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STRATEGIC PARTNERING ACTIVITY BY EUROPEAN FIRMS THROUGH THE ESPRIT PROGRAMME

by

Lynn Krieger Mytelka

KOREA INSTITUTE FOR
INTERNATIONAL ECONOMIC POLICY

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Lynn Krieger Mytelka
Carleton University

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STRATEGIC PARTNERING ACTIVITY BY EUROPEAN FIRMS THROUGH THE ESPRIT PROGRAMME

Strategic partnerships in research and development (R&D) are a new form of international relationship distinguishable from more traditional forms of joint ventures and licensing arrangements by three main characteristics. First, they are focused on joint knowledge production and sharing as opposed to a one-way transfer of technology—where knowledge is understood to include research and development, as well as design, engineering, marketing and management capabilities. Second, they are frequently contractual in nature with little or no equity involvement by the participants. Third, they tend to be part of the longer term planning activity of the firm rather than simply an opportunistic response to short-term financial gain[1].

After briefly tracing the extent to which R&D has become both more collaborative and more internationalized, the paper offers an explanation for this process and an illustration of strategic partnering activity in the context of the European Strategic Programme for Research and Development on Information Technology (ESPRIT). Lastly, it draws out some of the implications of this new form of international competition for the newly industrialized economies (NIEs).

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1. For a longer discussion of strategic partnerships see L.K. Mytelka "Crisis, Technological Change and the Strategic Alliance" in Lynn K. Mytelka (ed.) *Strategic Partnerships: States, Firms and International Competition* (U.K.: Pinter Publishers, 1990). Much of the material for this talk is drawn from this chapter and from L.K. Mytelka "States, Strategic Alliances and International Oligopolies: The European ESPRIT Programme" in Mytelka, *Ibid.*

1. THE INTERNATIONALIZATION OF R&D

Arms-length collaboration in research and development (R&D) reverses a fairly long tradition of directly appropriating knowledge through in-house research and development. That tradition dates back to the development of science-based industries in the 19th century (Freeman: 1974; Mowery, 1983) and it persisted well into the post-war years. In the period 1967-1970 US, MNCs were reported to have spent 97.4% of their total R&D expenditure in the US, almost all of it in-house (Michalet: 1976).

As to the internationalization of R&D, traditionally direct foreign investment involved little joint knowledge production and sharing, though one-way transfer in the form of licensing has been a feature of such activity since the 19th century. The Harvard MNC project (Cuhran, Davidson and Suri: 1977) and the work of Stopford and Wells (1972), for example, make no reference to the internationalization of R&D activities by the ventures covered in their studies. Similarly, in her study of 420 US overseas joint ventures in the manufacturing sector, created in the period 1974-1982, Hladik found that only 15% of the JVs engaged in R&D, although she broadly defined R&D to include minor product modifications as well as more collaborative R&D activities (Hladik: 1985, 64).

Collaborative R&D thus remained uncommon in foreign joint venture subsidiaries throughout much of the 1970s. By the end of that decade, however, several new trends had appeared.

Research, for example, was being decentralized by some MNCs to a few of their overseas laboratories. This was particularly evident in the pharmaceutical industry but in had spread to other industrial sectors as well. Takeovers of knowledge-based firms as a means to acquire a missing component in a wider knowledge-based system were also accelerating. This was particularly notable in the 'backward integration' of the electronics industry. Thomson, for example, purchased the US chip manufacturer MOSTEK, Philips purchased Signetics.

In the 1980s, takeovers and mergers of this sort have also been evident in telecommunications and in biotechnology.

Together these two trends are producing a spectacular growth in reverse transfers of technology from R&D facilities in overseas subsidiaries and affiliates (Behrman & Fischer: 1980). This phenomenon, moreover, is not restricted to the MNC giants that dominate many knowledge-intensive industries today. Rather, it has become a major factor in the internationalization of midsize, high-growth American companies such as Analog Devices and Cray Research (Mckinsey & Co, Inc.: 1987).

Alongside the practice of directly appropriating knowledge through mergers and takeovers, firms also began to develop innovative forms of decentralized networking through which knowledge is produced and shared. The number of such strategic partnerships has grown dramatically during the 1980s. In Paris at the LAREA/CEREM (1988), for example, we examined a set of nearly 500 inter-firm agreements in which at least one of the partners was a European company. The agreements, spanning four main sectors—information technologies, biotechnologies, materials technologies and aerospace technologies, were broken down by function into knowledge production, goods production, commercialization and global agreements. Over the five year period 1980-1985 covered by our study, the number of agreements involving a knowledge-production or knowledge-sharing component increased from 11% in 1980 to 47% per year in 1985.

Other studies confirm this trend. For the biotechnology and information technology sectors, for example, Hagedoorn & Schot (1988) found that over the decade of the 1970s, a TOTAL of 68 technological cooperation agreements in biotechnology and 156 in information technology were signed. By 1985 nearly twice that number of agreements were being signed EACH YEAR[2]!

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2. Initially this process stopped at the frontiers of the advanced industrial countries—Canada, Europe—more recently it has spread to the newly industrializing economies (NIEs). Texas

Strategic partnering in R&D has thus accelerated in the 1980s. But could this simply be an epi-phenomenon, destined to disappear as quickly as it developed? To answer this question we need to know about why strategic partnering activity came about in the first place, and what some of the forces are that now sustain it.

2. THE EMERGENCE OF STRATEGIC PARTNERSHIPS IN R&D

Three factors seem particularly important in explaining the emergence of strategic partnering activity (i) the growing knowledge-intensity of production (ii) shifts in demand world-wide and (iii) the resultant rise in uncertainty with which both firms and states are forced to deal.

The growing knowledge-intensity of production is evident as much in agriculture, forestry, fishing and mining as it is in in the manufacturing sector and within that sector across industries from textiles to telecommunications. It can be seen from OECD data on the growing number of scientists and engineers engaged in R&D and on the rising share of R&D in Gross Domestic Product and in manufacturing value added, especially in countries such as Japan and Germany where strategies of international competitiveness based on technological innovation and diffusion are being pursued.

Even more revealing, however, are data for the manufacturing sector which show that R&D expenditure has grown at three times the rate of tangible investment over the past two decades (OECD: 1987) and that the share of non-material investment, defined as R&D, training, patents, purchase of software and marketing, in the GDP of the major advanced industrial capitalist countries has been rising over the past ten years (Kaplan & Burcklen: 1986). Traditional calculations of productivity growth do not take such changes into consideration and

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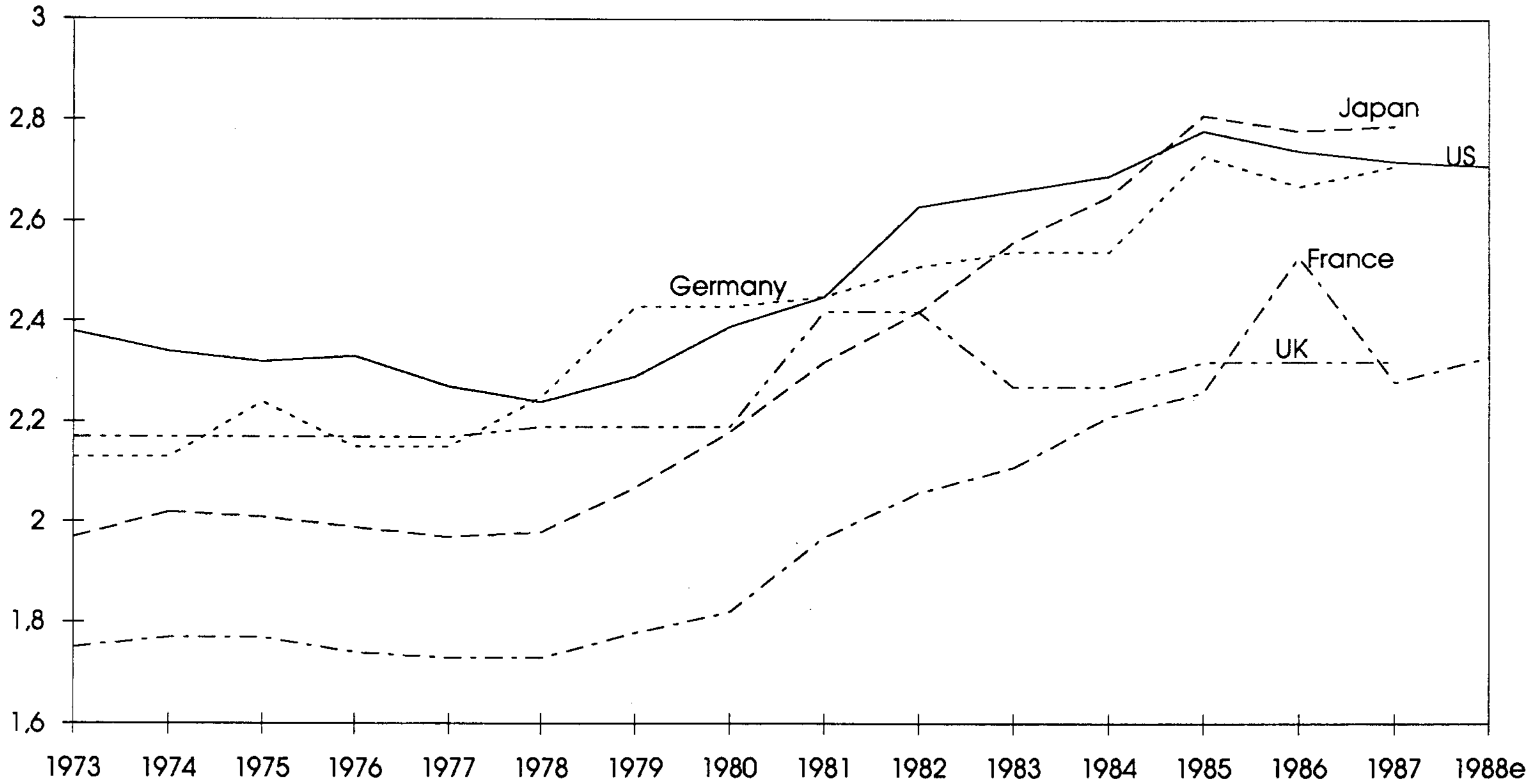
Instruments, for example, has established a software engineering laboratory in Bangalore, India.

FIGURE 1 GROSS EXPENDITURE ON R&D AS A PERCENTAGE OF GDP



Source: OECD, STIID Data Bank, Nov.1988

(e) estimate

thus do not provide us with an accurate picture of the transformations in the system of production currently underway.

The growing knowledge-intensity of production gave rise to a set of contradictory dynamics which have increased the costs, risks and uncertainties of knowledge production and intensified competition in these industries. On the production side, product life cycles in dynamic knowledge-intensive industries began to shorten as the very nature of the products, their uses and the manufacturing techniques required for their production differed substantially from one product generation to the next. With shortened product life cycles, firms were obliged to spend increasing amounts on R&D to remain at the technological frontier in their industry.

Normally this would lead firms to rely even more extensively on in-house R&D. But rapid technological change not only increased the costs of knowledge production, but also the risks in knowledge-intensive industries undergoing rapid technological change. This occurred because earlier strategies aimed at securing markets for products with high research and development costs were no longer as effective where the very conception of what might constitute the market for a new technology or product was unclear. Because technological trajectory in many fields have become discontinuous, it has become much more difficult to predict the future shape of product markets. This has further heightened uncertainty in the development and commercialization of new products and processes and reduced the effectiveness of long-term planning for firms.

The problems generated by rising costs, risks and uncertainties in knowledge-intensive industries have been exacerbated by shifts in demand growing out of the economic crisis of the 1970s and early 1980s and by the slow pace of productivity growth that began in the late 1960s and led to a loss of competitiveness by firms in many of the advanced industrial countries (Aglietta: 1976; Baily & Chakrabarti: 1988).

With slower growth in domestic purchasing power in the advanced industrial countries and crisis conditions in much of the Third World persisting into the present, markets that depended upon the sale of consumer durables became saturated. These changes undermined the strong linear relationship that had been established between a rapidly growing market, defined in terms of a range of goods, a heavily equiped manufacturing base that permitted economies of scale, and a set of R&D activities primarily oriented toward product differentiation.

This relationship had given rise in the 1950s to a pattern of competition characterized by the setting of a big firm on a big market and the building of an oligopolistic position within it. In this way, market shares were stabilized and oligopoly rents were secured. Within such a competitive framework, new technology was developed primarily to penetrate a previously identified market.

Shifts in demand in the context of the growing potential for rapid technological change, in part through technology diffusion policies put in place by the state, undermined this type of competitive behaviour. Reduced growth prospects heightened competition. New products, combining both new manufacturing processes and new goods, stimulated the rise of new industries and brought new entrants into existing industries (including the arrival of the newly industrializing economies), thus shaking the position of established leaders while market segmentation placed new pressures on the model of mass consumption based on the manufacture of standardized goods.

With markets under pressure, vertical integration linking the market to manufacturing and to R&D activities, once the formula for growth,now threatened to impair the ability of firms to adapt to change. Flexible response increasingly came to play a central role in the strategy of knowledge-intensive firms.

The result of these changes was the development of new competitive strategies designed to deal with the increased costs, risks and uncertainties of knowledge production itself but to do so without increasing the inertia of the firm.

3. NEW COMPETITIVE STRATEGIES

The new competitive strategies of the 1980s and 1990s share a number of common characteristics.

First, they involve a shift away from competition solely or even primarily based on cost. For industry life cycle theorists such as Vernon or Abernathy and Utterback (1975), the primary form of innovation in the initial phase of the product cycle was PRODUCT innovation. By being first on the market with a new product, innovators could reap the economic rents of monopoly pricing thus recovering their R&D costs. As the industry matured and competitors appeared, PROCESS innovation aimed at lowering costs would become the dominant form of R&D activity.

Under current competitive conditions lead times in the introduction of new products, however, have shrunk. The intensification of new product development emphasizing design, quality and customization has thus increasingly been accompanied by attention to process changes.

This new form of competition based simultaneously on price and innovation has further undermined the validity of the mass market-mass production strategy and it accelerated the search for knowledge-based competitive advantages.

Two other common characteristic of the new competitive strategies flow from the need to move towards dynamic knowledge-based competitive advantages. These are—a focus on exploiting the systems properties of new technologies and of new products and, in keeping with the need for flexibility, efforts to combine economies of scale with economies of scope.

In contrast to the assumption made by Schumpeter that the size of the firm is correlated with R&D performance, critical mass can thus be conceived quite differently today—in terms of the size of the 'system' needed to acquire the knowledge rather than the size of the firm itself[3]. This has a host of consequences

3. See also Ken'ichi Imai (1988) on this point.

for supplier-client relations (Mowery: 1990, Lundvall: 1988) and for the ability of small and medium-sized firms to transition from the status of sub-contractors to value-added firms in their own right.

A final characteristic of these new competitive strategies is their emphasis on uncertainty reduction whether through the development of inter-firm cooperative agreements or vertical integration. Rapid and frequently discontinuous technological change, and a weakening of the boundaries delineating competitors and markets has in a number of industries begun to undermine the old bases for oligopolization (Chamberlain: 1965). In so doing it has given rise to a need to participate in the shaping of future markets and not merely to respond to changes in them.

Although these new competitive strategies thus open some possibilities for knowledge accumulation by small independent firms, strategic partnering activity in R&D is also being used to create flexible, technology-based oligopolies in key technologies. As the ESPRIT programme illustrates, it thus becomes a complement to the more traditional practice of mergers and takeovers.

4. THE EUROPEAN ESPRIT PROGRAMME: AN ILLUSTRATION

As these changes radically altered the relationship of knowledge to production, encouraged the re-organization of production along more flexible, decentralized lines and gave rise to new forms of competition in the world economy, they also dramatically changed the parameters within which states could make economic policies that effectively enhanced the competitive advantage of domestic firms and by extension, the national economy as a whole. This was particularly true in Europe where state intervention has traditionally been more pronounced.

By the latter half of the 1970s, Europe's declining competitiveness in knowledge-intensive industries had become evident particularly in the widening gap in the balance of trade in knowledge-intensive products. Equally worrisome were indications that European firms, having experineced failure in earlier efforts at cooperation, were turning outwards in their search for new partners. Many felt this would rebound largely to the benefit of foreign partners.

In 1980, inspired by the Japanese R&D consortia and empowered by Article 235 of the Rome Treaty to promote the competitiveness of European industry, Etienne Davignon, then Commissioner of Industry in the European Community invited Europe's 12 largest information technology firms—Siemens, AEG and Nixdorf from Germany, GEC, ICL and Plessey from the United Kingdom, Olivetti and Stet from Italy, Thomson, CGE and Bull from France and Philips from the Netherlands— to draw up a work programme for their industry. The ESPRIT programme which resulted, has three objectives; (i) to promote intra-European industrial co-operation in R&D in five main IT areas-advanced microelectronics, software technology, advanced information processing, office systems and computer integrated manufacture (CIM); (ii) to furnish European industry with the basic technologies that it needs to bolster its competitiveness through the 1990s; and (iii) to develop European standards (Commission: 1987b, 1).

A total of 750 Mecu were committed to ESPRIT 1 which spanned the years 1983-88 and an addition 1600 Mecu to Esprit 2 under which a first call for projects was made in 1988 (Commission 1987a, 0-22). Under ESPRIT 1, 225 projects were undertaken ESPRIT 1 and a further 153 projects were approved under ESPRIT 2.

ESPRIT involves open calls for R&D projects; half financed by the participants and half funded by the Community. Each ESPRIT consortium must include at least two companies from two different European countries and may include research institutes and universities as well.

Over the course of its seven year history the ESPRIT programme has undergone a shift in focus. Initially, concerned lest the move towards inter-firm collaboration be interpreted as a step towards the creation of a European oligopoly of 'national champions' subsidized by the Community, the Commission emphasized the pre-competitive nature of the R&D activities to be undertaken

FIGURE 2 DISTRIBUTION OF ESPRIT 1 PROJECTS BY FUNCTION

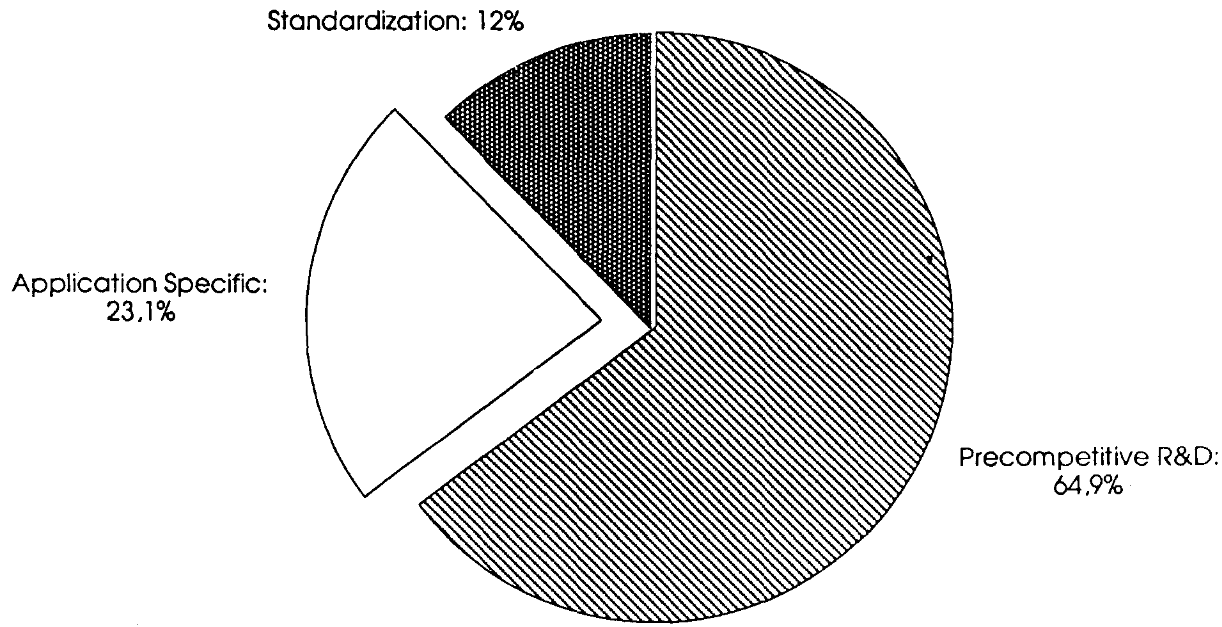
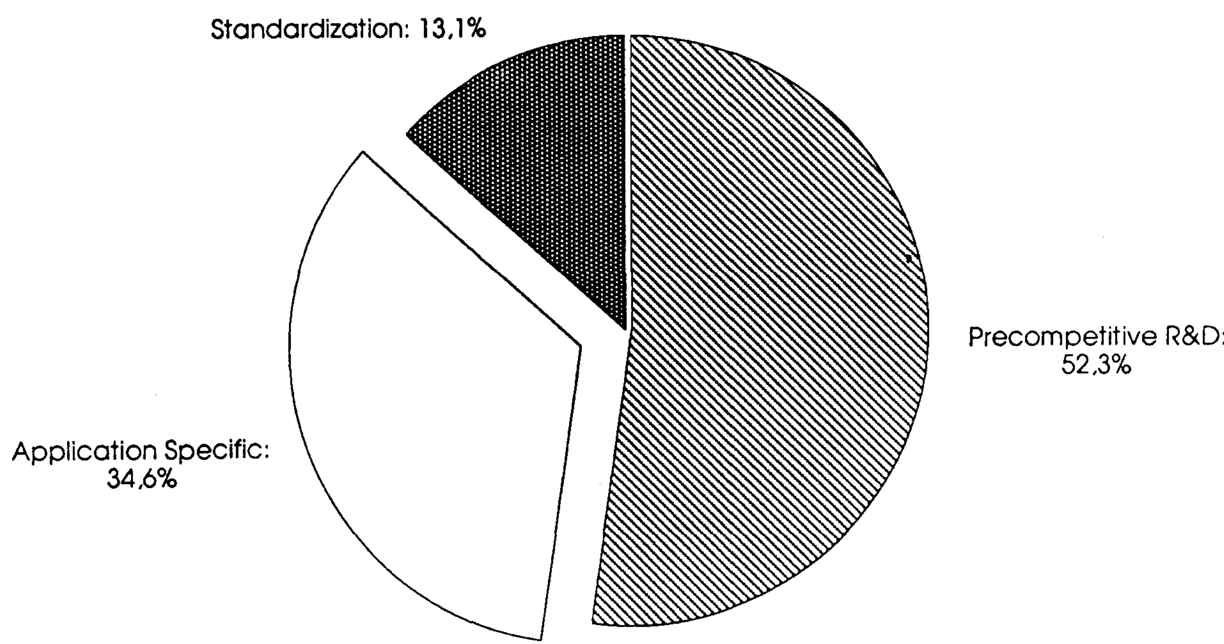


FIGURE 3 DISTRIBUTION OF ESPRIT 2 PROJECTS BY FUNCTION



through ESPRIT. Although a classification of ESPRIT projects by function, shows that roughly 65% of all ESPRIT 1 projects could be classified as pre-competitive, over one fifth of the 225 ESPRIT 1 projects were designed to produce working prototypes with immediate market application. The share of these application specific projects moreover, rose from 13% in the pilot year 1983 to over 40% IN 1986/7 -the last call for projects under ESPRIT 1.

A further 12% of the ESPRIT 1 projects, moreover, are standardization projects and these too have direct market relevance. Standardization projects make possible the harmonization of interfaces between products produced by different companies. They thus help to overcome the disadvantages associated with the relatively smaller size and less integrated nature of European firms as compared with their American and Japanese competitors.

By the time 17 ESPRIT 2 was in the development stage, European decision-makers were less concerned about the potential for anti-competitive behaviour within ESPRIT and more concerned about the competitiveness of European enterprises. The EUREKA programme, which was aimed more directly at joint development with a view to producing products for the market, had already been put into place and criticisms were being raised as to the utility of a programme that did not directly contribute to improving the competitiveness of European companies.

ESPRIT 2 has responded to such criticism by moving closer to the market. This is reflected in the growth in Application Specific Projects to nearly 35% and the fall in Precompetitive R&D projects to 52% of the total.

5. NETWORKING THROUGH ESPRIT

By combining generic technologies, often from hitherto distinct disciplines, the firm can position itself on a multitude of existing or potential markets. Networking through the ESPRIT programme illustrates the way in which cross-disciplinary alliances in applications specific markets have been developing.

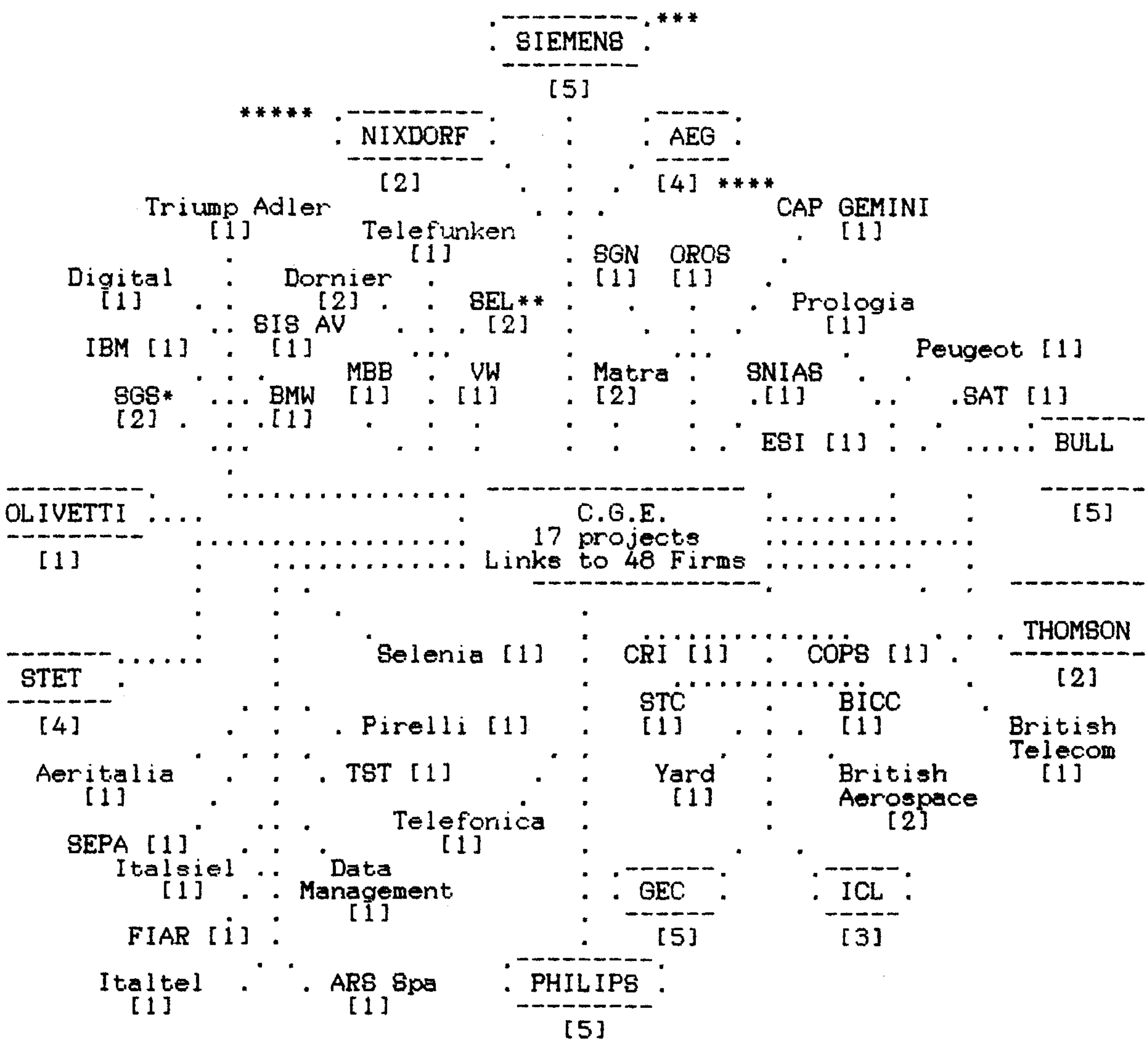
These alliances accelerate the development of new technologies by speeding up the process of debugging and accelerating the diffusion of these technologies to other sectors. They also serve to bring clients and suppliers and firms with complementary technological assets together. For small and medium-sized enterprises this has proven to be particularly useful. Lastly, strategic partnering through ESPRIT has permitted the larger firms, because of the range and number of projects in which they are participants, to window on the future shape of the market.

Through its 7 ESPRIT 1 projects, CGE has established links to 48 enterprises (Figure 4). Siemens, is another good example. It is a participant in 25 ESPRIT 1 and 28 ESPRIT 2 projects. Through these 53 projects Siemens has established links to firms in the aerospace industry (Aeritalia, SNIAS, Aerospatial), in chemicals and new materials (Hoechst, Akzo, Elf) in automobiles (BMW, Fiat, Peugeot, Renault, Volkswagen)—in the machinery industry (Krupp, Bosch, Comau, Dornier, Robotiker) as well those industries that comprise the information technologies covered by the ESPRIT programme, software (Cap Sogeti, Logica, Mari), computers (IBM, Digital, Nixdorf, ICL, Bull), office machines (Olivetti, OCE) and telecommunications (CGE-Alcatel, Telettra, Racal, British Telecom, Telefonica, Bell Telephone). A similar pattern of networking can be found for more specialized large firms such as Bull, France's preeminent computer manufacturer, and for small firms.

In addition to providing access to potentially new technological components with recombinatory possibilities, participation in ESPRIT projects has enabled the 12 European information technology majors—GEC, Thomson, Bull, Philips, Siemens, Olivetti, ICL, AGE, CGE, STET, Plessey and Nixdorf—to set the technological agenda for the future. Collectively these twelve firms participate in nearly two thirds of all ESPRIT projects. An analysis of the partnering activity of these firms through ESPRIT reveals three distinct ways in which technological structuring is occuring.

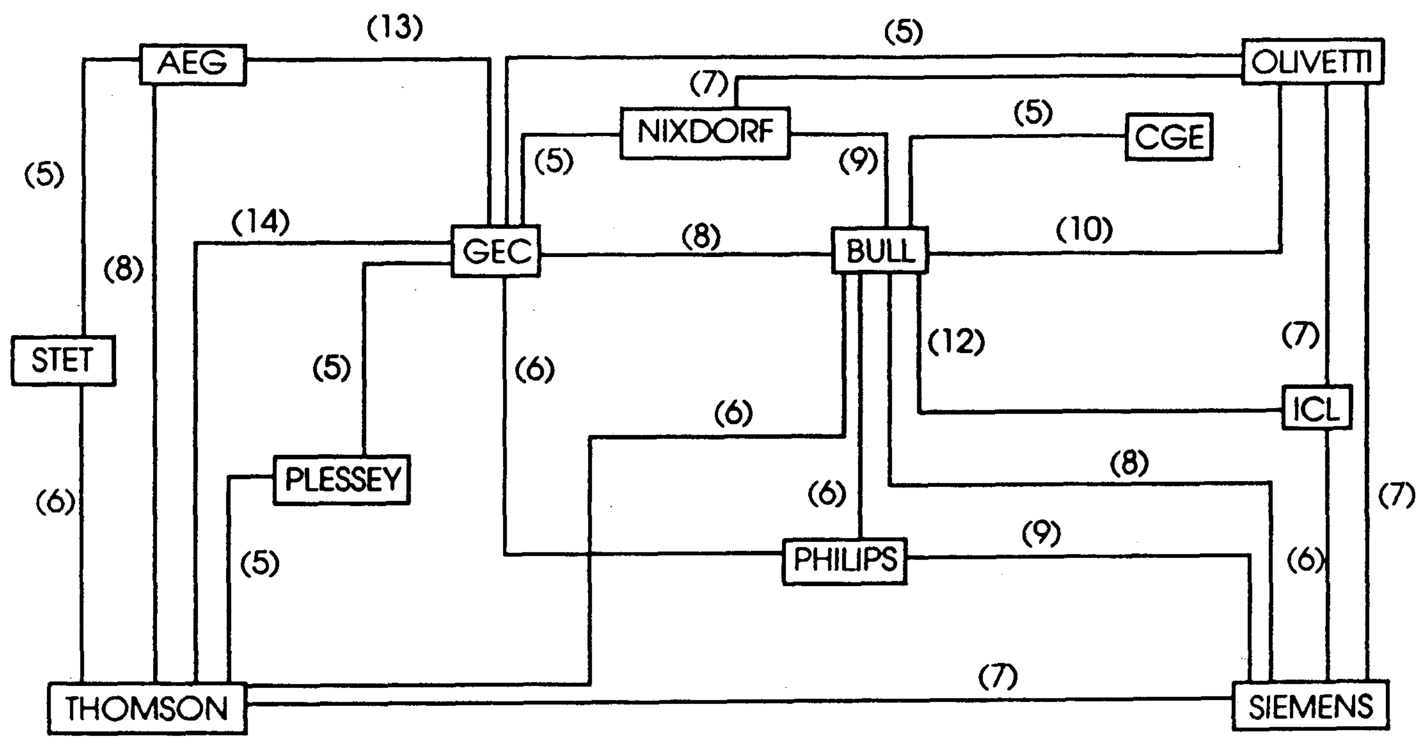
First, through linkages among the big-12 firms, a European technology-based oligopoly is in formation. We can see this by comparing the linkages among the

FIGURE 4
COMPANIE GENERALE D'ELECTRICITE: MULTIPLIER EFFECT OF LINKS THROUGH ESPRIT PROJECTS



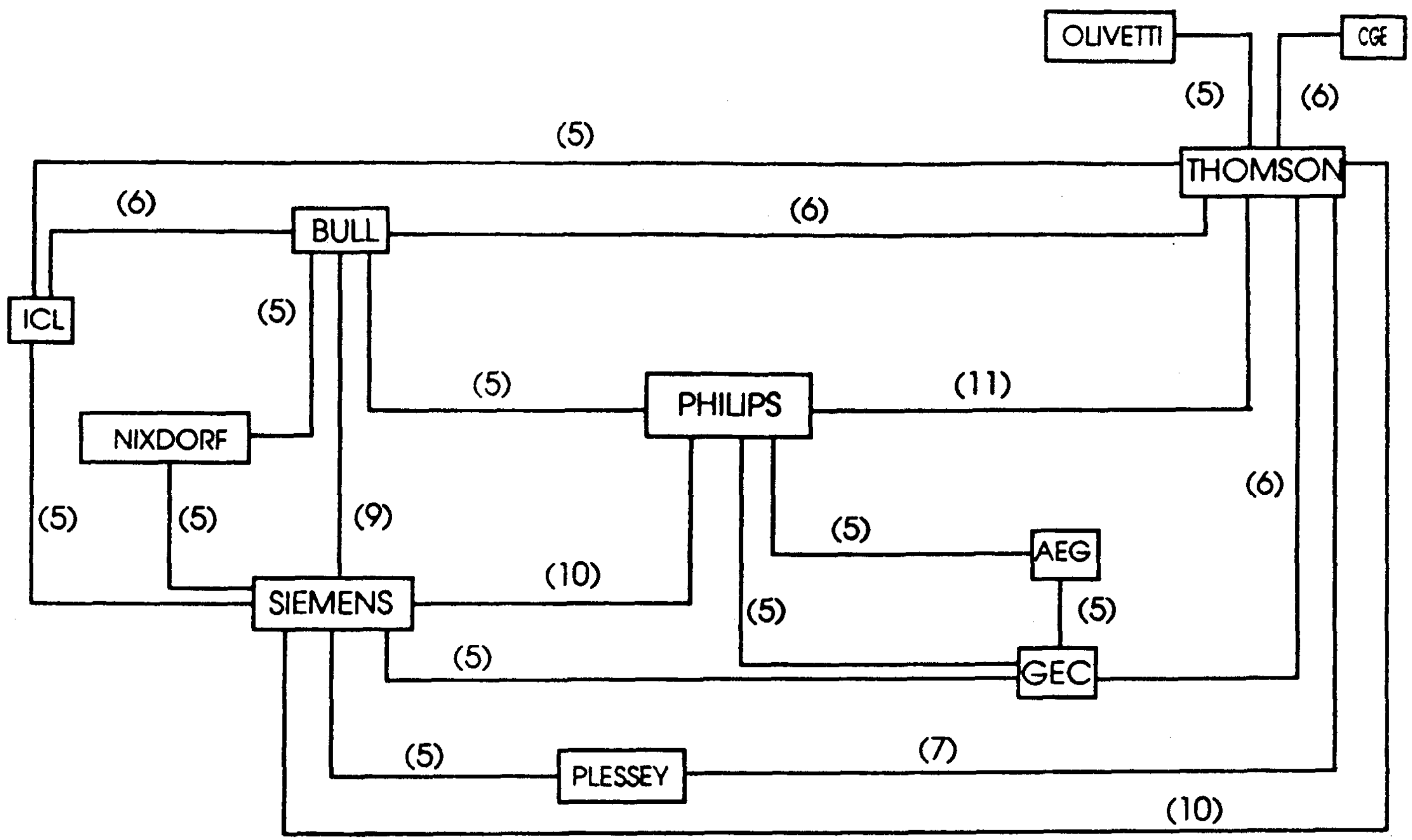
Notes: * now merged with Thomson
** now part of CGE's Alcatel NV
*** indicate members of the ESPRIT management committee
**** indicate the number of joint projects
***** new part of Siemens

FIGURE 5 LINKAGES AMONG EUROPE'S MAJOR INFORMATION TECHNOLOGY FIRMS THROUGH ESPRIT I



Source: ESPRIT Data Base

FIGURE 6 LINKAGES AMONG EUROPE'S MAJOR INFORMATION TECHNOLOGY FIRMS THROUGH ESPRIT II



Source: ESPRIT Data Base

European majors through ESPRIT 1 and 2. During ESPRIT 1, all twelve majors were intensively linked together—that is each of them was linked through AT LEAST FIVE projects to several of the other majors.

In ESPRIT 2 a pattern of concentration has appeared. This pattern shows the big-12 differentiating into a core group composed of Thomson, Bull, Siemens, Philips and GEC within which intensive links are maintained and a peripherial group whose members are intensively linked to only one or two of the core companies.

Two developments in the European information technology industry are reflected in this pattern of concentration.

— Mergers and acquistions. These have reduced the number of independent members among the Big 12 from 12 to 8 as GEC and Siemens took over Plessey, STC took over ICL and Northern Telecom bought into STC; Siemens took over Nixdorf and Daimler Benz took over AEG.
— Changing strategies among the big firms. Olivetti, for example has moved away from an emphasis on alliances through the ESPRIT programme; CGE has recentered on two domains—telecommunications through its merger with ITT and transportation through Alsthom; STET has been with-drawing from the information technologies sector through privatization.

In sum, these changes have led to a reduction in the size of the European information technology oligopoly from twelve to five or six.

Second, setting the research agenda also results from what I call the networking multiplier effect of participation in ESPRIT projects. Data on strategic partnering within ESPRIT 1 and 2 show an intensification of this process measured as the project/partner ratio. Thus in ESPRIT 1, Bull was a participant in 32 projects through which it established linkages to 63 other enterprises or a project/partner ratio of 1. 96. In ESPRIT 2, Bull participated in 22 projects through which it established ties to 134 firms or a project/partner ratio of 6.09. Similar increases in the project/partner ratios have been calculated for Philips and Siemens (Mytelka: 1990).

Third, structuring occurs through projects that link a single European major to a number of small firms and research organizations in a what is tantamount to the formation of a 'private' network. Philips, Olivetti, CGE and Thomson have been particularly active in pursuing this form of networking (Mytelka: 1990).

6. CONCLUSION

The emergence of strategic partnerships between firms and the encouragement they are currently receiving on the part of states[4] reflects a number of fundamental changes in the process of production and in the form that competition now takes in the world economy. Despite the pattern of global concentration that is rapidly emerging, these underlying changes in the demand, production and modes of competition, will likely keep strategic partnering activity alive as a vital complement to other growth and competitive strategies of the firm.

Strategic partnering activity may also offer new opportunities for firms in the newly industrialized economies (NIEs) to shift from earlier forms of sub-contracting and OEM relationships in which foreign partners set product and process norms to partnerships that have a potentially more dynamic impact on growth and technological development. This, of course, presupposes, that companies in the NIEs have developed indigenous R&D capabilities without which joint knowledge production and sharing with foreign partners would not be feasible.

This suggests that there is a role for governments to play in stimulating the development of national systems of innovation in which universities, public

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4. Europe is not alone in promoting strategic partnering activity. In Japan, the Key technologies research promotion centre was established by MITI and MPT in 1985 to invest in R&D consortia constituted as quasi-private companies. In the US SEMATECH was launched in 1987 with government funding. In Canada, the Department of Communication, along with Industry, Science and Technology Canada have announced the intention to launch a programme similar to ESPRIT called Vision 2000.

research institutions and corporate R&D laboratories constitute essential components. In Korea, the process of R&D consortium building between private firms and public research institutions is already well underway. The development of the TDX 10 telecommunications switch, the 4 megabyte DRAM and now the 16 megabyte DRAM and the HDTV consortia are contemporary examples and they find their counterparts in Japan, the US and the EC. In this fashion the NIEs and other Asian industrializing economies would follow the advanced industrial countries in promoting national technology policies as instruments of international competition.

Lastly, on a regional level, strategic partnerships are a potentially important new vehicle for cooperation within intra-regional groupings such as ASEAN, APEC or PECC. I would single out strategic partnering activity between firms in the ASEAN region and those in the NIEs in particular. In many knowledge-intensive industries technological capabilities have already been developed in these countries. The possibility that such capabilities can serve as the basis for the formation of strategic partnerships that would enable domestic firms to develop new products and processes of relevance to the region needs to be explored.

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