LTA 4/05 • p. 489–509

CHRISTOPHER PALMBERG and MIKA PAJARINEN

Internationalisation through Strategic Alliances – Determinants of Non-equity Alliances of Finnish firms

ABSTRACT

The internationalisation of firms is a salient feature of ongoing globalisation. Internationalisation has traditionally occurred through the extensions of the in-house activities of firms through foreign direct investments or other equity-based arrangements. However, the recent rapid growth of cross-border strategic alliances indicates that such international alliances increasingly complement in-house activities. Nowadays international alliances are typically based on looser non-equity agreements between firms in activities ranging from joint R&D, production, or various market-related activities. In this study we draw on new data to identify the determinants non-equity international alliance formation of large Finnish firms and thereby contribute with new insights into the reasons behind the recent internationalisation of these firms through strategic alliances. The econometric analysis is framed in terms of organisational theories of the firm, which emphasise the relationships between uncertainties embedded in the activities undertaken within alliances and their organisation. The results suggest that the involvement of firms in uncertain R&D- or market-related activities, and ICT, determine the preference for non-equity alliances over equity-based ones in their internationalisation effort. In contrast, production-related activities are associated with tighter equity-based alliance organisations. Non-equity strategic alliances have thereby contributed less to the internationalisation of production-related activities when compared with R&D and market-related activities.

Key words: *internationalisation, large Finnish firms, uncertainty, strategic alliances*

CHRISTOPHER PALMBERG, PhD
Researcher, ETLA/Etlatieto Oy • e-mail: christopher.palmberg@etla.fi
MIKA PAJARINEN, M.Sc. (Econ)
Researcher, ETLA/Etlatieto Oy • e-mail: mika.pajarinen@etla.fi

1 INTRODUCTION

The internationalisation of firms is a salient feature of ongoing globalisation. Equity-based foreign direct investment (FDI) is one example of this internationalisation. It can be understood as an internationalisation of the in-house activities of firms ranging from R&D and production to marketing or after-sales services through equity investment. But firms also internationalise through other means. One complementary mean to FDI is international strategic alliance (Narula and Zanfei, 2003; Serapio and Hayashi, 2004). An international strategic alliance is here defined as a formal cross-border agreement between firms, which is characterised by a commitment by the partners to reach a common strategic goal. Defined in this way international strategic alliances delimitate a subset of inter-firms collaboration that excludes 'ordinary' buyer-seller or subcontracting relationships, unilateral licensing, franchising, and buyback agreements where the partners often have opposing goals (see Palmberg and Martikainen (2003) for a lengthier discussion of the definition).

The recent increase of international strategic alliances is well documented in the business and research literature. Some even claim that this increase mounts to a new form of capitalism, namely "alliance capitalism". Alliance capitalism is characterised by collegial entrepreneurship as firms in-house activities increasingly are replaced by various multilateral and complex inter-firm network structures (Dunning, 1995; Dunning and Boyd, 2003). Traditionally this has been reflected in the increasing frequency of joint ventures between firms. An international joint-venture is essentially an extension of the in-house activities of firms, and shares certain similarities with FDI since they involve equity investments into a new entity controlled by the firm. However, the largest share of the recent increase in international strategic alliances is due to the proliferation of looser types of alliances based on non-equity agreements (Hagedoorn, 2002).

In this paper we leave the broader discussion of alliance capitalism aside and focus on the internationalisation of large Finnish firms through international strategic alliances. The internationalisation of Finnish firms has mainly been studied from the viewpoint of FDI (Pajarinen and Ylä-Anttila, 1999; Ali-Yrkkö et al., 2004). A recent study indicates that the largest Finnish firms indeed are internationalised, especially in terms of the share of turnover generated by production abroad, by the share of personnel located abroad, and by the share of R&D that they perform abroad (Lovio, 2004). Nonetheless, until now, less is known about the extent and nature of their international strategic alliances as a complementary mean of internationalisation.

This paper draws on a new database of strategic alliances involving large Finnish firms. A quick initial glance at this new data in figure 1 suggests that these firms have also internationalised through international strategic alliances at an increasing rate, especially since the late 1990s, even though there has been a levelling off in recent years. Further, the increase in international strategic alliances of Finnish firms is compatible with global trends in the sense that the largest

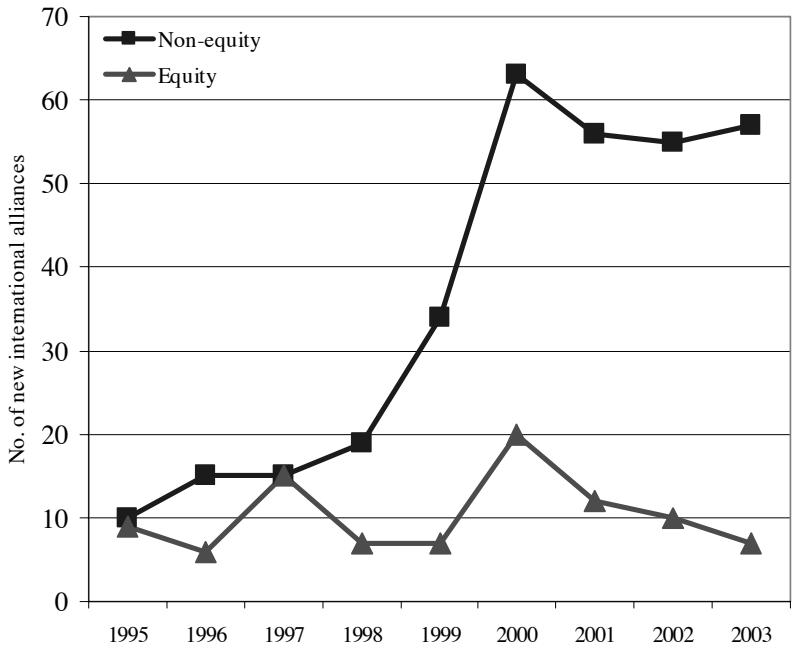

FIGURE 1. The growth of international strategic alliances of Finnish firms. (Source: the SAFIF database)

share of this increase is due to looser types of non-equity alliances rather than equity-based joint ventures.

The aim of this paper is to identify the determinants of non-equity alliance formation of Finnish firms and thereby also contribute with new insights into the reasons behind the rapid internationalisation of these firms through strategic alliances. Extant research has typically analyzed the choice of strategic alliance organisation from the viewpoint of transaction cost economics and structural sociology (see e.g. Hagedoorn and Narula, 1996; Gulati and Singh, 1998). These theoretical frameworks emphasize issues related to uncertainties in partner selection during alliance formation. A recent paper by Casciaro (2003) convincingly downplays the importance of partner selection uncertainties in favour of uncertainties embedded in the actual tasks undertaken in alliances and their industrial contexts. In this paper we elaborate further especially on this insight. Through our focus on international strategic alliances we can also incorporate variables relating to the nationality of the foreign partner of these alliances. We also incorporate positional asymmetries between the firms which appear as especially relevant from the viewpoint of Finland as a small country. The paper thereby complements extant research, and also offers new insights into the internationalisation of Finnish firms through strategic alliances.

The paper is structured as follows. Section 2 presents the analytical framework applied in the empirical analysis. Section 3 discusses the data sources and sample in greater detail, motivates and describes the variables used. Section 4 covers the descriptive and econometric analysis, while section 5 concludes the paper.

2 ANALYTICAL FRAMEWORK

2.1 Strategic alliances and the internationalisation of firms

Barely a day goes by without press releases of the formation of an international strategic alliance between firms. From extant research we indeed do know that the growth in strategic alliances has picked up especially since the early 1980s and increasingly transcend country boundaries. Which factors have contributed to this proliferation of international strategic alliances? Why are firms increasingly opting for looser types of non-equity alliances in the internationalisation efforts? One can identify a set of factual explanations that relate to the changing nature of competition and technologies in the global economy, as well as a range of theoretical frameworks focusing on governance structures pertinent to different firm activities.

As suggested above the growth in international alliances is generally considered to be intertwined with the ongoing process of globalisation. International alliances, especially of the non-equity kind, provide a means of firms to simultaneously be present, source knowledge and compete in these multiple countries and regions without the liabilities associated with FDI or joint ventures. Nonetheless, globalisation and inter-firm collaboration as such are not very new phenomena if we apply a historical viewpoint. Instead reference is often made to the overall reduction of the costs of coordinating economic activities within and between firms and other parties that drive globalisation itself. Two reasons are usually singled out as particularly important in this context. The first is the introduction of new space-shrinking technologies due to developments in the field of information and communication technologies (ICT). The second relates to the harmonisation of regulations and barriers as a result of economic liberalisation (Narula and Zanfei, 2003).

The effects of ICT on coordination costs are quite obvious. ICT technologies have developed very rapidly especially since the 1990s, while the price of the related equipment successively has dropped. As a result computers, mobile telephone networks and various Internet-related technologies have diffused widely and dramatically lowered communication costs in all industries. Communication and transactions across geographical space is now much more convenient and supportive for the coordination of international strategic alliances than ever before. Firms do not necessarily have to be physically present in the various countries and regions to which they internationalise their activities, and might thereby also prioritize strategic alliances over FDI or joint ventures as the more traditional modes of internationalisation.

The effects of economic liberalisation are more multi-faceted with different implications for different firms, industries and regions of the world. These have been further enhanced by the establishment of multinational organisations such as NAFTA and the EU, and multilateral international agreements such as WTO, WIPO etc. Such organisations and agreements have reduced risks and enhanced the enforceability of cross-border inter-firm agreements. From the viewpoint of Finland, the role of the Single European Market, EUREKA and the R&D framework program initiatives of the EU should be highlighted. Finland has been an active participant in these initiatives, especially after full EU-membership in 1995 (Lemola, 1994; Luukonen, 2002).

However, the reduction of coordination costs might not always be the prime motivator for international strategic alliance formation, especially since longer-term strategic goals are involved. The emergence of new technological fields and the general increase in technological complexity are important additional considerations that incentive firms to share risks and pool knowledge through alliances (Palmberg and Martikainen, 2006). Today many products and processes typically build on multiple technologies which require complementary knowledge inputs from many firms, especially in high-technology fields such as biotech, ICT or new materials. Due to national differences in regulations and norms governing new technologies cross-border collaboration is also often a requirement for market access. Meanwhile development costs are mounting. In these circumstances international strategic alliances often constitute a first-best path of internationalisation due to added flexibility, cost- and risk-sharing in the various activities of firms, especially when compared with FDI.

2.2 Determinants of non-equity alliance formation

The various theoretical frameworks that have sought to interpret the proliferation of international strategic alliances usually take their departure in transaction cost economics pioneered by Coase (1937) and developed further by Williamson (1975, 1985, 1991 and 1999), see also Lemola (1994). Transaction cost economics considers how different attributes of transactions that firms are involved in relates to the way in which firms organises, or govern, their transactional activities with other firms. These attributes are the frequency with which transactions occur, the uncertainty to which they are subject to, and the type of asset that is being transacted. Further, firms are assumed to act opportunistically.

The issue of uncertainty is especially important in transaction cost economics. Transactional uncertainty arises when the possible contingencies affecting the execution of the related agreement are complex and difficult for the partners to understand, predict or articulate. One example might be a situation where a firm considers how to organise a specific R&D project in a new and risky technology field. In such a situation transaction cost economics would suggest that a collaborative agreement, for example in the form of a non-equity R&D alliance, is unviable

due to the transactional uncertainties involved. This is nonetheless at odds with the observation of the rapid growth of such alliances recently, especially in high-technology areas characterised by uncertainties and various other contingencies.

Elaborations of the transaction cost framework have sought to come up with alternative interpretations for why firms engage in strategic alliances, especially of the non-equity and cross-border type. One line of research highlights the importance of trust as a mediating factor in the trade-offs between uncertainties and the preference for such alliances. The logic here is that an alliance is an organisational device that offers some degrees of control over transactional uncertainties between firms and that trust is the social mechanism that reduces opportunistic behaviour and transaction costs in such cases (Das and Teng, 1998). Partner selection is considered as crucial since an alliance with a familiar partner mitigates uncertainties, facilitates trust, and thereby reduces transaction costs. (see e.g. Gulati and Singh (1998); Nooteboom (1999)).

In this paper we take a dissenting view along the lines suggested by Casciaro (2003). She convincingly downplays the significance of partner selection uncertainties and instead introduces the concepts of task and strategic uncertainty. Task uncertainty is defined as the extent to which it is possible to predict in advance the behaviour of the elements that compose the task to be undertaken in an alliance, and will be affected by the complexity and number of elements composing a task. Strategic uncertainty stems from the strategic positioning of the alliance within chosen markets and concerns the markets' demand, supply and valuation of the products, services or technologies developed within an alliance.

The point made is that various combinations of task and strategic uncertainties are determined by the type of activities covered by the alliance. Strategic alliances, whether of the equity or looser non-equity type, commonly comprise of R&D, production or market-related activities. According to Casciaro (2003) these different types of activities embody different combinations of task and strategic uncertainties. Differing levels of task and strategic uncertainty, in turn, are considered the determinants of choice of non-equity alliances over equity-based ones irrespective of partner selection uncertainties. Strategic uncertainty is the theoretical elaboration of particular interest especially in this paper.

The organisation of alliances will be solely driven by task uncertainties in cases when strategic uncertainty is low. However, when strategic uncertainties increase the risks of equity investments in alliance formation will also grow and make equity-based alliances increasingly unviable. Such strategic uncertainty might, for example, relate to the exploration of new technology fields or product markets which are highly dynamic and competitive and characterized by technological complementarities between firms. In such cases non-equity alliance provides firms with a flexible option to explore new technologies or markets without excessive commitments. This insight is also compatible with the discussion of complementary assets in Teece (1992). The pre-

dicted effects of task and strategic uncertainty on the organisation of alliances is summarised in figure 2 below.

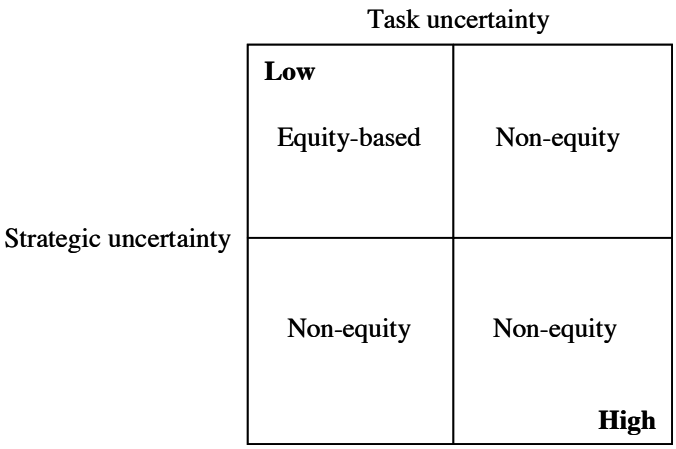

FIGURE 2. Effects of task and strategic uncertainty on alliance organisation.

The discussion of task and strategic uncertainty complements transaction cost economics with a more nuance interpretation of the trade-offs between uncertainty and the organisation of strategic alliances. Further, it refocuses the discussion on strategic alliance formation from partner selection issues to the actual tasks undertaken and their broader contexts. Nonetheless, it is clear that the asymmetric position of firms in technology fields and industries also will influence the organisation of alliances. This is the case especially in international cross-border alliances where different national cultures and other unobserved issues probably amplify firm asymmetries further.

The literature identifies different sources of positional asymmetries between firms. The effect of firm size on organizational behaviour is a common issue (see e.g. Hernan et al., 2003). In the context of strategic alliances larger firms might have scale-economy advantages in their equity investments related to equity-based alliances. But larger firm size might also enhance the ability of firms to simultaneously manage multiple alliances and thereby affect the willingness to collaborate with other firms on a looser non-equity basis. Larger firm size typically also correlates with the technological strengths of firms, for example as measured through the size of patent portfolios. Such differences between firms are additional sources of positional asymmetries in alliance formation, for example in terms of negotiating power and IPR positions, technological strength or absorptive capabilities in general (Baugh et al., 2001). They should be taken into account in empirical analysis of the alliance activity of firms.

3 DATA DESCRIPTION

3.1 Data sources and sample

The sample includes 22 Finnish firms. Inclusion of firms was based on firm size and industry affiliation. The point of departure was the most recent ranking list of the 500 largest Finnish firms produced by the business magazine Talouselämä. The forestry-related, metals/engineering, chemicals and ICT industries were selected as the most important ones to the Finnish economy. From this ranking list 4–5 of the largest firms were selected. Further, the list was complemented with three largest diversified multi-industry firms in Finland which could not easily be assigned to a particular industry.

The data on alliances was collected through systematic reviews of the press reports of these firms, complemented with a review of relevant articles in the largest Finnish business newspaper Kauppalehti. These sources were used to identify strategic alliances formed by the included Finnish firms during 1995–2004 and to collect data on the nature and content of these alliances into a database (the SAFIF database). An international strategic alliance is here defined as *a formal cross-border agreement between firms, which is characterised by a commitment by the partners to reach a common strategic goal*. Defined in this way international strategic alliances delimitate a subset of inter-firms collaboration that excludes 'ordinary' buyer-seller or subcontracting relationships, unilateral licensing, franchising, and buyback agreements where the partners often have opposing goals. The possible pitfalls of this methodology mainly relate to definitional issues and to potential under coverage since firms might have varying attitudes towards publicizing their involvement in alliances (see e.g. Palmberg and Martikainen (2003) for a further discussion).

As suggested in the discussion above, we seek explanations for the choice of non-equity alliances over equity-based ones in the tasks being undertaken within alliances, in their industrial contexts and in the characteristics of the partner firms. From a definitional viewpoint our starting point is thereby the information in the data on whether the alliances include equity-investments by the partner firms involved in the alliance. The data also contains information on the actual activities undertaken in terms of R&D, production or market-related activities. Typically the non-equity alliances in the data comprise of R&D development agreements, R&D or production second sourcing agreements, or various types of cross-licensing agreements. Non-equity market-related alliance typically cover various agreements whereby firms exchange marketing rights over specific products/components which make up a larger product system – this is quite common in ICT due to interoperability requirements.

This information on alliances was complemented with firm-level data on patenting at the US Patent Office (USPTO) to cover positional asymmetries of the partner firms, both in terms of size and technological strength. Direct firm size indicators could only be found for a limited

number of firms and were hence dropped. We also collected information on other complementary internationalisation efforts of the Finnish firms, such as foreign turnover and employment, and international mergers and acquisitions to cover FDI.

In order to clarify the empirical set-up we exclude international alliances between multiple firms. The final sample covers 417 bilateral international strategic alliances. Table 1 provides a list of the included Finnish firms, their industrial affiliation, size by net sales, and the number of international alliances that they have been involved in according to our data.

TABLE 1. Finnish firms included in the sample.

	Industry	Net sales in 2003 (mill. e)	Total number of alliances
Nokia	**ICT**	**29 455**	**179**
TeliaSonera	**ICT**	**1 939**	**30**
Elisa	**ICT**	**1 538**	**28**
TietoEnator	**ICT**	**1374**	**39**
Novo	**ICT**	**370**	**18**
Kemira	**Chemical**	**2 738**	**12**
Orion	**Chemical**	**2 262**	**16**
Uponor	**Chemical**	**1 021**	**8**
Dynea	**Chemical**	**992**	**2**
Raisio	**Chemical**	**861**	**6**
Stora Enso	**Forestry-related**	**12 172**	**6**
UPM-Kymmene	**Forestry-related**	**9 948**	**9**
Huhtamäki	**Forestry-related**	**2 108**	**5**
Ahlström	**Forestry-related**	**1 556**	**6**
Outokumpu	**Metals/engineering**	**5 921**	**16**
Kone	**Metals/engineering**	**5 344**	**2**
Metso	**Metals/engineering**	**4 250**	**8**
Wärtsilä	**Metals/engineering**	**2 358**	**7**
KCI Konecranes	**Metals/engineering**	**665**	**3**
Amer	**Diversified**	**1 104**	**4**
Instrumentarium	**Diversified**	**1 036**	**10**
Hackman	**Diversified**	**401**	**3**
Total		**89 413**	**417**

3.2 Dependent and independent variables

Type of international alliance

The dependent variable is constructed based on the information on whether equity investment was involved during alliance formation. It is coded as a binary variable labelled CATEGORY and takes the value 1 if the alliance is based on a non-equity agreement and the value 0 if it involves equity-investment. The dependent variable thereby captures the organisation of international al-

liance involving the included large Finnish firms, compatible with our aim to explain why these firms are opting for looser types of non-equity alliances in their internationalisation efforts and at an increasing rate.

Task and strategic uncertainty

Our focus on task and strategic uncertainty, rather than partner selection uncertainty, as determinants of the organisation of alliances is holistically incorporated through three dummy variables. The information collected on the alliance enabled the classification of all alliances into three main types, namely R&D, production or market-related alliances. R&D alliances are labelled as RTYPE, production alliances as PTYPE and market-related alliances as MTYPE. They take the value 0 or 1 depending on the specific type of tasks or activities involved.[1] The predictive effects of these variables on the organisation of alliances are derived from figure 2 above and similar to the set-up in Casciaro (2003).

The variable RTYPE is assumed to be associated with high task uncertainty since R&D activities typically embody complexity, unpredictable outcomes and high risks. However, the association of R&D activities with high levels of strategic uncertainty is more noteworthy in this context. This is due to the fact that R&D activities, per definition, aim for the development of new marketable products. In these circumstances insights into the markets' demand, supply and valuation is incomplete at best. We thereby predict that R&D activities will encourage firms to choose non-equity alliances over equity based ones in their internationalisation efforts.

The variable PTYPE is assumed to be associated with moderate to high levels of task uncertainty, and low to moderate levels of strategic uncertainty. This is because production involves the exchange of relatively standardised inputs and outputs between the partners, and is subject to high levels of standardisation and coordination. Nonetheless, strategic uncertainty tends to be low since voluminous production already presupposes knowledge about the markets' demand, supply and valuations, even in cases where the technologies are new to the market. We thereby predict that production activities will encourage firms to favour equity-based alliances over non-equity ones due to advantages of tighter coordination between firms.

The variable MTYPE is assumed to be associated with highly variant levels of task uncertainty as market-related alliances might differ greatly in nature. They might be limited in scope as joint promotional efforts or the transfer of marketing rights over established products. They might also cover complex joint design, retailing or after-sales activities in new markets whereby task uncertainty might be high. As regards strategic uncertainty it can be assumed that it ranges

1 Some alliances cover a combination of these activities. The variables are however constructed to describe the principal function of alliance and thus each alliance can belong to only one of the activity categories.

from low to moderate since joint market-related alliance activities also presupposes knowledge about the markets' demand, supply and valuations. Still the heterogeneous nature of market-related alliances implies that any clear-cut predictions are hard to make. In line with Casciaro (2003) we also refrain from doing so.

Technology fields

As suggested above the viability of non-equity alliances will depend on the broader industrial context, especially in terms of the nature of different technology fields. There is empirical evidence to suggest that non-equity alliances are preferred in new and dynamic technology fields in which risks and costs are higher, irrespective of the level of strategic uncertainty, while equity-based alliances are preferred in more stable fields (Hagedoorn and Narula, 1996; Hagedoorn, 2002).

In order to control for this we constructed dummy variables for different technology fields based on the description of the technological content of alliances.[2] These variables capture the technological contexts on an aggregate level, differentiating between the fields of chemicals (including pharmaceuticals) labelled CHEM, ICT labelled ICT, mechanical technologies labelled MECH and various other miscellaneous technology fields labelled MISC. They take the value 0 or 1 depending on the technology fields involved.

Positional asymmetries between partners

The variables capturing positional asymmetries between the partner firms are based on the number of granted patents at the USPTO that the firms have accumulated and are thus continuous. APOS is constructed as the absolute difference in granted patents of the alliance partners. We include a logarithmic transformation of this variable, LNAPOS, to incorporate for significant variance of APOS (see table 2). Further, we construct a dummy variable DAPOS to assess whether positional asymmetries in terms of the number of patents favourable to the foreign partner has any effects on the organisation of alliances from the viewpoint of the Finnish firms.[3]

As suggested above the level of patenting usually correlates positively with firm size. APOS, LNAPOS and DAPOS thereby capture the joint effects of technological strength asymmetries between the partners and firm size. From the extant literature we know that such positional asymmetries might affect alliance formation in various ways depending on the activity undertaken. We therefore also extend the analysis to include interaction variables defined as RTYPE*LNAPOS, PTYPE*LNAPOS and MTYPE*LNAPOS. These extensions seek to interrogate whether positional

2 The technology fields are defined based on the nomenclature used by the US Patent Office as done by Jaffe and Trajtenberg (2002).
3 We calculated the total stock of US patents granted April 2004.

asymmetries between partners to the alliances have a mediating effect on the suggested relationships between task and strategic uncertainty and the organisation of alliances. Nonetheless, no clear-cut predictions are derivable from the extant literature (Baughn et al., 2001).

Country of origin

Our focus on international cross-border alliances adds a new dimension to Casciaro (2003) which is limited to an empirical analysis of strategic alliances between US firms in the ICT industry. We can include country dummies to cover unobserved effects of different national regulations, norms or cultures on the organisation of international alliances. These country dummies are constructed based on the country of origin of the foreign partner firms to the alliances.

Altogether the database covers alliances with firm partners from 45 different countries. We single out the six most important countries as dummies to cover about 70% of all alliances. These dummies include SWE for Sweden, USA for USA, FRG for Germany, PRC for China, JPN for Japan, and FRA for France. The variable ROW captures all remaining countries, i.e. the remaining 30% of the alliances. They take the value 0 or 1 depending on the country of origin involved.

Complementary internationalisation

The role of FDI in the internationalisation efforts of firms is relatively well understood, also in the case of large Finnish firms. In this paper we suggest that international strategic alliances – especially of the non-equity kind – offer complementary means of internationalisation. In the extant literature there is some evidence to suggest that such alliances are interrelated with the FDI strategies of firms (Narula and Zanfei, 2003). In order to control for these possible interrelationships we also include variables to capture the extent of FDI that the included firms have been involved in.

FDI covers equity investment into established or new entities abroad. Cross-border mergers and acquisitions (M&A) is the dominating type of FDI in the case of large Finnish firms. We constructed a continuous control variable, FORMA, to captures this. FORMA is defined as the number of cross-border acquisitions that the Finnish firms have been engaged in 1996–2003. We also constructed the control variable FOREMP defined as the average percentage share of foreign employees in 1996–2003.[4] This variable can be interpreted as a very general measure of the degree of internationalisation of the firms, even though international strategic alliances are excluded.

4 Due to data constraints the length of time period for the two measures of complementary means of internationalisation is somewhat shorter than in the case of alliance data.

4 EMPIRICAL ANALYSIS

4.1 Descriptive analysis

Table 2 provides descriptive statistics of the sample and variables used in the analysis. We can see that 78 percent of all alliances are non-equity ones. Categorized by the type of activity, R&D alliances have the largest share in the sample (58%) followed by market related (27%) and production alliances (15%). Categories of the technological field reveal that 2/3 of alliances are related to ICT.

Our proxy for positional asymmetries between partners, APOS, indicates that there is a huge variance in the partner firms' patent portfolios and/or size. To cope with this feature in the ensuing empirical analysis we use logarithmic transformation of the variable (ln(1+APOS)). Further, DAPOS shows that almost 1/3 of alliances involve foreign partners with a larger patent portfolio than the Finnish partner.

By countries of foreign partners, the frequency is the highest for the US firms (43%), followed by the Swedish (7%) and German (7%) ones. Our measure for the degree of internationalisation, FOREMP, shows that on average the share of foreign employees is 45%. The proxy for FDI, FORMA, reveals that the number of M&As of the sample firms in 1996–2003 period ranges from 0 to 36, while the average is 14 acquisitions.

TABLE 2. Descriptive statistics.

	Mean	S.D.	Min	Max	N
CATEGORY	**0,78**	**0,41**	**0**	**1**	**417**
RTYPE	**0,58**	**0,49**	**0**	**1**	**417**
MTYPE	**0,27**	**0,45**	**0**	**1**	**417**
PTYPE	**0,15**	**0,36**	**0**	**1**	**417**
CHEM	**0,20**	**0,40**	**0**	**1**	**417**
ICT	**0,66**	**0,47**	**0**	**1**	**417**
MECH	**0,12**	**0,33**	**0**	**1**	**417**
MISC	**0,01**	**0,08**	**0**	**1**	**417**
APOS	**2489**	**3936**	**0**	**24818**	**417**
LNAPOS	**5,81**	**2,88**	**0**	**10,12**	**417**
DAPOS	**0,31**	**0,46**	**0**	**1**	**417**
SWE	**0,07**	**0,25**	**0**	**1**	**417**
USA	**0,43**	**0,50**	**0**	**1**	**417**
FRG	**0,06**	**0,25**	**0**	**1**	**417**
PRC	**0,05**	**0,22**	**0**	**1**	**417**
JPN	**0,04**	**0,20**	**0**	**1**	**417**
FRA	**0,04**	**0,19**	**0**	**1**	**417**
ROW	**0,31**	**0,46**	**0**	**1**	**417**
FOREMP	**0,45**	**0,22**	**0,04**	**0,92**	**417**
FORMA	**14**	**10**	**0**	**36**	**417**

Table 3 depicts unconditional pair-wise correlations. We can see that the preference for non-equity alliances over equity based ones by the variable CATEGORY correlates positively both with RTYPE and MTYPE and negatively with PTYPE. All these correlations are also statistically significant ($p<0.01$). CATEGORY correlates positively and statistically with ICT ($p<0.01$) and negatively with CHEM ($p<0.10$) and MECH ($p<0.01$). Further, all our measures for positional asymmetries between partners (APOS, LNAPOS, DAPOS) correlate positively and statistically significantly with CATEGORY.

From the country controls, positive and statistically significant correlation with CATEGORY is found in the case of USA ($p<0.01$), while the correlation is negative for PRC ($p<0.01$) and ROW ($p<0.05$). Finally, FOREMP seems to correlate negatively and statistically significantly ($p<0.01$) with CATEGORY while no correlation is found in the case of FORMA.

These unconditional correlations thus preliminary suggest that firms choice of non-equity alliances over equity-based ones in their internationalisation efforts foremost are determined by the involvement of R&D or market related activities, ICT-related technologies, and situations in which there are positional asymmetries between partners during the formations of alliance.

4.2 Econometric analysis

In order to elaborate further on the descriptive analysis we next run standard probit regressions in which the dependent variable is CATEGORY. Probit regressions use maximum likelihood methods to model the behaviour of a binary variable, such as CATEGORY, so that the results are interpreted in terms of the probability that the variable in question takes the value 1.[5] In this set-up we use three different sets of explanatory variables that are added in phases to the estimations.

The *first set* includes the variables capturing the different types of alliances based on the activities undertaken within the alliance (PTYPE is the omitted category). As suggested these are taken as indicative of various levels of task and strategic uncertainty related to alliance activity as the prime focus of the analysis. In addition, the first set includes dummy variables to capture technology fields (MECH is the omitted category).

We can see from Table 4 below that in this specification the coefficients RTYPE and MTYPE are positive and statistically significant ($p<0.01$), while the benchmark PTYPE is characterised by the opposite effect. These results confirm our descriptive analysis that R&D- and market- related alliance activities determine firms' choice of non-equity international alliances over equity based ones, while the effect of PTYPE is the opposite. Since R&D activities are taken to indicate higher levels of both task and strategic uncertainty, the effects of RTYPE and PTYPE are in line with our predictions derived from the analytical framework and the results in Casciaro (2003). In the case

5 See, for example, Greene (2003) for more detailed description of probit model.

TABLE 3. Pairwise correlations.

	CATEGORY	RTYPE	MTYPE	PTYPE	CHEM	ICT	MECH	MISC	APOS	LNAPOS	DAPOS	SWE	USA	FRG	PRC	JPN	FRA	ROW	FOREMP	FORMA
CATEGORY	1.000																			
RTYPE	0.207	1.000																		
	(0.000)																			
MTYPE	0.220	–0.718	1.000																	
	(0.000)	(0.000)																		
PTYPE	–0.563	–0.489	–0.256	1.000																
	(0.000)	(0.000)	(0.000)																	
CHEM	–0.086	–0.060	0.045	0.028	1.000															
	(0.081)	(0.218)	(0.364)	(0.568)																
ICT	0.313	0.164	0.072	–0.317	–0.701	1.000														
	(0.000)	(0.001)	(0.145)	(0.000)	(0.000)															
MECH	–0.345	–0.162	–0.150	0.414	–0.188	–0.531	1.000													
	(0.000)	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)														
MISC	–0.024	–0.042	0.012	0.044	–0.042	–0.120	–0.032	1.000												
	(0.629)	(0.391)	(0.816)	(0.368)	(0.387)	(0.014)	(0.513)													
APOS	0.173	0.148	–0.062	–0.128	–0.130	0.207	–0.143	–0.038	1.000											
	(0.000)	(0.003)	(0.210)	(0.009)	(0.008)	(0.000)	(0.004)	(0.439)												
LNAPOS	0.210	0.217	–0.142	–0.124	–0.002	0.094	–0.138	–0.028	0.632	1.000										
	(0.000)	(0.000)	(0.004)	(0.011)	(0.966)	(0.056)	(0.005)	(0.566)	(0.000)											
DAPOS	0.155	–0.096	0.191	–0.107	–0.050	0.095	–0.082	0.004	0.313	0.111	1.000									
	(0.002)	(0.051)	(0.000)	(0.030)	(0.306)	(0.053)	(0.096)	(0.936)	(0.000)	(0.024)										
SWE	0.026	0.035	0.029	–0.085	–0.062	0.089	–0.043	–0.023	–0.126	–0.299	–0.057	1.000								
	(0.600)	(0.473)	(0.556)	(0.082)	(0.208)	(0.069)	(0.378)	(0.642)	(0.010)	(0.000)	(0.250)									
USA	0.221	0.060	0.145	–0.265	–0.017	0.172	–0.238	–0.016	0.223	0.260	0.278	–0.232	1.000							
	(0.000)	(0.220)	(0.003)	(0.000)	(0.724)	(0.000)	(0.000)	(0.743)	(0.000)	(0.000)	(0.000)	(0.000)								
FRG	–0.003	0.028	–0.030	0.000	0.064	–0.040	–0.040	0.093	–0.081	–0.121	–0.030	–0.071	–0.227	1.000						
	(0.959)	(0.575)	(0.539)	(0.994)	(0.192)	(0.416)	(0.412)	(0.058)	(0.100)	(0.014)	(0.544)	(0.150)	(0.000)							
PRC	–0.187	–0.102	–0.049	0.203	–0.037	0.009	0.041	–0.020	–0.049	–0.041	–0.159	–0.063	–0.204	–0.062	1.000					
	(0.000)	(0.037)	(0.323)	(0.000)	(0.451)	(0.858)	(0.406)	(0.683)	(0.315)	(0.400)	(0.001)	(0.197)	(0.000)	(0.206)						
JPN	–0.059	0.062	–0.104	0.044	–0.047	–0.049	0.134	–0.018	0.199	0.172	0.086	–0.057	–0.183	–0.056	–0.050	1.000				
	(0.228)	(0.206)	(0.034)	(0.371)	(0.341)	(0.319)	(0.006)	(0.713)	(0.000)	(0.000)	(0.078)	(0.246)	(0.000)	(0.255)	(0.307)					
FRA	–0.046	0.019	–0.011	–0.013	–0.006	–0.017	0.038	–0.017	–0.058	–0.057	–0.027	–0.054	–0.172	–0.053	–0.047	–0.042	1.000			
	(0.353)	(0.698)	(0.831)	(0.787)	(0.906)	(0.735)	(0.439)	(0.729)	(0.240)	(0.250)	(0.588)	(0.275)	(0.000)	(0.284)	(0.337)	(0.388)				
ROW	–0.114	–0.084	–0.082	0.219	0.059	–0.188	0.205	0.005	–0.168	–0.084	–0.201	–0.179	–0.574	–0.175	–0.157	–0.141	–0.133	1.000		
	(0.020)	(0.087)	(0.096)	(0.000)	(0.230)	(0.000)	(0.000)	(0.921)	(0.001)	(0.087)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.004)	(0.007)			
FOREMP	–0.168	0.173	–0.351	0.199	0.153	–0.329	0.242	0.143	–0.005	0.231	–0.258	–0.044	–0.052	–0.098	0.047	0.099	–0.053	0.121	1.000	
	(0.001)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.003)	(0.912)	(0.000)	(0.000)	(0.376)	(0.290)	(0.046)	(0.337)	(0.044)	(0.281)	(0.013)		
FORMA	0.039	0.226	–0.184	–0.084	–0.130	0.190	–0.102	–0.065	–0.004	0.003	–0.102	0.219	–0.014	–0.065	–0.048	0.026	–0.088	–0.017	0.450	1.000
	(0.425)	(0.000)	(0.000)	(0.086)	(0.008)	(0.000)	(0.037)	(0.187)	(0.930)	(0.945)	(0.037)	(0.000)	(0.783)	(0.188)	(0.332)	(0.593)	(0.073)	(0.731)	(0.000)	

Notes: p-values are presented in the parentheses.

TABLE 4. Estimation results.

	Probit estimations. dependent variable CATEGORY					
	(1)		(2)		(3)	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
RTYPE	1.592	0.217***	1.896	0.564***	1.892	0.569***
MTYPE	2.031	0.267***	2.670	0.619***	2.667	0.625***
CHEM	0.207	0.260	0.093	0.282	0.076	0.284
ICT	0.695	0.228***	0.620	0.244**	0.567	0.276**
MISC	0.439	0.969	0.185	0.976	0.258	0.985
LNAPOS			0.191	0.088**	0.200	0.089**
DAPOS			0.357	0.211*	0.336	0.213
LNAPOSxRTYPE			–0.071	0.094	–0.071	0.095
LNAPOSxMTYPE			–0.123	0.110	–0.128	0.111
SWE			0.018	0.370	0.048	0.380
USA			–0.184	0.226	–0.188	0.227
FRG			0.022	0.354	0.003	0.358
PRC			–0.805	0.361**	–0.815	0.364**
JPN			–0.707	0.405*	–0.701	0.406*
FRA			–0.510	0.405	–0.544	0.411
FOREMP					–0.322	0.581
FORMA					–0.001	0.011
Observations	417		417		417	
Chi2	126.067		151.037		151.586	
degr. of freedom	5		15		17	
significance	0.000		0.000		0.000	
Pseudo R2	0.288		0.345		0.346	
Log likelihood	–155.747		–143.262		–142.987	

Notes: CATEGORY takes value 1 if the alliance is a non-equity one and 0 if it involves equity investment. S.E.= standard error. The asterisks indicates statistical significance of coefficients: (***) denotes significance at 1 percent level. (**) at 5 percent level and (*) at 10 percent level.

of MTYPE, no prediction was made and hence the result provides explorative evidence of the association between market-related activities and high strategic uncertainty. In addition, from dummy variables capturing technology fields of alliances, only the coefficient for ICT is positive and statistically significant ($p < 0.01$).

In the *second set* we extend the specification to include the variables to capture positional asymmetries between partners and foreign partners' country of origin (ROW is the omitted category).

In this set RTYPE, MTYPE and ICT remain positive and statistically significant although the significance of ICT weakens somewhat ($p < 0.05$). The coefficient for LNAPOS is positive and significant ($p<0.05$) which suggests that positional asymmetries between partners appear to matter and favour looser types of non-equity alliances in the internationalisation efforts of firms. In

addition, the coefficient for DAPOS is positive and weakly significant ($p < 0.10$). This gives some indication that from the viewpoint of the Finnish firms non-equity alliances are favoured in situations in which the foreign partner is larger in terms of technological strength/size. The coefficients for the interaction variables LNAPOS*RTYPE and LNAPOS*MTYPE are statistically insignificant. Table 4 also shows that the non-equity alliances tend to be disfavoured when Chinese or Japanese partners are involved as indicated by the negative and statistically significant ($p < 0.05$) coefficient for PRC and negative and weakly statistically significant ($p < 0.10$) coefficient for JPN.

In the *third set* we add the variables to capture complementary internationalisation efforts, FOREMP and FORMA. In this final set all previously noted results remain valid with the exception that DAPOS is now insignificant. However neither FOREMP nor FORMA turn up as significant, although the sign of their coefficients are both negative.[6] Thus, by and large there does not seem to be a noteworthy relationship between FDI or more traditional modes of internationalisation and international non-equity alliances in this data.

4.3 Robustness analysis

In the following we summarize the results of some additional analysis to study the robustness of our probit model estimation findings. Taking each robustness test in turn:

Robustness test 1

In order to show that our results are not biased by the estimation model used, we rerun estimations by using alternative estimation models. Specifically, we rerun the estimations by using 1) logit instead of probit model and 2) standard OLS with robust standard errors. In these estimations the coefficients for RTYPE, MTYPE and ICT maintain their signs and remain statistically significant (for RTYPE and MTYPE $p < 0.01$ and for ICT $p < 0.05$) in all three variable specification sets and hence appear robust. Also the sign and significance level of LNAPOS remain unchanged in the logit and OLS estimations while DAPOS is insignificant in these estimations. The coefficients for PRC and JPN remain negative and maintain their significant levels ($p < 0.05$ and $p < 0.10$, respectively) in sets 2 and 3 in which they are included. We can conclude that the main results appear as robust according to this first robustness test.

Robustness test 2

The largest Finnish firm, Nokia, also has the largest number of international alliances in the sample. To analyse whether our findings are driven by this single firm we excluded it from the sample

6 We ran estimations also with logarithmic transformations of FOREMP and FORMA. This modification had no effect on the results.

and rerun the probit estimations. In these estimations MTYPE, RTYPE and ICT remain positive and maintain their significance levels. However, the significance of the other coefficients weakens even though their signs remain the same. In the specification 3, for instance, only RTYPE, MTYPE and ICT are statistically significant. From the other variables LNAPOS is the closest to acceptable significance levels, in specification 2 the p-value is 0.090 and in specification 3 the p-value is 0.105. We can conclude that the effects of other than the three above mentioned variables are dependent on the inclusion of Nokia in the sample, even though the main variables which we are focusing in this paper remain robust also according to this second robustness test.

5 CONCLUDING DISCUSSION

The point of departure of this paper is in the recent rapid growth of non-equity alliances globally and from the viewpoint of large Finnish firms. We suggest that such alliances offer a complementary means of internationalisation when compared with FDI and other equity-based investments, such as joint ventures. Using new data we focus on the formation of international strategic alliances of these large Finnish firms with the aim of identifying the determinants of the choice of non-equity alliances over equity-based ones, and thereby also contribute with new insights into the reasons behind the rapid internationalisation of these firms through such strategic alliances.

In general the recent rapid growth of non-equity international alliances foremost relates to the introduction of space-shrinking ICT-related technologies, the harmonisation of regulations and barriers governing cross-border transaction, and to increasing complexities, risks and costs associated with new technologies. In the traditional theoretical literature strategic alliance formation and organisation is typically interpreted in terms of transaction costs and uncertainties related to partner selection during alliance formation. Instead, in this paper we followed a recent paper by Casciaro (2003) and framed the empirical analysis from the viewpoint of trade-offs between a combination of so-called task and strategic uncertainties, deduced from the type of alliance activity involved. Further, we included variables to control for different technology fields, to capture positional asymmetries between the partners, countries of origin, and complementary internationalisation efforts.

The descriptive and econometric analysis suggests that firms' choice of looser types of non-equity alliances over equity based ones in their internationalisation efforts are determined by their involvement in R&D and market-related activities, such as joint promotional efforts or design, transfer of marketing rights, retailing or after sales services. This result was interpreted in terms of high strategic uncertainty, or the high risks and costs involved in the development and commercialisation of new technologies, products or processes. In such situations large Finnish firms are increasingly prone to engage in non-equity alliances as a part of their internationalisation efforts.

This result is in line with extant research and the observation of rising R&D intensities in Finnish industries since the early 1990s. It is also compatible with the increasing involvement of these firms in international markets as captured by various other indicators (Lovio, 2004). In contrast, production-related activities are associated with tighter equity-based alliance organisations such as joint ventures. We thus also conclude that non-equity strategic alliances have contributed less to the internationalisation of production-related activities of these firms when compared with R&D and market-related activities.

These conclusions receive further confirmation based on the association between alliances in ICT-related technology fields with a preference for non-equity alliances since ICT is a prime example of a new and rapidly developing technology field characterised by high market uncertainty at present. We also know from extant research that non-equity alliances are particularly prominent in ICT-related fields due to prevalence of complementary technologies, systemic innovation, standardisation and network externalities (Palmberg and Martikainen, 2006).

Regarding positional asymmetries between firms the results indicate a positive association between non-equity international alliances and positional asymmetries – measured by the size differences of patent portfolios of partner firms – although the result suffers from non-robustness when Nokia is excluded from the estimations. Nonetheless, we take these results as a weak indication that positional asymmetries matter in alliance formation, as also suggested in extant research. Such positional asymmetries foremost concern issues related to bargaining power and IPRs, or the differing capability of firms to manage non-equity alliances which have not been captured in our analysis in a satisfactory way (Baugh et al., 2001). The specificities of the results regarding Nokia probably reflect the variance in the size of patent portfolios of Nokias partners, the superior internationalisation pattern of this firm when compared to most other firms in the sample, and specificities of the ICT industry.

In terms of country of origin of the foreign partners to the alliances, the only noteworthy result is that large Finnish firms forming alliances with Asian (Chinese and Japanese) partners appear to favour equity-based alliances rather than non-equity ones. However, a discussion on the specificities of these Asian countries' regulations, norms or business cultures governing alliances is beyond the scope of this paper and would warrant further in-depth research. Finally, we can conclude that the international alliance activities of large Finnish firms appear to be unrelated to their FDI activities. This conclusion is based on the insignificant effects of M&As intensity and the average share of foreign employees on the dependent variable. It suggests that the recent rapid growth of international strategic alliances presents new challenges for Finnish firms in the globalising economy.

Further research areas in the domain pursued here could concern the indications that positional asymmetries between firms matter in alliance formation. It would be important to develop

better indicators to capture such asymmetries in greater detail, as well as to investigate qualitatively how various types of asymmetries between firms affect their position in alliances and the outcomes that alliances have on the performance and positioning of firms in the markets. These are especially important questions from the viewpoint of Finnish firms, which might be classified as large in a Finnish context but nonetheless constitute small played in global competition. ■

REFERENCES

ALI-YRKKÖ, J., LOVIO, R. and YLÄ-ANTTILA, P. (eds.). 2004. *Multinational Enterprises in the Finnish Innovation System*. The Research Institute of the Finnish Economy (ETLA) B:208.

BAUGHN, C., DENEKAMP, J., STEVENS, J. and OSBORN, R. 2001. Protecting intellectual capital in international alliances. *Journal of World Business*. 32(2), 103–117.

CALOGHIROU, Y., IOANNIDES, S. and VONORTAS, N. 2003. *Journal of Economic Surveys*, vol. 17, no.4.

CASCIARO, T. 2003. Determinants of governance structure in alliances: the role of strategic, task and partner uncertainties. *Industrial and Corporate Change*, vol.12, no. 6, 1223–1251.

COASE, R. 1937. The Nature of the Firm. *Economica* no.5, 4. 386–405.

DAS, T. and TENG, B. 1998. Between trust and control: developing confidence in partner cooperation in alliances. *Academy of Management Review*, 23, 49–521.

DUNNING, J. 1995. Reapprasing the eclectic paradigm in an age of alliance capitalism. *Journal of International Business Studies*, Third Quarter, 461–491.

DUNNING, J. and BOYD, G. (eds.). 2003. *Alliance capitalism and corporate management – Entrepreneurial cooperation in knowledge-based economies*. Cheltenham: Edward Elgar.

GREENE, W. 2003. *Econometric analysis*. Fifth Edition. New Jersey: Prentice-Hall, Inc.

GULATI, R. and SINGH, H. 1998. The architecture of cooperation: managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly*, 43, 781–814.

HAGEDOORN, J., LINK, A. and VONORTAS, N. 2000. *Research partnerships*. Research Policy 29, 567–586.

HAGEDOORN, J. 2002. Inter-firm partnerships: an overview of major trends and patterns since 1960. *Research Policy* 31, 477–492.

HAGEDOORN, J. and NARULA, R. 1996. Choosing organizational modes of strategic technology partnering: international and sectoral differences. *Journal of International Business Studies*, Second Quarter 1996, 265–284.

HERNAN, R., MARIN, P. and SIOTIS, G. 2003. An empirical evaluation of the determinants of research joint venture formation, *The Journal of Industrial Economics*, vol. LI, 75–89.

JAFFE, A. and TRAJTENBERG, M. 2002. *Patents, citations & innovations – A window on the knowledge economy*. Cambridge MA: The MIT Press.

LOVIO, R. 2004. Internationalization of R&D activities of Finnish corporations – recent facts, management and policy issues. In Ali-Yrkkö, J., Lovio, R. and Ylä-Anttila, P (eds.) *Multinational Enterprises in the Finnish Innovation System*. The Research Institute of the Finnish Economy (ETLA) B:208.

LEMOLA, T. 1994. *Yritysten välisen teknologiayhteistyön tausta ja muutoksen suuntaviivat*. VTT tiedotteita 1540.

LUUKONEN, T. 2002. Technology and market orientation in company participation in the EU framework programme. *Research Policy* 31, 437– 455.

NARULA, R. and ZANFEI, A. 2003. The international dimension of innovation. *MERIT-Infonomics Research Memorandum Series* 2003–009.

NOOTEBOOM, B. 1999. *Inter-firm alliances – Analysis and design*. London: Routledge.

PAJARINEN, M. and YLÄ-ANTTILA, P. (eds.). 1999. *Cross-Border R&D in a Small Country – The case of Finland*. Helsinki: Taloustieto Oy.

PALMBERG, C. and MARTIKAINEN, O. 2003. The economics of strategic R&D alliances – A review with focus on the ICT sector. *ETLA Discussion papers*, No. 881.

PALMBERG, C. and MARTIKAINEN, O. 2006. Pooling knowledge – Trends and characteristics of R&D alliances in the ICT sector. Forthcoming in Zysman, J and Newman, A (eds.) *How revolutionary was the revolution? National responses, market transitions, and global technology in the digital era*. Stanford University Press.

SERAPIO, M. and HAYASHI, T. 2004. *Internationalization of research and development and the emergence of global R&D networks*. Amsterdam: Elsevier, Research in International Business vol.8.

TEECE, D. 1992. Competition, cooperation, and innovation. Organizational arrangements for regimes of rapid technological progress. *Journal of Economic Behavior and Organization* 18, 1–25..

WILLIAMSON, O. 1975. *Markets and Hierarchies: analysis and antitrust implications*. Free Press, New York.

WILLIAMSON, O. 1985. *The economic institutions of capitalism*. Free Press, New York/London.

WILLIAMSON, O. 1991. Comparative economic organization: the analysis of discrete sructural alternatives. *Administrative Science Quarterly*, 36, 269–296.

WILLIAMSON, O. 1999. Strategy research: governance and competence perspectives. *Strategic Management Journal* 20, 1087–1108.