Journal of Business Research 66 (2013) 2060–2070

Contents lists available at SciVerse ScienceDirect

Journal of Business Research

# Innovation in knowledge-intensive industries: The double-edged sword of coopetition

Ricarda B. Bouncken [a,*], Sascha Kraus [b]

[a] Strategic Management and Organization, University of Bayreuth, Prieserstr. 2, 95440 Bayreuth, Germany
[b] Institute for Entrepreneurship, University of Liechtenstein, Fürst-Franz-Josef-Strasse, 9490 Vaduz, Liechtenstein

ARTICLE INFO

*Article history:*
Received 1 July 2012
Received in revised form 1 December 2012
Accepted 1 January 2013
Available online 7 March 2013

*Keywords:*
Coopetition
SME
Innovation
Inter-firm learning

ABSTRACT

This study researches an important topic for knowledge-intensive SMEs that operate in clusters. Results from a sample of 830 SMEs as well as from qualitative validation interviews indicate that coopetition, the simultaneous pursuit of cooperation and competition, has a varying impact on innovations of SMEs. Three moderators influence coopetition's innovation performance: (1) sharing knowledge with the partner, (2) learning from the partner (inlearning), and (3) technological uncertainty. Overall, the study finds that coopetition can trigger radical innovation, but at the same time can harm the extremely novel revolutionary innovation. The damaging effect on revolutionary innovation is even stronger when SMEs share knowledge with their partners. However, a positive effect of coopetition on revolutionary innovation is achievable if SMEs do integrate their partners' knowledge through inlearning. Coopetition is also advantageous under greater technological uncertainty. A latent profile analysis in this study disentangles unobserved heterogeneity and displays seven different profiles of SMEs.



## 1. Introduction

Recent studies recognize that a firm's innovativeness may rely on coopetition, a simultaneous pursuit of cooperation and competition (LeRoy & Yami, 2009; Luo, Slotegraaf, & Pan, 2006). Coopetition is highly important for small and medium-sized enterprises (SMEs) operating in alliances and clusters. The dualism of competition and collaboration helps SMEs in high-tech industries to share R&D costs and economies of scale (Miotti & Sachwald, 2003), use synergistic effects through the pooling of resources (Mariani, 2009), search for complementary resources (Ancarani & Costabile, 2010), and distribute risks (Meyer, 1998). All of these can potentially improve SMEs' innovation. However, prior studies show that the coopetition that occurs via the risks of opportunism, particularly unintended knowledge spillovers, can be disadvantageous for innovation (Nieto & Santamaria, 2007). Thus the question emerges of whether advantages or disadvantages dominate for SMEs when these issues arise.

Prior research on coopetition applies case studies on large firms (Dubois & Frederiksson, 2008; Gnyawali, He, & Madhavan, 2006). As such, a need for large-scale empirical studies on coopetition's impact on innovation exists, specifically for SMEs. Because innovation can have varying characteristics and degrees of novelty, where growing novelty can sometimes mean increasing investments, information transfer, and risk, studies should take these characteristics of innovations into account. This study aims to provide insight into the effect coopetition on revolutionary and radical innovation while offering specific results from the inclusion of moderators related to knowledge sharing, learning from partner(s), and technological uncertainty.

Empirical results come from a recent survey study of 830 SMEs operating in clusters in the IT industry. To test the hypotheses, this study applies structural equation modeling on direct effects and latent interactions, which should provide a richer picture of effects and environmental conditions. A central characteristic of this kind of dimensional approach is its focus on interrelatedness between constructs. This study also extends the insights of the structural equation analysis by researching the relationships between the constructs as a function of unobserved heterogeneity (Hagenaars & McCutscheon, 2002), which represents an instance of conditional independence (Wang & Hanges, 2011). This latent profile analysis detects unobserved heterogeneity and, in doing so, moves beyond pure dimensional interrelationship testing. Qualitative validation interviews with 11 companies complement this study.

The paper starts with the elaboration of the theoretical background including the hypotheses. The following chapter explains the methodology, followed by a portrayal of empirical results. Drawing on validation interviews, the following section discusses insights and the implications of the results. The paper concludes with a description of its limitations and suggestions for further research.

## 2. Theoretical background

### 2.1. (Co-)Innovation in SMEs

Innovation is clearly a major constitutive element of any entrepreneurial activity (Morris, Kocak, & Özer, 2007). This element includes the

* Corresponding author.
*E-mail addresses:* bouncken@uni-bayreuth.de (R.B. Bouncken), sascha.kraus@uni.li (S. Kraus).

0148-2963/$ – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jbusres.2013.02.032

creation of novel or advanced products, services, or processes that the market sees as new and desirable (Cepeda-Carrión, Cegarra-Navarro, & Leal-Millan, 2012; Van de Ven, 1986; Woodside & Biemans, 2005). Innovation requires the conversion of knowledge into new products, processes, and services as well as the successful diffusion of these inventions into a society and/or market (Kline & Rosenberg, 1986). This is particularly relevant for SMEs. Being innovative can be a significant challenge for SMEs due to their smallness, limited resources and capabilities (Gnyawali & Park, 2009). For instance, these businesses often lack the financial means and the (tacit) knowledge required for R&D and large-scale innovation projects (BarNir & Smith, 2002; Gomes-Casseres, 1997). They also have small market shares, which makes innovation a risky activity (Bougrain & Haudeville, 2002).

Collaboration is therefore often crucial for technological progress (Winch & Bianchi, 2006). Gomes-Casseres (1994) demonstrates that alliances between SMEs help them to achieve economies of scale and scope in R&D and to jointly develop new technologies. In these cases, innovation activities are no longer just internal processes within a single firm (Lasagni, 2012). Innovation and technological breakthroughs result from complex processes in which the contributions of various individual parties build upon each other rather than from individual creations (Bougrain & Haudeville, 2002).

SMEs also enter into inter-organizational arrangements and clusters as a result (Freel, 2000). They often operate within a value-adding network of suppliers, customers, complementors, and competitors (Audretsch & Feldman, 1996; Clarkson, Fink, & Kraus, 2007; Lazoi, Ceci, Corallo, & Secundo, 2011) and as such are often collaborators and competitors at the same time. In other words, they operate within the realm of coopetition (Brandenburger & Nalebuff, 1995). Coopeting SMEs gain access to additional resources and knowledge of their partners and benefit from knowledge spillovers. Tacit knowledge is also more easily transferable within a cluster, where the likelihood for the mitigation and sharing of market uncertainty and risks is greater (Bougrain & Haudeville, 2002; Morris et al., 2007). Coopetition enables SMEs to outmatch stronger rivals and enter new markets while providing access to additional resources (BarNir & Smith, 2002). While Gnyawali and Park (2009, p. 652) state that SMEs can develop their ability to "effectively pursue technological innovations" by coopeting, Merrifield (2007) even claims that these forms of partnerships are essential for SMEs' survival.

### 2.2. Coopetition

Competitors typically strive for market shares without participating in collaborative efforts, that is, they go for their market share alone. Now, however, the relationships between competitors are much more complex, and markets increasingly demonstrate network structures as firms realize that a mix of competition and cooperation is the best way out (Ganguli, 2007). Instead of fighting against each other amidst fierce competition, competitors today often organize themselves into clusters and partnerships (Bougrain & Haudeville, 2002; Ganguli, 2007; Levy, Loebbecke, & Powell, 2003). This hybrid behavior which consists of both elements of cooperation and competition is known as coopetition (Brandenburger & Nalebuff, 1995), and has been increasingly popular in recent years (Bengtsson & Kock, 2000; Chen, 2008; Gnyawali et al., 2006).

So far, the concept of coopetition has received ample attention in research, with several studies emphasizing its importance and advantages (Brandenburger & Nalebuff, 1995; Gnyawali & Madhavan, 2001; Lado, Boyd, & Hanlon, 1997). Due to the cooperating and competitive nature of coopetition, one of the important advantages found is that firms gain access to additional know-how, skills, and resources while they can and should protect their own assets at the same time (Ma, 1999). Coopetition enables risk sharing and the creation of secure contacts (Meyer, 1998). The disadvantage of coopetition is the high risk of opportunism (Levy et al., 2003; Zerbini & Castaldo, 2007) in the case where competition partners use absorbed or shared knowledge in the future for their own purposes.

Ritala and Hurmelinna-Laukkanen (2009) distinguish three main motives for coopetition. First, companies that engage in coopetition wish to increase their current market size or create a new market. Here, companies pool their resources in order to improve current products and services or create new ones. Second, companies aim to improve resource utilization, mitigate risk, and share costs. Third, protecting the coopeting companies' market shares and improving their competitiveness can be a motive for coopetition. By aligning individual interests and bundling forces, coopeting firms are able to protect and possibly even improve their competitive position in the market and beat the competition coming from strong third parties (Gnyawali, He, & Madhavan, 2008; Gomes-Casseres, 1994).

### 2.3. Dilemmas in coopetition for innovation

Carayannis and Alexander (1999) emphasize the importance of coopetition for knowledge-intensive, dynamic, and complex fields such as technology industries, enabling access to knowledge and resources, particularly if the players are SMEs (Gnyawali & Park, 2009). These industries change rapidly, and the uncertainty about their future is high (Ganguli, 2007). Coopetition provides the opportunity to keep up with these changes more easily, share important supplementary knowledge, and cushion the blow against the risks coming from an uncertain future. But at the core of this issue is the question of why companies should consider joint innovation efforts in the first place (Knudsen, 2007). After all, this would mean facing the risks of opportunism (Zerbini & Castaldo, 2007), and the dangers of learning races in particular (Dussage, Garette, & Mitchell, 2000).

Nieto and Santamaria (2007) claim that coopetition is an inappropriate strategy for creating highly novel innovation. Gnyawali and Park (2011) look at leading firms and claim that coopetition increases innovation because of additional coopetition among other firms and group-to-group competition. Under these circumstances, consumers benefit from multi-feature products at reasonable prices stemming from economies of scale, complementary resources, integrative technologies, reduced duplication, and intensified competition at the group level. Perks and Easton (2000) assume less tension when coopetitors compete against third parties. In clusters, SMEs can coopete in one arena while aggressively competing in another. One firm may coopete with another firm that attacks a rival with whom no coopetitive ties are present (Gnyawali et al., 2006). Dubois and Frederiksson (2008) find positive effects on innovation as they analyze a triadic sourcing strategy between two suppliers with partially overlapping capabilities and similar development of new products as a case of coopetition. Coopetition ultimately results in more technological diversity as formerly competitive firms pool their knowledge, technologies, and complementary resources (Quintana-García & Benavides-Velasco, 2004). Bouncken and Fredrich (2012) show positive effects by coopetition on innovation and competitive performance. Trust and dependency moderate the effects on coopetition. Specifically, an environment of high trust and high dependency triggers the effects of coopetition on competitive performance.

Oliver (2004) assumes that coopetition will be more likely in the early, more exploratory stages of innovation processes that demand novel solutions. Nieto and Santamaria (2007) state that coopetition is only rational when performing basic research and establishing standard settings. In other cases, coopetition is the least advantageous strategy for innovation when the particular innovation is of a highly novel nature. A more novel product is highly influential for the maintenance of a competitive advantage, and opportunism might cause strong damage to the coopetitor. This is why a study on coopetition and innovation should consider highly novel innovations.

### 2.4. Innovation horizon

Innovation novelty has been a persistent topic of innovation that typically ranges from incremental to radical innovations (Dewar & Dutton, 1986). Other measures of innovation also exist (Audretsch, 2012; Garcia & Calantone, 2002; Gatingnon, Tushman, Smith, & Anderson, 2002; Govindarajan & Kopalle, 2006). Practitioners in firms (e.g., HP or Procter & Gamble; Brandt, 2012) and researchers (Utterback, 1987) use the concept of revolutionary innovations, particularly when explaining innovation advantages of SMEs versus larger firms, and when referring to extremely novel innovations. The literature acknowledges revolutionary innovation as extremely novel innovations that describe a huge technology breakthrough that changes existent technologies or makes them obsolete (Utterback, 1987), changes the rules of the game in the market (Anderson & Tushman, 1990; Rice, O'Connor, Peters, & Morone, 1998), and develops new schemes of usage and competition. Compared to SMEs, larger firms regularly struggle much more with revolutionary innovations because they demand different capabilities, mindsets, and cultures (Brandt, 2012; Jeng & Bailey, 2012). Larger firms hesitate more frequently than SMEs to pursue revolutionary innovations that do not apply to current customers and are off-line with current products or services. Further, SMEs are more strongly in need of being highly innovative to appeal to customers, draw attention and investment, and defeat the benefits of larger firms that are more effective at attracting clients (Kotabe & Swan, 1995).

This study on SMEs considers two forms: *radical* and *revolutionary* innovation measures. Both represent novel innovation with high resource demands in SMEs. Revolutionary innovation involves extremely novel products and includes technological as well as market discontinuities (Mcdermott & Handfield, 2000; Song & Di Benedetto, 2008) to a much greater degree than radical innovation.

As such, *revolutionary innovations* are highly novel, unique, or technological breakthroughs that significantly modify consumer usage and the patterns of a market as well as technological and market discontinuities (Gatingnon et al., 2002; Utterback, 1987). A revolutionary innovation invents a new market, altering how consumers interact with their environments, changing their values and behavior (i.e., living, leisure, or work). Depending on new product attributes, the innovation opens dramatically new options for use, or exposes previously neglected attributes (Tushman & O'Reilly, 2002).

The pursuit of revolutionary innovation confronts the highest levels of novelty, causing this type of innovation to be highly resource-demanding and risky (Kotabe & Swan, 1995). This effect is particularly true in the case of SMEs that encounter technology risks and uncertainty when pursuing revolutionary innovations (Gnyawali & Park, 2009). After all, achieving a new technological standard or a new market is difficult, if not impossible. SMEs are willing to devote resources to former rivals to develop a revolutionary innovation if they see great potential for sharing risks or utilizing complementary resources. The prospect of greater diffusion further motivates coopetition, particularly in SMEs that lack extensive market power. Greater technological strength of the focal firm increases the positive impact of portfolio leverage intensity on the rate of revolutionary innovation. Even though SMEs typically have the right cultures and mindsets for revolutionary innovation, their smallness often leads to typical liabilities such as smaller bargaining and market power in relation to the high risks of opportunism. This might reduce opportunities for revolutionary innovation through coopetition. SMEs' technological strength may also be insufficient for exploiting portfolio leverage via highly novel innovations. Further, revolutionary innovations frequently require resources from outside the industry (Calantone, Di Benedetto, & Meloche, 1988). As such, revolutionary innovation is less easily achievable through coopetition, which, by definition, occurs in the same industry. Concluding on these effects, the inherent risks of competition in the form of non-reimbursed investments, opportunism, asymmetrical power bases, and resource similarities will in some cases stifle advancements in SMEs' capabilities to achieve revolutionary innovation.

**Hypothesis 1a.** An identifiable connection between coopetition and reduced revolutionary innovations of SMEs exists.

*Radical innovations* cause marketing and technological changes (DeMartino, Neck, Dwyer, & Treese, 2012; Garcia & Calantone, 2002). Gassmann, Zeschky, Wolff, and Stahl (2010) claim that Original Equipment Manufacturers (OEM)s require new knowledge beyond their conventional network of R&D suppliers, when pursuing radical innovation. With its competitive element, coopetition can provide such novel knowledge. The collaborative element of coopetition helps to reduce the pressure to explore internal knowledge concerning new research domains and techniques (Andersén & Kask, 2012; Oliver, 2004). This suggests that, through coopetition, radical innovation gains advantages from a greater resource portfolio and risk-sharing. Gnyawali and Park (2011) show that coopetition among very big firms (giants) can increase firms' technological innovation. Kock, Nisuls, and Söderqvist (2010) show via a case study of four SMEs the different behaviors of coopetition within internationalization. Coopetition can lead to greater innovation via an increased product range as the process allows the possibility to sell innovative products and service solutions of the other parties in the network of the greater international market. Using a sample of SMEs in the biotechnology sector, Quintana-García and Benavides-Velasco (2004) show that collaborations with direct competitors lead to the acquisition of new technical knowledge and skills, as well as the development and access of additional capabilities, through intensive exploitation of existing knowledge within firms. Radical innovation does not require as many resources or as much technological expertise as revolutionary innovation. This is where SMEs can often capitalize on their advantage of being more entrepreneurial than larger firms due to their higher flexibility, their speed of decision-making, or closer proximity to the customers, for example (Bougrain & Haudeville, 2002; Salavou & Lioukas, 2003). Further, firms have an interest in customizing and differentiating their products from other firms' products as a means of attracting new clients. SMEs can achieve this via radical innovations within coopetition (Bouncken & Fredrich, 2012; Ritala & Hurmelinna-Laukkanen, 2009).

**Hypothesis 1b.** An identifiable connection between coopetition and increased radical innovations in SMEs exists.

### 2.5. Nexus to knowledge

*Knowledge* is important for the development, refinement, and driving of new ideas, as well as their commercialization within different areas. Knowledge is “a set of beliefs held by an individual about causal relationships among phenomena” (Sanchez & Heene, 1996, p. 9). Referring to an organizational level, firms learn when knowledge (e.g., rules and standard operating procedures) alters knowledge structures (Argyris, 1990).

The technology, design, and market success of innovation improves through the integration of knowledge from different sources, such as knowledge about consumer needs or technology advancements. This is consistent with the knowledge-based view of the firm, presuming that firms develop capabilities that improve their performance through knowledge work and learning (Grant, 1996). In each firm, individuals might store and use codified information about inter-firm work in records as well as databases, discuss lessons learned from inter-firm work, or observe implicit inter-firm routines between one other, to name a few examples, and thus accumulate, use, and extend their knowledge to improve processes and innovation (Felício, Rodrigues, & Caldeirinha, 2012; Kale & Singh, 2007). Studies on knowledge transfer and organizational learning show that the transfer of knowledge across projects can create new knowledge within firms (Newell, Bresnen, Edelman, Scarbrough, & Swan, 2006). Further, firms can share knowledge (routines, assets, etc.) on a regular basis as well as within projects and alliances to extend their resource base and improve innovation from those sources. Studies show evidence that alliances improve the rate of patenting (Shan, Walker, & Kogut, 1994) and product innovation (George, Zahra, & Wood, 2002; Kelley & Rice, 2002).

In practical terms, firms share embodied knowledge (e.g., technologies) when combining (technological) components and can exchange individually-held tacit knowledge in direct person-to-person interaction (e.g., in meetings or joint work groups) (Hansen, 1999). Additionally, the work with other firms opens avenues for absorption, interpretation and, therefore, learning. Within the inter-firm arrangement (alliance, project-collaboration, coopetition) firms can acquire or collectively develop held knowledge, like joint rules and procedures (Holmqvist, 1999), shared practices of project schedules, team coordination and teamwork (Scarbrough et al., 2004), or joint alliance capabilities (Ağca, Topal, & Kaya, 2012; Anand & Khanna, 2000; Hoang & Rothaermel, 2005) within learning. Rothaermel (2001) states that innovation is most successful when combining the exploitation of capabilities and the external exploration of new capabilities. So coopetition as a form of linkage with external parties provides a means for knowledge sharing, absorption, and integration and innovation as a result (Bradley, Kim, Kim, & Lee, 2012; Lee & Johnson, 2010).

Hamel, Doz, and Prahalad (1989) stress the advantages of learning alliances in which the main objective is to learn from each other. Within coopetition, SMEs can contribute information about technologies, markets, and additional value partners which they would not communicate via competition alone. Still, coopetition includes collaborative as well as competitive elements. In this vein, Khanna, Gulati, and Nohria (1998) later show that the tension between cooperation and competition affects the dynamics of such alliances. Larsson, Bengtsson, Henriksson, and Sparks (1998) even identify an interorganizational learning dilemma within the internal race to learn among the partners. Studies stress several risks of learning within inter-firm arrangements: asymmetric learning (Kale, Singh, & Perlmutter, 2000), knowledge protection and learning races (Inkpen, 2000), and risks of control and exploitation of trust in knowledge transfer (Inkpen & Currall, 2004).

Therefore, this kind of learning in inter-firm arrangements (alliances, project-collaboration, and coopetition) might therefore appear to have positive as well as negative impacts, which indicates that the best way to discuss the effects of knowledge work is in light of knowledge sharing and learning from partners (*inlearning*) (Chang & Chen, 2012; Cooke, 2001; Huarng, Mas-Tur, & Yu, 2012). The Okhuysen and Eisenhardt (2002) classification of knowledge sharing and integration further develops this idea. Sharing defines the process by which several individuals identify and communicate their information; integration occurs when external knowledge sources create new knowledge (Okhuysen & Eisenhardt, 2002). This process is *inlearning*: partners gain access to their partners' knowledge, assemble discrete pieces of knowledge, and subjectively process the knowledge (Okhuysen & Eisenhardt, 2002). In this line, Grant and Baden-Fuller (2004) stress that the goal of alliances is to acquire (existent or latent) knowledge of their partners. This appears to be especially relevant for SMEs that are deficient in knowledge for innovation development and are involved in coopetition. The authors argue that knowledge work in coopetition affects both revolutionary and radical innovations in the same way because both characteristics of innovation take advantages from external knowledge and at the same time might face risks from knowledge spillovers. Knowledge sharing enables the overcoming of barriers to transparency for an exploitation of practices and innovations (Luo, 2005). This sharing facilitates revolutionary and radical innovation that requires an extensive portfolio of resources. Through sharing, partners can get closer access to both explicit and implicit knowledge. This however permits an opportunism that arises from a firm's agenda to use knowledge spillovers in a one-way fashion and appropriate another firms' key technology (Nielsen & Lassen, 2012; Ritala & Hurmelinna-Laukkanen, 2009; Tracey, 2012). Firms may simply leave the coopetition with knowledge tapped from the coopeting firm, deploy the knowledge in competitive fields, destroy the coopetition, or jeopardize the former partner's competitive advantage (Lee & Johnson, 2010).

In the case of greater knowledge sharing, a negative effect on innovation results from coopetition having a competitive element that is stronger than normal collaboration.

**Hypothesis 2a.** Knowledge sharing negatively moderates the relationship between coopetition and the innovation of SMEs.

Phene, Fladmoe-Lindquist, and Marsh (2006) stress that creating innovations is dependent on a firm's access to external knowledge as open access overcomes competency traps, particularly in dynamic technological environments. This is consistent with Rothaermel's (2001) notion of positive effects via the exploitation of external knowledge. Inlearning describes the internal learning of external knowledge. Inlearning is also the process of interpreting, integrating, and using knowledge from external sources. Inlearning includes the encoding, storing, and converting of external knowledge to provide opportunities to transform implicit knowledge, technologies, branding policies, pricing strategies, and relationship building into explicit knowledge. Thus, inlearning captures the attainment and internal use of external knowledge that improves a firm's own innovation(s).

**Hypothesis 2b.** Learning from the partner (inlearning) positively moderates the relationship between coopetition and the innovation of SMEs.

### *2.6. Nexus to uncertainty*

Revolutionary and radical innovations frequently rely on the implementation of emerging and new technologies, which still remain somewhat unknown and untested, and which face uncertainty as a result (Fynes, de Búrca, & Marshall, 2004). Under high technological uncertainty, participants have problems predicting future necessities and deciding their technological path (Fynes et al., 2004). Wrong decisions under technological change can render the firm's competencies obsolete or reduce their tendency to invest in radical technological developments, which businesses often see as having the potential to cannibalize current products and services (Mezias & Glynn, 1993). Studies state that uncertainty reduction is one of the outcomes of coopetition (Gnyawali & Park, 2009; Vaiman, Scullion, & Collings, 2012). Coopetition appears to allow a greater resource portfolio and the sharing of risks, both of which help to cope with technological uncertainty.

**Hypothesis 2c.** Technological uncertainty positively moderates the relationship between coopetition and innovation of SMEs.

Fig. 1 shows the complete research model.

## 3. Methodology

### *3.1. Data*

The population for the survey (description below) consists of German IT SMEs with less than 250 employees (thereby following the official EU definition of an SME, see European Comission, 2003) that ally themselves in clusters with other firms. The firms fit into divisions 26, 61, and 63 of the International Standard Industrial Classification (ISIC). The IT industry is very useful for this study, as the industry is a knowledge-intensive industry in which firms are continuously in need of innovations and inter-firm arrangements (Bollingtoft, Ulhoi, Madsen, & Neergaard, 2003).

3300 SMEs received a questionnaire via mail in the spring of 2012. After having received responses from responsible middle managers, the respondents connected the authors with senior executives (CEOs, directors or owners) in their firms who then provided information on the firms' performance. The study thereby follows a “key informant approach”, interviewing the “single most knowledgeable and valid information sources” (Lechner, Dowling, & Welpe, 2006, p. 525) in the firms for the quantitative study as well as for the subsequent qualitative validation interviews.

The study has a good level of inter-rater-reliability thanks to the Pearson product–moment correlation calculated by correlating ratings between judges on multiple informants. Secondary research also provides results on the firms' number of employees and sales volume. 830 responses comprise the final analysis, building a response rate of around 25%. Table 1 shows further information about the SMEs. Additionally, Table 2 provides facts about the respondents' profile, stressing that the majority of the respondents are knowledgeable about firms' operations and performance.

### 3.2. Scales

This study uses both established and new scales, all operationalized on five-point Likert-type scales. The model has good local and global validity (see Table 3; e.g., $Chi^2$ (df) = 252.87 (122); RMSEA = .036; CFI = .974; SRMR = .043). Coopetition measurements come from a scale by Bouncken and Fredrich (2012). For revolutionary innovation this study uses and adapts the construct from Gatignon et al. (2002) and from Zhou, Kin, Tse, and Tse (2005). The measure of radical innovation builds upon the measure by Gatignon and Yuereb (1997) and their classification of advantages on different aspects (product design, product functionality, features, and quality performance). The two forms of innovation are distinct, discriminant, and inform the reader about different classes of innovation.

Discriminant validity by Fornell and Larcker (1981) informs about the quality of the SEM and also about problems of collinearity: if the value exceeds the cut-off value of 1, a problem of collinearity may exist. The values attained of .450 for revolutionary innovation and .340 are much lower (better) than 1. Furthermore, Fornell and Larcker (1981) state that for every pair of constructs the average extracted variance ρDEV has to be, for both factors, greater than the squared correlation. In this case, the two constructs, radical and revolutionary innovation, are distinct. The results show that all Squared-Factor-Correlations (see Table 4) are lower than the average variance extracted (AVE) (see Table 3). Squared factor correlation for radical innovation and for revolutionary innovation is .243. This is lower than the values .506 for revolutionary innovation and .715 of radical innovation.

Competitive performance included in the latent profile analysis is an adaptation of the measure by Deshpandé, Farley, and Webester (1993) and Worren, Moore, and Cardona (2002). The scales of knowledge sharing and inlearning emerge from a series of expert workshops, pretesting series, and the stepwise exclusion of less valid items through

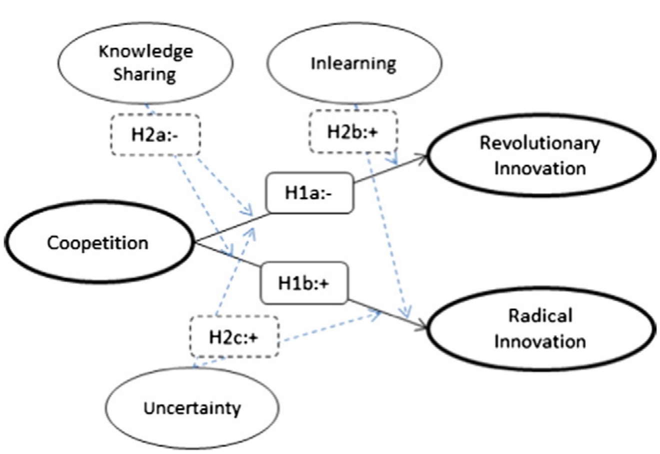


**Fig. 1.** Research model.

**Table 1**
Information about the SMEs included in the sample.

| | Mean | SD | Median |
|---|---|---|---|
| Employees | 66.1 | 61.8 | 45.0 |
| Turnover of sales in M € | 22.2 | 88.6 | 70.0 |
| Annual growth of turnover of sales in % | 16.3 | 27.1 | 10.0 |
| Revenue in % | 19.4 | 27.3 | 12.0 |

explorative and confirmatory factor analyses. Table 4 provides the values of the factor correlations of the constructs (Table 5).

### 3.3. Analysis

Structural equation modeling (SEM) with the maximum likelihood estimation method tests the hypotheses. This technique has several advantages; for example, controlling for error terms and avoiding problems of multi-collinearity. The first step controls for the effects of the control variables on innovation performance. Hypotheses 1a and 1b test the direct effects of coopetition on revolutionary and radical innovation. By the technique of latent interaction modeling this study tests Hypotheses 2a, 2b, and 2c for interaction effects. Latent interaction terms are the product of multiplication and centralization. Further, a latent class explores configurations of SMEs. Latent class analyzes interrelatedness among constructs as a function of unobserved heterogeneity (Hagenaars & McCutscheon, 2002; Muthen, 2003). The analysis indicates a case of conditional independence between variables, where unobserved heterogeneity can fully or partially explain the interrelations (Lazarsfeld & Henry, 1968). Latent class models explore whether individuals (or firms) belong to one of K latent classes that are unknown a priori in terms of number and sizes (Wang & Hanges, 2011). Latent class models assume that individuals (i.e., firms) in the same latent class are similar in terms of observed scores coming from the equivalent probability distributions. Typically, latent class models involve categorical variables and as a variation, the latent profile analysis including continuous indicators (Lanza, Collings, Lemmon, & Schafer, 2007). Latent profile analysis homogeneously specifies individuals (firms) into clusters in terms of their item responses. Latent profile analysis therefore enables this study to investigate issues behind interrelation analyses about different categories of firms unobserved in the previous dimensional analysis.

According to Curran and Blackburn (2001, p. 79), “the most common fieldwork strategy in small business research is the interview”, and data from around 10 analyzed firms is, according to Eisenhardt (1989), usually sufficient for theory building. Loosely following the idea of a mixed-methods approach (e.g., Molina-Azorin, Lopez-Gamero, Pereira-Moliner, & Pertusa-Ortega, 2012), the study therefore carries out eleven additional qualitative validation interviews with the key informants of the surveyed firms in order to provide further insights into this study. The firms come randomly out of the sample of the 830 firms, and the interviews of approximately 30 min follow a semi-structured field manual (Eriksson & Kovalainen, 2008).

**Table 2**
Information on the respondents' profile.

| | Frequencies | Frequencies |
|---|---|---|
| CEO, director, owner | 20.8% | 24.6% |
| Marketing director, sales management | 40.0% | 47.4% |
| Operational/product management | 15.5% | 18.3% |
| Other (R&D, consultant) | 8.2% | 9.7% |
| Missing status | 15.5% | |

**Table 3**
Fit values: N = 830; Chi$^2$ (df) = 252.87 (122); RMSEA = .036; CFI = .974; SRMR = .043.

| Construct | Item | Std. factor loading | Indicator reliability | Cronbach's alpha | Composite reliability | AVE | Fornell–Larcker |
|---|---|---|---|---|---|---|---|
| Coopetition | We are in close competition with our partner(s). | .517 | .267 | .652 | .604 | .260 | .346 |
| | We collaborate with competitors to achieve a common goal. | .512 | .262 | | | | |
| | An active competition with our collaborator(s) is important to us. | .500 | .250 | | | | |
| Revolutionary innovation | Most of the innovations of our company… …are breakthrough innovations. | .772 | .596 | .967 | .779 | .506 | .480 |
| | …are technological advancements that make old technologies obsolete. | .677 | .458 | | | | |
| | …deliver completely new benefits to customers. | .682 | .465 | | | | |
| Radical innovation | Products are based on radical improvements concerning… …technology. | .879 | .773 | .980 | .932 | .715 | .340 |
| | …customer value. | .860 | .740 | | | | |
| | …performance. | .796 | .634 | | | | |
| Uncertainty | In the development and introduction of innovations there is very high uncertainty about… …staff's familiarity with the science and technology used in the project. | .725 | .526 | .981 | .890 | .671 | .134 |
| | …technological feasibility. | .904 | .817 | | | | |
| | …functionality of products. | .819 | .671 | | | | |
| Knowledge sharing | Our knowledge and our partner's knowledge greatly complement each other. | .840 | .706 | .984 | .891 | .735 | .774 |
| | We gain advantages by combining our knowledge with our partner's knowledge. | .899 | .808 | | | | |
| | We and our partner are good at combining our knowledge in order to solve problems quickly. | .831 | .691 | | | | |
| Inlearning | We learn from our partner. | .768 | .590 | .694 | .853 | .666 | .853 |
| | Thanks to the knowledge learned from our partner, we can tackle challenges more quickly. | .926 | .857 | | | | |
| | We often draw on the knowledge of our partner and thus learn to solve problems more quickly. | .743 | .552 | | | | |

## 4. Results

### 4.1. Hypothesis testing

The following section provides information about this study's control variables. Clusters often help to improve collaboration through interrelation intensity and geographical proximity (Cooke, 2001; Porter, 2000). Frequent and intensive interrelations are typical for clusters improving coordination, commitment, and information transfer across firms, advancing the innovation per se, and creating value as a result. The estimations include the interrelation intensity and geographical closeness as controls to single out the effects which otherwise could blur the clarity of the effects found (see Table 2).

The findings support Hypothesis 1a, which assumes that coopetition is negatively associated with revolutionary innovations (path coefficient = .087; $p<.05$). This is also the case for Hypothesis 1b, that is coopetition positively associates with radical innovations (path coefficient = .212; $p<.001$). Interestingly, even though the moderating hypotheses for radical innovation lack support, full support for all moderating hypotheses for revolutionary innovation is present.

Even though the correlation between innovation-oriented dependent constructs ($r = .612^{***}$) exists, the path coefficients run in opposite directions, thus showing that radical innovation and revolutionary innovations are very obviously different forms of innovation.

The results for Hypothesis 2a show that knowledge sharing negatively affects revolutionary innovation through coopetition (Coopetition × Knowledge sharing = −.124, $p<.01$). In addition, inlearning increases the positive effect on revolutionary innovations (as stated in Hypothesis 2b, Coopetition × Inlearning = .159, $p<.01$). The findings show that greater technology uncertainty positively (Hypothesis 2c) moderates the effect of coopetition on revolutionary innovations (Coopetition × Uncertainty = .100, $p<.01$).

The graphs (see Figs. 2–4) illustrate the interaction effects and their direction. The slope of high knowledge sharing and low inlearning on

**Table 4**
Factor-correlation, significance, and squared factor-correlation (in brackets).

| | X1 | X2 | X3 | X4 | X5 | X6 |
|---|---|---|---|---|---|---|
| X1. Revolutionary innovation | 1 | | | | | |
| | (1) | | | | | |
| X2. Radical innovation | .49*** | 1 | | | | |
| | (.24) | (1) | | | | |
| X3. Coopetition | .01 | .19** | 1 | | | |
| | (.00) | (.04) | (1) | | | |
| X4. Uncertainty | .11* | .13** | .30*** | 1 | | |
| | (.01) | (.02) | (.10) | (1) | | |
| X5. Knowledge sharing | .26*** | .13** | .07 | −.04 | 1 | |
| | (.07) | (.02) | (.01) | (.00) | (1) | |
| X6. Inlearning | .18*** | .10$^t$ | .15** | | | |
| | (.03) | (.01) | (.02) | | | |

$^t$ = $p<.10$.
* $p<.05$.
** $p<.01$.
*** $p<.001$.

**Table 5**
Path coefficients and indirect effects. Correlation between dependent constructs: $r = .618^{***}$.

| | | Radical innovation | Revolutionary innovation |
|---|---|---|---|
| Control Variables | Regularity of relationship | −.056 | .041 |
| | Closeness of relationship | −.062 | −.013 |
| Main Effects | Coopetition | .212*** | −.087* |
| | Knowledge sharing | .311*** | .390*** |
| | Inlearning | −.117$^t$ | −.082 |
| | Uncertainty | .112** | .182*** |
| Interaction Effects | Coopetition × Knowledge Sharing | −.029 | −.124† |
| | Coopetition × Inlearning | .050 | .159* |
| | Coopetition × Uncertainty | .019 | .100** |

Note: n = 830.
† $p<.10$.
* $p<.05$.
** $p<.01$.
*** $p<.001$.
$^t$ = <.10

revolutionary innovation strongly decreases under greater coopetition. A strong inclination of low knowledge sharing and high inlearning towards revolutionary innovation in the case of high levels of coopetition is also present. Therefore, knowledge sharing is a further unfavorable condition for revolutionary innovation under coopetition. Differently, both high inlearning and high uncertainty are favorable conditions for revolutionary innovation.

### 4.2. Latent profile

The latent profile analysis of coopetition also includes firm size, revolutionary innovation, radical innovation, and competitive performance. The first step in latent class analysis is to identify the right number of classes. The maximization of a log-likelihood function that engenders a statistically consistent criterion for the allocation of individuals to the latent clusters leads to the identification of the latent mixture. Several researchers suggest the use of the Bayesian information criterion (BIC) as a preferable statistic for class enumeration (Collings, Fidler, Wugalter, & Long, 1993; Hagenaars & McCutscheon, 2002; Jedidi, Jagpal, & DeSarbo, 1997). Nylund, Asparouhov, and Muthe'n (2007) suggest using BIC, Voung–Lo–Mendel–Rubin Likelihood Ratio Test (LRT), adjusted Voung–Lo–Mendel–Rubin LRT, and adjusted Voung–Lo–Mendel–Rubin likelihood as guidelines. Following this enumeration, and including a further entropy measure, a seven-class solution is favorable (see Table 6) and reaches the best (lowest) BIC, and best significant adjusted Voung–Lo–Mendel–Rubin LRT. In addition, the seven-cluster solution achieves a significant Voung–Lo–Mendel–Rubin LRT and adjusted Voung–Lo–Mendel–Rubin LRT, while both LRTs for the eight-class solution are not significant. The seven-cluster solution develops groups that include 46 to 344 firms.

The next step analyzes predictors and outcomes with respect to latent class membership, providing a further comprehension of the unobserved heterogeneity (Wang & Hanges, 2011). The comparison of different indicator levels on four different latent profile indicators here provides an interesting picture of the latent profile of SMEs in coopetition (see Fig. 5). The figure first shows that small and larger SMEs can achieve high, middle, and low performances.

Class 1, representing 5.4% of the firms, are small SMEs achieving middle levels of revolutionary innovations and competitive performance with very few radical innovations. Class 2, covering 5.8% of the firms, are larger SMEs that are mildly successful in all three performance categories: revolutionary and radical innovations as well as competitive performance. Only classes 1 and 7 perform worse in terms of radical innovation. 16.9% of all the firms in the study are in class 3. These larger SMEs have medium performance across all performance categories, similar to the smaller SMEs of class 5. Class 4 (15.5%) consists of larger SMEs that are highly successful in all three performance categories: revolutionary and radical innovations as well as competitive performance. The largest number of SMEs is in class 5 (34.4%). These small SMEs show an average performance in

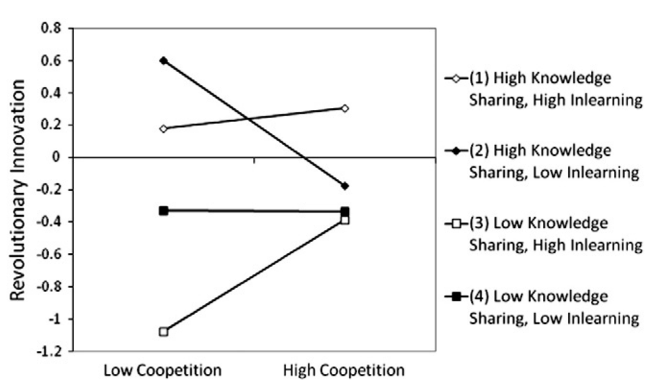


**Fig. 2.** Plots of the interactions on revolutionary innovation.

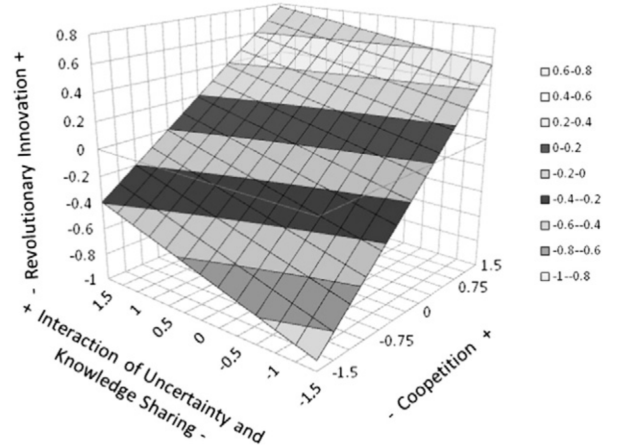


**Fig. 3.** Plots of the three-way interactions including knowledge sharing and uncertainty.

all categories. The very small SMEs that are top performers in all categories, particularly innovation, are in class 6 (11.7%). Class 7 covers only 2.6% of the firms. Larger SMEs such as these achieve medium revolutionary innovation and medium competitive performance but only low radical innovation, making them very similar to the smaller SMEs of class 1. In general, the study finds that both very small and larger SMEs in different classes can achieve low, medium, and high performance levels. Two classes (1 and 7) concentrate on revolutionary innovations and achieve low radical innovations. Interestingly, firms in the other classes achieve similar levels of both forms of innovation.

## 5. Discussion

### 5.1. Insights

The main findings of the quantitative empirical analysis are that coopetition negatively affects revolutionary innovation while influencing radical innovation positively. However, the majority of the SMEs interviewed in the qualitative section (seven out of eleven) point out the importance of competition for both revolutionary and radical innovation. For example, SME 7: “On the one hand, the advancement of existing/established products has to be pushed, but on the other hand, new and innovative ideas are needed on the market”, or SME 4: “The advancement of existing products has its boundaries. When a certain boundary is reached and established products cannot be optimized any further, you have to become active in a new market/explore new

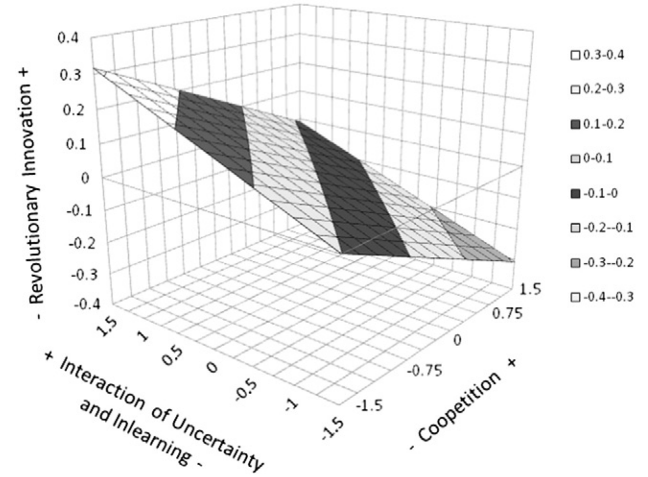


**Fig. 4.** Plots of the three-way interactions including inlearning.

**Table 6**
Class solutions and statistics.

| No. of classes | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| N (c#1) | 832 | 355 | 475 | 338 | 92 | 41 | 130 | 42 |
| N (c#2) | n/a | 477 | 225 | 79 | 163 | 348 | 344 | 41 |
| N (c#3) | n/a | n/a | 132 | 276 | 338 | 121 | 93 | 110 |
| N (c#4) | n/a | n/a | n/a | 139 | 82 | 173 | 42 | 134 |
| N (c#5) | n/a | n/a | n/a | n/a | 157 | 58 | 58 | 334 |
| N (c#6) | n/a | n/a | n/a | n/a | n/a | 91 | 46 | 91 |
| N (c#7) | n/a | n/a | n/a | n/a | n/a | n/a | 119 | 21 |
| N (c#8) | n/a | n/a | n/a | n/a | n/a | n/a | n/a | 59 |
| Entropy | n/a | 0.673 | 0.718 | 0.708 | 0.719 | 0.726 | 0.746 | 0.767 |
| BIC | 7976.355 | 7628.084 | 7530.559 | 7503.716 | 7445.524 | 7436.862 | 7434.449 | 7436.262 |
| Loglikelihood difference | n/a | 407.30 | 131.15 | 60.46 | 91.81 | 42.28 | 36.03 | 31.81 |
| LRT-significance | n/a | .000 | .000 | .187 | .000 | .073 | .057 | .275 |
| Lo–Mendell–Rubin adjusted LRT-value | n/a | 395.53 | 127.36 | 58.72 | 89.16 | 41.06 | 34.99 | 30.89 |
| Voung–Lo–Mendel–Rubin adjusted likelihood | n/a | .000 | .000 | .195 | .000 | .073 | .063 | .285 |

business areas." As such, SMEs are in need of revolutionary innovation, although coopetition is not a proper strategy to achieve this, thus highlighting the limitations of coopetition.

The positive effect on radical innovation does not change under consideration of three specified moderators in the quantitative analysis. The negative effect on revolutionary innovation still varies with the inclusion of moderators. Revolutionary innovation even declines in the case of greater knowledge sharing. Nevertheless, in the qualitative validation interviews, seven out of eleven SMEs indicate that they need to share their knowledge with the partners to a certain extent (i.e., only as much as necessary so that the partner receiving the knowledge cannot improperly use the knowledge against the focal firm). This shows another aspect of the detrimental effects of coopetition.

SMEs further emphasize the use of non-disclosure agreements. SME 6, for example, states: "This depends entirely on the contract. If non-disclosure is agreed upon contractually, specific internal knowledge will be exchanged. Then both parties are committed to complete discretion. But at any time, only the necessary amount of knowledge is shared." The firms are aware that knowledge sharing can have a negative impact on innovation and that a high risk of opportunism exists.

The results of the hypothesis testing show that coopetition can improve revolutionary innovation under the specific condition of high inlearning and/or technological uncertainty. In this way, SMEs can achieve, through coopetition, radical innovation and revolutionary innovation as well, with the latter only possible under specific environmental conditions. Additional support for this comes from the qualitative interviews. As expected, the access to additional external competencies and know-how which is transformable into internal knowledge through inlearning makes coopetition a favorable strategic decision. Asking whether the SMEs that engage in collaborations expect to learn/benefit from their partner, a rather clear image arises: ten out of eleven SMEs expect their firm to benefit from inlearning when collaborating with external partners. For example, SME 9:

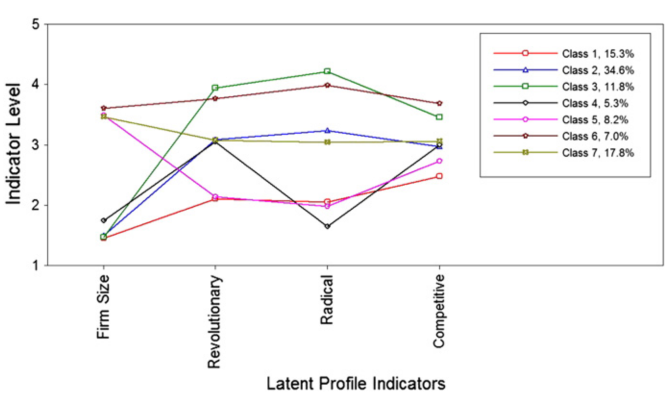


**Fig. 5.** Plots of the indicators and their level for 7 classes.

"Definitely. These partners usually operate in different areas which are unknown to us, and they possess software [technologies] which we do not have."

### 5.2. Relation to prior studies

Overall, these results presented here add to prior research on coopetition, and specify the results for SMEs in knowledge-intensive industries. The results also help to clarify the diverging results on coopetition from prior studies. These results are among the first to research innovation within coopetition in a large survey study. Prior studies have largely applied only case study research (see several of these in Dagnino, 2009). This study also advances the research frontier by looking at very typical (knowledge-intensive) SMEs and considering knowledge and technological uncertainty.

The strong and stable positive association between coopetition and radical innovation is in line with the studies stressing coopetition as a means of improving innovation (Bouncken & Fredrich, 2012; Quintana-García & Benavides-Velasco, 2004; Ritala & Hurmelinna-Laukkanen, 2009) rooted in complementary resources, information sharing, greater markets, as well as learning and risk sharing. The subtle (and even discouraging) results on revolutionary innovation when not considering inlearning or uncertainty relate to previous studies that evaluate coopetition as an inadequate strategy for innovation, particularly when they are of the highly novel variety (Anderson, Dodd, & Jack, 2012; Nieto & Santamaria, 2007). With highly novel innovations, SMEs should avoid knowledge, information or learning asymmetries between business partners (Cimon, 2004). Opposite effects of prior studies are at least partially attributable to the neglect of differentiating radical and revolutionary innovations and environmental factors: SMEs, uncertainty, and inlearning.

This study further explains findings with the notion that revolutionary innovations particularly occur with disruptions of technologies or markets in which new standards emerge (Srivastava & Gnyawali, 2011). They aim towards extreme novelty that requires high and risky long-term investments. These conditions seem to be very sensitive for SMEs in the context of coopetition. Furthermore, power asymmetries typically constitute a threat for SMEs; tensions are related to risky investments and conflicting ideas about designs and strategies complicate work in coopetition and can set off positive effects through risk-sharing and complementary resources for SMEs. For example, coopetition can direct competitive revolutionary innovation that includes different products or individually developed components from the cooperatively achieved core revolutionary innovation. Therefore, SMEs in coopetition will argue about the best-suited core of the revolutionary innovation, which directly affects costs and marketability later on. In addition, SMEs might not be in a sufficiently powerful position to influence decisions in their favor, and therefore take advantage of heterogeneous resources and risk sharing.

Risks of opportunism increase when SMEs share knowledge. Thus the inlearning processes inherent in coopetition are an important core or by-product of coopetition-enhancing revolutionary innovations. To explore the relations in more detail under uncertainty, this study plots three-way interactions (Figs. 3 and 4), revealing that low levels of uncertainty reduce revolutionary innovation, whereas under high uncertainty only one slope reduces revolutionary innovations: high knowledge sharing and low inlearning. High uncertainty therefore cannot compensate for the negative effect through knowledge sharing.

From the dimensional analyses and hypotheses testing the study assumes that coopeting SMEs, especially those in the IT industry, should focus on *radical* rather than on *revolutionary* innovations.

The latent profile analysis provides more information about unobserved heterogeneity, including that related to different groups of SMEs within the analysis. The seven identified classes show that SMEs can fall into different groups of very small or very large SMEs. Both small and large SMEs can be very successful, averagely successful, or mildly successful in terms of innovation and competitive performance. They can also equally focus on both forms of innovation presented here, or focus on revolutionary innovations. In this case, they only achieve medium competitive performance.

### 5.3. Limitations

One of the major limitations of the current study is the focus on one industry and the lack of a comparison with other non-knowledge-intensive sectors or other industries. Future research may want to investigate whether the results shown here are transferable to other (non-knowledge-intensive) sectors or to larger firms. Furthermore, the analyzed firms all operate in alliances and clusters. Comparing them to non-cluster firms might disclose differences in innovation behavior, ultimately recalling the question of whether firms in clusters innovate more or less (e.g., Baptista & Swann, 1998). Nevertheless, a managerial challenge is not to completely avoid coopetition, but to safeguard shared knowledge from unintended appropriation or imitation instead (Knudsen, 2007).

Additionally, the study does not research "trust" as a variable in the model. The question of whether coopetition or pure cooperation based on a high level of trust between the partners (e.g., Bouncken & Fredrich, 2012; Fink & Keßler, 2010; Zeng, Xie, & Tam, 2010) leads to higher success (in innovation as well as overall) might be worth studying in greater detail, as two different views on the level and extent of cooperation appear to exist.

Another limitation of the work is that the analyzed firms in the study are solely from Germany. Comparing the results with those of firms in other countries, especially since Germany is currently one of the few Western economies that face only minor obstacles in the still-ongoing worldwide economic crisis would be interesting. This has great potential for further research.

Last but not least, the commonly known weaknesses of SEM as a method are a limitation to the study. These include, for example, the informant report of only 5-point scales, which might be too far removed from real-life thinking and actions. A typically low response rate of less than 25% is another limitation (Woodside, 2010); in this case the response rate is exactly 25%.

## 6. Conclusion

The objective of this article is to research the effect of coopetition in knowledge-intensive SMEs engaging in clusters. The article researching 830 IT SMEs, contributes to the fields of innovation, along with entrepreneurship/SME research on the one hand, as well as cluster and coopetition research on the other. Results from hypothesis testing, latent class analysis, and validation interviews show that coopetition can have positive and negative effects on innovation depending on the innovation studied. Coopetition affects revolutionary innovation negatively, and radical innovation positively. Under specific contingencies, coopetition can improve revolutionary innovation: high inlearning and/or technological uncertainty positively moderate the effect of coopetition on revolutionary innovation.

## Acknowledgments

The authors thank Frédéric LeRoy and Johanna Gast for their very helpful comments in revising this article.

## References

Ağca, V., Topal, Y., & Kaya, H. (2012). Linking intrapreneurship activities to multidimensional firm performance in Turkish manufacturing firms: An empirical study. *International Entrepreneurship and Management Journal*, *8*(1), 15–33.
Anand, B., & Khanna, T. (2000). Do firms learn to create value? The case of alliances. *Strategic Management Journal*, *21*(3), 295–315.
Ancarani, F., & Costabile, M. (2010). Coopetition dynamics in convergent industries: Designing scope connections to combine heterogeneous resources. In S. Yami, S. Castaldo, G. B. Dagnino, & F. LeRoy (Eds.), *Coopetition: Winning strategies for the 21st century* (pp. 216–237). Cheltenham [u.a.]: Edward Elgar.
Andersén, J., & Kask, J. (2012). Asymmetrically realized absorptive capacity and relationship durability. *Management Decision*, *50*(1), 43–57.
Anderson, A. R., Dodd, S. D., & Jack, S. L. (2012). Entrepreneurship as connecting: Some implications for theorising and practice. *Management Decision*, *50*(5), 958–971.
Anderson, P., & Tushman, M. L. (1990). Technological discontinuities and dominant designs — A cyclical model of technological change. *Administrative Science Quarterly*, *35*(4), 604–633.
Argyris, C. (1990). *Overcoming organisational defences: Facilitating organisational learning.* Boston, MA: Allyn and Bacon.
Audretsch, D. (2012). Entrepreneurship research. *Management Decision*, *50*(5), 755–764.
Audretsch, D. B., & Feldman, M. P. (1996). Innovative clusters and the industry life cycle. *Review of Industrial Organization*, *11*(2), 253–273.
Baptista, R., & Swann, P. (1998). Do firms in clusters innovate more? *Research Policy*, *27*(5), 525–540.
BarNir, A., & Smith, K. A. (2002). Interfirm alliances in the small business: The role of social networks. *Journal of Small Business Management*, *40*(3), 219–232.
Bengtsson, M., & Kock, S. (2000). Co-opetition in business networks to cooperate and compete simultaneously. *Industrial Marketing Management*, *29*(5), 411–426.
Bollingtoft, A., Ulhoi, J. P., Madsen, H., & Neergaard, H. (2003). The effects of financial factors on the performance of new venture companies in high tech and knowledge-intensive industries: An empirical study in Denmark. *International Journal of Management*, *20*(4), 535–540.
Bougrain, F., & Haudeville, B. (2002). Innovation, collaboration and SMEs internal research capacities. *Research Policy*, *31*(5), 735–747.
Bouncken, R. B., & Fredrich, V. (2012). Coopetition: Performance implications and management antecedents. *International Journal of Innovation Management*, *16*(5).
Bradley, S., Kim, C., Kim, J., & Lee, I. (2012). Toward an evolution strategy for the digital goods business. *Management Decision*, *50*(2), 234–252.
Brandenburger, A. M., & Nalebuff, B. J. (1995). The right game–use game-theory to shape strategy. *Harvard Business Review*, *73*(4), 57–71.
Brandt, G. (2012). Evolutionary, Revolutionary or Blended Innovation: Which is Right for Your Organization? Forbes.
Calantone, R. J., Di Benedetto, C. A., & Meloche, M. S. (1988). Strategies of product and process innovation: A loglinear analysis. *R&D Management*, *18*(1), 13–21.
Carayannis, E., & Alexander, J. (1999). Winning by co-opeting in strategic government–university–industry R&D partnerships: The power of complex, dynamic knowledge networks. *The Journal of Technology Transfer*, *24*(2–3), 197–210.
Cepeda-Carrión, G., Cegarra-Navarro, J. G., & Leal-Millan, A. (2012). Finding the hospital-in-the-home units' innovativeness. *Management Decision*, *50*(9), 1596–1617.
Chang, C. H., & Chen, Y. S. (2012). The determinants of green intellectual capital. *Management Decision*, *50*(1), 74–94.
Chen, M. J. (2008). Reconceptualizing the competition–cooperation relationship: A transparadox perspective. *Journal of Management Inquiry*, *17*(4), 288–304.
Cimon, Y. (2004). Knowledge-related asymmetries in strategic alliances. *Journal of Knowledge Management*, *8*(3), 17–30.
Clarkson, M., Fink, M., & Kraus, S. (2007). Industrial clusters as a factor for innovative-drive in regions of transformation and structural change: A comparative analysis of east Germany and Poland. *Journal of East European Management Studies*, *14*(4), 340–364.
Collings, L. M., Fidler, P. L., Wugalter, S. E., & Long, J. D. (1993). Goodness-of-fit testing for latent class models. *Multivariate Behavioral Research*, *28*(3), 375–389.
Cooke, P. (2001). *Knowledge economies: Cluster, learning & co-operative advantage.* London: Routledge.
Curran, J., & Blackburn, R. A. (2001). *Researching the small enterprise.* London: SAGE.
Dagnino, G. B. (2009). Coopetition strategy. In G. B. Dagnino, & E. Rocco (Eds.), *Coopetition strategy: Theory, experiments and cases: 25–43*. Oxon: Routledge.
DeMartino, R., Neck, H. M., Dwyer, P. A., & Treese, C. (2012). Radical innovation in medium-sized enterprises: An exploratory study of strategic intent and innovation process. *International Journal of Entrepreneurship and Innovation Management*, *15*(3), 216–234.

Deshpandé, R., Farley, J. U., & Webester, F. E. (1993). Corporate culture, customer orientation, and innovativeness in Japanese firms: A quadrad analysis. *Journal of Marketing*, *57*(1), 23–37.

Dewar, R. D., & Dutton, J. E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, *32*(11), 1422–1433.

Dubois, A., & Frederiksson, P. (2008). Cooperating and competing in supply networks: Making sense of a triadic sourcing strategy. *Journal of Purchasing & Supply Management*, *14*(3), 170–179.

Dussage, P., Garette, B., & Mitchell, W. (2000). Learning from competing partners: Outcomes and durations of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal*, *21*(2), 99–126.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, *14*(4), 532–550.

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research.* London: SAGE Publications.

European Comission (2003). *SME definition: Comission recommendation of the 06 May 2003.* Brussels: EU Commission.

Felício, J. A., Rodrigues, R., & Caldeirinha, V. R. (2012). The effect of intrapreneurship on corporate performance. *Management Decision*, *50*(10), 1717–1738.

Fink, M., & Keßler, A. (2010). Cooperation, trust and performance — Empirical results from three countries. *British Journal of Management*, *21*(2), 469–483.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Freel, M. S. (2000). Barriers to product innovation in small manufacturing firms. *International Small Business Journal*, *18*(2), 60–80.

Fynes, B., de Búrca, S., & Marshall, D. (2004). Environmental uncertainty, supply chain relationship quality and performance. *Journal of Purchasing and Supply Management*, *10*(4–5), 179–190.

Ganguli, S. (2007). Coopetition models in the context of modern business. *The ICFAI Journal of Marketing Management*, *6*(4), 6–16.

Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management*, *19*(2), 110–132.

Gassmann, O., Zeschky, M., Wolff, T., & Stahl, M. (2010). Crossing the industry-line: Breakthrough innovation through cross-industry alliances with 'non-suppliers'. *Long Range Planning*, *43*(5–6), 639–654.

Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A structural approach to assessing innovation: Construct development of innovation locus, type and characteristics. *Management Science*, *48*(9), 1103–1122.

Gatingnon, H., & Yuereb, J. M. (1997). Strategic orientation of the firm and new product performance. *Journal of Marketing Research*, *34*(1), 77–90.

George, G., Zahra, S. A., & Wood, D. R. (2002). The effects of business–university alliances on innovative output and financial performance: A study of publicly traded biotechnology companies. *Journal of Business Venturing*, *17*(6), 577–609.

Gnyawali, D. R., He, J., & Madhavan, R. (2006). Impact of co-opetition on firm competitive behavior: An empirical examination. *Journal of Management*, *32*(4), 507–530.

Gnyawali, D. R., He, J., & Madhavan, R. (2008). Co-opetition. Promises and challenges. In C. Wankel (Ed.), *The 21st century management: A reference handbook* (pp. 386–398). Thousand Oaks, CA: SAGE Publications.

Gnyawali, D. R., & Madhavan, R. (2001). Cooperative networks and competitive dynamics: A structural embeddedness perspective. *Academy of Management Review*, *26*(3), 431–445.

Gnyawali, D. R., & Park, B. -J. (2009). Co-opetition and technological innovation in small and medium-sized enterprises: A multilevel conceptual model. *Journal of Small Business Management*, *47*(3), 308–330.

Gnyawali, D. R., & Park, B. -J. (2011). Co-opetition between giants: Collaboration with competitors for technological innovation. *Research Policy*, *40*(5), 650–663.

Gomes-Casseres, B. (1994). Group versus group: How alliance networks compete. *Harvard Business Review*, *72*(4), 62–74.

Gomes-Casseres, B. (1997). Alliance strategies of small firms. *Small Business Economics*, *9*(1), 33–44.

Govindarajan, V., & Kopalle, P. K. (2006). Disruptiveness of innovations: Measurement and an assessment of reliability and validity. *Strategic Management Journal*, *27*(2), 189–199.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, *17*(Winter Special Issue), 109–122.

Grant, R. M., & Baden-Fuller, C. (2004). A knowledge accessing theory of strategic alliances. *Journal of Management Studies*, *41*(1), 61–84.

Hagenaars, J. A., & McCutscheon, A. (2002). *Applied latent class analysis.* New York: Cambridge University Press.

Hamel, G., Doz, Y., & Prahalad, C. K. (1989). Collaborate with your competitors and win. *Harvard Business Review*, *67*(1), 133–139.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, *44*(1), 82–111.

Hoang, H., & Rothaermel, F. T. (2005). The effect of general and partner-specific alliance experience on joint R&D project performance. *Academy of Management Journal*, *48*(2), 332–345.

Holmqvist, M. (1999). Learning in imaginary organizations: Creating interorganizational knowledge. *Journal of Organizational Change Management*, *12*(5), 419–438.

Huarng, K. H., Mas-Tur, A., & Yu, T. H. K. (2012). Factors affecting the success of women entrepreneurs. *International Entrepreneurship and Management Journal*, *8*(4), 487–497.

Inkpen, A. C. (2000). A Note on the dynamics of learning alliances: Competition, cooperation, and relative scope. *Strategic Management Journal*, *21*(7), 775–779.

Inkpen, A. C., & Currall, S. C. (2004). The coevolution of trust, control, and learning in joint ventures. *Organization Science*, *15*(5), 586–599.

Jedidi, K., Jagpal, H., & DeSarbo, W. S. (1997). Finite-mixture structural equation models for response-based segmentation and unobserved heterogeneity. *Marketing Science*, *16*(1), 39–59.

Jeng, J. F., & Bailey, T. (2012). Assessing customer retention strategies in mobile telecommunications: A Hybrid MCDM approach. *Management Decision*, *50*(9), 1570–1595.

Kale, P., & Singh, H. (2007). Building firm capabilities through learning: the role of the alliance learning process in alliance capability and firm-level alliance success. *Strategic Management Journal*, *28*(10), 981–1000.

Kale, P., Singh, H., & Perlmutter, H. (2000). Learning and protection of proprietary assets in strategic alliances: Building relational capital. *Strategic Management Journal*, *21*(3), 217–237.

Kelley, D. J., & Rice, M. P. (2002). Advantage beyond founding — The strategic use of technologies. *Journal of Business Venturing*, *17*(1), 41–57.

Khanna, T., Gulati, R., & Nohria, N. (1998). The dynamics of learning alliances: Competition, cooperation, and relative scope. *Strategic Management Journal*, *19*(3), 193–210.

Kline, S., & Rosenberg, N. (1986). An overview of innovation. In R. Landau, & N. Rosenberg (Eds.), *The positive sum strategy — Harnessing technology for economic growth: 275–304*. Washington DC: National Academy Press.

Knudsen, M. P. (2007). The relative importance of interfirm relationships and knowledge transfer for new product development success. *Journal of Product Innovation Management*, *24*(2), 117–138.

Kock, S., Nisuls, J., & Söderqvist, A. (2010). Co-opetition: a source of international opportunities in Finnish SMEs. *Competitiveness Review: An International Business Journal Incorporating Journal of Global Competitiveness*, *20*(2), 111–125.

Kotabe, M., & Swan, K. S. (1995). The role of strategic alliances in high-technology new product development. *Strategic Management Journal*, *16*(8), 621–636.

Lado, A. A., Boyd, N. G., & Hanlon, S. C. (1997). Competition, cooperation, and the search for economic rents: A syncretic model. *Academy of Management: The Academy of Management Review*, *22*(1), 110–141.

Lanza, S. T., Collings, L. M., Lemmon, D. R., & Schafer, J. L. (2007). PROC LCA: A SAS procedure for latent class analysis. *Structural Equation Modeling*, *14*(4), 671–694.

Larsson, R., Bengtsson, L., Henriksson, K., & Sparks, J. (1998). The interorganizational learning dilemma: Collective knowledge development in strategic alliances. *Organization Science*, *9*(3), 285–305.

Lasagni, A. (2012). How can external relationships enhance innovation in SMEs? New evidence for Europe. *Journal of Small Business Management*, *50*(2), 310–333.

Lazarsfeld, P., & Henry, N. (1968). *Latent structure analysis.* New York: Houghton-Mifflin.

Lazoi, M., Ceci, F., Corallo, A., & Secundo, G. (2011). Collaboration in an aerospace SMEs cluster: Innovation and ICT dynamics. *International Journal of Innovation & Technology Management*, *8*(3), 393–414.

Lechner, C., Dowling, M., & Welpe, I. (2006). Firm networks and firm development: The role of the relational mix. *Journal of Business Venturing*, *21*(4), 514–540.

Lee, R. P., & Johnson, J. L. (2010). Managing multiple facets of risk in new product alliances. *Decision Sciences*, *41*(2), 271–300.

LeRoy, P., & Yami, S. (2009). Managing strategic innovation through coopetition. *International Journal of Entrepreneurship and Small Business*, *8*(1), 61–73.

Levy, M., Loebbecke, C., & Powell, P. (2003). SMEs, co-opetition and knowledge sharing: The role of information systems. *European Journal of Information Systems*, *12*(1), 3–17.

Luo, Y. D. (2005). How important are shared perceptions of procedural justice in cooperative alliances? *Academy of Management Journal*, *48*(4), 695–709.

Luo, X., Slotegraaf, R. J., & Pan, X. (2006). Cross-functional "coopetition": The simultaneous role of cooperation and competition within firms. *Journal of Marketing*, *70*(April 2006), 67–80.

Ma, H. (1999). Anatomy of competitive advantage: A SELECT framework. *Management Decision*, *37*(9), 709–718.

Mariani, M. M. (2009). Emergent coopetitive and cooperative strategies in interorganizational relationships. Empirical evidence from Australian and Italian operas. In G. B. Dagnino, & E. Rocco (Eds.), *Coopetition strategy: Theory, experiments and cases* (pp. 166–190). Oxon: Routledge.

Mcdermott, C., & Handfield, R. (2000). Concurrent development and strategic outsourcing — Do the rules change in breakthrough innovation? *Journal of High Technology Management Research*, *11*(1), 35–57.

Merrifield, D. B. (2007). Strategic collaborations — Essence of survival. *Research Technology Management*, *50*(2), 10–14.

Meyer, H. (1998). My enemy, my friend. *Journal of Business Strategy*, *19*(5), 10–16.

Mezias, S. J., & Glynn, M. A. (1993). The 3 faces of corporate renewal — Institution, revolution, and evolution. *Strategic Management Journal*, *14*(2), 77–101.

Miotti, L., & Sachwald, F. (2003). Co-operative R&D: Why and with whom? An integrated framework of analysis. *Research Policy*, *32*(8), 1481–1499.

Molina-Azorin, J. F., Lopez-Gamero, M. D., Pereira-Moliner, J., & Pertusa-Ortega, E. M. (2012). Mixed methods studies in entrepreneurship research: Applications and contributions. *Entrepreneurship and Regional Development*, *24*(5–6), 425–456.

Morris, M. H., Kocak, A., & Özer, A. (2007). Coopetition as a small business strategy: Implications for performance. *Journal of Small Business Strategy*, *18*(1), 35–55.

Muthen, B. (2003). Statistical and substantive checking in growth mixture modeling. *Psychological Methods*, *8*(3), 369–377.

Newell, S., Bresnen, M., Edelman, L., Scarbrough, H., & Swan, J. (2006). Sharing knowledge across projects: Limits to ICT-led project review practices. *Management Learning*, *37*(2), 167–185.

Nielsen, S. L., & Lassen, A. H. (2012). Images of entrepreneurship: Towards a new categorization of entrepreneurship. *International Entrepreneurship and Management Journal*, *8*(1), 35–53.

Nieto, M. J., & Santamaria, L. (2007). The importance of diverse collaborative networks for the novelty of product innovation. *Technovation*, *27*(6–7), 367–377.

Nylund, K. L., Asparouhov, T., & Muthe'n, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(4), 535–569.

Okhuysen, G. A., & Eisenhardt, K. M. (2002). Integrating knowledge in groups: How formal interventions enable flexibility. *Organization Science*, *13*(4), 370–386.

Oliver, A. L. (2004). On the duality of competition and collaboration: Network-based knowledge relations in the biotechnology industry. *Scandinavian Journal of Management*, *20*(1–2), 151–171.

Perks, H., & Easton, G. (2000). Strategic alliances — Partner as customer. *Industrial Marketing Management*, *29*(4), 327–338.

Phene, A., Fladmoe-Lindquist, K., & Marsh, L. (2006). Breakthrough innovation in the U.S. biotechnology industry: The effects of technological space and geographic origin. *Strategic Management Journal*, *27*(4), 369–388.

Porter, M. E. (2000). Location, competition, and economic development: local clusters in a global economy. *Economic Development Quarterly*, *14*(1), 15–34.

Quintana-García, C., & Benavides-Velasco, C. A. (2004). Cooperation, competition, and innovative capability: A panel data of European dedicated biotechnology firms. *Technovation*, *24*(12), 927–938.

Rice, M. P., O'Connor, G. C., Peters, L. S., & Morone, J. G. (1998). Managing discontinuous innovation. *Research-Technology Management*, *41*(3), 52–58.

Ritala, P., & Hurmelinna-Laukkanen, P. (2009). What's in it for me? Creating and appropriating value in innovation-related coopetition. *Technovation*, *29*(12), 819–828.

Rothaermel, F. T. (2001). Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, *22*(6–7), 687–699.

Salavou, H., & Lioukas, S. (2003). Radical product innovations in SMEs: The dominance of entrepreneurial orientation. *Creativity & Innovation Management*, *12*(2), 94–108.

Sanchez, R., & Heene, A. (1996). Competence perspectives on strategic learning and knowledge management. In A. Heene, & R. Sanchez (Eds.), *Strategic learning and knowledge management* (pp. 3–18). Chichester: Wiley & Sons.

Scarbrough, H., Swan, J., Laurent, S., Bresnen, M., Edelman, L., & Newell, S. (2004). Project-based learning and the role of learning boundaries. *Organization Studies*, *25*(9), 1579–1600.

Shan, W., Walker, G., & Kogut, B. (1994). Interfirm cooperation and start-up innovation in the biotechnology Industry. *Strategic Management Journal*, *15*(5), 387–394.

Song, M., & Di Benedetto, C. A. (2008). Supplier's involvement and success of radical new product development in new ventures. *Journal of Operations Management*, *26*(1), 1–22.

Srivastava, M. K., & Gnyawali, D. R. (2011). When do relational resources matter? Leveraging portfolio technological resources for breakthrough innovation. *Academy of Management Journal*, *54*(4), 797–810.

Tracey, J. B. (2012). A contextual, flexibility-based model of the HR-firm performance relationship. *Management Decision*, *50*(5), 909–924.

Tushman, M., & O'Reilly, C. A. (2002). *Winning through innovation: A practical guide to leading organizational change and renewal.* Boston: Harvard Business School Press.

Utterback, J. M. (1987). Innovation and industrial evolution in manufacturing industries. In B. R. Guile, & H. Brooks (Eds.), *Technology and global industry* (pp. 16–48). Washington DC: National Academy Press.

Vaiman, V., Scullion, H., & Collings, D. (2012). Talent management decision making. *Management Decision*, *50*(5), 925–941.

Van de Ven, A. H. (1986). Central problems in the management of innovation. *Management Science*, *32*(5), 590–607.

Wang, M., & Hanges, P. J. (2011). Latent class procedures: Applications to organizational research. *Organizational Research Methods*, *14*(1), 24–31.

Winch, G. W., & Bianchi, C. (2006). Drivers and dynamic processes for SMEs going global. *Journal of Small Business and Enterprise Development*, *13*(1), 73–88.

Woodside, A. G. (2010). Bridging the chasm between survey and case study research: Research methods for achieving generalization, accuracy, and complexity. *Industrial Marketing Management*, *39*(1), 64–75.

Woodside, A. G., & Biemans, W. (2005). Managing relationships, networks, and complexity in innovation, diffusion, and adoption processes. *The Journal of Business and Industrial Marketing*, *20*(7), 335–338.

Worren, N., Moore, K., & Cardona, P. (2002). Modularity, strategic flexibility, and firm performance: A study of the home appliance industry. *Strategic Management Journal*, *23*(12), 1123–1140.

Zeng, S. X., Xie, X. M., & Tam, C. M. (2010). Relationship between cooperation networks and innovation performance of SMEs. *Technovation*, *30*(3), 181–194.

Zerbini, F., & Castaldo, S. (2007). Stay in or get out of the Janus? The maintenance of multiplex relationships between buyers and sellers. *Industrial Marketing Management*, *36*(7), 941–954.

Zhou, K. Z., Kin, C., Tse, Y., & Tse, D. K. (2005). The effects of strategic orientations on technology- and market-based breakthrough innovations. *Journal of Marketing*, *69*(2), 42–60.