Is innovation research contingent on competitive context?

A systematic review of research in the agriculture and forest industry

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Abstract

Purpose – The purpose of this paper is to extend the understanding of innovation research and its contextual boundaries.

Design/methodology/approach – The paper opts for a systematic review of literature on innovation. Based on research in the agricultural and forest industries, it analyzes differences between research conducted in a competitive context of strong rivalry and research in a context characterized by strong buyer power. In particular, the review compares types of innovation under investigation and the level at which the innovation occurs.

Findings – It was found that competitive context significantly separates the type of innovation under investigation and innovation at different levels. Thus, the findings provide insights on the importance of competitive context to innovation research.

Research limitations/implications – The findings have implications for the understanding of the sources and directions of innovation, and the formation of innovation at the firm and industry levels. The review also provides a relevant foundation for further research.

Practical implications – The review provides a ground for managerial decision-making regarding innovation. A manager wishing to innovate is advised to evaluate the competitive context. The evaluation is crucial, as the context facilitates different types and levels of innovation.

Originality/value – The review is unique in its emphasis that reviewing studies of innovation requires the consideration of competitive context.

Keywords Agriculture industry, Systematic review, Research opportunities, Competitive context, Forest industry, Innovation research

Paper type Literature review

Introduction

The knowledge of innovation–which is commonly recognized as a new combination of existing knowledge and resources–has grown rapidly during the past two decades (Fagerberg *et al.*, 2012). There has also been increasing acknowledgement of the importance of conducting literature reviews. Previous reviews include the work by Büchgens *et al.* (2013) that focuses on studies of the role of organizational culture relevant to innovation. Kapoor *et al.* (2014) study innovation adoption, while Slater *et al.* (2014) examine studies on radical product innovation capability. Finally, Walker's (2014) review focuses on studies of internal and external antecedents of process innovations.

Although the previous reviews provide valuable insights, they assume that the competitive context, defined as the strength of forces driving competition (Porter, 1980,

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2008), is exogenous to innovation. While this may be convenient and useful for innovation research, in general, it brings with it two important limitations. First, the assumption does not capture the idiosyncrasy of competitive contexts in terms of varying technological and market opportunities. The importance of variety is underscored in the seminal work of Pavitt (1984) and that of Wesseling *et al.* (2014). In addition, some scholars go deeper and show that technology varies over time (Anderson and Tushman, 1990; Van de Ven and Garud, 1993).

Second, the assumption leads one to the conclusion that previous studies implicitly attempt to identify "best-practice" and make generalizations across contexts, although most innovation studies are based on findings from a specific context (Fagerberg *et al.*, 2012; Tidd, 2001). Hence, if no explicit attention is paid to the competitive context of innovation studies, scholars and executives may have to face an overwhelmingly complex literature and difficulties to find guidance. In other words, a lack of context-specific considerations is likely to undermine the understanding of innovation as a whole. Therefore, the argument underlying this article is that it is important to review studies of innovation further and to clarify to what degree study methodology is contingent on the competitive context.

The purpose of this article is to extend the understanding of innovation research and its contextual boundaries. Thus, the article contributes by answering these questions:

Q1. Is the execution of innovation research due to competitive context?

Q2. If so, what characterizes research in a particular competitive context?

A systematic and detailed review of 112 journal articles is intended to identify and explain similarities and differences in innovation research that is conducted in two different competitive contexts, namely the agricultural and forest industries. To the best of the authors' knowledge, this review is the first one on the matter. In particular, comparisons are made regarding types and levels of innovation. Results of the review contribute to the innovation theory by demonstrating the importance of the competitive context to innovation research. This means that scholars need to take into account the diversity of context when reviewing innovation studies.

The article is structured as follows. The next section presents the conceptual framework. This is followed by methods for the systematic review, results and discussion. Finally, conclusions and suggestions for further research are outlined.

Conceptual framework

The key concepts

The systematic review relies on specifications of relevant concepts. As mentioned above, the concept of innovation is generally defined as a new combination of existing knowledge and resources. Moreover, an innovation has a significant degree of novelty to the innovator and can also be new to the market or other relevant parties (Fagerberg *et al.*, 2012). This review distinguishes process innovation from product innovation. The process type covers services and products used to make processes more efficient, including technical and organizational components and supporting inter-organizational relationships (Walker, 2014). Product innovation means improvements or development of entirely new products and services that are offered to customers (Evanschitzky *et al.*, 2012).

Innovation is, furthermore, regarded as a multilevel phenomenon. Hence, innovation involves an actor (e.g. one or more firms) and the broader environment of industry

wherein the actor is embedded (Gupta *et al.*, 2007). For example, innovations on the firm level may include development of new products and new businesses within the established firm, and the impact of inter-firm linkages on various types of firm-level innovations. Innovation at the industry level may focus on the structures and functions of an industrial context on the one hand, and the emergence and diffusion of innovations of the industry on the other.

The review also considers performance implication deriving from innovation. Here, financial performance is separated from operational performance. Financial performance reflects the economic fulfilment of the actor, and includes measures such as sales growth, profitability and earnings per share (Venkatraman and Ramanujam, 1986). Operational performance is a broader and non-financial concept, and includes measures such as market share and product quality. Also, effectiveness would be a meaningful measure for operational performance, (Venkatraman and Ramanujam, 1986) although, in some circumstances, it would be a determinant of financial performance.

The review presented in this article examines the competitive context. Here, competitive context is defined by the strength of competitive forces in terms of rivalry amongst established competitors, threat of new entries and substitute products and the power of buyers and suppliers (Dobbs, 2014; Porter, 1980, 2008). Literature on innovation points out that differences among competitive contexts in terms of fluctuating technological and market characteristics may be important explanations of variations of innovation patterns (Pavitt, 1984; Wesseling *et al.*, 2014). According to Porter's argument, the basic premise of competitive context follows the industrial organization view (Bain, 1956). Here, the distribution of competitive forces matters for the long-term performance of firms. Hence, innovation occurs for firms to position themselves in relation to important competitive forces, and thereby improved performance may be achieved in the long run. Thus, the pattern of innovation is time-dependant and congruent with the competitive context.

Assumption for the review

The review in this article rests on an assumption. It is expected that the strength of competitive forces in a context is a major contingency of the execution of innovation research. Here, innovation research is manifested by studies of performance implications, and the level and type of innovation. Furthermore, the literature on competitive contexts underscores that the strength of the forces vary amongst industries (Dobbs, 2014; Porter, 1980, 2008). Therefore, differences are likely to appear among studies of innovation in different industries.

Empirical setting

To provide suitable competitive contexts for a test of the assumption, there is a focus on the agricultural and forest industries. The agricultural industry consists of actors (e.g. firms, research institutions, intermediaries) primarily embracing the production, value creation, keeping, grazing or feeding of livestock or crops. The forest industry consists of actors primarily engaged in the production, value creation or gathering of forest-based products.

As these industries are similar in many ways, they provide a relevant empirical setting for a test as to whether innovation is contingent on competitive context. The

similarities mean that impacts of different competitive contexts may be distinguished and analyzed. First, both industries are mentioned in the key objectives of the European Union aiming for "more productive, resource-efficient and resilient agriculture and forestry systems" (European Commission, 2011, p. 39). Second, internal characteristics of innovating firms in the two industries are rather similar. This applies to an extensive use of external sources for process technology and limited possibilities to diversify through innovation (Marsili and Verspagen, 2002; Pavitt, 1984). For example, Alfranca *et al.* (2009) reveals the considerable dependence on manufacturers of machinery that supply technology. Furthermore, firms often lack the financial resources or know-how needed for innovation which triggers significant public support. Thus, third, policymakers and intermediaries frequently provide subsidies or strategic assistance (Alfranca *et al.*, 2009; Klerkx and Leeuwis, 2008a, 2008b, 2009; Van Horne *et al.*, 2006).

Methods

Identification of articles

A systematic review was undertaken that included quantitative comparisons in accordance with the specification of Tranfield *et al.* (2003). This approach differs from conventional reviews in that it aims at synthesizing research in a transparent, systematic and reproducible manner (Torpe *et al.*, 2005). The identification of articles comprised four procedural steps as illustrated in Table I.

The keywords (Table II) for the identification of articles demonstrate the objective of covering the intersection of innovation studies in different competitive contexts. As competitive contexts are likely to differ between industries, the agricultural and forest industry and innovation were operationalized into two search clouds that comprise industry (e.g. agriculture, food production, forest, wood) and innovation (product development, enhancement, innovativeness). The keywords were identified through previous reviews and studies. In total, 20 keywords were used and identified articles had to match at least one keyword in each cloud; otherwise, the articles were excluded. Furthermore, to make the sample size manageable and secure quality, Step 2 meant concentration to peer-review academic journals in the English language. Step 3 included the specification of a relevant research database. As the intention was to collect studies from various disciplines, the Scopus database was chosen.

The original search identified 1,092 articles that were categorized into A (those who were probably relevant), B (somewhat relevant) and C (most relevant). The initial A-list of 1,092 articles was reduced on the basis of title and abstract reading. Full texts of the resulting 271 articles on the B-list were analyzed in-depth, and the remaining 112 articles were put on the C-list. The most common reason for exclusion was lack of focus on innovation or an inadequate connection to the preferred industries.

Analysis procedure

Each of the 112 studies was classified into interval variables in accordance with the degree to which it captures a certain type of innovation, innovation at different levels and type of performance implication of innovation. For type of innovation, two variables were constructed to indicate the degree to which an article focuses on product or process innovation. For example, the degree of focus on product innovation could be 60 per cent, and the focus on process innovation, then, would be 40 per cent. Similarly, two variables were designed that show the degree to which a study captures innovation at the firm or

Content of the steps	Individual steps	Basis	Resulting no. of articles
Identification of articles	Step 1: Identification of keywords	Previous research and reviews	–
	Step 2: Development of exclusion and inclusion criteria	–	–
	Step 3: Specification of relevant search engines and execution of search	–	1,092
	Step 4: Development of lists	–	–
	A list	Title (automated based on keywords)	1,092
	B list	Title and abstract	271
	C list	Full text	112
Categorization of articles	Step 5: Categorization of articles (e.g. year of publication, industry context affiliation)		112

Table I.
Procedure for the systematic review

Table II.
Keywords used in the identification of articles

Search clouds		Example of a search string
Agriculture and forest industry context	Innovation	
Agricult* OR crop* OR animal* OR "growing conditions" OR implements OR "food production" OR forest* OR wood OR "bioenergy"	Innovation OR "product stewardship" OR "product development" OR improvement OR enhancement OR diffusion OR value* OR *creat* OR adding OR revolution OR innovativeness	Agricult* OR "food production" AND innovation OR "product stewardship" OR "product development"

industry level. The same procedure was applied to the variables of financial or operational performance.

Following recommendations for analyzing interval variables (Field, 2013), the one-way ANOVA technique was chosen. Thus, a significant value for ANOVA F means that there is a difference between mean values of the variables of interest between the competitive contexts. Furthermore, prior to the analysis, a Levene's test (Field, 2013) verified the equality of variance in the two industry samples at $p > 0.05$.

Descriptive information of the studies

Table III shows the 112 studies included in the review and their industry affiliation.

Industry belonging	References
Agriculture industry[a]	Allaire and Wolf (2004), Beauchesne and Bryant (1999), Beckford (2009), Beckford *et al.* (2007), Boehlje and Bröring (2011), Carvalho and Barbieri (2010), Castella *et al.* (2004), Cavallo *et al.* (2014a, 2014b), Chhetri *et al.* (2012), Chung (2012), Damme *et al.* (2013), Diederen *et al.* (2003), Dogliotti *et al.* (2014), Dutrénit *et al.* (2012), Faure *et al.* (2013), Gao and Zhang (2011), Ghazalian and Furtan (2007), Gijsbers and Tulder (2011), Gray *et al.* (2004), Hall (2005), Hall *et al.* (2003, 2011), Hellin (2012), Horton *et al.* (2010), Hsu *et al.* (2011), Ibarra and Skees (2011), Iliopoulos *et al.* (2012), Kingiri (2013), Klerkx and Leeuwis (2008a, 2008b, 2009), Klerkx *et al.* (2012), Knudson *et al.* (2004), Kroma (2006), Kumar *et al.* (2011), Lamprinopoulou *et al.* (2014), Lybbert and Sumner (2012), Mapila *et al.* (2012), Mariola and McConnell (2013), Masters (2005), Morgan and Murdoch (2000), Ndyabawe and Kisaalita (2014), Nettle *et al.* (2013), Oreszczyn *et al.* (2010), Pachico (1996), Pamuk *et al.* (2014), Pant (2010, 2012, 2014), Raj (2013), Reddy *et al.* (2012), Rodgers (2008), Röling (2009), Schenkel *et al.* (2012), Shiferaw *et al.* (2009), Shylendra (2011), Smithers and Blay-Palmer (2001), Somers and Stapleton (2014), Sorensen (2011), Spielman *et al.* (2009), Stewart *et al.* (2002), Sumberg (2005), Tisenkopfs *et al.* (2014), Triomphe *et al.* (2013), Turaeva and Hornidge (2013), Vanclay *et al.* (2013), Vanloqueren and Baret (2009), Vera-Cruz *et al.* (2008), van der Veen (2010), Weiss and Bonvillian (2013), Wright (2012), Xuedong (2006).
Forest industry[b]	Alfranca *et al.* (2014, 2009), Anderson (2006), Barcic *et al.* (2011), Bélis-Bergouignan and Levy (2010), Björkdahl and Börjesson (2011), Bull and Ferguson (2006), Buttoud *et al.* (2011), Cao and Hansen (2006), Corsatea (2014), Crespell and Hansen (2008), Diaz-Balteiro *et al.* (2006), Hansen *et al.* (2007, 2014, 2011), Van Horne *et al.* (2006, 2012), Hovgaard and Hansen (2004), Knowles *et al.* (2008), Kubeczko *et al.* (2006), Levidow and Papaioannou (2013), Levidow *et al.* (2014), Madlener (2007), Nybakk *et al.* (2011, 2009), Madrigal-Sánchez and Quesada-Pineda (2012), Pässilä *et al.* (2013), Rametsteiner and Weiss (2006), Reiljan (2007), Roos *et al.* (2014), Sadraoui (2011), Salka *et al.* (2006), Seeland *et al.* (2011), Sikora and Nybakk (2012), Stendahl and Roos (2008), Stone *et al.* (2011), Tykkä *et al.* (2010), Välimäki *et al.* (2004), Wagner and Hansen (2005)

Notes: [a] 73 articles are included; [b] 39 articles are included

Table III. Studies included in the review and their industry affiliation.

Studies on the C-list were categorized to create the following tables: Table IV presents a description of innovation studies by year and industry, while Table V contains innovation studies across industry and country.

Furthermore, additional descriptive information was assembled. Table VI presents detailed information on the studies' methodological approaches and analysis methods, whilst Tables VII and VIII account for dependent and independent variables of the studies. Taken together, research on innovation in these industries is scattered, and

Table IV. Number of innovation studies by industry context and time period.

Period	Agriculture industry	Forest industry	No. of studies
1996-1997	1	0	1
1998-1999	1	0	1
2000-2001	2	0	2
2002-2003	3	0	3
2004-2005	7	3	10
2006-2007	4	11	15
2008-2009	10	5	15
2010-2011	13	10	23
2012-2013	23	5	28
2014-2015	9	5	14
Total number of studies	73	39	112
Percentage of total number of studies	65.18	34.82	100

Table V. Number of innovation studies by industry context and country[a]

Country	Agriculture industry	Forest industry	No. of studies[b]
Australia	4	3	7
Austria	0	6	6
Canada	3	6	9
France	1	4	5
Finland	1	6	7
Germany	1	4	5
Italy	3	3	6
India	8	0	8
The Netherlands	7	1	8
Norway	1	6	7
USA	7	9	16
Spain	2	4	6
Sweden	1	6	7
United Kingdom	4	4	8
Total number of presented countries	43	62	105
Percentage of total number of presented countries	40.95	59.05	100

Notes: [a] A study may focus on more than one country; [b] less than five studies for a country are not included

Approaches and methods	Agriculture industry	Forest industry	No. of studies
Reviews and theory development			
Literature review	1	1	2
Theory development	21	0	21
Qualitative methods			
Cross-sectional case studies	31	18	49
Longitudinal case studies	8	1	9
Statistical methods			
Analysis of variance (ANOVA, ANCOVA, MANOVA, variance component analysis)	0	5	5
Descriptive analysis[b]	4	8	12
Confirmatory factor analysis	1	3	4
Cluster analysis	1	0	1
Logistic regression of direct effects	2	3	5
Linear regression of direct effects	2	2	4
Regression with moderations	0	2	2
Multiple correspondence analysis	2	0	2
Panel regression (includes Poisson, logit, probit, etc.)	3	2	5
Structural equations	0	2	2
Total number of approaches and methods	76	47	123
Percentage of total number of approaches and methods	61.79	38.21	100

Notes: [a] A study may apply more than one method (e.g. ANOVA and regression analysis); [b] including studies that use correlation analysis, percentages or indicators, or exploratory factor analysis, without subsequent quantitative estimation techniques

Table VI.
Approaches and analyses methods used in the studies[a]

Dependent variables	Agriculture industry	Forest industry	No. of studies[b]
Product innovation	4	6	10
Process innovation	2	4	6
Innovativeness	0	3	3
Financial performance	0	5	5
Export	1	1	2
Capabilities	0	2	2
R&D investment	1	3	4
Total number of dependent variables	8	24	32
Percentage of total number of dependent variables	25	75	100

Notes: [a] The table only contains dependent variables in studies that employ statistical methods; a study may use more than one independent variable; [b] variables in fewer than two studies are not included

Table VII.
Dependent variables in the studies[a]

there are different ways of conceptualizations and modelling of innovation. Tables VI-VIII show, for example, that the linear view (Keupp *et al.*, 2012) of modelling typically follows the notion that one or several internal or external variables influence innovation.

Independent variables	Agriculture industry	Forest industry	No. of studies[b]
Product innovation	0	2	2
Process innovation	0	2	2
Organizational climate	0	2	2
Innovation strategy	0	3	3
Market orientation	0	2	2
Learning orientation	1	2	3
Risk-taking attitudes	0	2	2
Industry sector	2	1	3
Country	0	2	2
Household size	2	0	2
Firm size	2	7	9
Educational level and age of employees	3	3	6
Past financial performance	0	2	2
Export	0	3	3
R&D investments	1	5	6
R&D network	3	3	6
Total number of independent variables	14	41	55
Percentage of total number of independent variables	25.45	74.55	100

Table VIII.
Independent variables in the studies[a]

Notes: [a]The table only contains dependent variables in studies that employ statistical methods; a study may use more than one independent variable; [b]variables in fewer than two studies are not included

Results and discussion

Table IX presents differences regarding type of innovation and levels investigated, and types of performance implications. The table constitutes a basis for a test of the assumption that the way innovation is conducted is contingent on the competitive context.

Content of innovation studies	Strong rivalry amongst competitors; agriculture industry	Strong buyer power; forest industry	ANOVA F
Types of innovation investigated			8.28*
Product	13.84	29.33	
Process	86.16	70.67	
Innovation at different levels			18.20**
Innovation at the firm level	32.33	69.49	
Innovation at the industry level	67.67	30.51	
Types of performance implications			23.52[a]
Financial performance	4.00	83.33	
Operational performance	96.00	16.67	

Table IX.
Content of innovation studies in the industry contexts

Notes: *$p < 0.05$; **$p < 0.01$; [a]the analysis is based on 14 studies investigating implications on performance (five related to the agricultural industry and nine related to the forest industry), which are too few for a test

Types of innovation investigated

Significant differences appeared for the types of innovation that the reviewed studies capture ($p < 0.05$). Thus, while process innovation is a major concern in both industries, the forest industry focuses on product innovation to a significantly larger extent.

The differences indicate that different competitive forces set conditions for types of innovation. In the agricultural industry, scholars underline that rivalry amongst competitors is a driving force that shapes types of innovation. For example, the studies by Wright (2012) and Weiss and Bonvillian (2013) stress the importance of price competition. Wright (2012) identifies the role of subsidies in increasing wheat and rice production, and concludes that subsidies that encourage productivity and efficient resource utilization have led to rivalry based on low prices throughout the industry.

Weiss and Bonvillian (2013) scrutinize how innovation systems in the USA impact global innovation, and they underscore that the agricultural industry is embedded in subsidies and low price structures. This research strongly suggests that rivalry based on low prices complicates the development of products, and, instead, efficient processes are a major concern. Furthermore, the comprehensive study by Triomphe *et al.* (2013) presents similar findings. In this study, around 50 innovations stemming from external funding projects were investigated. The study underscores the importance of innovations in boosting productivity, including new processing techniques and new ways of producing. Thus, a process innovation in a competitive context characterized by a great deal of rivalry may be viewed as a necessary requirement for competition, rather than a strategic option by the firm.

The importance of rivalry has also been a central issue in many studies on agricultural product innovations. Smithers and Blay-Palmer (2001) investigate soybean products, and they provide empirical support for the notion that the agricultural rivalry structure constrains the development of product innovations. They argue that focus on low prices facilitates effective production rather than product development. Competition based on rivalry as a constraint is also highlighted in the study of Horton *et al.* (2010) investigating product innovations in terms of improved packing and labelling of potatoes.

However, there are exceptions to the pattern. For example, in recent years, scholars have begun to investigate product innovations introduced in non-traditional industries. Boehlje and Bröring (2011) examine agricultural bioenergy and conclude that agricultural products are increasingly innovated for the energy, industrial, and pharmaceutical industry. They report that different competitive conditions, along with new science and technology, motivate entries into new industries.

Two competitive forces, namely power of buyers and threat of substitute products, have been identified as important drivers of type of innovation, in the forest industry. The importance of the former is documented empirically by Reiljan (2007). The author investigates export withdrawals amongst Estonian firms and argues that backward integration by multinational firms is a way of utilizing buyer power. To a large extent, that power influences the industry's innovation activities. Here, multinationals seem to invest in value-adding activities and receive inputs by local firms. This phenomenon stipulates that backward multinationals' integration drives process innovation for local supplying firms, and product innovation amongst integrated multinational firms.

Researchers also underline that the threat of substitute products is a key factor influencing type of innovation. The study by Roos *et al.* (2014) provides some insight

into the threat of advancements of substitutes in the forest industry. Roos and his colleagues highlight that the threat has caused an overcapacity throughout the industry and, as a result, firms increasingly introduce product innovations. The authors examine innovation diffusion of cellulose and nanomaterial, and they argue that these product innovations serve as barriers towards other substitute products. However, although this force is important, powerful buyers are a stronger determinant in the industry.

Innovation at different levels

The ANOVA analysis in Table IX shows that research on innovation at various levels differs significantly between the agricultural and forest industries ($p < 0.01$). The results indicate that different forces determine the level on which an innovation occurs. Here, innovation may take place at the firm or industry level.

The industry level dominates in studies of innovations in the agricultural industry. Studies by Lybbert and Sumner (2012) and Beckford *et al.* (2007) represent research underlining the importance of industry rivalry. Lybbert and Sumner (2012) investigate policy options for innovation and technology diffusion in developing countries, and conclude that rigid focus on low prices limits the ability of actors at the firm level to adjust and adapt to disequilibria. Beckford *et al.* (2007) look at innovation behaviour of small-scale farmers in Jamaica, and the findings show that multinational rivalry based on low prices marginalizes strategic options available at the firm level.

A general advice put forward by scholars is that innovation flows need to be facilitated from the industry to the firm level in a rivalry-based context. For example, Vanclay *et al.* (2013) suggest that innovations at the industry level should facilitate innovation throughout value chains at the firm level. Furthermore, Pamuk *et al.* (2014) demonstrate that "innovation platforms", where firm-level actors and stakeholders meet and identify problems and solutions, facilitate productivity and innovation at the firm level.

Firm level dominates with regard to innovation in the forest industry. Several studies, such as Van Horne *et al.* (2006) and Cao and Hansen (2006), identify customer power as a key determinant. Van Horne *et al.* (2006) examine how innovation at the firm level is facilitated, and argue that industry participants are forced to innovate at the firm level due to the negotiating power of the integrated buyers. Thus, an innovation at the firm level represents a means to position a firm against powerful buyers. Similarly, Cao and Hansen (2006) investigate antecedents of innovation capabilities, and found that large firms are more innovative than their smaller counterparts. Most probably, this process is driven by global acquisition of firms and advanced technology, which necessitates innovations at the firm level. Furthermore, similar findings are presented by Crespell and Hansen (2008) and Wagner and Hansen (2005).

Types of performance implications stemming from innovation

If innovative firms and industries are to become more competitive, it is crucial to understand how innovations are related to performance. Hence, evaluating whether a particular innovation provides a valid endeavour requires a good understanding of performance implications. However, with the exception of the 14 studies reviewed in this article, knowledge on such implications is very scarce. Furthermore, the limited number of studies meant that it was not possible to carry out a statistical analysis regarding differences between the two contexts.

Concerning the implication regarding operational performance, an overwhelming majority places emphasis on the importance of price rivalry. For instance, in their comparison of the operational performance of agricultural innovations systems in Scotland and The Netherlands, Lamprinopoulou *et al.* (2014) found that strategic and long-term transformative change is needed, due to the innovation-hampering price structures set by the European Union. Therefore, researchers propose policy recommendations aimed at stimulating operational performance throughout the industry.

Similarly, the emphasis on operational performance in the agricultural industry is also discussed by Vanloqueren and Baret (2009). The researchers argue that measures of financial performance ignore essential socioeconomic and environmental objectives, and instead, favour short-term impacts. Thus, operational performance may be a better choice due to the vital importance of changing the industry globally on a long-term basis. However, these measures are frequently complex and difficult to grasp empirically. Nevertheless, operational performance generally includes transfer and outputs of new technology and production practices (Gijsbers and Tulder, 2011), outputs from co-production (Nettle *et al.*, 2013) and innovation platforms (Pamuk *et al.*, 2014) and the degree of sustainability (Dogliotti *et al.*, 2014).

Regarding financial performance, the majority of studies underscore powerful buyers as a strong determinant. Bélis-Bergouignan and Levy (2010) provide some insights into the influence of large vertically integrated firms. The authors investigated eight eco-innovation projects in France, and found that large international groups dominate among firms offering paper-based products. These integrated firms invest heavily in product development and export, with the intention of improving financial results. Even though ecological and socio-economic viewpoints are also important, the findings show the importance of maintaining profitability throughout the industry. Other relevant studies include Knowles *et al.* (2008) and Cao and Hansen (2006), which found correlations among measures of innovativeness/innovation and financial performance measures, and Hansen *et al.* (2011) that regresses innovativeness on financial performance. Furthermore, Crespell and Hansen (2008) and Nybakk *et al.* (2009) go further as they examine relationships among innovativeness and performance by incorporating industry context and size as moderators.

Conclusions and contributions

The knowledge of innovation has grown rapidly during the last two decades. In fact, a large part of the knowledge may be related to innovations in different competitive contexts. However, despite this, scholars reviewing articles on innovation tend to view this type of context as something that is excluded in the innovation formula. Therefore, this article tests whether the way innovation is conducted is due to the competitive context. The analysis distinguishes innovation in the agricultural industry from innovation in the forest industry. Statistically significant differences between the two competitive settings were found. The differences are explained in light of the industrial organizations theory, more specifically, forces driving competition (Bain, 1956; Porter, 1980, 2008).

The results of this article offer a number of contributions that advance our knowledge of innovation. First, the results contribute to the literature by addressing the importance of the competitive context in which the innovation occurs. The results show

that innovations are not universal, but contingent on the context. Second, the results show that the competitive context separates the type of innovation under investigation. More precisely, it was found that competition based on great rivalry amongst competitors determines process innovation, whilst buyer-power-based competition is a source of product innovation. Third, the level on which an innovation occurs differs between competitive contexts. For a firm-level innovation, competition based on buyer power is a major determinant, whilst great rivalry facilitates innovation at the industry level. Fourth, the review presents indices that the competitive context dictates relationships between innovation and type of performance.

Further research opportunities

This article offers insights into the sources and directions of innovation and the formation of innovation at the firm and industry level deriving from competitive context. However, the knowledge of innovation may benefit from further examination of contextual contingencies.

A starting point for further research would be the realization that the type of innovation is specific relative to relevant competitive forces, which seems to be especially true comparing rivalry-based competition and competition based on buyer power. First, one area of research that needs further attention is the dynamic and complex nature of competitive forces that shapes types of innovation. For instance, to what extent do competitive forces have a direct or moderating effect on different types of innovation? Following this type of questioning, Wesseling *et al.* (2014) investigates how increased rivalry relates to product innovations. The authors find that increased rivalry relates differently to different phases of product development. Hence, researchers are encouraged to look closely at relationships between the competitive context and different dimensions of product innovations.

Second, another fruitful area of research would be investigating how different types of innovation emerge in competitive contexts that would normally hinder innovation. Studies of interest include that of Augusto and Coelho (2009) investigating how internal characteristics of the firm influence product innovations. The findings show that a firm's orientation towards the market facilitates product innovation where competition is based on rivalry. However, it is possible that different internal characteristics may help the firm in different competitive contexts. For example, in a particular competitive context, a risk-taking and proactive behaviour may be necessary, whilst information gathering and responsiveness may be crucial in another context (Pehrsson and Pehrsson, 2015; Pehrsson, 2015).

Third, the present review provides some insight into relationships between the competitive context and the level at which innovation occurs. Interesting works include that of Pamuk *et al.* (2014) demonstrating how innovation at the industry level facilitates a firm-level innovation where competition is based on rivalry. However, it is important to examine the interplay between the competitive context and innovation at different levels. For instance, to what degree does the competitive context determine innovations at different levels? How are innovations flowing from one level to another facilitated or hindered by competitive context?

Fourth, there is a need to examine relationships between competitive context and performance manifestations. An interesting research objective is to achieve a better understanding of the complex nature of performance implications in various

competitive contexts. For example, to what degree does the competitive context influence the implication on performance following innovation? How are implications on performance, following innovation, facilitated by internal characteristics of the firm in a competitive context that would normally hinder that type of innovation? Furthermore, researchers are also encouraged to examine how implications of one type of performance influence implications on another type as discussed by Vanloqueren and Baret (2009).

Current research on innovation recognizes that other theoretical mechanisms can explain the same phenomenon analyzed in this paper. In particular, innovations may occur by path dependency, such as previous innovations. Thus, although a different type or level of innovation may be superior a dominant one, the dominant innovation excludes competing innovations. The presence of path dependency has been observed in the agricultural industry, such as innovations of seed. It has, for instance, been shown that seed varieties developed in Taiwan until 2000 relied on varieties developed by Japanese scientists before 1945 (Chung, 2012). However, there is currently a theoretical explanation neither for the importance of past innovations in the agricultural industry nor on how to overcome path dependency. Hence, researchers are encouraged to look closely into the phenomenon in the agricultural industry.

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