Organizational modes of inter-firm co-operation and technology transfer*

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Abstract

In economic analyses co-operative agreements are occasionally discussed with reference to their dissimilarity in organizational and economic 'solidity' and the impact of separate modes of co-operation on economic performance. However, many studies still refer only to joint ventures and apparently assume that other forms of co-operation share identical features. Nevertheless, it should be clear that co-operative agreements differ with respect to both organizational and economic effects. For example, a joint venture is a new company established by two or more partners and, as such, it introduces a change in an existing market structure; a licensing agreement, which regulates technology transfer in return for a fee, definitely has less far-reaching consequences for the companies involved. In other words, it is important to note that the organizational design of co-operation can be expected to be related to the strategies and economic performance of companies, reflecting their ability to model their inter-firm relationships.

The major objective of this paper is to present a detailed overview of different modes of inter-firm co-operation. This study shows the variety of inter-firm agreements, reflecting the complexity and dynamics of private governing structures in capitalist economies which are attempting to cope with the present far-reaching consequences of technological development.

1. Introduction¹

In economic analyses co-operative agreements between distinct companies are occasionally discussed with reference to their dissimilarity in organizational and economic 'solidity' and the impact of separate modes of co-operation on economic performance. However, many studies still refer only to joint ventures and apparently assume that other forms of co-

*This paper is one of a series of papers in a research project entitled 'Inter-company Co-operation and Technological Development' at MERIT. This research focuses on the empirical analysis of changes in industry structures and global trends in different modes of inter-firm agreements in a large number of fields of technology. It also addresses theoretical questions regarding inter-firm co-operation as well as methodological issues on applied network and multivariate analysis of strategies and industry structures. Empirical analysis is based upon the Co-operative Agreements and Technology Indicators (CATI) data base, which contains information on several thousands of world-wide co-operative agreements and the companies involved.
operation share identical features. In many empirical studies, joint ventures, technology exchange agreements, licence agreements and a number of other modes of co-operation are placed under the same heading as 'strategic partnerships' or corporate ventures. Nevertheless, it should be clear that such agreements differ in both organizational and economic effects. For example, a joint venture is a new company established by two or more partners and, as such, it introduces a change in an existing market structure; a licensing agreement, which regulates technology transfer in return for a fee, definitely has less far-reaching consequences for the companies involved. In other words, it is important to note that different forms of organizational design of co-operation will have divergent effects on market structures and the companies involved. Various modes of inter-firm co-operation can also be expected to be related to different strategies and economic performances of participating companies, reflecting their ability to model their inter-firm relationships.  

To improve our understanding of inter-firm co-operation a number of taxonomies have been introduced. Auster [2] has differentiated 'international corporate linkages' into technology transfers and exchanges, R&D arrangements and joint ventures. Chesnais [3, p. 515 ff.] presented a taxonomy of types of inter-company agreements which are, amongst other things, set against government involvement, technological characteristics, capital requirements and industry structures. This taxonomy will be discussed more thoroughly at a later stage of our research; at present, we will refer only to its distinction of different modes of co-operation. Somewhat different categorizations are found in refs. 4 (p. 4) and 5 (p. 6). The former introduced a categorization based on the degree of ownership and control, and the latter proposed a classification of different types of co-operative agreements, leading from more extensive to intensive forms of co-operation between companies. Elaborating upon these taxonomies, we suggest the tentative classification of modes of co-operation in terms of the extent of inter-organizational dependence, as presented in Table 1.  

In the following we will present an overview of the forms of co-operation listed in Table 1. Our attention will be focused on those modes of co-operation in which technology transfer, technology-sharing, R&D collaboration or, more generally, innovation-motivated co-operation is an essential feature of the agreement.

<table>
<thead>
<tr>
<th>Mode of co-operation</th>
<th>Organizational interdependence</th>
</tr>
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<tbody>
<tr>
<td>Joint ventures and research corporations</td>
<td>Large</td>
</tr>
<tr>
<td>Joint R&amp;D, such as research pacts and joint development agreements</td>
<td>Medium</td>
</tr>
<tr>
<td>Technology exchange agreements (mutual), technology sharing, cross-licensing, mutual second-sourcing</td>
<td></td>
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<tr>
<td>Direct investment, minority and cross-holding</td>
<td></td>
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<tr>
<td>Customer-supplier relations, R&amp;D contract, co-production, co-makership</td>
<td></td>
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<tr>
<td>One-directional technology flow, second-sourcing, licensing</td>
<td>Small</td>
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</table>

2. Distribution of several modes of inter-firm co-operation

It will be clear that the various modes of co-operation introduced in Table 1 not only represent divergent forms of organizational interdependence, but also that their occurrence
and public 'appearance' can be expected to vary. In Fig. 1 we present the distribution of these modes of co-operation as relevant shares of MERIT’s databank on alliances. It is shown that joint research pacts (such as joint development agreements and research pacts), and research joint ventures and research corporations are important modes of co-operation. The former represents over 25% of all co-operative agreements, and the latter mode comprises over one-fifth. Technology exchange agreements (such as technology sharing, cross-licensing and mutual sourcing) and customer-supplier relationships are the two smallest groups of agreements in our databank. Direct investments and one-directional technology flows each account for about 16% of the agreements.

Nevertheless, the relative importance of the different modes of co-operation should be kept in mind in the discussion of the particularities of each mode in the following sections.

Before we enter into the peculiarities of specific modes of co-operation we will present some figures on historical developments in inter-firm co-operation as they follow from our data. In Table 2 the distribution of new agreements for various modes of co-operation is given, going back as far as the early 1950s. It can be seen that there has been a clear growth in the number of agreements since the early 1980s. Over 90% of all agreements in our databank have been established since 1980, and nearly 50% were formed in the past 4 years. It is clear that there has been a growth in absolute numbers for all modes, although growth rates differ substantially. Consequently, we can observe some changes in the relative importance of different forms of co-operation. The relative importance of joint ventures and research corporations has gradually decreased from over 50% of all agreements in the early period to less than 20% in recent years. The share of joint R&D agreements has risen from less than 10% to almost 34%. Technology exchange agreements have gained some importance in the early 1980s, but we notice a relative decline in the last period. The portion of direct investment peaked in the late 1970s, when over a third of all new agreements were established through this mode; since then, the share of this mode has approached the 10% level. Both customer-supplier relations and one-directional technology flows show a somewhat fluctuating pattern in their relative contribution to inter-firm agreements, although customer-supplier relations have gradually increased in relative importance.

Research so far suggests a number of factors which explain this general growth in alliances, such as

- the internationalization of markets;
- the speed, complexity, interrelation and uncertainty of technological development;

Source: MERIT-CATI.

Fig. 1. Distribution of modes of co-operative agreements (percentages of N=3964).

It is important to note that misrepresentation might occur to a certain extent, because some more casual agreements, such as customer-supplier relationships and one-directional technology flows, are little reported publicly, even in the professional literature and press. Furthermore, it should be noted that the present picture represents a total of many fields of technology, whereas it should be taken into consideration that the distribution varies considerably for different fields of technology [6].
TABLE 2. Increase in number of inter-firm agreements by form of co-operation, 4-year periods, absolute numbers and percentages

<table>
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<tr>
<td>Joint ventures and research corporations</td>
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<td>112</td>
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<td></td>
<td>53.2%</td>
<td>41.8%</td>
<td>22.6%</td>
<td>20.8%</td>
<td>17.8%</td>
<td>21.6%</td>
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<tr>
<td>Joint R&amp;D</td>
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<td>22</td>
<td>65</td>
<td>255</td>
<td>653</td>
<td>1009</td>
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<tr>
<td></td>
<td>9.0%</td>
<td>14.4%</td>
<td>13.1%</td>
<td>20.9%</td>
<td>33.7%</td>
<td>25.5%</td>
</tr>
<tr>
<td>Technology exchange agreements</td>
<td>6</td>
<td>4</td>
<td>33</td>
<td>152</td>
<td>165</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>3.8%</td>
<td>2.6%</td>
<td>6.7%</td>
<td>12.4%</td>
<td>8.5%</td>
<td>9.1%</td>
</tr>
<tr>
<td>Direct investment</td>
<td>27</td>
<td>29</td>
<td>168</td>
<td>170</td>
<td>237</td>
<td>631</td>
</tr>
<tr>
<td></td>
<td>17.3%</td>
<td>19.0%</td>
<td>33.9%</td>
<td>13.9%</td>
<td>12.2%</td>
<td>15.9%</td>
</tr>
<tr>
<td>Customer-supplier relationships</td>
<td>5</td>
<td>19</td>
<td>47</td>
<td>133</td>
<td>265</td>
<td>469</td>
</tr>
<tr>
<td></td>
<td>3.2%</td>
<td>12.4%</td>
<td>9.3%</td>
<td>10.9%</td>
<td>13.7%</td>
<td>11.8%</td>
</tr>
<tr>
<td>One-directional technology flow</td>
<td>21</td>
<td>15</td>
<td>71</td>
<td>259</td>
<td>271</td>
<td>637</td>
</tr>
<tr>
<td></td>
<td>13.5%</td>
<td>9.8%</td>
<td>14.3%</td>
<td>21.2%</td>
<td>14.0%</td>
<td>16.1%</td>
</tr>
<tr>
<td>Total</td>
<td>156</td>
<td>153</td>
<td>496</td>
<td>1223</td>
<td>1936</td>
<td>3964</td>
</tr>
<tr>
<td></td>
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<td>100%</td>
<td>100%</td>
<td>100%</td>
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<td>100%</td>
</tr>
</tbody>
</table>

Source: MERIT-CATI.

- increase in costs of R&D;
- the necessity for large companies to monitor a spectrum of technologies (see ref. 6* for a survey of the literature).

3. Organizational modes of inter-firm co-operation

3.1. Joint ventures and research corporations

We refer to joint ventures and research corporations as combinations of the economic interests of at least two separate companies in a 'distinct company'; profits and losses are shared according to equity investment. Joint ventures can be analysed in the context of a number of transitional company strategies in various market situations. Some argue that patterns of joint venture formation can be found in long-term cycles of economic development [7,8]. In theory, different market situations and strategies, such as entry into new markets, repositioning and expansion in existing markets and exit strategies in declining markets, can influence the effectiveness and 'popularity' of joint ventures [9,10]. Variation in joint venture strategies within such market situations can be explained in terms of either transaction cost or strategic behaviour, although a mixture of both strategies is possible. We can expect that options from strategic behaviour will prevail in particular in entry and repositioning strategies. Transaction cost economizing will influence joint venture formation negatively in expansion strategies and positively in pull-back strategies where costs of transactions and other costs become decisive (see also ref. 11).

In our present research we consider as joint ventures those companies that have shared R&D as a specific company objective in addition to production, marketing, sales etc.
Research corporations are joint R&D ventures with distinctive research programmes. Joint ventures, in particular those with an impact on joint R&D, have, according to many observers, become more popular in recent decades. A gradual growth in the number of R&D-related joint ventures has been reported [12-14]. However, joint ventures of the pure R&D type are not very common; manufacturing and marketing are frequently included in the arrangement [14].

As mentioned earlier and shown in Table 2, the relative importance of joint ventures and research corporations as a major mode of intercompany technology transfer has decreased substantially despite their substantial growth in absolute numbers. It is clear that in the past decade a number of other forms of co-operation, in particular joint R&D agreements, have become an alternative to joint ventures.

Despite the still-existing ‘popularity’ of R&D-related joint ventures, the economic and organizational stability of the joint venture mode as such appears questionable. Some experts estimate that about 70% of all joint ventures fall short of expectations or are disbanded. Major reasons for these failures are found in different views of participating companies on strategy and lack of agreement in advance on how to run the company; see, for instance, Business Week (21 July 1986). Kogut's research [15] shows that over 45% of a sample of about 150 joint ventures were terminated within 5 years, with instability rates for international joint ventures peaking after 5 and 6 years. Berg et al. [8, p. 37] found that about 40% of 50 joint ventures in the U.S. chemicals industry in the period 1924-1969 were terminated within 5 years. However, others doubt whether there is hard evidence that the failure rate of international joint ventures exceeds the normal corporate failure rate for single-company ventures [5, p. 25].

Sometimes cost economizing is introduced as the decisive factor in explaining joint venture behaviour. For example, Berg et al. [8] and Berg and Hoekman [9] have introduced a simple model with one large company and one small company, in which co-operation is based upon cost and benefit differentials between both partners. Basic assumptions are very strong as there is free access, and there are no synergies or costs of search. Their model boils down to the appropriation by joint ventures of the benefits curve of the larger company and the cost curve of the smaller company. Consequently, the surplus is higher for the joint venture than it would be for both its partners independently. In our opinion, it is obvious that such assumptions are too restrictive for understanding of the actual problems, benefits and complexities of joint venture formation, because strategically motivated joint ventures are frequently established by companies of similar size, and costs are only one of a number of factors in explaining joint venture formation.

In the literature, potential advantages of joint ventures are associated with the spreading of risks, sharing of fixed costs, capturing of economies of scale, access to new markets, competitive repositioning and sharing of research efforts. Problems in maintaining joint ventures derive from the risks of sharing proprietary know-how, the desire for control by individual partners, co-ordination of different time-horizons, disagreement on design specifications, government policies and the effects of M.E.S. in R&D which can make de-centralization of R&D both costly and difficult to control by partners [4,14,16,17]. Potential disadvantages, from a general welfare economics point of view, are reduction of actual competition, possibility of foreclosure of particular markets and ability to reduce potential competition [14, pp. 22-23].

It will not come as a surprise that R&D-related joint ventures appear to be concentrated in R&D-intensive industries, as demonstrated in a study by Kogut and Singh [18]. Harrigan [10] also found that R&D joint ventures are particularly established in high-tech industries, such as a wide array of information.
technology-related sectors in electronics and communications, and pharmaceuticals. Some-what similar results have been found by Berg and Friedman [12].

However, this does not suggest that R&D joint ventures are concerned with the core of research activities or major strategic activities of their parent companies. Harrigan (4, p. 326) found that

"the higher a product line or area of technology was in strategic importance, the more reluctant firms were to use co-operative strategies to leverage their competitive positions. Joint ventures were formed to supplement some existing strengths; but other forms of co-operation were used in those areas that constituted firms' strategic cores."

She also found few joint ventures with basic research, but the number of joint ventures with development activities demonstrated a growth. These technologically inspired joint ventures were applied by some partners for leapfrogging and to overcome shortcomings of in-house R&D. Then, firms with distribution strengths would choose partners with technological strength to compensate for the lack of in-house capabilities [4, p. 339 ff.; 14, 19].

Research by Hladik [13,16] and Harrigan [4,10] indicates that successful co-operation in joint ventures is affected by the similarity of partners in terms of size, financial resources and technical assets, which we would like to understand as similarity balanced by complementarity. Also, previous relationships and the phenomenon of 'hostages' in continuing collaboration reduce the likelihood of joint venture termination [4,10,13,16; 15, p. 180]. Kogut also found that increasing concentration in industries influences the probability of termination.

Some authors argue that it can be expected that upstream innovative activities within the firm, which are not too close to core technologies, are more likely to be subject to joint ventures than product-related development work, because of competitive pressures [4,20]. However, empirical research on co-operative agreements so far has not been able to identify a clear relationship between joint venture formation and stages of innovative activity [6b].

Our previous research [6b] indicates that many companies consider joint ventures and research corporations as relevant forms of organization of joint research in new areas of research, in particular after a first phase of joint experimenting with technology exchange agreements. If the R&D involved is more crucial to one company, we can expect this partner to attempt to achieve a majority stake or disproportionate influence in the joint venture's management. Sometimes joint ventures are established with smaller, but promising, companies at the fringes of the larger companies' fields of interest. A take-over strategy probably remains a 'hidden' option in case the activities of the joint venture become more important to the larger partner.

3.2. Joint R&D and technology exchange agreements

Both these categories of inter-firm agreements refer to a large number of co-operative arrangements which cover a substantial share of all technological alliances. Joint R&D and technology exchange agreements cover agreements that regulate technology and R&D sharing and/or transfer between two or more companies, such as:

- joint research pacts which establish joint undertaking of research projects with shared resources;
- joint development agreements;
- technology sharing agreements;
- cross-licensing;
- mutual second-sourcing.

These categories of co-operation cover a wide range of legal and organizational
arrangements and also a substantial share of the total of all agreements between companies. In particular, large companies seem to apply many of the agreements mentioned above to explore possible benefits of co-operation before entering into more far-reaching agreements such as joint ventures [6*].

The first two forms of co-operation mentioned above govern agreements where two or more companies organize joint R&D activities

"to reduce costs, minimize risk, and allow synergy among firms pursuing similar innovations" [2, p. 4].

From Table 2 we learn that this mode of co-operation overtook the joint venture as the most important form of partnership in the second half of the 1980s. In recent years over a third of all agreements have been in this category.

The other mode of co-operation, technology exchange agreements, consists of a number of agreements. With technology-sharing agreements, which remains a rather 'vague' category of co-operation, companies negotiate the allocation of established knowledge or artefacts generated either by one partner or through collective efforts. Such agreements can take such a large number of organizational and legal forms that it is difficult to present general features of those agreements, apart from those briefly mentioned above.

The other two sub-categories of technology exchange agreements are the more extended and specific mutual forms of what are usually unilateral organizations of technology flow. Both cross-licensing and mutual second-sourcing are those forms of agreements that have developed from single-source technology transfer mechanisms. Standard licensing agreements are contracts whereby one company, which has proprietary rights, gives another company the right of use in return for payments. Single licensing usually concerns the transfer to partners of somewhat older technologies and products [21, pp. 88-89; 22, p. 76]. So-called licensing for reciprocity and cross-licensing are combined in our understanding of co-operative agreements cross-licences. Strictly, both forms of licensing should be distinguished. With licensing for reciprocity, companies exchange licences to supplement their own research with licensed technology or to avoid patent protection. Cross-licensing refers to agreements in which the value of both licences or packages of licences is calculated [23, pp. 60-64]. In particular, large companies appear to apply these agreements for 'swapping' packages of patents to avoid patent infringements, from which it can be concluded that, compared with unilateral licensing, this bilateral form of technology transfer regulates the relocation of more advanced technology.

As with licensing and cross-licensing, mutual second-sourcing is the bilateral form of the more general second-sourcing agreement. Ordinary second-sourcing agreements are typical of industries involved in information technology; in particular, these agreements are applied by companies which produce micro-electronic components [1]. The OECD [24, p. 52] has described normal second-sourcing contracts as follows:

"Second-sourcing involves a transfer of product technology, often including masks or technical specifications, which allows one firm to make an exact copy of another firm's product . . . . Although second-sourcing will result in loss of market share for the originator of the product, the compensating advantage is the market growth resulting from many suppliers . . . . Present trends in the industry have reinforced this type of arrangement. Complex production processes are vulnerable to minor failure, thus greatly limiting one firm's ability to continuously supply its customers. Furthermore, many end products are becoming more and more dependent on the design of a single component. The result has been a dense network of second-source agreements."
It will be clear that mutual second-sourcing reflects the preference of companies to minimize the risk of opportunistic behaviour by its second-sourcing partner through a reciprocal arrangement.

As shown in Table 2, such technology exchange agreements play a moderate role in inter-firm co-operation; they account for less than 10% of all agreements in our databank. There has been a substantial increase in absolute numbers in the past decade, but on the whole this mode of co-operation is of relatively minor importance compared with the other forms discussed here.

3.3. Direct investment and co-operation

In particular conditions, equity investments can be seen as a form of co-operation between companies which in the long run could affect the technological performance of at least one 'partner'. There are a number of advantages in such equity investments, which can, to a certain extent, be strategically motivated. One company could achieve some control over another company, although the active involvement of the management of the partner company is retained and the assessment of expertise of the company can be made without a complete integration [17]. Such minority stakes, in particular those by a large company in a smaller 'high-tech' company, can be understood as a case of co-operation, in particular if such minority sharing is coupled with research contracts. This practice has become well known specifically in the field of biotechnology [25, p. 31].

In spite of the attention being paid to minority sharing, its achievements and present popularity could be relatively small. From Table 2 it follows that direct investment reached a peak in its relative contribution to inter-firm co-operation during the second half of the 1970s. Since then, the number of agreements has risen moderately, but its relative contribution has dropped below that in earlier periods.

In our opinion, it is doubtful whether large-scale entry into technological achievements of another company and its strategic options are acquired in this way. Because of limited participation, the access to exclusive rights or decision-making will frequently remain small. If a smaller 'high-tech' company is of any interest to a larger company, the more favourable options are probably either majority sharing (integration), joint ventures, technology exchange agreements or research contracts.

In the case of cross-holding, the relations between two companies could be of a more equal character. Although some of the reservations made with reference to minority-sharing apply to cross-holding as well, it can very well be a first step towards integration or closer cooperation between the companies involved.

3.4. Customer-supplier relations and one-directional technology flows

In the first of these modes of inter-firm cooperation we have combined those categories of agreements through which contract-mediated collaboration in either production or research is established. We expect that this form of co-operation is underestimated in our figures because this form of agreement is little reported publicly. Despite such distortion Table 2 shows a substantial growth in recent years, when the number of customer-supplier agreements have doubled and its relative contribution has improved considerably.

These customer-supplier relations can be divided into a number of forms of partnership:

(1) Co-production contracts confirm the agreement between companies to produce a commodity; usually the 'leading' company supplies the technology and critical components, and other companies manufacture less critical components and assemble final products.

(2) Co-makership relations establish long-term contracts between users and suppliers,

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with users out-sourcing a part of their production process to suppliers of sub-assemblies. Cooperation is found in close contacts on quality control, and planning of supply according to standards which are usually set by the user-companies.

(3) Research contracts regulate R&D co-operation in which one partner, usually a large company, contracts another company, frequently a small one, to perform particular research projects. In the literature, some advantages and disadvantages of this mode of co-operation are discussed. For the contract-initiating party, advantages can be found in the possibility to focus on particular areas of research, with substantial cost-saving compared with full-fledged in-house research facilities. Disadvantages for those companies can sometimes be found in the lack of in-house expertise to assess the value of contract research and the dissociation of development expertise from manufacturing expertise [17,26]. On the other hand, there are also some advantages and disadvantages for small R&D-intensive companies engaged in contract research. Benefits are found in terms of secure R&D funding and ensured co-operation with experienced partners. There are also considerable disadvantages, such as:

- loss of capital if R&D is unsuccessful;
- low profit margins from licensing technology;
- contract relationships, and thus revenues, are very likely to be transitory.

Furthermore, these small research companies have few commercial rights to any inventions they developed under contract and they frequently end up with few or no benefits [25, pp. 31–32].

It should be noted that not all contract research is between large companies and small research companies. Some of these contracts are signed between large companies which operate in adjacent fields of technology, e.g. chemicals and electronics. If such contracts occur, the arrangements are frequently settled on mutual terms.

Finally, there are unilateral technology flows, such as second-sourcing and licensing, which were briefly discussed above when we addressed their bilateral counterparts. Advantages of second-sourcing are found in secure and overall growth of supply for one side and secured and regulated demand for the other. Licensing provides speedy entry and relatively inexpensive technology access to the licensee, but, as mentioned above, against the background of limited sophistication of the technology. Benefits for the licensee have to be weighed against the costs of royalties; both licensor and licensee can always be confronted with disloyal and opportunistic behaviour of their partners.

As with customer–supplier relations we expect second-sourcing and licensing agreements to be underestimated in our data as a result of a lack of publicly available information. As shown in Table 2, the absolute number of such agreements has risen substantially during the 1980s, when over 80% of all these agreements were established.

4. Some concluding remarks

Nowadays we notice a growing number of studies on inter-firm co-operation, joint ventures and strategic partnering. In many of these studies, several forms of co-operation are discussed without differentiation between organizational and economic dissimilarities. The major objective of this paper has been to explain the essential characteristics of various modes of co-operation between companies to obtain an introductory understanding of their economic relevance and impact.

In general, it can be said that there has been an increase in the number of co-operative agreements in the last decade. A vast majority (over 85%) of all agreements were established
in the 1980s with almost 50% of all agreements being created since 1985. In other words, we are probably witnessing a substantial change in the strategy of companies regarding inter-firm partnering.

However, certain differences between particular forms of co-operation should be recognized. Some dissimilarities between the categories of modes of inter-firm co-operation become clear at first sight if we consider the distribution of modes of co-operation. Joint ventures and joint R&D, the two most coherent modes, are also the two most reported forms of co-operation, and together represent almost half of all agreements. It seems beyond doubt that both these modes of co-operation are very important mechanisms for inter-company technology flows.

Also, the other modes still represent important methods of inter-firm co-operation; even the relatively less significant form of technology exchange agreement still covers almost 10% of all partnerships. Some forms of co-operation might be somewhat underestimated because of a lack of publicity available information, but each of these forms, from customer–supplier relationships to direct investment and one-directional technology flows, is still substantially represented as a major carrier of inter-firm technology transfer.

It has become clear that there are different degrees of organizational coherence depending on the form of co-operation, which could range from close co-operation in a joint venture to more casual agreements. Such differences are not only relevant to our understanding of the present situation in a number of industries, but also enable us to pay attention to possible historical variations in the degree of co-operation in exploring technological developments.

The mode of co-operation most studied, or most frequently mentioned in the literature, is the joint venture. R&D-related joint ventures, with research corporations as a particular form, can be expected to be used by companies to explore strategic options in both entry and repositioning of markets. This mode is characterized by, among other things, the relatively high degree of inter-firm interdependence. Despite this interdependence and its still-existing ‘popularity’, it appears to be a somewhat unstable form of organization, though probably more stable than some of the other modes of co-operation discussed.

There is some evidence which suggests that R&D joint ventures focus particularly on development activities and preferably do not interfere with the core technology of companies or, if companies are R&D-intensive, their more basic research. Success of joint ventures, and also of other forms of co-operation, appears to be influenced by the similarity of the companies’ technological capabilities and economic performance, although this similarity has to be matched by complementarity with respect to concrete interests.

The unstable character, the sensitivity of R&D in such joint ventures and the substantial investments made in joint ventures could explain why joint R&D agreements have achieved a larger share of all agreements in recent years at the expense of the share of joint ventures. Such considerations could have made companies decide to experiment first with joint R&D agreements, which are less costly and less far-reaching than joint ventures but more solid than some of the other modes of co-operation discussed here.

A large number of co-operative agreements are brought together under the labels of joint R&D and technology exchange agreements. These modes of inter-firm co-operation are at the intermediate level of interdependence between partners. They refer to joint activities which go beyond mere sharing of established technology and knowledge and more elementary commercial relations. This intermediate character, in terms of strong but not too mandatory commitments, makes such arrangements well suited for exploration of closer forms of co-operation such as joint ventures.
In all forms of joint agreements it is possible that, despite the bilateral or multilateral character of cooperation, one partner has a hidden agenda to acquire either the technology involved or its partner itself. Modes of cooperation such as direct investment, customersupplier relations and one-directional technology flows are, although to different degrees, more clearly of a unilateral technology transfer type. There will always be differences in concrete situations, but in general it seems that one partner in such arrangements has the upper hand in terms of discretionary power to organize the arrangement.

This brief exploration demonstrates the variety of inter-firm agreements, which reflects the complexity and dynamics of private governing structures in capitalist economies attempting to cope with the present far-reaching consequences of technological development. Although it seems like the usual knock-down argument of papers with an exploratory character, the conventional remark that 'much research remains to be done before we can understand the implications of this phenomenon' appears truly relevant for this interesting field of economic research.

Notes

1 I am grateful to Jos Schakenraad, my co-researcher in this long-term research project, for his comments and help in providing statistical information for this paper, and to an anonymous referee for helpful comments on the first draft.

2 See Hagedoorn and Schakenraad (1) for a discussion of relevant theoretical contributions by Williamson, Teece and others.

3 Information on our databank can be found in ref. 1.

References

1 J. Hagedoorn and J. Schakenraad, Some remarks on the Co-operative Agreements and Technology Indicators (CATI) information system. MERIT working paper, University of Limburg, 1989.


**Modes organisationnels de coopération entre compagnies et transfert de la technologie**

**RÉSUMÉ**

Dans les analyses économiques les accords de coopération sont de temps en temps examinés quant à leur dissemblance de la "solidité" organisationnelle et économique, et à l'effet de modes de coopération individuels sur le rendement économique. Beaucoup d'études, cependant, ne s'appliquent encore qu'aux entreprises cogérées et semblent supposer que d'autres formes de coopération partagent les mêmes traits. Néanmoins il faut dire que les accords de coopération diffèrent quant aux effets et organisationnels et économiques. Par exemple une entreprise cogérée est une nouvelle compagnie établie par deux partenaires ou plus, et en tant que telle, introduit un changement dans la structure actuelle du marché; une convention d'autorisation qui régit le transfert de la technologie moyennant une redevance à des conséquences beaucoup moins importantes pour les compagnies intéressées. Autrement dit, il faut constater qu'on peut s'attendre à un rapport entre la conception organisationnelle de la coopération d'une part, et les stratégies et le rendement économique des compagnies d'autre part, ce

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qui reflète leur capacité de modeler leurs rapports entre compagnies.
Le but principal de cet exposé est de présenter un examen détaillé des modes différents de coopération entre compagnies. Il montre la variété de conventions entre compagnies, ce qui reflète la complexité et la dynamique des structures gouvernant les échanges, dans les économies capitalistes, lesquelles cherchent à faire face aux conséquences actuelles de grande portée du développement technologique.

**Organisationsmodi der Zusammenarbeit zwischen Firmen und Übertragung der Technologie**

**ABRISSE**


Das Hauptziel dieses Referats ist es einen ausführlichen Überblick der unterschiedlichen Modi der Interfirmen-Zusammenarbeit darzustellen. Dieses Referat stellt die Vielfalt der Vereinbarungen zwischen Firmen dar, die die Komplexität und Dynamik der privaten Verwaltungsrätseln, in kapitalistischen Wirtschaftssystemen, die die zeitigen weitreichenden Folgen der technologischen Entwicklung zu bewältigen versuchen, zeigt.
económico de las empresas en cuestión y refleja su capacidad de adaptación en las relaciones interempresariales. El objetivo principal de este documento es de presentar un vista general con detalles de las distintas modalidades de cooperación inter-empresa. Este estudio demuestra la gran variedad de acuerdos inter-empresariales que existe y, por tanto, refleja la complejidad y las dinámicas de las estructuras gubernamentales privadas, en los países capitalistas, que intentan asimilar las repercusiones del desarrollo tecnológico ya hoy tan extendidas.