha: 0.82)**		
The degree of adoption of the following practices in the production function		
1. Employee reward systems for problem-solving	0,63	Adapted from Vázquez-Bustelo et al. (2007)
2. Objective-based employee remuneration	0,81	
3. Incentives for the team, not only for individuals	0,75	
Production management tools and techniques **(Cronbach's Alpha: 0.79)**		
The degree of use of the following tools, techniques and systems		
1. Computer-aided process planning (CAPP)	0,67	Items 1-2, 5 adapted from Vásquez-Bustelo et al. (2007) and Bottani et al. (2010); items 3-4 adapted from IMSS (2013); item 6: new – see e.g. COSO (2004) and Hoyt and Liebenberg (2011) for some background
2. Automatic identification/bar code systems/RFID	0,53	
3. Total quality management systems (TQM)	0,44	
4. "Smart" ICT applications supporting supplier/customer collaboration, connectivity (plants, equipment, robots, lines, workers), data processing (big data)/information mining, modeling/simulation	0,54	
5. Manufacturing resource planning (MRP II) / enterprise resource planning (ERP)	0,45	
6. Enterprise risk management (ERM)	0,49	
Production tools and techniques **(Cronbach's Alpha: 0.82)**		
The degree of use of		Items 1-2, 4 adapted from Vásquez-Bustelo et al. (2007) and Bottani et al. (2010); items 3, 5 adapted from IMSS (2013)
1. Computer numerically controlled machines tools (CNC)	0,59	
2. Flexible manufacturing and/or assembly systems (FMS/FAS)	0,77	
3. Total productive maintenance (TPM)	0,45	
4. Computer-aided testing systems (CAT)	0,51	
5. Advanced manufacturing technologies (e.g. water and photonics-based/laser cutting, additive manufacturing/3D	0,54	

	printing, high precision technologies, micro/nano-processing)		
***Lean tools and techniques* (Cronbach's Alpha: 0.76)**			
The degree of use of			
1.	Just-in-time (Kanban controlled) production (JIT)	0,52	Adapted from IMSS (2013)
2.	Continuous improvement (CI)/kaizen	0,62	
3.	Mechanisms such as kaizen, improvement teams and improvement incentives to systematically and continuously improve our performance	0,88	
***Production investments* (Cronbach's Alpha: 0.81)**			
In our production function, we systematically			Items 1-2 inspired by and adapted to production operations from Atuahene-Gima (2005); also used by Zhou and Wu (2010); item 3 inspired by Kim et al. (2012)
1.	Invest in incrementally improved equipment, tools and techniques to improve the performance of our production processes	0,81	
2.	Acquire state-of-the-art knowledge, skills, equipment, tools and techniques	0,81	
3.	Acquire new managerial and organizational skills that are important for production	0,57	
Innovation capability			
***NPD job design and teamwork* (Cronbach's Alpha: 0.70)**			***Sources***
The degree of adoption of the following practices in the NPD function			
1.	Teamwork involving employees with different know-how and skills	0,47	Adapted from Vázquez-Bustelo et al. (2007)
2.	Self-managed teams with decision-making capacity	0,65	
3.	Teams that collaborate with suppliers and customers	0,63	
***NPD rewards and incentives* (Cronbach's Alpha: 0.81)**			
The degree of adoption of the following practices in the NPD function			
1.	Employee reward systems for problem-solving	0,84	Adapted from Vázquez-Bustelo et al. (2007)
2.	Objective-based employee remuneration	0,76	
3.	Incentives for the team, not only for individuals	0,67	
***NPD tools and techniques* (Cronbach's Alpha: 0.86)**			
The degree of use of			
1.	Computer-aided design/engineering (CAD/CAE)	0,75	New scale. Items based on/inspired by various sources, including Swink et al. (2005),
2.	Concurrent engineering	0,50	
3.	FMEA, value analysis, Taguchi method, Ishikawa diagram, design of experiment	0,48	

4. Design mock-up, rapid prototyping (stereolithography, 3D printing)	0,70	Vázquez-Bustelo et al. (2007), Bottani (2010), IMSS (2013) and Kortmann et al. (2014)
5. Design for manufacturing/assembly	0,82	
6. Platform thinking, product modularization	0,59	
7. Stage-gate process	0,50	
***NPD investments* (Cronbach's Alpha: 0.82)**		
In our NPD function, we systematically		
1. Invest in incrementally improved equipment, tools and techniques to improve the performance of our product development processes	0,59	Items 1-2 inspired by and adapted from Atuahene-Gima (2005); also used by Zhou and Wu (2010); item 3 inspired by Kim et al. (2012)
2. Acquire state-of-the-art product development knowledge, skills, equipment, tools and techniques	0,81	
3. Acquire new managerial and organizational skills that are important for our product development processes	0,72	
***NPD process improvement* (Cronbach's Alpha: 0.73)**		
In our innovation function, we systematically		
1. Support and encourage creativity, inventiveness and participation in product innovation and improvement	0,55	Item 1 adapted from Yam et al. (2004), Vázquez-Bustelo et al. (2007), and Akman and Yikmaz (2008); items 2-3 adapted from Akman and Yikmaz (2008
2. Invite and use feedback and ideas from external partners (customers, suppliers, research institutes) to improve our product development practices and performance	0,80	
3. Adapt to changes in the competitive environment by innovating and improving our products	0,48	
***NPD involvement* (Cronbach's Alpha: 0.83)**		
In our innovation function, we systematically		
1. Involve marketing, purchasing and production in the front-end stages of product development (opportunity identification, ideation, concept development)	0,69	Inspired by Yam et al. (2004)
2. Involve marketing, purchasing and production in the back-end stages of product development (product design, prototyping, test)	0,78	
3. Involve marketing, purchasing and production in the new product introduction process (process design, pilot production, production launch)	0,85	

Strategic capability		
***Customer and competitor orientation* (Cronbach's Alpha: 0.84)**		
Indicate the extent to which you agree with the following statements		
1. Our business objectives are primarily driven by customer satisfaction	0,87	Items 1-6 adapted from Im and Workman (2004) and Menguc and Auh (2008) (based on Narver and Slater, 1990); item 7 adopted from Atuahene-Gima (2005)
2. We continuously monitor and assess the amount of resources we commit for serving customers effectively	0,65	
3. Our competitive advantage is based on understanding customer needs	0,70	
4. Our business strategies are driven by the goal of increasing customer value	0,45	
5. We measure customer satisfaction systematically and frequently	0,47	
6. We pay close attention to after-sale-service	0,45	
7. We systematically process and analyze customer information (e.g. about their needs, the way they use our products) to fully understand their implications for our business	0,50	
***Cross-functional strategic integration* (Cronbach's Alpha: 0.87)**		
In our company, functions such as product development, marketing, purchasing and production		
1. Coordinate their activities to ensure better use of our market and technological knowledge	0,61	Adapted from Atuahene-Gima (2005; based on Narver and Slater, 1990)
2. Regularly share information about customers, suppliers, technologies, and competitors	0,69	
3. Collaborate and coordinate in setting the goals and priorities in order to ensure effective response to market conditions and technological opportunities	0,63	
4. Are all involved in major strategic decisions	0,59	
***Production strategy integration* (Cronbach's Alpha: 0.86)**		
In our company		
1. The production strategy is well aligned with corporate strategy	0,58	Adopted from Swink et al. (2005)
2. Strategic production goals and objectives are clearly defined	0,83	
3. The production strategy leverages existing capabilities	0,62	
4. The production strategy and goals are clearly communicated to all employees	0,65	
5. The production strategy is frequently reviewed and revised	0,52	
***Product development strategy integration* (Cronbach's Alpha: 0.79)**		
In our company		
1. The product development strategy is well aligned with corporate strategy	0,79	Adopted/adapted from Swink et al. (2005) (adapted to NPD)
2. Strategic product development goals and objectives are clearly defined	0,98	
3. The product development strategy leverages existing capabilities	0,68	

4.	The product development strategy and goals are clearly communicated to all employees	0,62	
5.	The product development strategy is frequently reviewed and revised	0,56	

Table 3. Business performance

Business performance			
***Business performance* (Cronbach's Alpha: 0.94)**		***Factor loadings***	
Our *average* performance relative to our main competitors over the past three years			
1.	Sales	0,79	Calantone et al (2002), Da Silveira (2005), González-Benito (2007) and IMSS (2013)
2.	Sales growth	0,83	
3.	Net profit	0,93	
4.	Profit growth	0,90	
5.	Return on sales (ROS)	0,86	

While operations and innovation is mostly about "doing this right, i.e. implementing strategy effectively, we consider that strategy is mostly about "doing the right things" and identified four factors measuring **strategic capability** on a scale ranging from 1 = "strongly disagree" to 5 = "strongly agree":

- External orientation (seven items).
- Cross-functional strategic integration (four items).
- Integration of production and corporate strategy (five items).
- Integration of production development and corporate strategy (five items).

Performance was operationalized using five items (sales, sales growth, net profit, profit growth, and return on sales) representing business performance relative to the firm's main competitors over the past three years – scale 1="much lower", 5="much higher".

The operationalizations, Cronbach Alphas, item loadings and sources of all these constructs are reported in Tables 2 and 3. We control for the influence of size**,** measured as the number of employees.

4. FINDINGS

Our key hypothesis, i.e. stronger the operational, innovation and strategic capabilities of a firm, the better its business performance, was estimated in two stages. First, we analyzed the correlation between the three capability variables. Table 4 reports the Pearson coefficients and shows the presence of high positive and significant correlation coefficients (>0.45 in each case). Thus, firms that are good at one capability are more likely to be good in the other two capabilities, too. It is also worth noting that innovation and operational capabilities are positively correlated with firm size, whereas strategic capabilities seem uncorrelated with size.

Table 4. Pearson correlation analysis

	Innovation Capabilities	Operational Capabilities	Strategic Capabilities	Log Size
Innovation Capability	1			
Operational Capability	0.4845***	1		
Strategic Capability	0.5276***	0.5086***	1	
Log Size	0.2456***	0.1733*	0.0023	1

$^{\dagger}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

In the second stage, we assessed the impact of the three capabilities on business performance through four different regression model specifications. Model 1 reports the specification where the effects of the three capabilities are estimated. None of the variables has a positive effect on performance. However, this model is affected by multicollinearity problems, given the high positive correlation between the three capabilities as illustrated above. However, a Wald test was used to estimate to whether the sum of the coefficients associated with the three capabilities is significantly different from zero. The test is significant with a p<0.05, which shows that at least one of the capabilities has a positive effect on performance and that the combined effect of the three capabilities on performance is positive and significant. Also, the magnitude of the three coefficients is comparable, thereby showing that there is not a prevailing effect on performance due to one of the three capabilities.

Models 2, 3 and 4 give some support to our key hypothesis, showing that operational and strategic capability have a positive and significant impact on performance; however, the performance effect of innovation capability is insignificant.

Table 5. Regression models

		Model 1 Performance	Model 2 Performance	Model 3 Performance	Model 4 Performance
b_1	Innovation Capability	-0.0345 (0.1383)	0.1490 (0.1128)	…	…
b_2	Operational Capability	0.2164 (0.1390)	…	0.2388* (0.1074)	…
b_3	Strategic Capability	0.1137 (0.1656)	…	…	0.2601† (0.1468)
b_4	Log Size	0.2455 (0.2309)	0.1549 (0.1602)	0.2198 (0.2247)	0.1976 (0.1552)
b_5	Log Size Squared	-0.0152 (0.0209)	-0.0062 (0.0101)	-0.0133 (0.0203)	-0.0088 (0.0099)
b_0	Constant	1.2147 (1.0277)	1.9168* (0.8849)	1.5392† (0.8642)	1.2957 (0.9712)
	N	139	144	141	146
	adj. R^2	0.0659	0.0560	0.0797	0.0729
	Wald Test $b_1 + b_2 + b_3 = 0$	$F(1, 125) = 4.20$ Prob > F = 0.0426	n.a.	n.a.	n.a.

Robust standard errors in parentheses
† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
n.a.= not applicable
Country dummies included.

Furthermore, despite the inclusion of size as a control variable, the model specifications explain only a limited portion of variance in business performance (the adjusted R^2 is lower than 10% for any specification analyzed). Thus, the three capabilities under analysis have only a limited, if any, impact on business performance.

5. Discussion

One view on continuous innovation is that it represents a firm's capability to combine and balance exploration and exploitation. However, innovation theory has shed limited light the capabilities needed to support and manage the combination of these two conflicting ambitions. Boer and Hyland (2006) argue for the importance of the role that strategic capability can have along operational and innovation capability on the achievement of superior business performance. Furthermore, they argue that being strong in each of these capabilities is not enough; they need to be aligned, coordinated and perhaps even be integrated. Finally, the authors hypothesize that the effective "design" and "functioning" of the continuous innovation stool is context dependent. This paper aims to make a first step towards testing stool model, focusing on the hypothesis that stronger operations, innovation and strategic capabilities are associated with superior performance. The findings suggest that the three capabilities are highly and positively correlated. However, their individual and joint effect on business performance is limited.

This result goes against much previous research on the business performance effects of ambidexterity – see O'Reilly and Tusman (2013) for an overview, and opens some important venues for further research. Most importantly, the analyses need to be refined and extended. Several lines of reasoning may be followed to understand this finding.

Construct complexity – The constructs employed in the present paper are rather "massive" – altogether, the continuous innovation capability construct measures a total of 63 items representing 16 factors underlying three capabilities; the performance construct is measured using five items. Some of the capability items and factors may have a stronger performance effect than others. Most effects will be positive, but some may be negative, insignificant or U-shaped, and different items and factors may have different effects on the different performance items. Some factors may strengthen or weaken each other, while others may not interact at all. Further research should disentangle the constructs and look deeper into the individual factors, their interactions and performance effects t. This requires an analysis using structure equation modeling.

External factors affect business performance – Business performance is not only affected by a firm's capabilities. Competitive intensity may pay a role – firms in, for example, the automotive and electronics sectors have to be excellent just in order to survive. Economic context could be another factor affecting a firm's performance positively (e.g. enhancing growth) or negatively (e.g. reducing sales). An analysis using external data such as the Global Competitiveness Index (GCI) (e.g. Schwab, 2017) and its underlying indicators could shed light on this suggestion.

A mediating role of operational performance? – Put somewhat black and white, we operationalized strategic capability as the ability of "doing the right things" (*cf.* Teece, 2014) and operations and innovation capability as the ability to implement strategic choices effectively, i.e. "doing things right" (*cf.* Teece, 2014). Thus, operations and innovation capability should have a more direct and stronger effect on operational performance than strategic capability. Furthermore, operational performance should impact business performance. This suggestion could be investigated by adding operational performance as a mediator to our research model (Figure 3).

Maturity of capabilities – We focused on business performance relative to competitors, and measured the as-is situation of the 63 items, most of which represent operations, innovation and strategic management practices. However, we cannot know when these practices were actually implemented and how mature they actually are. As Sousa and Voss (2008, p. 706) observe, "*the generally accepted view [is] that there are time lags between the implementation of practices and their performance effects";* therefore*, "future studies, especially if employing smaller samples, should control for practice maturity*" by "*estimating the typical length of time for different sets of practices to achieve maturity in an organization or by developing actual measures (or indicators) of maturity*". Alternatively, a longitudinal research design could be used.

Context affects the strength of a firm's capabilities and, through that, its performance – We controlled for size. However, various other organizational and environmental characteristics should be expected to affect the adoption, interaction and performance effects of the three capabilities. Obvious candidates are:

- Firm level characteristics:
  - Strategy – Miles and Snow's (1978) strategy typology distinguishes between reactors, defenders, analyzers and prospectors. Put briefly, reactors do not have a strategy and do not excel in operations nor innovation. Defenders focus on operations, prospectors on innovation, analyzers on both in a, usually, ambidextrous form of organization. This implies that the importance of operations, innovation and even strategic capability depends on firm strategy. Other authors have theorized about or studied the importance of strategic intent for exploitation and exploration (e.g. O'Reilly and Tushman, 2008).
  - Organizational structure – previous research has indicated the influence of centralization, formalization, connectedness (e.g. Jansen *et al.*, 2009a, 2009b; Chang and Hughes, 2012; Raisch and Birkinshaw, 2008).
  - Organizational culture – following Cameron and Quinn's (2006) competing values framework, firms have rather different strategic orientations, core values,

leadership styles and performance priorities supporting the control-flexibility and internal-external dimensions underpinning the developmental, group, rational and hierarchical cultures distinguished in their framework. An externally-flexibility oriented developmental culture, for example, should affect continuous innovation differently than its opposite, an internally-control oriented hierarchical culture.
    - Product and process characteristics[1]: firms vary widely in terms of aspects such as the modularity of their products, production process type (job shop, batch, mass, continuous process), customer order decoupling point. position in the supply chain, and vertical integration, all of which have influence on their operations, innovation and strategic practices and, in effect, capabilities.
    - Top management – including characteristics such as behavioral integration, consensus and leadership (e.g. Lubatkin *et al.*, 2006; O'Reilly and Tushman, 2008; Chang and Hughes, 2012).
- Environmental characteristics:
    - Technological, competitive and market environment: various authors studying exploitation-exploration and ambidexterity have investigated and confirmed the role of factors such as environmental turbulence or dynamics, complexity and hostility (or munificence) (e.g. Menguc and Auh, 2006; Raich and Birkinshaw, 2008; Lavie *et al.*, 2010; also see O'Reilly and Tusman, 2013).

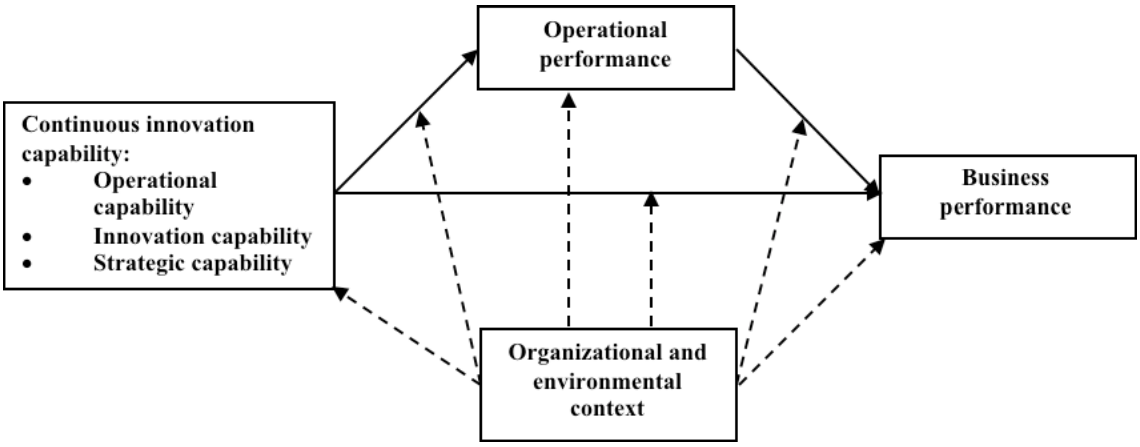

Figure 3. The research model extended with the possible role of operational performance and context in the associations between continuous innovation capability and business performance

An important question to be answered is: what is the role of these factors relative to each other and to the association between continuous innovation capability and performance? Do they act together, (partly) as a *Gestalt*, or entirely independently and, then, as antecedent, moderators, mediators? There is no consensus on this issue in the literature. Figure 3 extends the research model, hypothesizing a mediating role of operational performance and suggesting different roles of organizational and environmental context.

6. CONCLUSION

[1] It is not unusual to also consider the influence of industrial sector using e.g. ISIC or NACE codes. However, the variety of firms in each sector, even at three or four digit level, expressed in terms of product and process characteristics is too high to be useful for capability-performance research.

This paper is a first attempt to test the continuous innovation stool model (Hyland and Boer, 2006) using data obtained through the multi-respondent Continuous Innovation Survey. Our contribution is twofold. First, we operationalized the three capabilities that represent continuous innovation capabilities in a rigorous way. Second, we assessed their effect on performance, testing the competitive effect associated with each capability and showing a comparable effect due to these capabilities on business performance. The main finding is that both the individual and the combined effects of the three capabilities is limited. A variety of factors ranging from the role of strategy to that of organizational and environmental characteristics, each requiring further research, may explain this finding.
Further research is also needed to investigate the role of alignment, coordination and integration. In most firms, exploitation and exploration are spatially separated (Volberda, 1998; Markides, 2013). That is, strategy is the domain of top management, innovation that of the product development department, and production is responsible for operations. Further research should look into the performance effects of alignment, coordination and perhaps even integration (Boer *et al.*, 2006; Markides, 2013) of the functions "carrying" and the practices underpinning the three capabilities.
Fortunately, the Continuous Innovation Survey database contains most of the firm-level data needed to pursue these venues. External data such as the Global Competitiveness Index (GCI) (e.g. Schwab, 2017) and its underlying indicators are available to test the impact of country-level factors.

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