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ESPRIT: EUROPE'S RESPONSE TO US AND JAPANESE DOMINATION IN INFORMATION TECHNOLOGY

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Abstract

The European Strategic Programme for Research in Information Technologies was created as a defensive response to the US and Japanese lead in information technology. Esprit was driven by the belief that intra-EU collaboration is an effective means to enhance the competitiveness of the European IT industry. Esprit has undergone a number of changes to facilitate collaboration and innovation. Yet, only after eighteen years of Esprit did the European Commission appreciate the need to encourage worldwide co-operation within its new Fifth Framework Information Society Technologies Programme. In the emerging Information Society it is conceded that new ideas are as likely to be found outside Europe as within. This chapter seeks to demonstrate that successful Esprit projects maintained valuable external links with many unacknowledged partners worldwide throughout the 1990s. It argues that the world of innovation is borderless and

that Commission policies to impose boundaries to collaboration are unlikely to contribute to successful innovation.

ESPRIT: EUROPE'S RESPONSE TO US AND JAPANESE DOMINATION IN INFORMATION TECHNOLOGY

1. Introduction

Established in 1983, Esprit (the European Strategic Programme for Research in Information Technologies) is the oldest of the European Commission's research and technology development (RTD) programmes. It is also the largest and has been a model for all the Commission's other RTD programmes. Esprit arose from the fear that Europe was lagging far behind the US and Japan in vital information technologies (IT) (Georghiou, 1999; Mytelka and Delapierre, 1987). Collaboration, rather than competition, among Europe's IT companies, it was imagined would yield synergies, the flexibility to adapt in volatile markets, and the shorter product cycles essential to international competitiveness (Assimakopoulos and Macdonald, 1999). The complementary notion of pre-competitive research allowed the Commission to subsidise RTD while avoiding the accusation of interfering in the market (Quintas and Guy, 1995). The collaboration of Esprit has attracted considerable academic attention (e.g., Hagedoorn and Schakenraad, 1993; Hagedoorn *et al*., 2000); whatever Esprit's success in encouraging innovation, it has become a classic in innovation policy.

Esprit in the 1980s was very much the child of the large firms of the European IT industy, the Big Twelve. Some would argue that Esprit was still fulfilling their requirements in the

late 1990s, when a much broader range of stakeholders was involved in building the emerging information and knowledge societies. Over the years, the Commission has attempted to transform Esprit by encouraging the participation of firms from Europe's less developed regions, of small and medium size firms from across the EU, and lately of stakeholders from throughout the IT supply chain, including users from a broad range of institutional settings. Even so, Esprit stands accused of retaining its technology-driven approach to IT, not necessarily because this produces more innovation and greater competitiveness, but because of the political advantages offered by the doctrine of collaboration (Macdonald *et al*., 1999).

The purpose of this chapter is to explore the significance of external linkages for innovation in Esprit in the light of the reality of collaboration. The empirical data focuses on ten Esprit projects, examined as case studies. Particular attention is given to the informal networks that link members of Esprit projects to the most dynamic parts of the IT world in the US and beyond. How do these function in the midst of collaboration and the formal networks it imposes (see Osborn and Hagedoorn, 1997)? Formal networks are defined as those which are bound by a formal contract between the Commission and project partners. In contrast, informal networks include many unacknowledged partners acquired through inter-personal links that transcend formal agreements (Johannisson, 1998). As in other fast developing industries, informal relationships in the IT sector seem to bring the tacit information that is conducive to innovation (Badaracco, 1991; Boisot, 1998).

The rest of the chapter is in five sections. In Section 2, a brief history of Esprit is provided, examining the changes that have taken place within the Programme to encourage collaboration and innovation in European IT industry. Section 3 considers the European interpretation of the US and Japanese threat, and Section 4 describes our research methodology. Section 5 presents the main findings, based on the ten Esprit projects, and discusses in some detail the role of external links for collaboration and innovation in two illustrative cases from the world of electronic commerce in the late 1990s. Finally, Section 6 draws some conclusions.

2. Continuity, Transformation and Change

In the early 1980s, European firms had begun to realise that their technology was lagging in such core high technology areas as IT and some had already begun to collaborate (Mytelka and Delapierre, 1987). Policy makers were becoming increasingly concerned about the gradual loss of competitiveness they perceived in the European economy and in the European IT industry in particular. The globalisation of high technology industries (Narula, 1999), and the wide disparities between industrial and technological capabilities of the various country members revealed by the continuing expansion of the EU (especially evident in the divide between the wealthy countries of the European North and the poor countries of the European South) further reinforced this perception (Hagedoorn *et al*., 2000). Moreover, policy makers on both sides of the Atlantic had become very enthusiastic about 'Japanese-style' collaborative research and the perceived success of *keiretsu* (Georghiou, 1999; Ray, 1998).

European industry generally was beginning to show much more interest in collaborating in R&D, previously an activity conducted secretly and independent of competitors' R&D (Narula and Hagedoorn, 1999). According to Narula (1999), the underlying objective of the Framework Programmes of the European Commission was not to encourage collaboration *per se*. Rather, it was to encourage collaboration in the run-up to the single European market in 1992. Collaboration would allow EU industry to restructure and be better able to face the competitive environment of the single market. It was hardly surprising, then, that collaborative R&D became central to Commission policy in the early 1980s (Peterson, 1991), and thus that collaboration became central to Esprit. In 1981, the Commission suggested that the Big Twelve take a concerted approach to information technology (IT), and invited their collaboration in drawing up a common strategy (Mytelka and Delapierre, 1987). Following the launch of a small pilot programme in 1983, Esprit proper was started in 1984. There have now been four phases of Esprit research (Esprit I: 1984-87, Esprit II: 1987-90, Esprit III: 1990-94, and Esprit IV: 1994-98), all jointly funded by the Commission and the participating organisations. The Fifth Framework Programme (1998-2002) has recently initiated the Information Society Technology (IST) Programme, placing all European Commission information and communication technologies **(**ICT) research under one umbrella programme.

The early Esprit was very much driven by the belief that collaboration among industry, universities and public research institutes across Europe was an effective means of narrowing what was perceived as a technological gap between European companies and their American and Japanese competitors (Hagedoorn *et al*., 2000; Mytelka and

Delapierre, 1987; Narula, 1999). As Mytelka and Delapierre (1987: 233) point out, collaboration among European firms was more attractive than alliances with non-European firms because it was thought to involve less risk and to enable firms to take advantage of economies of scale in one or more of their production processes while remaining separate entities.

Over the last decade, Esprit has been through vast changes in its organization and scope (Assimakopoulos *et al*., 2000). The European Commission has responded to new trends in the collaborative behaviour of the IT industry by, for example, expanding Esprit participation, encouraging collaboration throughout the IT value chain, and increasing emphasis on the users of IT. Some of these developments are summarised in Table 1. Despite these alterations in emphasis, many of the characteristics of the early Esprit were evident until the conclusion of the Programme in 1999. For example, Esprit always insisted that the research it supported be collaborative in nature, specifically that there had to be a minimum collaboration in each project of two partner organisations from two EU member countries.

[Table 1 to be inserted about here]

The early Esprit was also determinedly pre-competitive, focusing on research that was considered to be distant from the individual market interests of collaborators. The notion of pre-competitive research provided a convenient label for the activity undertaken within collaboration, one acceptable to the free market ideology of most European governments

of the period (Georghiou, 1999). It was argued that collaboration in pre-competitive research did not constitute government interference with market forces (Quintas and Guy, 1995), and fitted comfortably within a technology-push model of innovation. However, sweeping changes in the IT industry, together with improved understanding of how innovation is generated, have encouraged Esprit to change its emphasis from technology-push to market-pull. This has required abandoning the idea that partners can collaborate only when they are being pre-competitive. It has been accepted that they may also collaborate when they are cooperating in competition. Indeed, the success of the IST Programme is dependent on the willingness and ability of partners to collaborate in competitive circumstances.

The early Esprit was dominated by the rigid conviction that innovation emanated, quite obviously, from science and engineering. Just as the model of innovation within Esprit has changed from technology-push to market-pull, Esprit research is no longer confined to science and engineering and now includes at least some social science research. The IST Programme acknowledges that socio-economic research cannot be isolated to a single domain, but must underpin all its IT research. In consequence, the IST Programme cannot be accused of fostering innovation intended to benefit only the suppliers of IT equipment: IST innovation is now directed towards all users of IT. It has been accepted that European competitiveness in IT depends not so much on increasing IT research capital as on increasing social capital. There is now no part of the economy which is not heavily dependent on IT.

The research consortium - termed the ‘project’ by the Commission - has long been the primary unit of Esprit organisation. The project has often seemed to be the only unit. All Commission organisation was centred on the project, as was most monitoring and evaluation. In 16 years (1983-1998), some 2,250 Esprit projects have been completed or are now nearing completion, and more than EUR 5.5 billion has been spent (Assimakopoulos and Macdonald, 1999). The project officer – the key Commission official – tended to regard projects as self-contained, to be completed within a specific timeframe as specified by a formal contractual agreement.

The changes that Esprit has undergone in terms of participation, focus, organisation and orientation were responses to particular trends and developments in the IT sector, and more general shifts in the competitive environment. Throughout the history of Esprit, the main objective of the Commission has been to create and sustain a fertile platform for collaboration and innovation. However, it is difficult, perhaps impossible, to confine collaboration and to harness innovation by restricting them to a single geographical region, even one with all the resources of Europe. More important, it may be pointless.

3. Europe’s Response to the Competition

It is important to bear in mind the nature of the times of which Esprit was so very much a product. By the early 1980s, the importance of what had come to be called the ‘microelectronics revolution’ was evident, and not just in terms of the technological innovation that helped make the electronics firms themselves more competitive. The application of the transistor and then the integrated circuit in computing and in telecommunications had begun to transform product and process in virtually all

industries, and consequently the competitiveness of all was increasingly seen to be dependent on the new technology. The white heat of the technological revolution that Harold Wilson declared would transform the economy in the UK was to be generated largely by microelectronics. But to recognise the impact of microelectronics was not to contain the impact. There would be implications, socio-economic implications, and uncertainty about what these might be, what they might affect, and when caused considerable concern. In such a climate, fear flourished. For example, the adoption of computing equipment was generally perceived to result in the loss of many jobs and in the de-skilling of others. Inevitably, microelectronics assumed a political importance that extended far beyond its economic role. Microelectronics came to symbolise the future to an extent than other technologies could not even begin to emulate – and, of course, with some justification.

Microelectronics, then, could not help but command political attention. Governments in most developed countries were compelled to calm fears of the disruption the new technology would cause. This presented a minor challenge, but where there is challenge there is also opportunity and microelectronics offered a major opportunity of the sort that is attractive to politicians and policy makers. By the early 1980s, it was common practice to perceive microelectronics as but one – although certainly a major one – of a series of new and related technologies considered collectively as ‘high technology’. The benefits of high technology were reckoned to be immense, far outweighing its costs. So, even if some jobs were lost and others de-skilled, new jobs would be created and of a very superior sort. And if high technology sounded the death knell of the old smokestack

industries, it brought shiny new ones in their place. The political advantage of being able to bring about such social and economic benefits was not lost on governments, and everywhere they sought to become involved with high technology. Their current determination to be associated with the Internet and with electronic commerce is not dissimilar (Cabinet Office, 1999).

This presented something of a problem in that the US, and Silicon Valley in particular, provided the outstanding example of successful innovation in microelectronics (Macdonald, 1983). Government intervention had played little part in this success. Consequently, governments elsewhere, desperate to be associated with high technology, could hardly just copy the role played by the US government. They could, though, assist in replicating elsewhere conditions apparently conducive to high technology that had developed in the US in the absence of government intervention. Governments are not naturally equipped to create market conditions and the potential for muddle and mistake is great. The science park phenomenon illustrates this nicely.

Hundreds of science parks, perhaps thousands by now, were created in the developed world in imitation of Silicon Valley, or rather of an understanding of Silicon Valley that fitted the preconceptions and requirements of governments anxious to encourage high technology. The essence of Silicon Valley, on which its innovation is dependent, is the flow of information through information exchange among individuals, often in defiance of organisation, system and control. It is an informal world of high mobility and throbbing information networks, not the sort of world to be readily re-created in distant

lands by distant governments. So, these governments chose to perceive a different sort of Silicon Valley altogether, one which better fitted their requirements (Sorensen and Levold, 1992), the chief of which was to be able to establish centres of high technology activity anywhere, instantly and cheaply. Government rhetoric depicted a model of high technology unbounded by the physical constraints of old technology and demanding only knowledge to thrive. It followed that a centre of high technology could be placed wherever there was knowledge, despite the absence of anything else. A university was perfect and would provide the information for local entrepreneurs to turn into innovation. History was re-interpreted to present Stanford as just such a university, Silicon Valley as its science park, and such firms as Hewlett Packard its tenants.

Of course, this fabrication was supported by more than just government convenience. The notion of information being an organisational resource like any other, to be bought and sold like any other organisational resource, is not only compatible with the sort of systems governments can encourage, but also confirms the value of these systems. Established interests are also keen to support the fabrication. Universities, academic scientists and engineers are not averse to confirmation of their seminal role in innovation, providing the seed from which innovation sprouts. Industry and its managers like to believe that they play the major part in what they construe as a process, an innovation process that can be controlled and managed. Administrators generally value the notion of innovation as process in that they can justify input in terms of output. The irony, of course, was that this understanding of how Silicon Valley works is just about the opposite of the creative, constructive chaos which is really responsible for its innovation.

Similarly, the advantages of applying an organisational model of innovation are evident in the strengthening of the patent system since the early 1980s. The patent provides a means by which the information of invention is protected, and a means by which this information is disseminated. The innovation on which competitiveness depends is now seen to emanate from the former rather than from the latter, to the huge advantage of those organisations and those nations with the resources to develop their own inventions (Macdonald and Lefang, 1997). And again, it was political exploitation of high technology as being critical to US competitiveness and hence to US national security that permitted the extraordinary attempts of the US throughout the 1980 to prevent the flow of high technology information from the West to the Soviet bloc, attempts which were readily extended to preventing its flow to Western competitors, especially the Europeans and the Japanese (Macdonald, 1990). Perversely, a system intended to ensure that US industry remained innovative and competitive probably had the opposite effect in restricting the information flow essential for innovation.

The nub of the problem is that much information for innovation in high technology flows by informal means, in personal networks, by means of information exchange among individuals (Keegan, 1974; Rogers, 1982). This reality is hard to incoorporate in government policy and programmes for innovation. In direct contrast, high technology as a malleable construct that can be shaped around existing systems, high technology as myth, immune from testing, is so politically irresistable that its exclusion from government policy and programmes is well nigh impossible – despite the possibility of

damage to innovation and competitiveness. Thus, the US in the 1980s persisted in the Sematech venture, designed to encourage US microelectronics firms to collaborate in innovation, long after the deficiencies in this particular model of innovation - especially the restriction of membership to a few old and established firms - were exposed (Saxenian, 1990). Sematech was justified on the grounds that microelectronics had become essential to innovation and competitiveness generally (Spencer and Grindley, 1993), but these very same forces had created a global industry in which the entire world was involved. The US and Silicon Valley may have led the way, but by the 1980s even they could not innovate effectively in isolation. Similarly, the Alvey Programme in the UK, again based on the notion that governments could orchestrate the collaboration that would generate innovation in IT (Oakley, 1984; Thomas, 1985), probably undermined the innovation of those firms excluded from collaboration (Hare *et al*., 1989). Government intervention was not always behind collaborative RTD. In 1982, for example, some American microelectronics firms chose to form their own collaboration in the Microelectronics and Computer Technology Corporation (MCC), with a pooled staff of about 300, all working together in Austin, Texas (Larsen, 1984; Davis, 1985; Peck, 1986). A reaction to Japanese competition rather than an emulation of European policy, the MCC, and other groupings formed in imitation of the MCC (*Business Week*, 1983; Fusfeld and Haklisch, 1987), survived rather than prospered.

There was, of course, no doubting the competitive advantage US and Japanese firms held in microelectronics. European governments might console themselves with the appreciation that the advantage of the former had come about through the country’s head

start, and that they might erode this lead by replicating in Europe the circumstances under which high technology flourished in the US – a case of policy making up for the European market's failure to act as the US market had done. But the Japanese case offered no possibility of such consolation; there was certainly no way that a Japanese environment could be re-created in Europe. Or was there? European policy makers allowed themselves to become convinced that the Japanese had become so successful in microelectronics because MITI, the Ministry of International Trade and Industry, had engineered the co-ordination of government, industry and universities to be innovative in microelectronics. Indeed, when Esprit was launched, the Commission had grand ambitions to be a European MITI (Dickson, 1983). The Fifth Generation Computer Programme was trumpeted by the Japanese to European governments already convinced that innovation in microelectronics came through collaboration and that collaboration could be arranged by government (Newman, 1982). That Japanese co-ordination was as much a product of Japanese culture as of the efforts of MITI, and that this co-ordination was deeply dependent on personal links and obligations, were conveniently overlooked, much as the reality of Silicon Valley was disregarded (see Galinski, 1984; House of Commons, 1988). In a similar way, the absence of cultural context has not prevented the wholesale adoption in Europe of Japanese management methods.

So, Europe, and especially the European Commission, imported from Japan the notion that formal collaboration arranged by government was essential for innovation and hence for competitiveness in microelectronics, and from the US evidence of the conditions required for high technology industry. It was clear that government in Europe had to do

something for microelectronics, and equally clear that misconstruing both the Japanese and the US model permitted considerable latitude (see Mackintosh, 1979). The Big Twelve, for example, the firms that dominated the European Electronics industry and that were to dominate the early Esprit, could be portrayed not simply as socially and economically integrated in the Japanese fashion, but also as enterprising and entrepreneurial in the Californian way. The collaboration of Esprit might seem very different from the personal information networks of Silicon Valley, but in the context of the scramble by governments everywhere for association with high technology, and in the absence of the need for any appreciation of how high technology really works, formal collaboration in pre-competitive research was quite acceptable.

4. Research Methodology

The sample for this research involved all 67 Esprit projects with UK main contractors included in the Prosoma showcase (www.prosoma.lu) between June 1997 and October 1998. Administrative leaders of these 67 projects were contacted by post or/and e-mail between November 1997 and November 1998, and asked to identify the individual they considered to be the technological leader of their project in the UK. The findings presented here are based on network data collected from ten of these Esprit projects. A formal network for each UK main contractor was identified from the Prosoma and Cordis databases (www.cordis.lu) of the Commission. Subsequently, personal informal networks were mapped following a multi-step approach. Individuals identified as technological leaders within the participating main contractors were sent postal questionnaires and each was asked to nominate up to seven other individuals who had provided information of

significant value for innovation related to the specific Esprit project (see Giusti and Georghiou, 1988). In the second round, these nominated individuals were themselves contacted and asked the same question. The nomination process continued until resources were exhausted and in some cases extended to five rounds. For the majority of the projects, semi-structured, face-to-face interviews were conducted. It is from these that the quotations used in this chapter are derived.

The computerised network analysis made use of two software packages for social network analysis and visualisation: Ucinet 5 (Borgatti *et al*., 1999) and Mage 5.2 (Richardson and Presley, 1999). The former was used to compute a set of coordinates for the personal network of each technological leader following a three-step approach. It placed all nominations within a symmetrical socio-matrix, revealing who was connected with whom within a particular project. An assumption was made that all ties were reciprocal in nature since nearly all respondents indicated that they supplied information for other innovation of more or less equal value. Secondly, it calculated Euclidian distances among the nominated individuals. Euclidian distance is a measure of structural similarity among the nodes of a network. If, for example, two individuals have identical patterns of connections to all others in a network, then the Euclidian distance between them is zero (Wasserman and Faust, 1994). Thirdly, based on Euclidian distances, a set of (x, y, z) coordinates for each individual was calculated using a 3-dimensional scaling routine (Borgatti *et al*., 1999). Based on each set of coordinates, Mage produced three-dimensional kinetic images for exploring the social structure of each personal network. It

is pertinent that Mage was initially produced for the visualization of protein molecules, but has since been used to visualize and make sense of social structures (Freeman, 1998).

5. Main Findings

Table 2 summarises the main findings of the study, revealing internal linkages (dyadic ties within the EU boundary) and external linkages for the ten Esprit projects. A linkage is a nomination tie showing that information considered to be of significant value for innovation was exchanged between two individuals. In some external linkages, both individuals worked for organizations outside the EU.

[Table 2 to be inserted about here]

As Table 2 shows, the information flows of only three of the ten projects were confined to the EU. Out of the 171 dyadic ties, almost a third (31 per cent) transcended the EU boundary. This is an important finding, given that none of the 10 projects had any formal partners outside the EU. If there was no contractual need to involve outsiders, it seems that the only plausible explanation for these external links is that individuals in the majority of projects believed that external, informal contacts were particularly useful for innovation (Aldrich and von Glinow, 1992). It would seem that the majority of Esprit projects with UK main contractors accommodated informal, unacknowledged partners outside the EU with the aim of acquiring information valuable for their innovation.

As might have been expected, the majority (57 per cent) of UK main contractors' external linkages were with the United States. EU firms have generally been eager to participate with the US companies because of their technological lead in IT (Narula, 1999). The cultural and linguistic connections of individual in UK firms would also explain US dominance of their external linkages. Also striking is the global spread of external linkages: through these individuals, UK main contractors maintained important links with such countries as Australia, Brazil and Norway. As it has long been known that UK organisations participating in the Commission's RTD programmes have more collaborative links than their partners (Georghiou *et al.*, 1992), it is perhaps worth speculating that the attraction of a UK partner may lie less in its intrinsic qualities than in its links with the United States.

Two case studies have been selected to examine in more detail the role of external linkages: Imprimatur and E2S. Some 30 per cent of linkages in the Imprimatur project were outside the EU, and some 72 per cent in the E2S project. Semi-structured interviews with individuals from these projects indicate that external linkages play a critical role in innovation. They transcended local social circles and brought in valuable information from well beyond the project.

IMPRIMATUR (Intellectual Multimedia Property Rights Model and Terminology for Universal Reference)

Imprimatur was an Esprit IV project. It aimed to build consensus on electronic copyright management and intellectual property rights (IPR) protection in the late 1990s. The UK main contractor was the Authors' Licensing and Collecting Society (ALCS, www.alcs.co.uk), based in London.

> "The Imprimatur consortium is trying to build consensus around digital rights trading. That sounds very easy. It isn't. At the moment, most content is sold in books, CD ROMs, videos and so forth. When this content migrates onto networks, the question is how can you trade it securely and fairly between the creator, the producer, the distributor and the consumer."

Because the Internet and web disregard national boundaries, problems are caused by differences in cultures, legal systems, and so on. To achieve consensus in such infrastructural issues, a large number of stakeholders must be consulted. Electronic commerce and digital rights are just such an issue.

Graph 1 shows the personal network of the Imprimatur main contractor. The balls represent individuals and the ties represent nomination network data. The size of balls varies according to centrality (degree, betweeness, and closeness) (Wasserman and Faust, 1994), and the colour of ties varies according to their natures (internal or external). Internal ties are blue and external ties are pink. As was expected, the most central individual in the network is the UK main contractor himself (the largest ball at the upper right hand side of the Graph. However, what is even more interesting is that a part of his

personal network is outside the Esprit formal agreement. The network includes sources of information essential to the Esprit project in the US (e.g., Digital Copyright Forum, and the Copyright Clearance Center) and in Australia. The network also includes sources in Scandinavian countries and the Netherlands. It is notable how nominated sources outside the Esprit project themselves nominate sources of information within the project so that networks which might have been thought to have been internal to Esprit are in fact intertwined with external information networks. The extent of overlap can be seen in the case of an American contact (bottom right hand side of the Graph) from the Copyright Clearance Centre who is linked with the UK main contractor, but also with two other nominations of the latter: a professor at a Dutch university and an ALCS manager. Such overlaps allow valuable information for Esprit innovation to flow back and forth from the UK to the US via a number of direct and indirect routes within and outside the ALCS.

[Graph 1 to be inserted about here]

It seems that mutual interest and trust hold these information networks together. Neither is easy to establish and both take time and effort. A concern encountered frequently among those interviewed was that the European Commission was insufficiently sensitive to these arrangements and to the personal investment that had gone into making them. In forcing on those working on Esprit projects contacts outside their own personal networks, the Commission put at risk their personal information networks. Consequently, the Commission endangered the very innovation it was trying to encourage. The concern

expressed by the technological leader of the Imprimatur main contractor in the UK is typical.

> "My network of contacts spans the world, reflecting the global nature of IPR [intellectual property rights]. It also spans private companies, NGOs, INGOs, supra-governmental organizations like the UN and OECD and governments themselves. One extremely irksome thing the Commission often tries to force on those who work in Esprit is the collaboration with people outside this network of contacts. Such people are outside my network of contacts for both personal and professional reasons. Therefore when the EC insists one works outside one's network, such a collaboration is bound to fail because it is not based on mutual interest or trust."

Not surprisingly, there is some tension between project officers in the Commission and participants in Esprit projects. Individuals interviewed insisted that their information networks are deliberate constructs which can easily be damaged by the clumsy efforts of the Commission to create its own dedicated networks.

> "…before you marry somebody you have a period of engagement, you meet, you go to parties together. In a sense, Esprit has sometimes felt like it was trying to force people into marriages before they actually got to know each other."

E2S (Secure Internet Commerce)

E2S was also an Esprit IV project. It sought to develop enabling technologies for secure business to business transactions over the Internet. According to Prosoma, E2S technology is a major step towards ensuring the security of confidential information and commercial transactions over the Internet. The E2S architecture is based on secure electronic transaction (SET) technologies for bankcard payment systems. SET is an open standard developed jointly by Mastercard, Visa and their technology partners to enable card transactions to be made securely over open computer networks using encryption technology. Now available in Europe, SET is enabling European banks to take a leading role in the international development of secured electronic commerce for consumers. The UK main contractor was ANSA Architecture Projects Management in Cambridge. Other key partners in the project were Hewlett Packard (HP) research laboratories located in Bristol in the UK, and in Grenoble and the Cote d'Azur in France.

Graph 2 reveals that more than two thirds of the personal network of the main contractor's technological leader lies outside the EU boundary. Only three internal linkages - to the HP laboratory in Bristol, VISA headquarters in Paris, and the Technical University of Darmstadt in Germany – are within. There are no internal linkages in Graph 2 from the other project partners. For example, contacts at HP laboratories in Grenoble and in the Cote d'Azur did not regard those within the project as important sources of technological information about the project. The most valued sources are in the East and West Coast of the United States. Note that the biggest ball in the network (bottom right hand corner of Graph 2) is the vice-chairman for electronic commerce in an American

bank situated in downtown San Francisco. The second most central individual (upper right hand corner of Graph 2) is an engineer at Bell Laboratories in New Jersey. It is also interesting that there is a contact at the Citibank Group in New York (right hand side, in the middle of Graph 2) who is common to both the source in the Bank of America and that at Bell Laboratories. It would seem from the structure of this network that UK main contractors benefit most from personal contacts with individuals in the most dynamic parts of the IT world and these are outside the EU.

[Graph 2 to be inserted about here]

6. Concluding Thoughts

Esprit was the first, the largest and the longest of the European Commission's research programmes. Understandably, it became a model for other research programmes, but it was also a child of its time. The early 'eighties expected and required government involvement in high technology, in which IT was fundamental (Macdonald, 1987). Europe expected to be internationally competitive in IT, both in the industry itself and in other industries through the use of IT. Government involvement took the form of supporting if not national champions then European champions, firms reckoned to be large and strong enough to take on the best and biggest in the world. In the Esprit case, government involvement also took the form of supporting pre-competitive research carried out in collaborative, technology-driven projects which, because of the way they were formulated, monitored and assessed, tended to focus on what the Big Twelve, the equipment suppliers, wanted to do anyway.

Technology policy has moved on in the last two decades. The IST Programme, which replaces Esprit in the Fifth Framework, is very much market-driven and user-driven. Market-pull has replaced technology-push and the contrived notion of pre-competitive research, which did not survive to see the end of Esprit any more than did the dominance of hardware over software, has been dropped altogether. And yet, the Commission's insistence on collaboration is as strong as ever. It is true that collaboration in IST can still be justified in the terms in which it has been justified in Esprit over the last two decades. It is also true that collaboration among firms is hardly going out of fashion, though it commonly takes the form of mergers, joint ventures and acquisitions these days. But European firms would rather collaborate with firms outside Europe, especially firms in the United States, than with those in Europe, and they certainly have no desire to restrict their collaboration to technological innovation. It is surely sobering that an indication of the success of Esprit is that "prior to ESPRIT European firms sought out American companies for technological partnerships. Because of Esprit European companies now seek out European partners" (in Peterson and Sharp, 1998, p.73).

But collaboration did not endure in Esprit and has not been retained in IST for the advantages claimed for it in the early 'eighties, nor because it is still fashionable. No, the Commission has retained collaboration in IT research for other reasons altogether, basically so that SMEs, firms from the periphery of Europe, and now the users of IT, can be included in projects.

> "The reasons the Commission have to impose some partners is that they will be left out if they don't, and they put money into the pot in Europe, and occasionally they are saying why don't you pick up this company in trouble... Yeah, all right we will have them in the project... It is a pain but we did it because it helps.... The EC is full of politics. Full of it, and we try and avoid that, and try and focus rather hard on what we try to do."

Mere inclusion does not guarantee that new participants actually do participate in projects, that they contribute or benefit at all: the reality of collaboration can mean the same old groupings and little new blood. Though the Commission justified its requirement for collaboration among participants in its RTD programmes in terms of the advantages for innovation, collaboration also satisfied the Commission's own political requirements. Collaboration may bring political benefits for the Commission, but not necessarily benefits in terms of IT innovation. Much Esprit collaboration was nominal in that it was arranged to satisfy application requirements, to improve prospects of funding, or to please project officers with the consequence that some partners made little or no contribution to innovation. Such collaboration could hardly have improved the prospects of innovation. It may even have imposed a cost on innovation for which the benefits brought through informal networks extending beyond the formal collaboration were some compensation.

This study indicates that much of the information for innovation in Esprit did come from external sources – external to Esprit projects and often external to Europe. Very often it

was acquired by personal and informal means. It would seem that the formality of collaboration in Esprit managed to accommodate this informal networking, not because the Commission was sensitive to the importance of these networks and anxious not to disrupt their operation, but because their members were absolutely determined that the Commission would not interfere with their networks.

Non-European firms may now participate in European Commission programmes, but as non-funded and therefore unequal partners. This is some concession to reality, but still inadequate recognition of the non-European contribution to EC programmes in IT. The Commission still requires European firms to collaborate so that they may be more efficient in IT research, more innovative, and thus more competitive, especially against the Americans and Japanese. Such a notion is really no longer appropriate in the modern IT industry, an industry whose product, structure, ownership, research, innovation and market are utterly global. It is positively surreal in a research programme like IST, which specifically seeks to exploit networks and clustering, and in the very IT technology which facilitates information networking, both formal and informal. The consequence of the Commission's continued insistence on European collaboration may well be reduced IT activity in Europe, and this is far too great a price to pay for the political convenience of the European Commission.

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