Available online at www.sciencedirect.com
ScienceDirect
Technovation 28 (2008) 257–265
technovation
www.elsevier.com/locate/technovation

Alliances, corporate technological entrepreneurship and firm performance: Testing a model on manufacturing firms ☆

Bostjan Antoncic[a,*], Igor Prodan[b]

[a]Faculty of Management, University of Primorska, Cankarjeva 5, SI-6000 Koper, Slovenia
[b]Regional Technological Centre Zasavje, Grajska pot 10, SI-1430 Hrastnik, Slovenia

Abstract

Corporate entrepreneurship can be considered important for organisational performance. While being recognised as being important for the development of innovations and technologies of small- and medium-sized firms and for the innovation/technology strategies of large firms, inter-organisational relationships in terms of networks and alliances have received inadequate research attention in the context of corporate entrepreneurship in general and in corporate technological entrepreneurship in particular. This study developed and tested a model of alliance-driven corporate technological entrepreneurship activities that impact on organisational performance. The model was tested on 226 usable responses from mail survey data from a sample of manufacturing firms from Slovenia. The model indicates the value of engagement in strategic alliances for the development of corporate technological entrepreneurship activities and consequential performance improvements.

Keywords: Corporate technological entrepreneurship; Alliances; Performance; Slovenia

1. Introduction

Corporate entrepreneurship can be considered important for organisational survival, profitability, growth and renewal (Zahra, 1996). In industries with high technological opportunities, for a firm to succeed it is important to engage in corporate entrepreneurship and take risks and at the same time make investments in developing products and technologies (Zahra and Covin, 1995). For a firm it is beneficial to use its internal and external sources in the pursuit of a competitive advantage by being effective and timely in the commercialisation of new technology (Zahra and Nielsen, 2002). While being recognised as important for the development of innovations and technologies of small- and medium-sized firms and for the innovation/technology strategies of large firms, inter-organisational relationships in terms of networks and alliances have received inadequate research attention in the context of corporate entrepreneurship (Antoncic, 1999, 2001) in general and in corporate technological entrepreneurship in particular. Strategic management literature (for example, Eisenhardt and Schoonhoven, 1996; Baum et al., 2000; Kale et al., 2000; Rothaermel and Deeds, 2006) has emphasised the theme of alliance arrangements which have been seen as a means to extend the operational or knowledge boundaries of firms, often in terms of the search for knowledge or competencies. Technological corporate entrepreneurship-related activities, particularly in terms of technological innovation, play an important role in developed economies and are also important for the performance and revitalisation of transition economies (for example, Bacova, 1987; Antoncic and Hisrich, 2000, 2001; Bojnec, 2001; Antoncic and Zorn, 2004; Lackenbauer, 2004; Ozcelik and Taymaz, 2004; Sporer, 2004; Bojnec and Novak, 2006; Ferto, 2007) since they can be considered a driving force of the process of restructuring and catching up (Gunther and Gebhardt, 2005; Berger and Diez, 2006). Despite these studies and many other general studies about

☆A previous version of this paper was presented at the 2006 Babson College Entrepreneurship Research Conference in Bloomington, IN, USA.

*Corresponding author. Tel.: +386 5 6102051; fax: +386 5 6103015.
E-mail addresses: bostjan.antoncic@fm-kp.si (B. Antoncic), igor.prodan@guest.arnes.si (I. Prodan).

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doi:10.1016/j.technovation.2007.07.005

transition economies (for example, research in journals such as Eastern European Economics and Post-Communist Economies), there has been minimal study of the direct influence of alliance-driven corporate technological entrepreneurship on firm performance in transition economies. This study aims to develop and test a model of alliance-driven corporate technological entrepreneurship activities that impact on organisational performance.

2. Theory and hypotheses

Corporate entrepreneurship, also referred to as corporate venturing (Vesper, 1990), internal corporate entrepreneurship (Jones and Butler, 1992) or intrapreneurship (Pinchot, 1985), is defined as entrepreneurship within an existing organisation, including emergent behavioural intentions and behaviours of an organisation related to departures from the customary (Antoncic and Hisrich, 2003) which can have several characteristic dimensions such as new business venturing, product/service innovation, process innovation, self-renewal, risk-taking, proactiveness and competitive aggressiveness. In this paper, the focus is on corporate technological entrepreneurship which can be considered part of corporate entrepreneurship and defined in terms of technological and process innovativeness activities.

More specifically, the emphasis is on development and innovation in technology. Zahra (1993) wrote about technological entrepreneurship and considered it as one of the innovative aspects of manufacturing firms. Several expressions are used in research papers for technological entrepreneurship (technology entrepreneurship, technical entrepreneurship, techno-entrepreneurship, technopreneurship) and several definitions are applicable. Dorf and Byers (2005) defined technological entrepreneurship as a style of business leadership that involves identifying high-potential, technology-intensive commercial opportunities, gathering resources such as talent and capital and managing rapid growth and significant risk using principled decision-making skills. Technology ventures exploit breakthrough advancements in science and engineering to develop better products and services for customers. The leaders of technology ventures demonstrate focus, passion and an unrelenting will to succeed. Shane and Venkataraman (2003) defined technological entrepreneurship as the processes by which entrepreneurs assemble organisational resources and technical systems and the strategies used by entrepreneurial firms to pursue opportunities. Technological entrepreneurship (The Canadian Academy of Engineering, 1998) can be the innovative application of scientific and technical knowledge by one or several persons who start and operate a business and assume financial risks to achieve their vision and goals. Technically, engineers are well-qualified in many respects for this activity but often lack the necessary business skills and entrepreneurial mentality.

Corporate technological entrepreneurship can include new production methods and procedures (Schollhammer, 1982). The tendency of technological leadership has been considered important for the entrepreneurial posture (Covin and Slevin, 1991). Techniques and technologies in production have been seen as part of organisational innovativeness (Knight, 1997). Corporate technological entrepreneurship can be mostly concerned with technology-related innovation (process innovation) (Tushman and Anderson, 1997), where technology may be described as 'the ensemble of theoretical and practical knowledge, knowhow, skills and artifacts that are used by the firm to develop, produce and deliver its products or services…(it) can be embodied in people, materials, facilities, procedures and in physical processes' (Burgelman and Rosenbloom, 1997, p. 273).

Thus, we define corporate technological entrepreneurship as a process within an existing organisation in which a technological entrepreneur or a group of technological entrepreneurs establish and manage an enterprise based on research, development, innovation and technology. This process also involves taking risks; technological entrepreneurs generally have broad technical knowledge, but they often lack the necessary business savvy to make the new technological company a success. Because a large field of expertise and a relatively high financial input are needed when the company is established and when it starts growing, a number of other experts from the technological entrepreneur's business networks and outside institutions should also be present during these processes.

2.1. Corporate technological entrepreneurship and performance

Growth and profitability are performance elements that can be considered important consequences of corporate entrepreneurship. Corporate entrepreneurship has been regarded as an important element of successful organisations (Peters and Waterman, 1982; Kanter, 1984; Pinchot, 1985; Thornhill and Amit, 2001; Miles and Covin, 2002; Heidemann Lassen, 2007) since it has its consequences for organisational survival, growth and performance (Kazanjian et al., 2001). On one hand, the relationship between corporate entrepreneurship and growth has received wide support in past research. Corporate entrepreneurship was found to be predictive of the growth of small firms (Covin, 1991) and large firms (Covin and Slevin, 1986; Zahra, 1991, 1993; Zahra and Covin, 1995). A positive corporate entrepreneurship–growth relationship was discovered for established firms in Slovenia (Antoncic and Hisrich, 2001, 2004) and the USA (Morris and Sexton, 1996; Antoncic and Hisrich, 2001) and health care firms (Stetz et al., 1998). Luo et al.'s (2005) results indicate that corporate entrepreneurship is positively related to sales growth and market share in a study of Chinese firms. On the other hand, past research on the relationship between corporate entrepreneurship and profitability produced mixed

support. Corporate entrepreneurship was found to be related to the profitability of large firms (Covin and Slevin, 1986; Zahra, 1991, 1993; Zahra and Covin, 1995) and small-, medium-sized and large firms from various industries in Slovenia, but not in the USA (Antoncic and Hisrich, 2001). In contrast, Zahra and Garvis' (2000) study examined 98 US companies and showed that international corporate entrepreneurship was positively associated with a firm's overall profitability and growth as well as its foreign profitability and growth. Similarly to Antoncic and Hisrich (2001), Morris and Sexton (1996) did not find a significant positive relationship between the entrepreneurial intensity and profitability of US firms. One explanation of such mixed results is that 'firms in the US are more growth oriented and value growth more than profitability than the firms in Slovenia that may be still more survival and profit rather than growth oriented' (Antoncic and Hisrich, 2001, p. 523). For firms in transition economies it may be particularly beneficial to exercise corporate entrepreneurship in order to ensure change and growth (Antoncic and Hisrich, 2000). Hence, we would expect a general positive relationship between corporate entrepreneurship and performance in terms of profitability and growth. Small innovating firms tend to be significantly more likely to have grown more than small non-innovating firms (Freel, 2000). Since corporate technological entrepreneurship in terms of innovativeness in processes and technologies can be considered a dimension of corporate entrepreneurship (Antoncic and Hisrich, 2003), we suspect that the relationship between corporate technological entrepreneurship and performance elements could also be positive. This research forms the basis of the following hypothesis:

Hypothesis 1. The extent of corporate technological entrepreneurship will be positively related to organisational performance in terms of:

1a: growth; and
1b: profitability.

2.2. Alliance characteristics and corporate technological entrepreneurship

Open and prompt communication is indispensable for inter-firm co-operative relationships (Das and Teng, 1998). Poor communication within an alliance and between partners can spoil the start-up of a venture and significantly undermine its performance; it can create an atmosphere of mistrust and suspicion that may undermine both the legitimacy and effectiveness of the venture (Kelly et al., 2002). Information-sharing is an important element of dyadic network exchanges (Uzzi, 1997) and network connections referring to structural embeddedness (Jones et al., 1997). Mohr and Spekman (1994) found that communication quality and participation are crucial for success in vertical partnerships between manufacturers and dealers in the personal computer industry. Kauser and Shaw (2004) found that the level of co-ordination (which is based on communication) between partners is higher in successful international strategic alliances than in less successful partnerships. Face-to-face interaction has been seen as the most efficient way to address unexpected complications in a supplier relationship as evidenced in the case of computer systems firms in Silicon Valley (Saxenian, 1991). The frequency of communication has been advocated as an important element of success in strategic alliances among biotechnology firms (Deeds and Hill, 1998). Also, the frequency of communication within the network positively influences a firm's satisfaction with its knowledge-sharing in the network (Wagner and Buko, 2005). Midgley et al. (1992) found that both pre-existing and innovation-specific communication network links are used in innovation diffusion. Therefore, it is expected that the frequency and quality of inter-firm communication will have a positive impact on corporate technological entrepreneurship. This discussion leads to the following hypothesis:

Hypothesis 2a. The extent of inter-firm communication will be positively related to the extent of corporate technological entrepreneurship.

Trust refers to the belief in another partner's reliability in terms of the fulfilment of obligations in an exchange (Pruitt, 1981). According to Das and Teng, 'just as control mechanisms are meant to enhance the probability of having the desired behaviour, trust also is useful in enhancing the perceived probability of desired behaviour' (1998, p. 494). In addition, Das and Teng (1998) proposed that the deployment of formal control mechanisms in strategic alliances would undermine the level of trust among alliance partners. Weaver and Dickson (1998) considered trust to be a more appropriate assumption than opportunism in alliances among small and medium-sized enterprises. In the context of business trust and knowledge transfer (which occurs in corporate entrepreneurship), Roberts (2000) propagates the opinion that the exchange of knowledge, particularly tacit knowledge, is not amenable to enforcement by contract but by trust. Although contracts are an important part of any inter-organisational relationship, it is generally accepted that an informal understanding based on trust may prove even more powerful than contracts in assuring a successful relationship (Adobor, 2005). Trust may be associated with the length of the relationship in strategic alliances (Parkhe, 1993). Saxton argued that 'a high level of mutual involvement acts as both a signaling and a monitoring mechanism by establishing and building trust and commitment' (1997, p. 446). Kauser and Shaw (2004) found that the level of trust between partners tends to be greater in successful international strategic alliances than in less successful partnerships. Trust was also found to be related to the success of vertical partnerships (Mohr and Spekman, 1994) and of the development of a new programme (Logaj

and Trnavcevic, 2006). It can also be seen as an essential prerequisite for technological innovation that comes from inter-firm R&D collaboration (Hausler et al., 1994) and appears to be a crucial component in the persistence of networks of innovators (Saxenian, 1991). Mediated by resource exchange and combination, inter-unit trust was also found to have a significant influence on the product innovation of a multinational firm (Tsai and Ghoshal, 1998). Thus, inter-firm trust is expected to have a positive impact on corporate technological entrepreneurship. The next hypothesis follows from this discussion:

Hypothesis 2b. The extent of inter-firm trust will be positively related to the extent of corporate technological entrepreneurship.

Organisational support and commitment in alliances can be important for corporate technological entrepreneurship. Commitment indicates the willingness of alliance partners to exert effort in the relationship (Porter et al., 1974; Mohr and Spekman, 1994) and was found to be related to the success of vertical partnerships (Mohr and Spekman, 1994). In networks, like in a firm, some permeability of boundaries is needed for fostering innovation (Jones et al., 1997). Gudmundson et al.'s (2003) study indicates that the initiation and implementation of innovation are related to aspects of culture and ownership. They also found that organisational support is more important for the implementation than for the initiation of innovation. Management and organisational support are somewhat blurred with values that refer to cognitive evaluations of appropriate behaviour but, in contrast to organisational values, support is more tangible. Support can be expressed through a commitment to inter-organisational relationships in the form of time and resources such as management time commitment, employee rewards and time availability for inter-firm collaboration. Hence, organisational support can be seen as a crucial element of corporate technological entrepreneurship in inter-firm relationships and alliances. On the basis of this discussion, the following hypothesis is postulated:

Hypothesis 2c. The extent of externally oriented organisational support will be positively related to the extent of corporate technological entrepreneurship.

Inter-organisational value congruence can be important in corporate technological entrepreneurship. Organisational values, norms and cultures are utilised as social control mechanisms that encourage desirable behaviour in alliances (Das and Teng, 1998). 'Since structural embeddedness diffuses information throughout the system, it also facilitates the development of macroculture—the common values, norms, beliefs shared across firms' (Jones et al., 1997, p. 925). Corporate culture is defined as 'the fundamental totality of all common value and norm conceptions and shared models of thinking and behaving which influence decisions and behaviour of the employees in the company. The group considers these values and norms to be proven to be helpful and successful, so they are presented as the proper way to think and to do things to new members' (Ulijn and Weggeman, 2001). Parkhe (1991) identified corporate culture as one of the organisational-level dimensions of inter-firm diversity that represent sources of tension in strategic alliances and that consequently reduce alliance success; in order to improve alliance success, he proposed a solution should to be employed to cope with this difference: to encourage organisational learning to facilitate an intermediate (between the alliance partners) corporate culture. Thus, the congruence of organisational values between partner firms can be seen as an important predictor of corporate technological entrepreneurship.

Hypothesis 2d. The extent of inter-organisational value congruence will be positively related to the extent of corporate technological entrepreneurship.

The number of alliances may be essential for corporate technological entrepreneurship. In high-technology industries, such as biotechnology, innovation may be primarily dependant on organisational learning through inter-organisational collaboration (Powell et al., 1996). Centrality in a network can be important for the diffusion of innovations (Pitt et al., 2006). Saxenian (1991) pointed out for Silicon Valley firms that production networks of collaborative relationships promote technological advances and new product development. Kelley and Rice (2002) found that firms forming a high rate of alliances are likely to have a high rate of product innovation. Deeds and Hill (1996) found a positive relationship between the use of alliances and new product development. This relationship between the number of strategic alliances and the rate of new product development, however, tends to be non-linear (inverted U-shape). Similarly, Rothaermel and Deeds' (2006) findings, based on a study of 325 biotechnology firms, provide broad support for the suggestion that the relationship between alliances and new product development is inverted U-shaped regardless of the alliance type (upstream, horizontal and downstream alliances). Deeds and Hill (1996) found that at low levels the relationship is positive but at high levels of strategic alliances the costs of additional alliances outweigh the benefits, causing the rate of new product development to decrease. We expect a similar relationship between the number of alliances and corporate technological entrepreneurship. Inter-organisational networks tend to contribute to the diffusion and acceleration of technological innovation (Park, 1996; Robertson et al., 1996). The number of network links (density), in particular, can significantly affect the extent of innovation diffusion (Abrahamson and Rosenkopf, 1997). Gemunden et al. (1996) found a positive relationship between network configuration in terms of intensity and the pattern of technological interweavement and product and process innovation success in high-technology industries. In addition, Ritter and Gemunden (2004) found a positive relationship between the degree of a company's

innovation success and its level of network competence. Thus, a hypothesis based on the above discussion emerges as follows.

Hypothesis 2e. The association between the firm's number of alliances and the extent of corporate technological entrepreneurship will be positive, but it will have the form of an inverted U-shape.

3. Methods

The methodology will now be discussed in terms of the measurement instrument, data collection, the sample and data analysis.

3.1. Measurement instrument

In this research, corporate technological entrepreneurship, alliance characteristics and performance elements were mostly measured through scales previously tested and used by other researchers. Perceptual measures were selected based on their congruence with the concepts under examination. Five-point scales (Likert-type scales and semantic differentials) were used to keep the questionnaire as simple as possible. In some cases, longer scales were needed to capture the information. Companies reported answers for the past 3-year period.

Corporate technological entrepreneurship was measured by selected items of technological/process innovation from the corporate entrepreneurship scale used by Antoncic and Hisrich (2004) and included eight items; the questions refer to investments or an emphasis on creating proprietary technology, an emphasis on pioneering and experimentation in technological developments, on R&D and technological innovation and on designing new processes and methods of production.

Alliance characteristics were assessed across five dimensions. Communication was measured by Mohr and Spekman's (1994) communication quality scale that was supplemented with two items (frequency and quality of communication). Trust was measured by scales adopted from Mohr and Spekman (1994) (three items on perceived trust) and from Weaver and Dickson (1998) (three items on perceived opportunistic behaviour). The organisational support dimension was operationalised by using three items adapted from Hornsby et al. (1993) and one item adapted from Mohr and Spekman (1994). Questions on organisational support for collaboration discussed encouraging and rewarding employees to collaborate with partner companies, permeability of the firm boundaries and the organisational commitment to alliance partners. The organisational value congruence dimension was operationalised as the perceived level of congruence between the values of the focal firm and its strategic alliance partners across different alliance types. Finally, the number of strategic alliances of the focal firm was measured. In contrast to the study of Deeds and Hill (1996), who used the number of alliances with different types of firms, the number of alliances was assessed according to different alliance types such as customer–supplier relationships, licensing, technology-sharing, joint development and equity joint ventures (Mowery et al., 1996), as well as by the overall level. This multi-type assessment is important because alliance types as different forms of collaboration may have differential effects on corporate entrepreneurship. In the Slovenian electric appliance and equipment industry, for example, customer–supplier dyadic ties may be important in the development of new markets, as evident in the companies Jaksa and Le-Tehnika, whereas technology-sharing and joint development may be important for innovativeness in products and technologies, as evident in the case of Hyla (see Glas et al., 1999). More importantly, by using alliance-type-specific questions the measure may be more precise and therefore better understood by managers as well.

Dependant variables—performance—were measured in terms of growth and profitability in absolute and relative terms (Antoncic and Hisrich, 2001): absolute growth items are the average annual growth in the number of employees in the last 3 years and the average annual growth in sales in the last 3 years, while the relative growth item is growth in the market share (Chandler and Hanks, 1993) in the last 3 years; absolute profitability items are the average annual return on sales (ROS), the average return on assets (ROA) and the average annual return on equity (ROE) in the last 3 years, while relative profitability items are a subjective measure of firm performance relative to competitors (Chandler and Hanks, 1993) and its extension (Antoncic and Hisrich, 2001, 2004): the company's profitability in comparison to all competitors as well as to competitors that are at about the same age and stage of development. Control variables included firm age and size, as well as industry dynamism.

3.2. Data collection, sample and data analysis

Questionnaire data were collected from the top executives of selected firms in Slovenia. A representative random sample with 226 usable responses was obtained from a mail survey data from a sample of manufacturing firms with 30 and more employees. The sample distribution was comparable to the database population in terms of firm size and geographical location.

The constructs and their dimensions were tested by using confirmatory factor analysis. After the confirmatory factor analyses the number of items was reduced by forming construct dimension items as an average of the dimension items. The model was estimated by using structural equation modelling. The model included the hypothesised relationships and correlations among construct dimension items. The impact of control variables was analysed in two ways: (1) the model was re-estimated with the two-half split samples based on age and size variables; and (2) industry

characteristics were assessed with their inclusion in the model.

4. Findings

The resulting model goodness-of-fit indices indicated a moderately good model fit (NFI 0.88, NNFI 0.84, CFI 0.92, SRMR 0.11, RMSEA 0.09; despite the fact that the Wald Test indicated that by dropping some parameters the goodness of model fit would increase, particularly NFI and NNFI values increase to levels above the 0.90 threshold for a good model fit, all parameters important for the hypothesised relationships were kept in order to clearly demonstrate the results of hypotheses testing). The corporate technological entrepreneurship variance explained was 27%. Coefficients from structural equations are shown in the Appendix. Structural coefficients did not indicate substantial variations with the introduction of control variables (the control variables were not found to be important).

Hypothesis 1 postulated the relationship between corporate technological entrepreneurship and organisational performance in terms of growth (1a) and profitability (1b) and received support (positive and significant coefficients between corporate technological entrepreneurship and performance elements (standardised): absolute growth 0.22, relative growth 0.33, absolute profitability 0.21 and relative profitability 0.19).

Hypothesis 2a postulated the relationship between inter-firm communication and corporate technological entrepreneurship. This hypothesis did not receive full support (the coefficient was positive but not significant).

Hypothesis 2b predicted the relationship between inter-firm trust and corporate technological entrepreneurship and was not supported (the coefficient was close to zero).

Hypothesis 2c (organisational support for alliances–corporate technological entrepreneurship relationship) received support (a positive significant standardised coefficient of 0.24).

Hypothesis 2d (inter-organisational value congruence–-corporate technological entrepreneurship relationship) received support (a positive significant standardised coefficient of 0.19).

Hypothesis 2e postulated a positive association between the firm's number of alliances and the extent of corporate technological entrepreneurship with the form of an inverted U-shape. The first part of this hypothesis received strong support (a positive significant standardised coefficient of 0.25), while the second part (non-linear form) received moderate support (quadratic term: a standardised coefficient of −0.09, but only significant at 0.10).

5. Discussion and conclusion

The study offers some important contributions and implications. First, a model of alliance-driven corporate technological entrepreneurship was developed and empirically tested. It showed the value of engagement in strategic alliances for the development of corporate technological entrepreneurship activities and consequential performance improvements. The results are especially relevant for manufacturing firms. Despite the fact that data collection of this study was limited to the Slovenian economic environment and that national culture traits can influence the formation of technological alliances (Steensma et al., 2000), we are confident that the findings of this study can be generalisable to some extent to other economic contexts because findings based on Slovenian samples were found in past research to be comparable with: (1) developed Western countries as evidenced in, for example, past cross-national comparative studies in corporate entrepreneurship (Antoncic and Hisrich, 2000, 2001; Douglas et al., 2003) and in business ethics (Bucar et al., 2003); and (2) other countries of Central and Eastern Europe such as Romania as evidenced, for example, in comparative studies of corporate entrepreneurship (Antoncic and Scarlat, 2005) and technological innovativeness (Antoncic et al., 2007). Thus, the findings of this study may be generalisable to some extent to transition economies (economies with a relatively shorter tradition of a market-based economic system, for example, the countries of Central and Eastern Europe which have transitioned from a planned to a market-based system in the past two decades or so) and to developed economies (economies with a long tradition of a market-based economy, such as, for example, the countries of Western Europe and North America).

The model of alliance-driven corporate technological entrepreneurship is the main contribution of this study. The theoretical implications of the model developed in this study are: (1) corporate technological entrepreneurship can be considered an important predictor of firm performance and shall be given stronger emphasis in future research in entrepreneurship in general and in corporate entrepreneurship in particular; (2) several strategic alliance dimensions can be relevant to the development of corporate technological entrepreneurship in organisations; at least three can be considered essential, as indicated in this study: alliance number, support, and value congruence, and perhaps also others which were not examined in this study such as alliance motivations (Yasuda, 2005) and business strategies of firms (Yasuda and Iijima, 2005); and (3) alliance trust may be less important than other alliance characteristics (number, support, value congruence, communication) for corporate technological entrepreneurship; this peculiar finding may to some extent be contrary to both the expectations and findings from past research into strategic alliances (for example, Parkhe, 1993; Mohr and Spekman, 1994; Kauser and Shaw, 2004) and in innovation (for example, Saxenian, 1991; Hausler et al., 1994; Tsai and Ghoshal, 1998; Quintana-Garcia and Benavides-Velasco, 2004).

Second, the model has practical implications. On the basis of the findings based on the model estimations the study pinpoints the alliance element selection strategies

with the purpose of developing corporate technological entrepreneurship that may be the most beneficial for the performance of the firm. The most important alliance elements in the development of corporate technological entrepreneurship were found: the number of alliances (U-shaped relationship), organisational support and value congruence. In practice this means the following: in order to foster corporate technological entrepreneurship firms must take good care of their alliance relationships. They may like to consider: (1) increasing the number of alliances, but not to exaggerate in this activity; (2) increasing the levels of organisational support for alliances (encouraging and rewarding employees to collaborate with partner companies, increasing the permeability of the firm's boundaries and boosting the organisational commitment to alliance partners); and (3) improving the organisational value congruence with alliance partners (across different alliance types). Overall, as stressed by de Man and Duysters (2005), companies can benefit by building up capabilities to manage alliances.

The model also emphasises the importance of technological corporate entrepreneurship activities for the growth and performance of firms. Manufacturing firms may benefit by improving their technological entrepreneurial activities such as investments for creating proprietary technologies, pioneering and experimentation in technological developments, R&D and technological innovation and designing new processes and methods of production.

The key limitations of the study are: the use of perceptual measures, the use of only one predictor (corporate technological entrepreneurship) of performance, and the estimation of the model on a sample of manufacturing firms in only one country. Despite these limitations, we are convinced that this study offers important contributions and opens grounds for future research. Future investigations may include, for example, the following areas: cross-national comparisons of corporate technological entrepreneurship models and extensions of the model to non-manufacturing industries.

Acknowledgement

The authors would like to thank two helpful Technovation reviewers for their comments on a previous version of this manuscript.

Appendix

Structural equations with total effects (direct and indirect) (standardised coefficients) are given in Table A1.

Table A1

Predictors	Dependents				
	Technological entrepreneurship	Absolute growth	Relative growth	Absolute profitability	Relative profitability
Alliance characteristics					
Inter-firm communication	0.10	*0.02*	*0.03*	*0.02*	*0.02*
Trust	−0.02	*−0.00*	*−0.01*	*−0.00*	*−0.00*
Organisational support	0.24*	*0.05**	*0.08**	*0.05**	*0.04**
Value congruence	0.19*	*0.04**	*0.06**	*0.04**	*0.04**
No. of alliances	0.25*	*0.06**	*0.08**	*0.05**	*0.05**
No. of alliances (quadratic term)	−0.09	*−0.02*	*−0.03*	*−0.02*	*−0.02*
Technological entrepreneurship		0.22*	0.33*	0.21*	0.19*
Error (direct)	0.85	0.98	0.95	0.98	0.98
R^2 (direct)	0.27	0.05	0.11	0.04	0.04

*Coefficients significant at the 0.05 level (one-tailed).
Indirect effects are in *italics*.

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Bostjan Antoncic is an Associate Professor of Entrepreneurship at the Faculty of Management, University of Primorska, Slovenia. His main research interests include corporate entrepreneurship, entrepreneurial networks, and international entrepreneurship. He has authored or co-authored four books and various research articles. His papers were published in academic journals such as the Journal of Business Venturing, Entrepreneurship and Regional Development, Industrial Management and Data Systems, Journal of Developmental Entrepreneurship, Journal of Enterprising Culture, Managing Global Transitions, Journal of Management Development, and Journal of Small Business and Enterprise Development.

Igor Prodan earned his Ph.D. at the Faculty of Economics, University of Ljubljana, Slovenia. He works as a researcher and a department manager in Regional Technological Centre Zasavje and as an assistant at the university. He has published several original scientific articles, review articles and scientific and professional conference articles and also one scientific monograph. He is involved in different international (fifth Framework programme EU, sixth Framework programme EU, Eureka) and national projects. His major research area is technological entrepreneurship and innovation management.