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OPEN INNOVATION AND INTERNATIONALIZATION OF HIGH-TECH SMEs': THE DOUBLE MODERATING ROLE OF PROACTIVE MARKET ORIENTATION

Abstract:

The purpose of this paper is to examine the relationship between open innovation, internationalization and commercialization among high-tech SMEs, as well as the moderating role of proactive market orientation at two different stages. We contribute not only to the scant empirical evidence on open innovation among SMEs, but further link it to internationalization of high-tech SMEs and specifically address the issue of proactive market orientation as a potential double moderator. Our results support the positive link between open innovation and internationalization among SMEs. We also show that proactive market orientation moderates positively open innovation-internationalization relationship while reactive market orientation is negatively related to high-tech SME internationalization. This provides deeper insight into the previously examined relationship of innovation-internationalization of traditional SMEs. Several managerial implications for high-tech SMEs are also outlined at the end.

Keywords: high-tech SMEs, internationalization, proactive market orientation, open innovation, innovation commercialization

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INTRODUCTION

Lew, Sinkovics & Kuivalainen (2013, p. 1102) point out that "studies on the behavior of technology-based and innovative firms are not as common in the IB literature as would be expected" and that a large empirical gap exists related to the internationalization of high-tech firms through various types of innovation and strategic orientations. While there may be growing empirical work on the general relationship between innovation and internationalization (Altomonte et al., 2013; Cassiman & Golovko, 2011) and vice-versa (Ren, Eisingerich & Tsai, 2013; Love & Ganotakis, 2013; Garcia, Avella & Fernandez, 2012) among firms, less is known about the specifics of high-tech SMEs (Ren, Eisingerich & Tsai, 2013; Love & Ganotakis, 2013). Such firms tend to innovate more openly through networks due to resource constraints (Chetty & Stangl, 2010), need to develop specific networking marketing capabilities (Ren, Eisingerich & Tsai, 2014) and are pushed to more strongly commercialize their innovations internationally in the market (Suh & Kim, 2014).

The purpose of this paper is to examine the relationship between open innovation, internationalization and commercialization among high-tech SMEs, as well as the moderating role of proactive market orientation at two different stages. By acknowledging the specific nature of innovation through networks among resource-constrained high-tech SMEs we employ Chesbrough's (2003) open innovation concept and test its impact on high-tech SMEs' internationalization. This provides a long called for empirical contribution to the scant literature on open innovation among SMEs (Gassmann, Enkel & Chesbrough, 2010). Secondly, by testing

proactive market orientation as a double moderator in the relationships between open innovation and internationalization, as well as internationalization and commercialization of innovation abroad, we add to the literature on the role of strategic orientations in the upstream internationalization process of high-tech SMEs. Our results offer several important theoretical implications for the open innovation, SME internationalization and industrial marketing literatures, as well as provide important managerial implications.

THEORETICAL FRAMEWORK

Figure 1 shows our model. The model tests the role of proactive market orientation as a double moderator between open innovation and internationalization, as well as between internationalization and innovation commercialization abroad among high-tech SMEs.

**** INSERT FIGURE 1 ABOUT HERE ****

In their analysis and overview of past, present and future research of SME internationalization Ruzzier, Hisrich & Antoncic (2006) traced the link between innovation and SME internationalization as far as Rogers' (1962) work on innovation diffusion. His work has influenced the so-called Innovation-related model (I-model) of internationalization in the IB literature, which is particularly relevant for SMEs (Pykäläinen & Ojala, 2009). Like other step-wise internationalization models, the I-model depicts a series of step-wise internationalization stages which Leonidou & Katsikeas (1996) have generally divided into the pre-engagement, initial and advanced phases of internationalization. However, within the I-model of internationalization the advancement across the various internationalization stages is not only a learning- and contingency-based process, but can be considered as an innovation process very much similar to introducing a new product to the market; and thus prone to possible failure

(Gemser, Brand & Sorge, 2004). In most cases this "innovation" is of incremental nature and corresponds to a gradual step-wise internationalization process characterized by the Uppsala model. In other cases, however, it can also be more radical and can lead to different types of SME internationalization patterns. This is the case for high-tech SMEs with a strong internationalization propensity at an earlier stage of their life-cycle (Love & Ganotakis, 2013).

(Open) Innovation and internationalization

Knowledge and innovation are important sources of competitive advantage for all types of (international) firms (Chetty & Stangl, 2010), but particularly for SMEs (Suh & Kim, 2014). Internationalization can be a viable strategy for SMEs needing to recoup invested resources in innovation (R&D) and marketing to build sustainable competitive advantage (Conant, Mokwa & Varadarajan, 1990). Radas & Božič (2009) believe that "innovations may be even more important for SMEs than for large firms", since SME competitiveness is believed to be more fundamentally related to innovation than in large firms where other sources of competitive advantage may be utilized (p. 438). While "internationalization and innovation are linked" through the importance of networks (Chetty & Stangl, 2010, p. 1729), the nature of the relationship between innovation and internationalization is more "sensitive" among SMEs (Singh, Garg & Desmukh, 2008); especially high-tech SMEs (Sedoglavich, 2012).

According to the Resource-based view of the firm SMEs have limited resources for both innovation (Love & Ganotakis, 2013) and internationalization (Singh, Garg & Desmukh, 2008). In terms of specific types of resource constraints SMEs tend to have less internal funds and display lower levels of R&D investment (Oerlemans, Meeus, & Boekema, 1998), have more limited human capital, and face difficulty in attracting and keeping high-skilled staff, which is

quite important for innovation (Ghobadian & Gallear, 1996). They also tend to have narrower strategic orientations, which are not always linked to their operations and organizational capabilities (Ruokonen & Saarentko, 2009). Because of these constraints, "external resources and complementary assets" (Chetty & Stangl, 2010, p. 1726) play a much more important role for SMEs, especially high-tech SMEs. This increases the importance of networks, which have been shown to play a particularly important role in SME internationalization (Chetty & Stangl, 2010). Networks are also important in terms of innovation, as they extend a firm's knowledge base (Kogut, 2000), provide access to external resources (i.e. financial, human, information) and capabilities (i.e. commercialization, risk mitigation), as well as facilitate learning through interaction (Chetty & Stangl, 2010).

Chesbrough, Vanhaverbeke & West (2006, p. 1) define open innovation as: "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively". Gassmann & Enkel (2004) distinguished between three archetypes of open innovation (philosophy), namely: the outside-in, the inside-out and the coupled process archetype. While the outside-in archetype uses external knowledge sourcing and leverages specific resources and capabilities from suppliers, competitors and research institutions, the inside-out archetype is more closely connected to revenue generation from commercialization, sales of intellectual property, transferring ideas to external environment and establishing dominance among competing standards. The coupled process archetype balances both of the approaches in a sort of feedback-feedforward logic in order to foster greater specialization and reap the benefits of complementarity in an alliance or network logic.

The adoption of the open innovation concept introduced by Chesbrough (2003) is important not just for large firms, but also for SMEs (Chesbrough, 2010). This is because,

"SMEs need to heavily draw on their networks to find missing innovation resources, and due to their smallness, they will be confronted with the boundaries of their organizations rather sooner than late" (Van de Vrande et al., 2009, p. 426). While the empirical evidence on the adoption of open innovation among SMEs is still quite scant, work by Gassmann, Enkel & Chesbrough (2010) outlines the research link between open innovation and internationalization of SMEs as one of the most promising future research directions which will hopefully produce more empirical evidence related to open innovation and internationalization of SMEs.

Empirical evidence from high-tech SMEs shows that "internationalization and innovation combined is the most advisable option when domestic markets are limited" (Sedoglavich, 2012, p. 444). While technology and innovation can be used to build competitive advantage in order to be leveraged through internationalization according to the so called I-model of internationalization, the learning and experience obtained in international markets (Love & Ganotakis, 2013), particularly those more competitive ones (Radas & Božič, 2009), further impacts commercialization of innovation by entering new types of networks (Suh & Kim, 2014) which allow them to penetrate new potential markets and market segments abroad (Slater & Mohr, 2006), as well as promotes additional innovation in what is called learning from exporting (Love & Ganotakis, 2013). *Hypothesis 1: There is a positive relationship between the use of open innovation (philosophy) and the internationalization of high-tech SMEs.*

Role of market orientation

Open innovation should be a viable option for stimulating SMEs' internationalization, but its effects may be subject to particular boundary conditions (Van de Vrande et al., 2009; Gassmann, Enkel & Chesbrough, 2010). A particularly salient factor in this relationship may be a firm's market orientation, as a specific type of strategic orientation (Matsuno & Mentzer,

2000). The concept of market orientation has emerged as a bedrock marketing concept (Deshpande & Farley, 1998) following the seminal works by Kohli & Jaworski (1990) and Narver & Slater (1990). The former conceptualized it as a behavior connected to generation, dissemination and responsiveness to market intelligence. The latter saw it more as a value-based organizational culture related to customer orientation, competitor orientation and interfunctional coordination. Through its market orientation "a business aims at sustainable competitive advantage and business performance by creating superior value for its customers" (Ruokonen, 2008, p. 143). In this regard market orientation is a central tenant of firm competitive advantage through creating unique and difficult to imitate value for customers (Liao et al., 2011).

Market orientation has been closely linked to business performance (Shoham, Rose & Kropp, 2005; Kirca, Jayachandran & Bearden, 2005) and examined both in SME context (Blankson & Cheng, 2005), as well as in terms of internationalization (Cadogan et al., 2002; Cadogan & Diamantopoulos, 1995). Cadogan & Diamantopoulos (1995) examined Kohli & Jaworski's (1990) and Narver & Slater's (1990) conceptualizations of market orientation and re-conceptualized the concept of market orientation to fit the challenges of firms operating internationally. According to their re-conceptualization market orientation related to generation, dissemination and responsiveness to market intelligence, which were all "characterized by a customer and competitor orientation and guided by a coordination mechanism which ensures that these activities are carried out effectively and efficiently" (Cadogan & Diamantopoulos, 1995, p. 55).

Cadogan & Diamantopoulos (1995, p. 56) also pointed to "additional manifestations" of responsiveness to market intelligence in international markets, while coordination mechanisms needed to take into account organizational characteristics specific for international organizations,

like e.g. doubling and separating functions for specific international markets, blurred organizational boundaries and agent-principal coordination problems between units in home and foreign markets. Subsequent work by Cadogan et al. (2002) showed that the environment plays a more important role in moderating the role between export market orientation and export firm performance. While export market orientation was generally established as an important determinant of export performance, this relationship was influenced by the level of market turbulence and varied in terms of specific types of export performance between product and service export firms. For example, high export market orientation did not lead to superior export performance in case of low levels of market turbulence for service firms (Cadogan et al., 2002).

There is a generally established positive link between market orientation and innovation in the marketing literature (Liao et al., 2011). Following the earlier works by Deshpande, Farley & Webster (1993) and Hurley & Hult (1998), Conrad (1999) considered the effects of specific types of organizational cultures. Calori & Sarnin (1991) reported that strategic orientation moderates the relationship between organizational culture and business performance. Li, Lin & Chu (2008) looked at different aspects of strategic orientation like strategic rigidity, strategic consensus, market opportunity appraisal and learning orientation and their moderating effects on the relationship between innovation and performance. Work on SMEs by Erdil, Erdil & Keskin (2004) and by Low, Chapman & Sloan (2007) also found strong correlations between innovation, market orientation and business performance.

The work by Laforet (2008) on SMEs (not high-tech) found a strong link between innovation and market orientation which was stronger among *prospector* SMEs pursuing a proactive orientation, compared to *defender* SMEs pursuing a reactive orientation. This is consistent with the innovation literature which has emphasized a clear link between the adoption

of proactive strategies and innovativeness (Laforet, 2008). It is also consistent with Narver, Slater & Maclachlan's (2004) distinction between proactive and reactive market orientation which has been in the marketing literature usually examined in terms of new product performance and success. Contrary to perceiving market orientation as a culture, Atuahene-Gima, Slater & Olson (2005) considered it an organizational capability and found a strong link between market orientation capabilities and product innovation. Their U-shaped/inverted U-shaped relationship between responsive/proactive market orientation and new product performance respectively shows that, while "the effects of responsive and proactive MO [market orientation] on new product program performance are more complex than previously theoretically argued and empirically examined" (Atuahene-Gima, Slater & Olson, 2005, p. 464). Voola & O'Cass (2010) and Tsai, Chou & Kuo (2008) came to similar conclusions. *Hypothesis 2: The positive relationship between open innovation and internationalization of high-tech SMEs is moderated by proactive market orientation.*

Commercialization of innovation

Plamberg (2006) understands innovation at the firm level as a tool in achieving market performance captured by "commercially-based" indicators such as, for example, market share, break-even and profitability. In his analysis of Finnish innovations in the 1980s and 1990s he found a strong and significant link between export of innovation and commercialization, as exporting firms more quickly reached break-even points and started generating cash flows by taking advantages in larger export market(s).

In exploring the paradigm of open innovation Chesbrough, Vanhaverbeke & West (2006) emphasized the tendency of SMEs to focus quicker on commercialization issues than large firms, which can again be linked to resource constraints (i.e. financial) and their overall market

vulnerability. Gassman, Enkel & Chesbrough (2010, p. 216) see commercialization of innovation as a "core competence" of growth-oriented firms. In SMEs, and particularly high-the SMEs, such growth tends to be more strongly linked to internationalization (Sedoglavich, 2012). In a study of internationalized SMEs from South Korea Suh & Kim (2014) found that internationally-leading SMEs tended to be more successful in their commercialization, since they are able to better utilize international partnerships, networks and alliances which play a crucial part in the process of commercialization. In understanding the exact mechanism of the positive impact of firm internationalization on commercialization activities the empirical results by Lew, Sinkovics & Kuivalainen (2013) showed that firm internationalization positively impacts so called exploratory capabilities of firms, which can in turn be seen as essential in the process of commercialization. While Slater & Mohr's (2006) work approaches the question of market selection from the perspective of Moore's (2014) innovation diffusion across various types of market segments (i.e. innovators, early adopters, early majority etc.), the relationship between market selection and innovation commercialization can also be extended to the question of foreign vs. domestic markets and specific internationalization patters of high-tech SMEs, particularly within the I-model of internationalization (Gankema, Snuiff & Zwart, 2000). *Hypothesis 3: There is a positive relationship between high-tech SME internationalization and innovation commercialization abroad.*

Slater & Mohr (2006) addressed most directly the relationship between strategic orientation of firms, innovation commercialization and market selection. They built on the work of Miles & Snow (1978) – which identified *prospectors*, *defenders* and *analyzers* as three alternative organizational archetypes in terms of linking organizational structures to product-market performance – and linked it to the market orientation literature (Kohli & Jaworski, 1990;

Narver & Slater, 1990) and the market strategy implementation literature (Matsuno & Mentzer, 2000; Slater & Olson, 2001). Slater & Mohr (2006) believed that a firm's strategic orientation (resulting in the development of specific resources and capabilities, as well as targeting of specific customer segments and markets) is the single most important aspect of understanding cross-firm differences in innovation commercialization which they connect to the so called innovator's dilemma (Christensen, 1997) and crossing the proverbial "chasm" in innovation diffusion to mass markets (Moore, 2014). Taking a more strategic perspective Ren, Eisingerich & Tsai (2014, p. 2) believe that marketing (and corresponding market orientation) "has a vital role to play for SMEs given that the development and commercialization of new products and services is informed by firms' marketing efforts".

Similarly to Slater & Mohr (2006) the importance of firms' strategic orientations for new product commercialization was also examined by Mu & Di Benedetto (2012) who found that market orientation has together with technology, entrepreneurial and networking orientation "concurrent positive effects on new product commercialization and that strategic orientations support each other in influencing new product commercialization performance" (p. 351). Specifically with regards to the impact of market orientation on new product commercialization performance Mu & Di Benedetto (2012) found that "market orientation is likely to enhance an organization's new product commercialization performance" (p. 340). Slater, Hult & Olson (2007) also drew on Miles & Snow's (1978) typology. Their analysis confirmed that *prospectors* were more inclined to target innovators and early adopters, which had a positive impact on performance, while targeting early majority had a negative impact on performance. *Analyzers* were more inclined to target early majority, which had a positive impact on performance, while targeting innovators had a negative impact on performance. *Hypothesis 4: The positive*

relationship between high-tech SME internationalization and innovation commercialization abroad is moderated by proactive market orientation.

METHODOLOGY AND DATA

Data

Our data set consists of a sample of 160 high-tech SMEs (with 5 to 250 employees) in Slovenia collected through a web-based questionnaire sent to all high-tech SMEs in Slovenia's business registry. High-tech SMEs were identified based on the guidelines from OECD's Oslo manual (2005) and the guidelines for the identification of high-tech manufacturing and Knowledge-intensive service (KIS) sectors by Eurostat (2009).Within the identified population of high-tech SMEs in Slovenia, only about 5% were high-tech manufacturing SMEs, while the rest belong to KIS sectors.

Web-based surveying was complemented by telephone reminders and follow-ups. The respondents were primarily managers responsible for innovation activities within their respective firms. According to the Innovation Union Scoreboard (2014) Slovenia is closest to the average innovation performance within EU-28 (Hollanders & Es-Sadki, 2014), and belongs to the so called *innovation follower* group of countries. As a new EU member states since 2004, and a small and highly-export oriented market economy (exports account for 60% of GDP) Slovenia can be thought of as a good yardstick for other new EU member states and their high-tech SMEs. A quarter of our sample was high-tech manufacturing SMEs, while the rest were service high-tech SMEs (KIS). In terms of size, roughly about 60% of the sample consists of SMEs with 5-10 employees, followed by SMEs with 11-50 employees (25%), and SMEs with 51-250 employees (15%). The median number of employees in the sample is 17 employees.

Methodology

In terms of construct operationalization, all the original questionnaire items are shown in Appendix 1. We used a reduced 7-item construct for open innovation taken from the original 15 measures developed by Rangus, Drnovšek and De Minin (2013). Internationalization of high-tech SMEs was measured with four items, which were adapted from the literature to fit the specific scope of high-tech SMEs' internationalization. The included the following four items:

- Domestic market is the most important market for us (reverse-coded item) (Radas & Božič, 2009).
- We followed our clients to foreign markets (Sharma & Majkgård, 1998; Grönroos, 1999).
- In the most important markets we have a leading or strong market position (Suh & Kim, 2014).
- We are present with various functions in our foreign markets, not just sales (i.e. also R&D, manufacturing, marketing etc.) (Hollenstein, 2005; Love & Ganotakis, 2013).

Proactive market orientation was operationalized as an 8-item construct with measures developed by Narver, Slater & MacLachlan (2004), while innovation performance was operationalized as a 9-item construct with measures developed by Tsai (1997) and Wang & Ahmed (2004). These measures have also been used and validated by Škerlavaj, Song & Lee (2010). While all the other constructs were measured on 7-point ordinal scales (1-lowest possible value, 7-highest possible value), innovation commercialization abroad was the only single-item operationalization, measured as a percentage of sales abroad with products aged three years or less. This measure was taken from Love & Ganotakis (2013), who used it as a proxy for commercialization of innovation in foreign markets by exporting high-tech SMEs. We applied a

three series of hierarchical regression analyses. The results are shown in Table 3. In the hierarchical moderated regression analysis models (Models 2 and 4) the predictor variables were mean-centred due to the interaction terms.

RESULTS

Descriptive statistics

Table 1 provides an overview of selected descriptive statistics, while Table 2 provides some additional descriptive statistics about innovation and internationalization characteristics of our high-tech SME sample, which were employed as control variables in our model.

**** INSERT TABLE 1 ABOUT HERE ****

As we can see from the Table 1 all of the multi-item constructs display very high internal reliability statistics, with Cronbach alpha values above .90. Generally speaking, the surveyed high-tech SMEs in the sample displayed quite a high level of proactive market orientation (mean score of 4.41 on a 7-point ordinal scale), followed by relatively high levels open innovation philosophy (4.25). The average level of internationalization was slightly lower, albeit still moderately high, with a mean score of 3.95. In terms of significant pair-wise correlations the internationalization construct was the only construct not to display significant pair-wise correlations with open innovation, or proactive market orientation, but it displays a significant pair-wise correlation coefficient with innovation commercialization abroad ($ß=.33$, $p < .01$).

**** INSERT TABLE 2 ABOUT HERE ****

With regards to additional indicators shown in Table 2 we can see that the high-tech SMEs in our sample have a large amount of different external collaboration partners (30.79 on average), display higher degree of reactive market orientation (4.65) than proactive market

orientation (4.41), invest a considerable share of sales in R&D (10.80), and are quite internationally oriented (on average generate only about a quarter of their sales in the domestic market and present in almost 20 different foreign markets).

Table 3 provides an overview of our key results based on our three-step hierarchical regression analyses approach. In terms of Hypothesis 1 (Model 1) we can see that open innovation is positively related to internationalization (β =.47, se = .20, $p < .05$), thus the hypothesis is supported. Among the various control variables, reactive market orientation is significantly negatively related to internationalization, whereas the percentage of turnover in R&D investments and the number of foreign markets is significantly positively related to internationalization, as can be expected.

In Model 2, we examined the moderating effect of proactive market orientation on the relationship between open innovation and internationalization. The interaction term was significant (γ = .09, se = .03, $p < .01$), indicating that for companies with stronger proactive market orientation, the relationship between open innovation and internationalization is even more positive. Thus, hypothesis 2 is also supported. However, based on the results from Model 1 we can further say that while reactive market orientation is significantly negatively related to internationalization of high-tech SMEs in our sample, proactive market orientation is a significant moderator on the positive relationship between open innovation and internationalization.

**** INSERT TABLE 3 ABOUT HERE ****

Models 3 and 4 focused on innovation commercialization abroad as the dependent variable. In Model 3, we examined the relationship between high-tech SMEs' internationalization and innovation commercialization abroad, which was found to be significant

and positive (β =.19, se = .08, $p < .05$); thus, supporting Hypothesis 4. Among the control variables, the percentage of turnover in R&D investments variable exhibited a strong positive significant relationship with innovation commercialization abroad, whereas other control variables were insignificantly related to it. In Model 4, we added the interaction term examining the moderating role of proactive market orientation on the relationship between internationalization and innovation commercialization abroad. This was found to be marginally significant (γ = .35, se = .20, $p < .10$), providing partial support for Hypothesis 5. More specifically, our results to this hypothesis indicate that in about nine times out of ten, we can claim that for high-tech SMEs with stronger proactive market orientation, the relationship between internationalization and innovation commercialization abroad is even more positive.

DISCUSSION

Theoretical implications

Most generally, our results strongly support the positive link between innovation and internationalization among SMEs (Pla-Barber & Alegre, 2007). We can extend this also to Chesbrough's (2003) open innovation and link it to the role of networks in the internationalization process of SMEs (Chetty & Stangl, 2010), since implementing the open innovation philosophy requires the use of external innovation partners. This is particularly true for high-tech SMEs in so called small states, which are limited not only by a considerably weaker "home diamond", but also need to develop non-location-bound firm-specific advantages (NLB FSAs) through a fundamentally different recombination process of turning home country-specific advantages (CSAs) into firm-specific advantages (FSAs) (Verbeke, 2009; Rugman & Verbeke, 1993). For high-tech SMEs in particular, knowledge is the cornerstone of their FSAs.

However, high-tech SMEs do not only exploit their knowledge in foreign markets to achieve growth of the firm and better performance, but also create and extend it in foreign markets (host CSAs) to offset limited home country CSAs (Sedoglavich, 2012). This suggests learning from exporting to have a particularly important role for high-tech SMEs (Love & Ganotakis, 2013), as such a recombination process is especially sensitive to resource limitations among high-tech SMEs – i.e. limitation related to endowed factors (i.e. natural factors), advanced factors (i.e. financial resources), human capital (Wan & Hoskisson, 2003) – as well as weaker institutions (Williams et al., 2014).

Because of this, the adoption of open innovation principles, generally seen in the innovation literature to be beneficial to any firm (Chesbrough, Vanhaverbeke & West, 2006; Chesbrough, 2003), is particularly important for SMEs (Chesbrough, 2010); and especially high-tech SMEs (Pustovrh et al., 2013). Despite this, SMEs have received relatively little research attention in the open innovation literature compared to large firms (Gassmann, Enkel & Chesbrough, 2010). Thus, our results are important for both the innovation literature and the SME internationalization literature, since they provide empirical evidence related to SME open innovation, as well as further add to the emerging literature on the link between various types of innovation philosophies and SME internationalization (Chetty & Stangl, 2010; Pla-Barber & Alegre, 2007).

The second important contribution of our research is related to market orientation, as a strategic orientation of the firm. Our results confirm previous work by Matsuno & Mentzer (2000) and show that proactive market orientation moderates the positive relationship between open innovation and high-tech SME internationalization. These results are also consistent with empirical SME evidence by Laforet (2008), Erdil, Erdil & Keskin (2004), and by Low, Chapman

& Sloan (2007), which have all found strong links between proactive strategic orientations and SME innovation. Our evidence complements their work by confirming this also for the link between open innovation and SME internationalization. Even more important, we believe our results related to proactive market orientation provide new insight into the actual recombination process of turning home country-specific advantages (CSAs) into firm-specific advantages (FSAs) in high-tech SMEs, which is also consistent with empirical evidence by Atuahene-Gima, Slater & Olson (2005). They considered proactive market orientation as a specific firm capability. Our results directly correspond to Atuahene-Gima, Slater & Olson's (2005) U-shaped/inverted U-shaped relationship between responsive/proactive market orientation and new product performance. We show that proactive market orientation moderates positively open innovation-internationalization relationship while reactive market orientation is negatively related to high-tech SME internationalization. This provides deeper insight into the previously examined relationship of innovation-internationalization of traditional SMEs.

Lastly, our empirical evidence related to innovation commercialization abroad provides valuable theoretical implications in understanding high-tech SMEs, their innovation and internationalization. It particularly points to two specific issues. First, consistent with Sedoglavich (2012) internationalization can be seen as a clear mediator between open innovation and innovation commercialization among high-tech SMEs. It also shows that for high-tech SMEs seeking growth in international markets commercialization of their innovation is indeed as distinctive strategic competence (Gassman, Enkel & Chesbrough, 2010). These findings are particularly valuable for the open innovation literature, as they will hopefully motivate scholars in the field to incorporate a stronger IB focus in their future work. Likewise, IB scholars should

pay more attention in their future research not only to various types of firm innovation, but also to various types of innovation philosophies/orientations driving such innovation.

Second, proactive market orientation does not only moderate the open innovation-internationalization relationship, but also subsequent internationalization-innovation commercialization relationship abroad. This evidence complements the work by Suh & Kim (2014) and extends it to high-tech SMEs, since internationally-leading SMEs can be distinguished from internationalized SMEs by their higher level of proactive market orientation. Linking our results to Lew, Sinkovics & Kuivalainen's (2013) work on upstream internationalization processes and the role of exploratory capabilities, we can see that while proactive market orientation is an important double moderator in our model, its role becomes stronger the closer we get to the market.

Managerial implications

In terms of managerial implications, our results emphasize the need for integrated business functions and a holistic strategy, where managers should particularly consider integrating innovation and internationalization strategy. In high-tech SMEs an international angle should be incorporated into their innovation strategy not just on the side of input processes, but also output processes. At the same time, commercialization of innovation *abroad* should be considered as an essential cornerstone of any high-tech SME's strategy. In this regard, managers should focus on identifying and developing the necessary exploratory capabilities to support these processes. Among such capabilities market exploration appears to be a particularly crucial capability and should not be understood in the narrow sense of exploring simply ones domestic

market. Managers need to understand that both innovation and internationalization are diffusion-based processes which require overlapping resources, processes and capabilities.

However, open innovation, internationalization and commercialization of innovation should be considered by managers as necessary, yet insufficient steps towards firm performance and growth. This needs to be further accompanied by strong proactive market orientation which will not only open the firm in terms of its innovation internationally, but seek to commercialize innovation in foreign markets. It allows firms to grow and gain new knowledge which in turn can be recombined into NLB FSAs in a feedforward-feedback process. Proactive market orientation which integrates open innovation and internationalization remains a challenge for most high-tech SMEs in any country. However, we should not ignore the observation that SMEs are vulnerable to imitation and unwanted knowledge dissemination, as they rarely protect their R&D processes and outputs. Although the existing framework of IP protection is less adjusted to SMEs, greater internationalization of R&D, innovation cooperation outside national and regional borders and open innovation on international scale is nevertheless recommendable for high-tech SMEs.

CONCLUSION

Sample size, the cross-sectional nature of our study and the use of single respondents are all limitations of our research. Also, despite being the most widely used measure of commercialization of innovation (Love & Ganotakis, 2013), we are aware that percentage of sales of products up to three years old in foreign markets may not be the most comprehensive indicator of innovation commercialization abroad by high-tech SMEs, particularly in terms of understanding exploratory capabilities and upward internationalization processes of high-tech SMEs.

Our empirical results show that the positive relationship between open innovation and internationalization is importantly moderated by proactive market orientation. They further show internationalization to be a particularly important mediator between open innovation and innovation commercialization abroad among high-tech SMEs, and that the relationship between internationalization and innovation commercialization abroad is even more strongly moderated by proactive market orientation. We hope that this research has illustrated the complementarities between the open innovation and SME internationalization literatures, and will lead scholars to advance both fields through more open common cooperation.

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Figure 1: Antecedents and outcomes of high-tech SMEs' internationalization – proactive market orientation as a double moderator

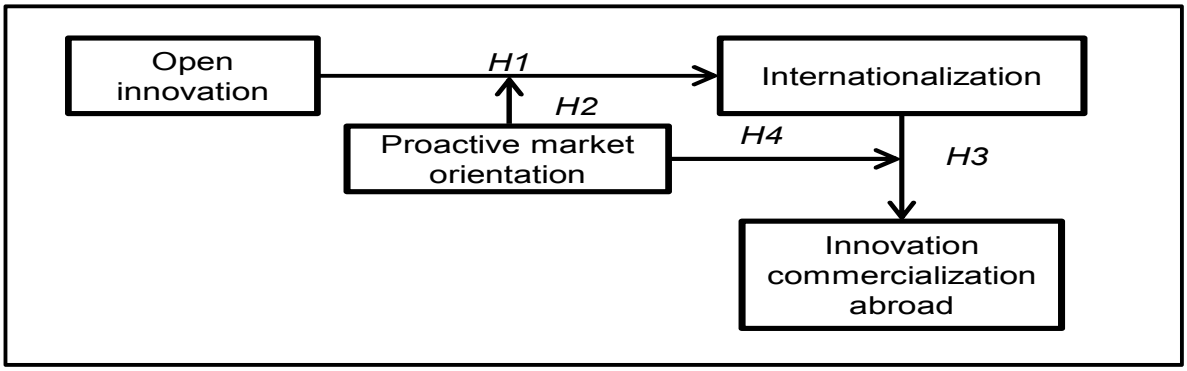

Table 1: Means, standard deviations, and correlations for our conceptual model (7-point ordinal scales)

Constructs/variables	Mean *(Std. dev.)*	1	2	3	4
1-Open innovation	4.25 *(1.56)*	**(.92)**			
2-Proactive market orientation	4.41 *(2.31)*	.63**	**(.94)**		
3-Internationalization	3.95 *(1.47)*	.17	.12	**(.91)**	
4-Innovation commercialization abroad	11.94 *(24.97)*	.20*	.22**	.33**	**n/a**

Source: Slovenian high-tech SMEs' survey, 2013 (n=160).
Notes: $^{**}p < .01$, $^{*}p < .05$; Cronbach alpha values shown on the diagonal of the correlation matrix in brackets for multi-item constructs. The last construct (innovation commercialization) was measured as a single-item variable.

Table 2: Selected descriptive statistics for additional control variables

	Mean *(Std. dev.)*	**Significant pair-wise correlations with constructs in the conceptual model**
No. of different collab. partners	30.79 *(14.51)*	All constructs: $p < .01$, except internationalization: $p < .05$
Reactive market orientation	4.65 *(2.29)*	Open innovation, proactive MO: $p < .01$
R&D investment as % of sales	10.80 *(17.48)*	Proactive MO: $p < .05$; Internationalization, innovation commercialization abroad: $p < .01$
% of sales in domestic market	25.14 *(34.97)*	Open innovation: $p < .01$
No. of present foreign markets	19.64 *(31.48)*	Internationalization, innovation commercialization abroad: $p < .01$

Source: Slovenian high-tech SMEs' survey, 2013 (n=160).
Notes: $^{**}p < .01$, $^{*}p < .05$.

Table 3: Three-step hierarchical regression analyses results

Variables	**Internationalization**				**Innovation commercialization**			
	Model 1		**Model 2**		**Model 3**		**Model 4**	
	b	*SE*	*b*	*SE*	*b*	*SE*	*b*	*SE*
Open innovation	**.47***	**.20**	.26	.21				
No. of different collaborative partners	.00	.02	.01	.02				
Proactive market orientation	.32	.23	-.09	.27	.19	.18	.13	.12
Reactive market orientation	-.49*	.22	-.38†	.22	-.17	.16	-.14	.11
R&D investments (% of turnover)	.03**	.01	.03*	.01	.53**	.10	.52**	.10
% of turnover on domestic markets	-.01†	.01	-.01†	.01	-.08	.05	-.07	.05
No. of foreign markets	.10**	.01	.10**	.01	.18	.13	.16	.13
Internationalization					**.19***	**.08**	.16	.14
Open innovation x proactive market orientation			**.09****	**.03**				
Internationalization x proactive market orientation							**.35**†	**.20**
R^2	.39**		.42**		.35**		.36**	
F (df)	13.85** (152.7)		13.54** (151.8)		13.46 (153.6)		12.00 (152.6)	
ΔR^2			.03*				.01*	

Source: Slovenian high-tech SMEs' survey, 2013 (n=160).
Notes: Values in bold are relevant to tests of Hypotheses; $^{**}p<.01$, $^{*}p<.05$, $^{\dagger}p<.10$.